

FACULTY OF ECONOMICS - PRILEP
UNIVERSITY „St. KLIMENT OHRIDSKI“ - BITOLA



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SHAPING THE FUTURE
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Prilep, North Macedonia

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DOES THE INTERNET PENETRATION HELP REACH MILLENNIUM GOALS: THE CASE OF CENTRAL ASIAN TURKIC REPUBLICS

Rasim YILMAZ¹ and Cuneyt KOYUNCU²

Abstract:

The Sustainable Development Goals (SDGs) are a collection of measurable and universally-agreed development targets established by UNDP. SDGs are designed at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. SDGs include 17 goals build on the Millennium Development Goals which are set at the Millennium Summit of United Nations Conference in New York in 2000.

This study investigates whether the diffusion of the internet can help reach millennium goals for Turkic Republics of the former Soviet Union. Three models are constructed to test this hypothesis. Bivariate estimation results indicate strong correlation between the internet and millennium goals of environmental sustainability, human capital development, and improvement in income distribution and human development. Multivariate estimation results are also support the relationship between the internet and millennium goals. Thus, our results suggest government support for the diffusion of information and communication technologies to reach further levels in millennium goals.

Key words: *Internet, Information and Communication Technologies, Millennium Goals, Central Asian Turkic Republics*

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Introduction

The Sustainable Development Goals (SDGs) are a collection of measurable and universally-agreed development targets established by UNDP. The Sustainable Development Goals (SDGs) are designed at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. SDGs include 17 goals build on the Millennium Development Goals which are set at the Millennium Summit of United Nations Conference in New York in 2000. Table 1 presents definition and explanation of the goals.

Table 1: Definition and Explanation of Sustainable Development Goals

Goals	Definition	Explanation
1	No Poverty	End poverty in all its forms everywhere
2	Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	Good Health and Well-Being	Ensure healthy lives and promote well-being for all at all ages
4	Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender Equality	Achieve gender equality and empower all women and girls
6	Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
7	Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduced Inequality	Reduce inequality within and among countries
11	Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13	Climate Action	Take urgent action to combat climate change and its impacts
14	Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	Peace, Justice and Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Partnerships for Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

The 17 Sustainable Development Goals (SDGs) with their 169 targets are intended to be met by the end of 2030. Accordingly, there has been increasing efforts for finding tools to meet the goals.

The goals address the social, economic, and environmental aspects of sustainable development. Apart from its other effects, diffusion of ICT can be the main instrument in achieving most of the Sustainable Development Goals (SDGs) (MDGs). Several case studies support this argument.

The internet penetration rate varies among the Central Asian Turkic Republics. As of 2016, Azerbaijan had the highest the internet penetration rate with 78.2%, followed by Kazakhstan with 74.4%. The internet penetration is moderate in Uzbekistan and Kyrgyz Republic with 46.7% and 30.2%, respectively. Tajikistan and Turkmenistan present lower internet diffusion with 20.4% and 17.9%, respectively (see Table 2).

Although the internet penetration rates are similar among the states except Turkmenistan in 2007, Azerbaijan and Kazakhstan displayed higher performance in terms of the internet diffusion after 2007.

Table 2: Percentage of Individuals Using the Internet-Central Asian States

	Azerbaijan	Kazakhstan	Uzbekistan	Kyrgyz Republic	Tajikistan	Turkmenistan
1994	0,001	0,0005	..	..	..	..
1995	0,002	0,0113	0,0015	..	..	..
1996	0,006	0,0318	0,0042	..	..	..
1997	0,025	0,0645	0,0105	..	..	..
1998	0,037	0,1310	0,0207	0,0728	..	..
1999	0,099	0,4642	0,0306	0,2047	0,0327	0,0450
2000	0,147	0,6685	0,4843	1,0414	0,0486	0,1332
2001	0,305	1,0061	0,5975	3,0029	0,0512	0,1752
2002	4,999	1,6747	1,0819	2,9992	0,0554	0,3021
2003	..	2,0004	1,9125	3,9087	0,0645	0,4251
2004	..	2,6503	2,5937	5,0903	0,0774	0,7540
2005	8,030	2,9617	3,3435	10,533	0,2986	0,9972
2006	11,99	3,2683	6,3883	12,306	3,7724	1,3195
2007	14,54	4,02	7,4906	14,03	7,1976	1,4063
2008	17,08	11	9,0801	15,7	8,78	1,75
2009	27,4	18,2	11,9	16	10,07	1,95
2010	46	31,6	15,9	16,3	11,55	3
2011	50	50,6	18,6	17,5	13,03	5
2012	54,2	61,906	23,6	19,8	14,51	7,19
2013	73,00	63,304	26,8	23	16	9,6
2014	75,00	66	35,5	28,3	17,49	12,2
2015	77	70,829	42,8	30,2	18,98	14,99
2016	78,2	74,587	46,791	34,5	20,47	17,99
2017	79	76,426	..	..	..	..

Source: World Telecommunication Database

The aim of this study is to empirically examine the impact of the Internet on the Sustainable Development Goals (SDGs) in the context of Turkic Republics. For this end, three models are developed to address different dimensions of the goals. The next section provides a model addressing environmental aspects of the goals, while section 3 presents models focusing on income inequality and human development dimensions of the goals and section 4 provides a model centering human capital development aspects of the goals. The last section concludes.

ICT and Environmental Sustainability

One of the millennium goals is to ensure environmental sustainability. Information and communication technologies may help reach environmental sustainability for Turkic Republics of the former Soviet Union. In order to test this hypothesis, this part of the study empirically investigates the relationship between diffusion of the internet and forest ownership (deforestation) in the panel data context. Our panel includes 6 countries (Azerbaijan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan) and the period between 1990 and 2015.

The following bivariate and multivariate random and fixed time effect models, which is based on the previous studies of Jorgenson and Burns (2007) and DeFries et al. (2010), are estimated:

$$FOREST_{it} = (\alpha + \tau_t) + \beta_1 INTERNET_{it} + u_{it} \quad (1)$$

$$FOREST_{it} = (\alpha + \tau_t) + \beta_1 INTERNET_{it} + \beta_2 PCR_{it} + \beta_3 RPG_{it} + \beta_4 GDPPC_{it} + u_{it} \quad (2)$$

and the following bivariate and multivariate random time effect models (REM);

$$FOREST_{it} = \alpha + \beta_1 INTERNET_{it} + (\tau_t + u_{it}) \quad (3)$$

$$FOREST_{it} = \alpha + \beta_1 INTERNET_{it} + \beta_2 PCL_{it} + \beta_3 RPG_{it} + \beta_4 GDPPC_{it} + (\tau_t + u_{it}) \quad (4)$$

where it subscript stands for the i -th country's observation value at time t for the particular variable. α is the intercept term and τ_t represents time-specific effects which affect all countries in the same way (i.e., τ_t is variant across time but not across countries). u_{it} is idiosyncratic error term of the regression model.

Dependent variable of the model is forest area as a percentage of land area. The data comes from World Development Indicators. Our main explanatory variable of interest in this study is INTERNET which is the percentage of individuals using the internet. The data is taken from World Telecommunication database. The expected relationship between the internet diffusion and forestation in our model is positive as such increase in the internet penetration increases the percentage of forest area.

Three more determinants of forestation, which are suggested by previous studies (Jorgenson and Burns, 2007; DeFries et al., 2010), are introduced to test the robustness of bivariate estimation results: permanent cropland as a percentage of total land area (PCR), rural population growth (RPG), and GDP per capita at constant 2010 USD (GDPPC). The source of those variables is World Development Indicators (WDI).

Bivariate estimation results for forestation model is presented at Table 3 below. The coefficient on the INTERNET variable is negative and statistically significant at 1% level in bivariate model estimation. Bivariate estimation results suggest that there is a strong positive correlation between the internet diffusion and forestation.

Table 3: Bivariate Model Estimation Results (Forestation)

	FORESTATION
C	5.8065
Standard Error	1.7818
P-value	0.0015
INTERNET	0.0158
Standard Error	0.0023
P-value	0.0000
Number of Observations	121
Number of Countries	6
R-squared	0.2808
Estimated Model	REM
Hausman-statistics	0.0456

Multivariate estimation results are presented at Table 4. The coefficient on INTERNET variable is positive and statistically significant at the 1% level, which suggests that forestation increases as the percentage of individuals using the internet increases.

In regard to other independent variables, the estimated coefficient of CROPLAND variable is negative and statistically significant at the 1% level in all models. The results indicate that surge in the agricultural land demand leads to deforestation. The coefficient of RURPOPGRO variable statistically significant and have expected sign. The result displays that rural population growth causes deforestation. The coefficients of GDPGRO variable is positive and statistically significant at 5% level which implies that deforestation tends to decrease as nations becomes more developed.

Table 4: Multivariate Model Estimation Results (Internet)

	FORESTATION
C	3.8184
Standard Error	2.0062
P-value	0.0596
INTERNET	0.0109
Standard Error	0.0034
P-value	0.0021
CROPLAND	-0.4870
Standard Error	0.3156
P-value	0.1257
RURPOPGRO	-0.2187
Standard Error	0.0597
P-value	0.0004
GDPGRO	0.3657
Standard Error	0.1695
P-value	0.0331
Number of Observations	115
Number of Countries	6
R-squared	0.4179
Estimated Model	REM
Hausman-statistics	5.8544

ICT, Income Inequality and Human Development

Millennium goals of reducing child mortality, improving maternal health, combating HIV/AIDS, malaria and other diseases are related to human development while millennium goals of eradicating extreme poverty and hunger and promoting gender equality and empowering women are affiliated to income inequality. Improvements in income equality can indicate decrease in poverty and hunger, improvement in gender equality and women empowerment. Similarly, enhancement in human development can be the sign of reduction in child mortality, improvement in maternal health, decrease in HIV/AIDS, malaria and other diseases.

Information and communication technologies may help reduce income inequality and improve human development for Turkic Republics of the former Soviet Union. In order to test this hypothesis, this part of the study empirically investigates the relationship between diffusion of the internet and income inequality (and human development) in the panel data context. Our panel includes 6 countries (Azerbaijan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan) and the period between 1990 and 2015.

The following bivariate and multivariate random and fixed time effect models, which is based on the previous study of Gupta et al. (1998), are estimated:

$$POVERTY_{it} = \beta_1 + \beta_2 INTERNET_{it} + u_{it} \quad (1)$$

$$POVERTY_{it} = \beta_1 + \beta_2 INTERNET_{it} + \beta_3 ORERATE_{it} + \beta_4 EDUCATION_{it} + \beta_5 CSTACK_{it} + u_{it} \quad (2)$$

and the following bivariate and multivariate random effect models (REM);

$$POVERTY_{it} = \beta_1 + \beta_2 INTERNET_{it} + \varepsilon_i + u_{it} \quad (3)$$

$$POVERTY_{it} = \beta_1 + \beta_2 INTERNET_{it} + \beta_3 ORERATE_{it} + \beta_4 EDUCATION_{it} + \beta_5 CSTACK_{it} + \varepsilon_i + u_{it} \quad (4)$$

where it subscript stands for the i -th country's observation value at time t for the particular variable. All variables are in logarithmic forms. On the other hand, whenever the observation value of a particular variable takes the value of zero then we add the value of 0.000001 to all observations of that variable in order to be able to take the logarithms. β_{1i} represents country specific factors not considered in the regression, which may differ across countries but not within the country and is time invariant. ε_i is a stochastic term, which is constant through the time and characterizes the country specific factors not considered in the regression. u_{it} is error term of the regression.

There are two dependent variables and hence two models in this section. Our dependent variables are income inequality (GINI) and human development (HDI). GINI and HDI focus on different dimensions of poverty. GINI is related to income inequality while HDI is associated with human development.

GINI is the Gini index. The Gini coefficient is a measure of inequality between 0 and 1, where 0 corresponds with perfect equality (where everyone has the same income) and 1 corresponds with perfect inequality (where the richest person has all the income and everyone else has zero income). HDI is the Human Development Index and is a proxy for human development. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions. The HDI was

created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone.

HDI data is taken from UNDP while GINI data is obtained from the World Bank.

Our main explanatory variable of interest in this study is INTERNET which is the percentage of individuals using the internet. The data is taken from World Telecommunication database. The expected relationship between the internet diffusion and income inequality in our model is negative as such increase in the internet penetration decreases income inequality.

We also introduced three more determinants of income inequality which are suggested by previous study by Gupta et al. (1998) into our analysis to see how robust our finding is: the total natural resources rents as a percentage of GDP (ORERATE), the gross tertiary school enrollment to total enrollment ratio (EDUCATION), and gross fixed capital formation as a percentage of GDP (CSTOCK). The source of those variables is World Development Indicators (WDI).

Table 5 reports bivariate estimation results for regressions where INTERNET is used as an independent variable. All coefficients of INTERNET variable are statistically significant at the 1% level and take the expected signs. The results indicate that surge in the percentage of individuals using the internet is associated with an increase of Human Development Index and decrease in Gini coefficient (i.e. decrease in inequality).

Table 5: Bivariate Model Estimation Results (Internet)

	HDI	GINI
C	0.635523	3.291161
Standard Error	0.017469	1.476861
P-value	0.0000	0.0000
INTERNET	0.001733	-0.126095
Standard Error	0.000123	0.036607
P-value	0.0000	0.0012
Number of Observations	101	21
Number of Countries	6	5
R-squared	0.6679	0.2017
Estimated Model	REM	REM
Hausman-statistics	1.3532	0.1040

Table 6 presents multivariate estimation results. All coefficients of INTERNET variable continue to have statistically significant and expected signs, suggesting that the internet diffusion is positively associated with human development index (HDI) while it is negatively correlated with Gini coefficient. Regarding other variables, results indicate that capital stock and natural resource endowment are associated with higher human development index.

Table 6: Multivariate Model Estimation Results

	HDI	GINI
C	0.5772	3.7641
Standard Error	0.0117	2.2318
P-value	0.0000	0.0000
INTERNET	0.0018	-0.0770

Standard Error	0.0001	0.0338
P-value	0.0000	0.0297
ORERATE	0.0018	0.0020
Standard Error	0.0003	0.0637
P-value	0.0000	0.9742
CSTOCK	0.0010	-0.1302
Standard Error	0.0003	0.0963
P-value	0.0068	0.1862
EDUCATION	-0.0002	-0.0575
Standard Error	0.0005	0.0566
P-value	0.5841	0.3174
Number of Observations	78	36
Number of Countries	5	5
R-squared	0.9355	0.4296
Estimated Model	FEM	REM
Hausman-statistics	77.5562	3.9435

ICT and Human Capital Development

One of the millennium goals is to achieve universal primary education which is related to human capital development. Information and communication technologies may help improve human capital for Turkic Republics of the former Soviet Union. In order to test this hypothesis, this part of the study empirically investigates the relationship between diffusion of the internet and human capital in the panel data context. Our panel includes 3 countries (Kazakhstan, Kyrgyz Republic, Tajikistan) and the period between 1990 and 2015.

The following bivariate and multivariate fixed time effect panel data models (FEM) implemented by the studies of Binder and Georgiadis (2011) and Shuaibu and Oladayo (2016) are employed to assess the impact of ICT penetration on human capital:

$$HUMANCAPITAL_{it} = (\alpha + \tau_t) + \beta_1 INTERNET_{it} + u_{it} \quad (1)$$

$$HUMANCAPITAL_{it} = (\alpha + \tau_t) + \beta_1 INTERNET_{it} + \beta_2 GDPPCGRT_{it} + u_{it} \quad (2)$$

and the following bivariate and multivariate random time effect models (REM);

$$HUMANCAPITAL_{it} = \alpha + \beta_1 INTERNET_{it} + (\tau_t + u_{it}) \quad (3)$$

$$HUMANCAPITAL_{it} = \alpha + \beta_1 INTERNET_{it} + \beta_2 GDPPCGRT_{it} + (\tau_t + u_{it}) \quad (4)$$

where it subscript stands for the i -th country's observation value at time t for the particular variable. α is the intercept term and τ_t represents time-specific effects which affect all countries in the same way (i.e., τ_t is variant across time but not across countries). u_{it} is idiosyncratic error term of the regression model. All variables are expressed in logarithmic forms. Since our models are full logarithmic models, parameter in front of each independent variable represents elasticity.

The dependent variable of our model is human capital. Human Capital Index is used as a proxy for human capital development. Human Capital Index is an index of human capital per person based on years of schooling and returns to education. The data is taken from Penn World Tables (PWT).

Our main explanatory variable of interest in this study is INTERNET which is the percentage of individuals using the internet. The data is taken from World Telecommunication database. The expected relationship between the internet diffusion and human capital development in our model is positive as such increase in the internet penetration enhance human capital development.

Table 7 reports bivariate estimation results. The coefficients on INTERNET variable is statistically significant at the 1% level and take the expected positive sign. The results show that increase in the percentage of individuals using the internet leads to increase in human capital index.

Table 7: Bivariate Model Estimation Results (HCI-Human Capital Index)

	HCI
C	3.0267
Standard Error	0.0399
P-value	0.0000
INTERNET	0.0045
Standard Error	0.0012
P-value	0.0009
Number of Observations	57
Number of Countries	3
R-squared	0.1839
Estimated Model	REM
Hausman-statistics	0.7385

As a part of robustness checks, a number of control variables suggested by previous studies (Binder and Georgiadis, 2011; Shuaibu and Oladayo, 2016) are included in the bivariate models in order to test the validity and robustness of the bivariate estimation results. Multivariate estimation results are provided at Table 8. Estimation results indicate that both INTERNET and GDPPCGRT variables are positively associated with Human Capital Index, suggesting that increase in the percentage of individuals using the internet and GDP per capita growth positively affects human capital development.

Table 8: Multivariate Model Estimation Results (HCI)

	HCI
C	2.9665
Standard Error	0.0251
P-value	0.0000
INTERNET	0.0040
Standard Error	0.0010
P-value	0.0002
GDPPCGRT	0.0175
Standard Error	0.0037
P-value	0.0000
Number of Observations	56
Number of Countries	3
R-squared	0.3982
Estimated Model	REM
Hausman-statistics	4.5050

Conclusion

The Sustainable Development Goals (SDGs) agreed on by the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012 consists of 17 goals with their 169 targets for all countries in the world. The goals are intended to be reached by the end of 2030.

Building on three models, this study examines the effect of ICT on The Sustainable Development Goals (SDGs) in the context of Turkic Republics. The empirical results of the study suggest that promoting the use of ICT in Turkic Republics can help them to reach The Sustainable Development Goals (SDGs).

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BANK LOANS VS THE BUSINESSES FUNDING THROUGH THE ISSUE OF SECURITIES: EVIDENCE FROM MACEDONIA

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Abstract:

The businesses funding is a complex process because it means financial resources providing, their use, reproduction, return of the borrowed funds to the financial sources, regulation of the economic-financial relation etc. Because of that, the crucial task of the business entities' business and financial policy is the selection of appropriate funding sources that will enable their maximal financial stability.

Self-financing is the cheapest form of financing the reproduction process, which enables high rate of financial independence at making financial decisions, and flexibility in the financial policy running. However, the business entities cannot fund their growth and development only from their own sources. Namely, they often rely on borrowed sources, i.e. on the banks and other financial institutions loans, on the issue of securities, specific forms of funding, and also they use international financing sources.

In the Macedonian economy, due to the complex economic and social conditions, many businesses are faced with the issue of providing quality funding sources. Due to those reasons, the basic aim of this study is to analyze the opportunities for the Macedonian firms to use some funding sources and to identify the problems in selecting the appropriate funding source, which will enable the funding costs reduction, i.e. optimization of the businesses financial structure.

Key words: funding sources, securities, bank loans

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Introduction

Financing of businesses is a complex process which involves procurement and utilisation of funds so that business firms will be able to carry out their operations effectively and efficiently.

So, finance is the most important requirement of every business and it is considered as a lifeline of the business and a crucial determinant on the existing and development of every business.

Inadequate finance poses many problems and may bring an end to the life of the business. The importance of finance has considerably increased in modern days due to the following reasons in addition to the usual need:

- **Need for Large Scale Operation:** Now-a-days business activities are generally undertaken on a large scale. The products of any country are now freely and easily available in other countries. The entire world has become a big market. So to survive in the business world the businessman has to expand the horizon of his activities and function on a large scale. This expansion of business always demands more funds.
- **Use of Modern Technology:** Use of latest technology in the process of production as well as distribution has become imperative for every business now-a-days. To meet the competition, production process now demands use of modern machinery, equipment and tools. Hence, there is a greater need for finance to meet the challenge of the world's markets successfully.
- **Promotion of sales:** In this era of competition a lot of money is to be spent on activities for promoting sales. This involves advertisement, personal selling, use of sales promotional schemes, providing after sales service and free home delivery, etc. which need a huge amount of funds.

The business entities can provide the necessary funds for investment projects realization through internal and external sources. Internal funding provides greater autonomy, sovereignty and freedom during the financial decision making. However, quite often, business entities are unable to meet their need for capital only from internal financial sources, and therefore there is a need to acquire capital from external sources. In the developed market economies, the capital market gives an opportunity to economic entities to use different forms of funding. The efficient capital market enables acquiring of the necessary finances through: long-term investment loans, issuance of securities – shares and bonds; as well as use of different derivative financial instruments (Vitanova *et al.*, 2011).

The decision for selecting the financing sources of the business entities' investment projects is one of the most complex activities for the management. Namely, the management's basic aim is to create an optimal capital structure which involves minimal financing costs, and at the same time not to lose the ownership control over the company.

Most frequently, the business entities combine various financing sources, taking into account the relation between the equity capital and the borrowed capital. However, the possibility to make a combination of various financing sources is determined by the business entity's life-cycle, its growth phase, the goal and potential of the sector's growth where the particular business entity works, and by its management's attitude towards the risk.

In fact, in the beginning of the business entity's lifespan, it has a low number of available sources for financing its work. By the growth of the business entity, the internal financial possibilities exhaust, while the possibilities for using the external capital in a form of credits from commercial banks, and through securities issue, increase.

In this paper, we analyze the access by Macedonian firms to external financing, both from bank and non-bank sources. The data in this paper comes from the combination of two different databases, the statements of the National bank of the Republic of North Macedonia and the Annual Statements of the Macedonian Stock Exchange.

Literature Review

The financing is an important factor that determines the business entities' survival and development. Financing is important for firms because it helps in expansion of operations, innovation, and investing in production facilities and new staff (OECD, 2006). At this, the decision whether to use the equity capital or to fund the work through a debt is one of the most frequent dilemmas the management is faced to.

Namely, there are many researches that analyze the different financing sources advantages and disadvantages, and the factors which determine the decision for selecting the appropriate source.

The traditional view of corporate finance states that debt is generally cheaper than equity as a source of investment finance implying that a firm's average cost of capital becomes lower as it increases its debt relative to equity. Thus, as the firm's average cost of capital reduces with increases in its debt to equity ratio, the corresponding company market value schedule rises and therefore the optimal leverage is determined at the point where the firm's weighted average cost of capital is minimized and the value of the firm is maximized (Alhassan Andani & Seidu Al-hassan, 2012).

In contrast to the traditional view, Modigliani and Miller (1958) concluded that capital structure would be irrelevant, implying that the market value of the firm and its cost of capital are independent of its capital structure and as a result there is no optimal capital structure.

The study of Raquel L. G. *et al.* (2007) examines access by Spanish firms to external financing, both from bank and nonbank sources. Their findings reveal that Spanish firms are quite dependent on short term non-bank financing (such as trade credit), which makes up about 65 percent of total firm debt. They also find that short-term bank debt seems to be accessed more during economic expansions, which may suggest a substitution away from non-bank financing as firm conditions improve. Their research shows that the impact of funding costs on access to external financing, whether from banks or non-banks, is affected by the nature of borrowing firms' bank relationships and collateral. Moreover, collateral plays a key role in making long-term finance available to firms.

The research of Spiros B. *et al.* (2006) examines firms' access to bank and market finance when allowance is made for differences in firm-specific characteristics. A theoretical model determines the characteristics such as size, risk and debt that would determine firms' access to bank or market finance; these characteristics can result in greater (or lesser) tightening of credit when interest rates increase. Their research confirms that small, young and risky firms are more significantly affected by tight monetary conditions than large, old and secure firms.

Raana Farooqi-Lind (2006) investigates the capital structure choices of non-listed firms in Sweden and later compares it to that of listed firms. She finds a number of differences in the capital structure of listed and non-listed firms, as well as differences both in the relationship of debt levels to the explanatory variables employed in most capital structure studies between listed and non-listed firms and in the magnitude of the effect of the variables. This supports the expectation of differences based on listed and non-listed firm differences in the agency costs of debt and equity. Of the most important

influences on capital structure, tangibility is common to both listed and non-listed firms. If one makes the assumption that firms with a large proportion of tangible assets in their asset structure are the more mature firms, this would point to the fact that for both listed and non-listed firms, growth options are a major determinant of capital structure choice.

Determinants of Access to External Finance

Corporate sector growth is vital to economic development. One of the main problems of the corporate sector is the access to finance. So, the access to external finance is a key determinant of a firm's ability to develop, operate and expand (Raquel L. G. *et al.*, 2007).

To understand how firms finance their operations, it is necessary to examine the determinants of their financing or capital structure decisions. Company financing decisions involve a wide range of policy issues. At the macro level, they have implications for capital market development, interest rate and security price determination, and regulation. At the micro level, such decisions affect capital structure, corporate governance and company development (Green, C.J., *et al.* 2002).

The practice shows that the most important determinants that affect financing decisions are the following:

- Maintaining an optimal balance between the equity and the borrowed (foreign) capital. Namely, these particular relations are basic indicators for the financial power and strength of the business entity, its creditworthiness, rating and business perspective. These parameters, as well as the relations between them, on the other hand, enable us to determine the place and the role of the economic entity on the capital market;
- The degree of indebtedness of the business entity. This indicator has an utmost importance in most cases when deciding on how to provide the needed capital. Namely, if the business entity is considerably indebted or approaches the limit of allowed debt, it does not have a choice, but to provide the necessary capital through issuance of shares;
- The degree of development and independence is also very significant factor that has to be considered. In a situation when the business entity has a successful and stable development, it is logical to decide on mobilization of debt capital, for a simple reason that this will allow it to maintain the high degree of independence and business autonomy in the future as well, which is a very significant prerequisite for maintaining the competitive advantage on the market in sharp economic conditions;
- The degree of risk of the investment capital for which the mobilization of financial resources is made. If the risk of the investment of the potentially mobilized capital is higher, the economic entity will give a priority to the issuance of shares, while on the other hand, if the risk is lower, then it will decide upon debt capital;
- Current conditions on the capital market according to which an equity or debt capital can be acquired;
- The market price of own shares (in case of joint stock company). If the current, market price of the shares is high and significantly exceeds their nominal value and there is interest for the shares among potential investors, it is realistic to assume that the necessary capital will be obtained through an issuance of shares because they are expected to be attractive on the market;

- The interest rate on the long-term loans granted from the banking institutions. In conditions of low-interest rates and a stable bank loan policy, the economic entities will decide to obtain the necessary funds by taking long-term loans from the banks;
- Tax policy and its instruments have a major impact on the decision to select the source that will provide the necessary funds. In situations when by tax deductions and benefits, bonds are being favoured, it is assumed that the economic entity will obtain the necessary capital by issuance of bonds. In cases when these tax deductions apply to the shares, the economic entity will perform mobilization of capital through issuance of shares.

Given all these factors when choosing one of the capital sources, the business entities should always consider the following:

- If they decide to provide the necessary capital through an issuance of stocks, then the ownership structure of the capital will shift in favour of equity capital; and
- If they decide to provide the necessary capital through an issuance of bonds or by loans, then the ownership structure of the capital will shift in favour of debt capital.

It is necessary to emphasize that there is no universal combination that can be used by all business entities in mobilization of the needed financial resources, and that is why before making a decision they should always make a detailed analysis of all the factors in order to choose the combination that will allow to maximize the value of the entity and minimize the costs for the capital.

External Sources of Financing

The sources of investment finance can be divided into internal and external. Internal sources (retained earnings) are both in theory and practice considered as the most appropriate source of investment finance, but their amount is limited by the profitability of the firm. External debt (loans and issues of securities) is limited by the capacity of the firm to guarantee its obligations, i.e. by the amount of fixed assets that could serve as collateral.

The firm's financing policy therefore requires managers to identify ways of funding new investments so as to generate more wealth and ensure firm sustainability (Abor & Biekpe, 2005). However, the mix of the various funding sources that maximizes the firm's value constitutes the firm's optimal capital structure.

The choice between the equity or debt capital for business needs funding is very complicated process. It is of utmost importance that they resolve certain issues through a detailed analysis, before they decide on how they will provide the necessary capital, whether by loans or by issuance of securities, primarily because the capital secured by an issuance of shares has a proprietary nature, and the capital secured by an issuance of bonds or loans has a debt nature.

The reasons and motives for an economic entity on the capital market to find itself in a role of a user of equity or a debt capital are multiple and varied. A capital market is a financial market where debt and equity securities can be issued and traded. Such markets involve the participation of a wide range of retail and institutional investors, who can invest through pension funds, insurance companies, mutual funds, and other investment routes.

Capital markets play an important role in the overall growth of an economy and help channel savings into productive investments (World Bank, 2017). The role of the capital market to a large extent

would ensure the efficient allocation of resources, and this is key for economic growth and development.

Osei (1998) observes that a well-organized capital market is central to the mobilization of both domestic and international capital and that capital has been a major constraint to economic development for many developing countries.

The amount of new external equity (new funds from the owners) is largely dependent on the legal form of the firm and its ownership structure, on the degree of involvement of the owners into the management of the firm and their willingness to take on new partners, and in the case of public limited companies also on the effectiveness of the stock market (Mikóczyová Jana, 2010).

Financing of the business entities through issue of shares brings them many benefits, i.e.:

- This financing source has the lowest pressure on the company, because the mobilized resources can be continuously used, while the dividend pay-off to the shareholders is made by internal decision of the managing bodies;
- The dividend need not be paid-off, while not paid-off dividend can be transformed into dividend shares;
- Increases the company's ability for engaging financial resources from foreign sources (Trajkoska G. *et al.*, 2014)

On the debt side, bonds, debentures and asset-backed securities (ABS) such as collateral debt obligations and mortgage-backed securities, are the most common securities traded in capital markets (Divjot S. *et al.*, 2019).

On the other side, borrowings from banks are an important source of finance to companies. Bank lending is generally considered outside the purview of capital markets, since bank loans are not securitized and tradable, and therefore involve very limited institutional investor participation. Moreover, banks are subject to different regulations compared to capital markets. In the Macedonian context, banks come under the purview of the National Bank of the Republic of North Macedonia while capital market is regulated by Securities Exchange Commission.

The institutional set up of the financial system in the country is a key element of the access to external finance. The financial system in our country is characterized high level of concentration of the banks' capital in the whole assets of the financial system. This means that about 82.5% of the whole assets of the financial system in Republic of North Macedonia are owned by banks. So, in our country commercial banks are important loan providers. Given their important position, banks remain the most significant factor in maintaining the stability of the overall financial system and other financial institutions. Up to now, in R. North Macedonia, the most important place has been occupied by the credit market, in which the banks have the main role (NBRM, 2018).

Corporate Sector Financing in Republic of North Macedonia

Republic of North Macedonia is a small country with registered 72315 active business entities in the in 2018. The data on the structure of active business entities according to the number of persons employed show that the highest share of 79.1% belongs to business entities with 1-9 persons employed, followed by business entities with no persons employed or entities with unascertained number of persons employed (no data on persons employed) with 11.4%, and entities with 10-19 persons employed with 4.3%. The share of entities with 20-49 persons employed was 2.9%, those

with 50-249 persons employed participated with 1.9%, while entities with 250 or more persons employed had a share of only 0.3% (State Statistical Office, 2018).

Regarding previous findings, 99.7% of the registered businesses in our country are small and medium sized businesses.

Most businesses in the Republic of North Macedonia are registered as limited liability companies (LLC and Ltd.), while only 500 entities are registered as joint stock companies from which in 2018 only 105 companies are listed on the Macedonian Stock Exchange.

Capacity utilization in the enterprises in recent years has ranged from 52-62%. There are more reasons for such low utilization percentage, but these are noted as most important: financial problems, insufficient domestic demand, slow conquest of foreign markets, competitive imports, and uncertain economic environment.

Furthermore, one of the most serious problems with which the businesses in the Macedonian economy are faced to, is to provide sources for funding their work. This especially refers to the small and medium businesses, which, as it is highlighted above, have the highest (99.7%) participation in the registered business entities in Macedonia and they are the key driver of the Macedonian economy in the view of creating new jobs. The researches concerning their financial problems have shown that the main problem of the small and medium businesses, are the unfavourable loans offered by the commercial banks, i.e. the high interest rates and the complex procedures for the bank credits approval.

Limited access to bank credit, in particular for small enterprises, is viewed by many policy makers and academics as a major growth constraint for emerging and developing economies (Levine R.,2006).

Beside this condition, businesses in the Republic of Macedonia have still most of their investment projects financed with funds provided through expensive bank loans which certainly adversely affects their long-term financial balance and the capital structure. Traditionally, Macedonian companies have mostly relied on bank lending to finance their fixed investment and working capital needs.

In the following paper are shown the gross loans to nonfinancial companies for the period from 2007 up to 2018.

Table 1: Gross loans to nonfinancial companies (in million MKD)

Година	Gross loans to nonfinancial companies (in million MKD)	Percentage share of the Gross loans of nonfinancial companies to GDP
2007	68,881	18.47%
2008	93,292	22.49%
2009	95,016	22.92%
2010	102,443	23.43%
2011	109,912	23.68%
2012	112,757	24.16%
2013	114,374	22.79%
2014	123,981	23.50%

2015	133,065	23.81%
2016	136,116	22.88%
2017	139,857	22.68%
2018	149,565	22.65%

Source: Indicators on the banking system of the Republic of North Macedonia, Balance Sheets of the Banking System for the period from 2007 to 2018

Although the number of active business entities in the period of analysis (2007-2018) has not been drastically changed, the results of the conducted research have shown that the volume of the bank credits used by the corporative sector has been drastically increased.

In the financing sources structure, the capital and the reserves have the highest percentage and have kept their stable share (of 52.3%), followed by the loan liabilities, which share has also been stable (16.8%) (NBRM, 2019).

The indicator of the total indebtedness, as one of the basic indicators of the corporative sector's financial stability, has been decreasing slowly for the second consecutive year and in 2018 it is 47.7% (47.9% in the previous year). Decreasing has also been seen with the indicator of the long-term indebtedness (20.5% in 2017, 19.8% in 2018), while the indicator of "the financial leverage" (debt-to-equity and reserves ratio and total assets-equity and reserves ratio) has remained on a stable level.

Such positive movements in the segment of the corporative sector indebtedness are a consequence of the improved results in the corporative sector working during 2018, which has had a positive influence on the domestic financial sector stability, having in mind the fact that the corporative sector is an important credit-user from the domestic banks.

Opposite to the funding through the bank credits, providing of the necessary financial resources through issue of securities in the transition countries (including our country as well) has marginal importance, so the advantages of this form of funding are not very well known to the business entities. An additional reason for such a situation is uneconomical mechanism in financing by bank credits, which is a basic method for financing the corporative sector in the transition countries.

However, the developed market economies experience shows that the capital market has a key role in financing the real economic activity, and with that, in supporting the economic growth, as well. Capital market is a very important segment of the financial market, mainly because of that, that in this market the business entities can come to indispensable capital either through credits from banking institutions or through issue of long-dated securities.

Besides that, the capital market enables the risks allocation among the economic agents, and with that it directly contributes to the economic prosperity. At the same time, the functional and efficient capital markets understand existence of low transactional costs, and a possibility for the economic agents to value the financial resources, and therefore, to make investment decisions.

But, the capital market importance for the Macedonian financial system is low, mainly due to the modest securities offering and the low volume of stock market trading by these instruments. The share of the long-term securities issues, and of the classic stock market trading turnover in the GDP, is still on a low level. The issuers' lack of innovation and competitiveness, from the one hand, and the insufficient information and competitiveness of the potential investors in the Macedonian companies

on the other hand, also have some influence on the domestic capital market underdevelopment. So, the state is still the most active securities issuer. On the other hand, domestic legal entities are the main long-term investor in the domestic capital market.

In the Republic of Macedonia the capital market is poorly developed despite the existence of a large number of institutions that enable its operation. Namely, the Stock Exchange of securities exists 23 years, was founded in 1996 and today it has 11 members of which 6 banks and 5 brokerage houses. It trades shares, bonds and other stock material in accordance with the Commission for Securities.

The basic aim of the Macedonian stock exchange was to provide effective, transparent and safe functioning of the organized secondary securities market in R. Macedonia, through permanent effort of all investors to provide entrance, i.e. exit of financial instruments for trading in the different stock markets at fair market price, to help trade companies to attract new capital for financing their development and to contribute for building confidence into Macedonian securities market.

Despite the country's businesses having the opportunity to mobilize financial resources available through the issuance of shares or bonds, relatively few of the companies finance its operations through the capital market. Their role as issuers of securities is very rare. The following data are presented for the realized issuance of securities for the period 2007-2018 year.

Table 2: Realized Issues of Long-Term Securities for the period 2007-2018 (in million MKD)

Realized Issues of Long-Term Securities (in million MKD)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Corporate bonds	300	653	0	0	0	0	0	0	0	0	6	0
Shares issued by banks	1.728	2.728	5.395	3.327	3.531	10.032	121	6.325	117	1.111	249	2.887
Shares Issued by other financial institutions	1.108	1.275	0	414	3.314	2.546	111	0	0	1.111	249	2.009
Shares Issued by nonfinancial institutions	155	914	226	17	217	191	10	267	0	0	0	0
	164	539	5.170	2.897	0	7.295	0	6.059	117	0	0	878

Source: Reports of Financial Stability in Republic of Macedonia in the period from 2007 to 2018, National Bank of Republic of Macedonia

The dynamics of the corporative bonds market is especially weak, i.e. since the establishment of the Macedonian stock exchange up today, only three issues have been realized, of which only the last issue has been made through a public offering from a financial institution (NLB bank), which was partially realized with a realization percentage of 88,86%. Such situation in this market segment is a consequence of the fact that the companies have not been interested enough in issuing corporative bonds, and of the lack of sufficient level of banking expertise (in the domain of investment banking) concerning the structuring and promoting this kind of securities. On the side of issuing proprietary securities, the weak interest of non-financial companies in financing their activities through the capital market, is evident. Also, most of the new issues of shares have been made by means of a private offering (Spaseska *et al.* 2019).

Table 3: Percentage share of the issued shares in GDP

Year	Shares issues (in million MKD)	Shares issued by nonfinancial institutions(in million MKD)	Percentage share of the issued shares in GDP	Percentage share of the shares issued by nonfinancial institutions in GDP
2007	1,728	7	0.0046%	0%
2008	2,728	539	0.0066%	0.0013%
2009	5,395	5,170	0.0130%	0.0125%
2010	3,327	2,897	0.0076%	0.0066%
2011	3,531	0	0.0076%	0%
2012	10,032	7,295	0.0215%	0.0156%
2013	121	0	0.0002%	0%
2014	6,325	6,059	0.0120%	0.0115%
2015	117	117	0.0002%	0.0002%
2016	1,111	0	0.2%	0%
2017	249	0	0.04%	0%
2018	2,887	878	0.4%	0.0013%

We have similar situation in the segment of equity securities (shares). The data presented in the previous table show some growth in the shares issuance as an alternative form of financing, in the period from 2007 to 2012, and after that, a drastic decline of the new shares issuances followed, with the exception of 2014 and 2018, when issuances of non-government securities in the amount of 2.887

million MKD were realized, compared to 249 million MKD in 2017. But, by a share of 0.4% in the GDP, the newly-issued equity securities are still of little importance for the domestic financial system.

But, on the other hand, if we look at the shares issuers' structure, it can be seen that the largest part of the newly-issued shares, have been issued by the banks and other financial institutions, i.e. the corporative sector uses in a very low degree the equity securities as an alternative form of financing its investment projects.

Table 4: Comparative analysis of the percentage participation of the issued shares in GDP and percentage participation of the shares issued by nonfinancial institutions in GDP

Percentage share of the gross loans to nonfinancial companies in GDP	Percentage share of the shares issued by nonfinancial companies in GDP
18.47%	0%
22.49%	0.0013%
22.92%	0.0125%
23.43%	0.0066%
23.68%	0%
24.16%	0.0156%
22.79%	0%
23.50%	0.0115%
23.81%	0.0002%
22.88%	0%
22.68%	0%
22.65%	0.0013%

On the basis of the conducted comparative analysis of the credits and the capital market use as a funding source, it can be concluded that the bank credits still have dominant participation in financing the businesses in R. North Macedonia and are the most frequently used funding source, which has been mainly a result of the underdevelopment of the money market and the capital market and generally the low degree of the economic growth.

Conclusions

The financing of the corporative sector's investment projects is a permanent and dynamic process which determines the business entities' survival and development. The business entities most often use a combination of various financing sources, taking care of the ratio between the equity and the borrowed capital. Here, the possibility for using the appropriate financing sources changes depending on the business entity's development stage, i.e. its potential for growth, and on the management's aversion to the risk.

In the current complex economic and social conditions, one of the most serious problems of the business entities in the economy of R. Macedonia is providing appropriate financing sources for their work. The research conducted in this study has shown that the bank credits have dominant participation in the total financing sources, which has been a result mainly to the underdevelopment of the money market and the capital market and generally the low degree of the economic development.

Besides the fact that capital market is one of the important part of financial system, which can enable firms to raise capital by issuing shares and on that way has become one of the important ingredients of firms' expansion and in turn economic growth, the Macedonian companies very rarely use it for providing necessary financial resources and they limit themselves on getting financial support from the banks, that additionally decreases their low/poor efficiency.

There are many reasons for this situation, but one of the most important is the lack of familiarity of the management with the advantages coming of capital mobilization through issue of securities and their fear of losing control over the company in case of issuance of new shares.

Therefore, it is very important to increase the business entities' information on the advantages of the capital market mobilization through long-term securities issue, which will bring increased securities offering in the Macedonian market, and its further development will be animated, as well.

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ARE WE READY FOR CENTRAL BANK DIGITAL CURRENCY?

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Abstract:

In previous period of over a decade new cryptocurrencies are emerging, and it raises the question are we ready whether central banks should issue their own. Broader use of distributed ledgers technology (DLT) by new entrants or incumbents could have impact not only in payments, but also can be adopted by some financial market infrastructures, and more widely by other networks in the financial system and the economy as a whole. Because of these implications, it is highly recommended that central banks continue monitoring and analyzing the impact both in digital currencies and DLT. Central banks are actually examining two possible implications of issuing CBDC on the monetary policy and on the financial system. First, many of the risks that are linked with e-money and other forms of electronic payment instruments are also relevant for digital currencies. Second, the development of distributed ledger technology is an innovation with potential for applications beyond payments. Central bank digital currency (CBDC) has the capacity to transform all features of the monetary system and alleviate the way of conducting monetary policy in systematic and transparent way. CBDC are potentially almost costless medium of exchange, secure store of value, and stable unit of account. To achieve these prerequisite, CBDC would be account-based and interest-yielding, and the monetary policy framework would promote true price stability. In this paper, we analyze the key features of CBDC, focusing on basic design characteristics without looking at technical details and presenting progress in different countries that are exploring use-cases for state-based cryptocurrencies.

Key words: Central Bank Digital Currency

I. Introduction

*“Trust is the raw material from which all types of money are minted”
(Harari 2011)*

Since ancient Roman times, fundamental logic for the government-issued currency remains familiar to modern monetary economists. Namely, currency is a medium of exchange that facilitates economic and financial transactions, currency is used for storing value, and currency is a unit of account for the pricing of goods and services. Moreover, Roman jurist Paulus who served as chief legal advisor to the Roman emperor Severus Alexander (222-235 C.E.), realized that material, struck in due form by the mint, demonstrates its utility and title not by its substance as such but by its quantity, so that no longer are the things exchanged both called wares but one of them is termed the price.

Today, nearly two millennia later, we are witnessing dramatic changes in financial technology and creation of new business models, forms for performing transactions and cryptocurrencies with distributed ledger technology (DLT). This raises the question of how the central banks will respond to these changes. One of the possibilities is to adopt these new technologies and that central banks issue digital currencies. In some way, central banks already issue “digital currency” because bank reserves now only exist in electronic form as liabilities of the central bank. But the question is whether such digital liabilities should be issued using new technology and be made more widely available to the general public. This is essential because applicability of central bank money will be a key success factor for the breakthrough of DLT. It is important to emphasize that CBDC are fundamentally different from the various forms of cryptocurrencies. The latter have been issued by private entities and in previous periods since their creation are subject to dramatic price volatility.

However, the new process and business logic may cause uncertainties compared with traditional setups and the central banks are aware of several of these challenges. Before issuing CBDC, central banks should take into consideration many aspects regarding impact on the payments system, on the privacy of transactions, on the private sector innovation, on the deposits held at commercial banks, on the financial stability of making a risk-free digital asset more widely available, on the transmission of monetary policy, on the technology which would be deployed in such a system and the extent to which it could be decentralized, but also what type of entities would exist in such a system and how they should be regulated. Some of the central banks are already doing research regarding this matter. The logic is that CBDC would be fixed in nominal terms, universally accessible, and valid as legal tender for all transactions. To achieve these prerequisites, CBDC would be account-based and interest-yielding, and the monetary policy framework would promote true price stability.

The rest of this paper is organized as follows. Section II gives a literature review. Section III provides a general and non-technical overview of the pros of CBDC. Section IV discusses the taxonomy and way of distribution of CBDC. Section V presents examples of countries exploring the possibilities of CBDC. Section VI concludes.

II. Literature review

More than a decade has passed from the last global financial crisis, and it is impossible to predict when the next crisis will be and how severe it can be. We have witnessed unprecedented monetary

policies introduced by the central banks. Moreover, the effect from these policies is still subject of analysis.

Pfister and (Valla, 2017) summarize that two different approaches to central banking in the after math of the crisis: i) the first one, labelled as “new normal,” monetary policy strategy that is broadened to encompass objectives as financial stability or full employment, so the inflation target is raised and large scale asset purchases are retained as a standard instrument for implementing monetary policy; ii) second approach, which they label as “new orthodoxy,” central banks keep the same objectives but interest rates can be brought to unprecedented negative levels, thus making large scale asset purchases possibly unnecessary.

As shown in Figure 1, Central bank’s liabilities in USA, Eurozone, UK and Japan raised after the last global financial crises.

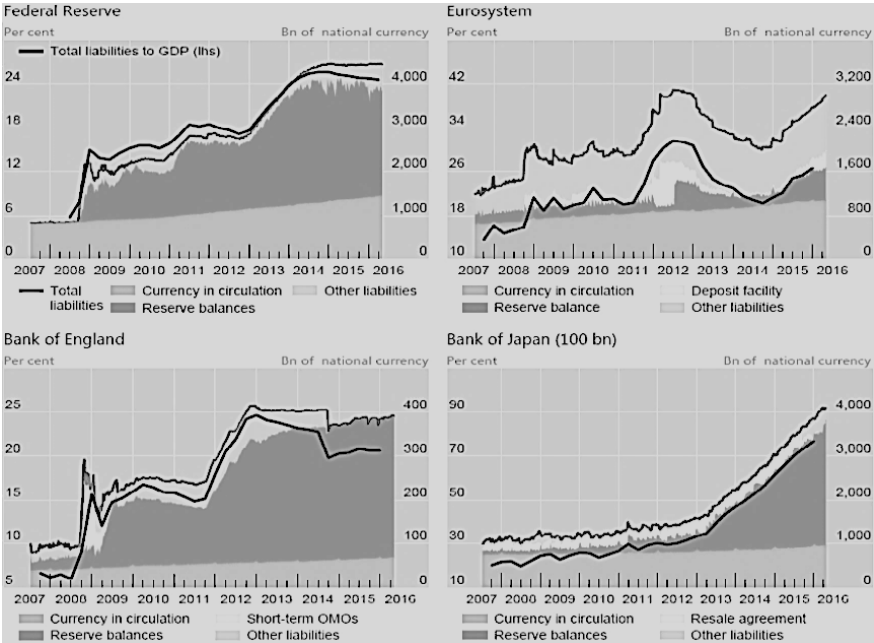


Figure 1: Central bank liabilities, (Borio and Zabai 2016)

(Borio and Zabai, 2016) argue that this development of unconventional monetary policy measures is risky and are likely to be subject to diminishing returns and even more short-term benefits may well give way to longer-term consequences, but the overall pressure to rely on increasingly experimental measures may at some point become too strong. Furthermore they argue that the balance between benefits and costs tends to worsen the longer this unprecedented monetary policies stay in place and exit difficulties and political economy problems may emerge, and at the end central banks’ credibility and legitimacy could come into question.

Similar point of view is presented by (Agarwal and Kimball,2015) who concludes that eliminating the zero lower bound will be with some costs, but those costs should be weighed against the both benefits of ending recessions and also benefits of ending inflation. They summarize that key analytical point is that by and large the costs of inflation, but what is essential to wage cost of inflation relative to the unit of account.

(Fung and Halaburda, 2016) argues that key policy question for central banks is whether or not to issue its own digital currency that can be used by the general public to make payments, but in fact,

there are two closely related questions: (i) Why might a central bank choose to issue its own digital currency? (ii) If a central bank were to issue its own digital currency, what should it look like? They conclude that addressing those questions will influence whether it is in the best interests of society for a central bank to issue its own digital currency and, if so, what considerations should be given to its design. But they emphasize that it is important to keep in mind that there are other aspects besides retail payment system efficiency that are important in the discussion of a central bank digital currency.

(Bordo and Levin, 2017) summaries that alternatively, the central bank might provide stimulus through credit subsidies or by financing public infrastructure spending or income transfers to households, but the viability of such coordinated monetary-fiscal policy measures could be highly dependent on the vagaries of politics and thus, the central bank might find it self with no real policy alternatives. They argue that by introducing CBDC with interest-bearing design and the obsolescence of paper currency would contribute to greater macroeconomic stability, because interest rate adjustments would no longer be constrained by any effective lower bound in response to severe adverse shocks. Moreover they conclude that lower bound has been a key reason why many central banks currently aim at positive inflation rates of 2 percent or more, whereas CBDC will essentially eliminate the need to maintain such an “inflation buffer” or to deploy alternative monetary policy tools such as quantitative easing or credit subsidies.

(Bjerg, 2017) argues that the contemporary question of CBDC is similar to the historical questions of the birth of paper money and we are witnessing invention of a new kind of money: electronic money. He also argues that like the evolution of paper money in its time, the innovation of electronic means of payment has made our economies more efficient and convenient and enabled entirely new forms of economic interaction, but the introduction and proliferation of electronic money has, however, also introduced entirely new forms of risk and instability in the economy, which are also comparable to the ones brought about by paper money. He concludes that question of 21st century monetary policy is how to respond to these new forms of risk and instability.

Furthermore, (Fernández-Villaverde and Sanches, 2018) recently performed analysis with assumption that paper currency becomes obsolete and the central bank does not produce any form of digital currency and all payments are made using privately-issued money (including virtual currencies). Under these assumptions, the analysis indicates that the economy may be subject to indeterminacy and that there may not be any equilibrium that exhibits stable prices. Their analysis finds that price stability can be assured by the issuance of CBDC in conjunction with an appropriate monetary policy framework. This kind of concerns is also subject of interest of central bankers. Nicolaisen (2017), Deputy Governor of Norges bank in his speech at the Norwegian Academy of Science specifically warns about the risks associated with a scenario in which the Norwegian economy no longer has any functional legal tender.

Moreover, (Nicolaisens, 2017) emphasizes the importance of respecting social preferences for the form of money and choosing the direction our future monetary system and payment system will take requires not only economists, but also technologists, lawyers and other social scientists. And political decisions will ultimately need to be made by elected representatives. Nonetheless, these trends are not uniform across countries or types of households. The amount of cash in circulation is about 10 percent of GDP in the Eurozone and in Switzerland and exceeds 20 percent of GDP in Japan as shown in Figure 2.

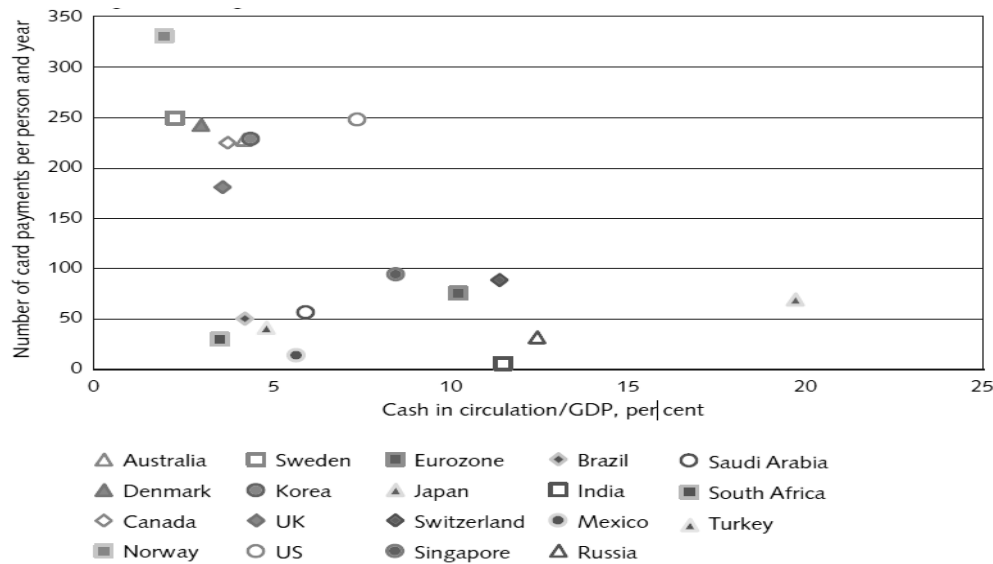


Figure 2: Usage of cards and cash in a selection of countries in 2013, (Segendorf and Anna-Lena, 2015)

According to (SverigesRiskbank, 2016) survey, even in Sweden, about one-third of the households indicated that they would not be able to cope with the disappearance of cash. Those survey results also point to significant variations across demographic groups, with the greatest use of cash by the elderly and by individuals with relatively low levels of education and income.

III. What are the advantages of CBDC?

Economic volatility, sanction threats, “de-risking” strategies and import tariffs, are all realities of the current financial system - and some countries are more vulnerable. We may need an alternative. Initially central banks considered cryptocurrencies as a threat on their exclusive control of the supply of fiat currency, but now central banks are exploring the options and trying to issue their own digital currency.

(Yeager, 1992) argues that for monetary regimes, the basic institutional choice concerns the unit of account—the unit in which prices are set, accounting conducted, costs and benefits estimated, and contracts drawn and that adopting a fiat currency as unit of account implies deciding on some principles for its management, but that adoption still cannot achieve some detailed pattern of economic outcomes. (Friedman, 1960) argues that government-issued money should bear the same rate of return as other risk-free assets. These two goals—that is, a stable unit of account and an efficient medium of exchange—seemed to be incompatible due to the impracticalities of paying interest on paper currency, and hence (Friedman, 1948) advocated a steady deflation rather than price stability.

But is it possible achievement of both goals (stable unit of account and an efficient medium of exchange) by using CBDC having in mind that (Bordo et al, 2007) concludes that true price stability was not achieved during the classical gold standard era, but rather, the general price level exhibited substantial fluctuations and persistent drift due to shifts in the relative supply and demand for gold?

(Bordo and Levin, 2017) argues that with CBDC it will be possible for central banks to aim their policies towards true price stability and this would be substantively different from the current practice of inflation forecast targeting and that by contrast, under a price level target, consumer prices would

still exhibit transitory fluctuations but monetary policy will ensure that the aggregate price level returns to its target over time. They also argue that households and businesses would be able to formulate their plans with confidence because the cost of a representative basket of consumer items (as measured in terms of the CBDC) and such stability could be particularly beneficial for lower-income households and small businesses, which typically have little or no access to sophisticated financial planning advice or complex financial instruments that can help insure against such risks.

(Barrdear and Kumhof, 2016) estimated that on macroeconomic level the productivity gains from adopting CBDC would be similar to those of a substantial reduction in distortionary taxes and could serve as a practically costless medium of exchange. Moreover, (Dyson and Hodgson, 2017) argue that in the time in financial crisis funds could be deposited directly into the CBDC accounts of lower-income households, thereby cushioning their purchasing power from the effects of the downturn as well as from the temporarily negative level of the CBDC interest rate.

(He et al., 2017) conclude that the introduction of CBDC would facilitate more rapid and secure settlement of cross-border financial transactions. They also argue that a CBDC could overcome the coordination failure of inability to agree on a single new technological standard for electronic payments.

Regarding the discouraging tax evasion, money laundering, and other illegal activities, the potential benefit of CBDC, (Rogoff, 2015) concludes that given the role of paper currency (especially large-denomination notes) in facilitating tax evasion and illegal activity, taking into consideration the continuous and persistent and perhaps recurring problem of the zero bound on nominal interest rates, it is appropriate to consider the costs and benefits to a more proactive strategy for phasing out the use of paper currency and taking into consideration of relentless technological advance era of paper currency era is coming to an end.

IV. Taxonomy and distribution of CBDC

The (Committee on payments and market infrastructure, 2015) has identified three key aspects relating to the development of digital currencies: i) The first is the assets (such as bitcoins) featured in many digital currency schemes and these assets typically have some monetary characteristics (such as being used as a means of payment), but are not typically issued in or connected to a sovereign currency, are not a liability of any entity and are not backed by any authority and furthermore, they have zero intrinsic value and, as a result, they derive value only from the belief that they might be exchanged for other goods or services, or a certain amount of sovereign currency, at a later point in time; ii) The second key aspect is the way in which these digital currencies are transferred, typically via a built-in distributed ledger and this aspect can be viewed as the genuinely innovative element within digital currency schemes; iii) and the third aspect is the variety of third-party institutions, almost exclusively non-banks, which have been active in developing and operating digital currency and distributed ledger mechanisms.

(Bech and Garratt, 2017) use Venn diagram to illustrate so called “money flower”. The four-ellipse version as shown in Figure 3, which they call the “money flower”, shows the two potential types of CBDC (retail and wholesale) fit into the overall monetary landscape.

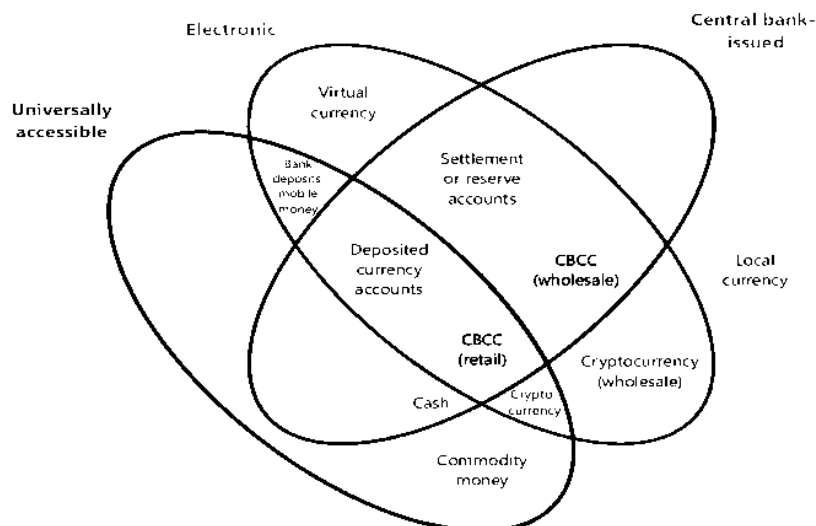


Figure 3: The money flower: taxonomy of the money (Bech and Garratt, 2017)

(Bech and Garratt, 2017) actually establish new taxonomy of money properties: issuer (central bank or other); form (electronic or physical); accessibility (universal or limited); and transfer mechanism (centralized or decentralized, i.e., peer-to-peer). They argue that this taxonomy reflects what appears to be emerging in practice and distinguishes between two potential types of CBDC, both of which are electronic: central bank-issued and peer-to-peer. One is accessible to the general public (retail CBDC) and the other is available only to financial institutions (wholesale CBDC).

And now we come to one essential question that is how and to whom it would distribute its digital currency? (Barrdear and Kumhof, 2016) are presenting two models as a solution: i) In the first, the central bank offers to exchange its non-equity liabilities at par against digital currency to commercial banks and the digital currency would then be “retailed” through these banks to other banks and non-banks including individuals, corporations, wallet providers and operators of the payments system; ii) The second model of distribution would have the central bank making its digital currency available not only to banks, but also to select other financial institutions and non-financial institutions. In the first model central bank would avoid the need to deal with technical difficulties of end-user usability and platform compatibility. In the second model central bank will be involved more closely into operating the system and may raise privacy concerns, especially if transactions are validated by multiple.

V. Examples of countries exploring use case for CBDC

A. The Sveriges Riksbank - e-krona project

According to central bank of (Sweden Riskbank, 2019) the use of banknotes and coins is declining in society and at the same time, technological advances with regard to electronic money and payment methods are proceeding rapidly. The Riksbank is therefore investigating whether Swedish krona need to be made available in electronic form, the so-called e-krona.

(Boel, 2016) concludes that technological innovation could potentially lead to a diminished lending role from the traditional banking sector if phenomena such as peer-to-peer lending and cryptocurrencies become mainstream. Furthermore, at the same time, the role of central banks could change in a world without cash and regulators and central banks therefore need to understand how

these innovations could potentially transform the banking sector as we know it today and fundamentally change the traditional channels through which monetary policy affects the economy.

(Söderberg, 2018) submerses that e-krona, if it becomes a reality, would be issued and managed by the central bank, which is a public authority, in a way that guarantees that it fulfils the fundamental functions that are required of money and it would therefore be based on the chart list and functionalist principles that are now the basis for our monetary system. Moreover, crypto-assets enthusiasts in many cases lack confidence in the ability of states and central banks to manage money and it is therefore very important to make a clear distinction between crypto-assets and central bank issued digital currencies - the former are usually issued in a decentralized process with no formal issuer, while the latter are issued by national states and managed by central banks and the principles for maintaining confidence in a potential e-krona and a crypto-asset are thus diametrically different.

B. The Monetary Authority of Singapore - Project Ubin

(The Monetary Authority of Singapore, 2017) project Ubin, under management of the Monetary Authority of Singapore (MAS) and in collaboration with major financial institutions (the Association of Banks in Singapore) carried out pilot studies of inter-bank transactions using digital ledger technologies, and developed three models for decentralized inter-bank payment and settlements.

To quote (The Monetary Authority of Singapore, 2017): “the SGD-on-ledger is a specific use coupon that is issued on a one-to-one basis in exchange for money. The coupons have a specific usage domain – in our case for the settlement of interbank debts - but no value outside of this. One is able to cash out by exchanging the coupons back into money later ... SGD-on-ledger has three useful properties that make it suited to our prototype. First, unlike money in bank accounts, we do not receive interest on the on ledger holdings. The absence of interest calculations reduces the complexity of managing the payment system. Second, to ensure full redeem-ability of the SGD-on-ledger for money, each token is fully backed by an equivalent amount of SGD held in custody. This means that the overall money supply is unaffected by the issuance of the on ledger equivalents since there is no net increase in dollar claims on the central bank. Third, SGD-on-ledger is limited use instruments and can be designed with additional features to support the use case - such as security features against misuse.”

(Datta, 2019) concludes that the three highlighted properties from the project Ubin emphasize the importance of responsibly using blockchain without creating instability while solving actual pain points of digital financial activities that exist with legacy infrastructure: particularly that the processes are unnecessarily complex with respect to the functionalities provided, making the solutions inefficient (slower and/or expensive). Such a tokenized approach also allows a natural integration of the currency with other workflows and functionalities that may be carried out over a multi/all-purpose blockchain platform.

C. Bank of Canada - Project Jasper

(Chapman et al., 2017) summarizes that the Project Jasper provided vital insights into how a central bank and participating financial institutions can complete interbank payments on a distributed ledger and also offer an understanding of the functioning of a wholesale payment system using different DLT platforms and how modern payment system features, such as queues, could be incorporated to increase efficiency by reducing collateral needs. They also argue that developing a working prototype improved awareness of potential risks associated with DLT-based systems and how they can be

mitigated. Moreover, they argue that there are two key challenges in developing Project Jasper: i) establishing how to transfer value and ii) how to most efficiently settle payments with the minimum amount of digital depository receipt or liquidity.

Furthermore, (Chapman et al., 2017) concludes that the principles for Financial Market Infrastructure require that financial market infrastructures settle in central bank money whenever practical and available and that this usually means settling using accounts at the central bank. They explain that to do this, the concept of a digital depository receipt was used to represent Bank of Canada deposits and that it's a digital representation of currency that is issued by the Bank of Canada.

(Garratt, 2017) argues that this method used by Bank of Canada could be one of the approaches for a wider use of central bank money in the future and that digital depository receipts are issued in the system by the Bank of Canada and are backed one for one by cash pledged to the Bank by participants and also the exchange of DDRs for central bank money means there is no increase in money circulating in the banking system.

Actually, the digital depository receipts are used by participants in the system to exchange and settle interbank payments. The processing cycle of Project Jasper achieved ultimate settlement finality on the books of the Bank of Canada after exchanging digital depository receipts with the Bank of Canada for Canadian dollars transferred into their respective settlement accounts. For all intents and purposes, these digital depository receipts functioned as cash in the system.

(Bech and Hobijn, 2007) argue that historically speaking, interbank payments were settled using systems that conduct end-of-day netting between participants, but as volumes and values increased in these systems, central banks became concerned about the risks inherent in netting. In response, most central banks have opted for the implementation of real-time gross settlement systems. They conclude that with these systems, payments are processed individually, immediately and with finality throughout the day.

Phase 1 of Project Jasper was implemented as a pure real-time gross settlement system with every individual payment on the ledger being prefunded by digital depository receipts in the participant's wallet. Real-time gross settlement systems eliminate settlement risk at the cost of an increased need for liquidity. Liquidity demands on real-time gross settlement systems can be enormous, given the large values that are settled in these systems—typically up to one-fifth of a country's gross domestic product on a daily basis. To make real-time gross settlement systems less liquidity-demanding, operators around the world have implemented liquidity-saving mechanisms. The most effective ones are those that support settlement by periodically matching offsetting payments that have been submitted to a central payments queue and settling only the net obligations. However, offsetting algorithms cause delay in settlement, which is unacceptable for some types of payment. Banks therefore need a way to make these time-critical payments.

Phase 2 of Project Jasper explored the possibility of giving banks the choice of entering payments for immediate settlement or into a queue for netting and deferred settlement. Project Jasper appears to be the first public instance of implementing a liquidity-saving mechanism algorithm on a distributed ledger platform.

D. Cooperation between projects

(Bank of Canada, Bank of England and The Monetary Authority of Singapore,2018) jointly published a report which assesses alternative models that could enhance cross-border payments and settlements. The report examines existing challenges and considers alternative models that could in time result in improvements in speed, cost and transparency for users. This report provides an initial framework for the global financial community to assess cross-border payments and settlements in greater depth. Specifically, it discusses how a variety of payment models could be implemented, from both a technical and non-technical perspective. The MAS and Bank of Canada are now collaborating to develop possible technical solutions to the proposed payment models.

(Bank of Canada, Bank of England and The Monetary Authority of Singapore,2018) report has three main conclusions: i) the first is to conduct further research and experimentation to better evaluate the different models, in particular the hypothesis that a holistic approach to infrastructure change can deliver more far-reaching benefits than incremental improvements to the current model and this could include the creation of a technical proof-of-concept solution aimed at assessing the delivery of future-state capabilities; ii) the second is to consider further the policy implications of some of the more radical changes outlined in this report, particularly the impacts on the transmission mechanisms for monetary policy, whether broader access to central bank money settlement could drive improvements without large-scale infrastructure change, and the role of the RTGS operator in the future state, and iii) while this report has focused on change driven through revolution in the central payment infrastructures, further thinking could be done on how policy-makers and industry could work to get her on private sector innovation to address, in the shorter term, the challenges faced by users of cross-border payments.

VI. Conclusion

Central banks have to decide on whether to be passive and inertial or to be proactive regarding adoption of CBDC. In the passive approach central banks monitor development in the field of Fintech and utilize experiences of the other central banks pioneers in CBDC. As it might seem prudent, this brings several hidden risks taking into consideration the latest development in Fintech.

In this paper we found that central banks are already exploring logistical and technical detail considering CBDC. Furthermore, we also found that central banks are even exploring the models for mutual cooperation between distinguished projects for CBDC, which will eliminate the future issues of inability to agree on a single new technological standard for electronic payments.

But we suggest that decision on adoption of CBDC should consider not only economic aspects, but also social, technological, legal and other aspects.

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EUROPEAN PAYMENT SERVICES DIRECTIVE 2 IN NORTH MACEDONIA: ARE WE READY TO COMPLY?

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Abstract:

The Payment Services Directive 2 (PSD2) will have a profound and direct impact on the European banking industry. It is also widely accepted as a regulation producing ripple effects both in the banking and other sectors in and beyond Europe. Extending the first Payment Services Directive, PSD2 is intended to strengthen the security of online transactions, promote a more efficient and integrated payments market, protect customers, provide a level playing field between different payment service providers, and resolve all security gaps and risks that were not previously addressed. PSD2 creates space for innovative financial services, and by developing and advancing openness in banking, it calls into question the traditional banking models and imposes important operational and technological amendments to banks, their vendors, collaborates and the entire banking ecosystem mechanisms and function. PSD2 principles are also important for regulating the new Account Information Services (AIS) and Payment Initiation Services (PIS) along with the Third Party Providers (TPPs) - AISPs and PISPs. By properly synthesizing and analyzing the financial information from different banks and institutions, the former act as aggregators for the various customers. The latter, on the other hand, look to arrange and administer the financial transactions of their customers. Given the above considerations, this paper aims at answering three main questions about the PSD2. At first, we will take an in-depth look at the concepts and principal goals of the European Directive. Secondly, we will examine the implications of the EU regulation on the (1) legislative measures in the area of financial services and (2) day-to-day operations of both the central bank and commercial banks, or any other entity that may also be affected. Finally, this paper may serve as a guideline for the queries and dilemmas that managers in North Macedonia have about the PSD2, and may also assist by providing certain instructions and recommendations in managing change during the implementation process.

Key words: PSD2, financial services, change management, compliance, North Macedonia

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1. Introduction

The banking industry across the world, including Europe, is facing incredible dynamics both as a result of bottom-up FinTech disruption and top-down regulatory and strategic impulses. Our research interest lays in investigating what the Payment Services Directive 2 (PSD2) is about and what impact it would have on the European banking ecosystem, along with the banking in North Macedonia, as a candidate for EU membership. Since PSD2 is intended to strengthen the security of online transactions, promote a more efficient and integrated payments market, protect customers, provide a level playing field between different payment service providers, and resolve all security gaps and risks that were not previously addressed it creates space for innovative financial services, while by developing and advancing openness in banking, it calls into question the traditional banking models and imposes important operational and technological amendments to banks, their vendors, collaborates and the entire banking ecosystem mechanisms and function. For this reason, we will take an in-depth look at the concepts and principal goals of the PSD2 as well as its main components - the security articles, the Third Party Providers roles and positioning, to portray: 1) the emerging business models that come as result of the traced trajectory by PSD2 (and GDPR as its complementary regulation); 2) the respective current practices in banks; and 3) the existence and function of TPPs and countries' legislatives synchronisation for EU and candidate countries, such as the Republic of North Macedonia. We will therefore use a primary and secondary data as well as case studies and interviews with TPP and bank managers to answer our main question in discussion - are we ready to comply with PSD2? This is a work in progress and as such it outlines steps taken so far and intentions for the future research efforts and design.

The rest of the paper is organized as follows. Part 2 takes a look at PSD2, the reasons that led to its creation, and the goals behind this Directive. It also makes an in-depth analysis of PSD2 security details (Articles 97 and 98) and explains the new players created as a consequence of PSD2. Part 3 examines the business models that emerge as a result of the forthcoming changes. Part 4 focuses on the effects on and possible responses by the commercial banks. Parts 5 and 6 look closely into specific countries and their response to PSD2, i.e. North Macedonia and the way that the country prepares for the future implementation, as well as Croatia, an EU country that has already implemented the Directive and will serve as a comparison benchmark for the implementation in North Macedonia. Part 7 concludes and makes recommendations.

2. Payment Services Directive (PSD2): a brief overview

The European Commission adopted the original Payment Services Directive (2007/64/EC) in 2007, with the aim of increasing pan-European competition in the financial services market and creating a level playing field in that market by harmonizing the regulations on consumer and service provider rights and obligations. Even though this Directive was twice updated, in 2009 (2009/924/EC) and 2012 (2012/260/EC) (European Commission, 2007), it gradually started to become more and more outdated and unable to cope with the contemporary technological and financial advances. The lack of regulation on transactions with countries outside of the European Union, the lack of proper protection for the consumers and inability to encompass the market's heterogeneity were among the main issues of this Directive. However, the biggest problem lurking in the background was related to the payment services providers which emerged as a third party among the consumers and producers and which were neither mentioned, nor regulated by the Directive. These third party service providers were offering cheap and fast payment services, banking services, financial data aggregation and were also making online shopping easier for the customers. They started to appear increasingly each year. This

entailed the need to harmonize the rules, introduce licensing and supervision, as well as to standardize the security standards with the aim of fully protecting the customers. Addressing these problems and establishing a legislative that could bear with the contemporary and future issues meant that the European Commission had to prepare a Payment Services Directive 2 – PSD2 (EU/2015/2366) that would repeal the previous one and be adopted by the European Parliament on 8 October 2015. EU members had a two-year window in which they were supposed to incorporate its provisions into their national legislations. The PSD2 came into force on 13 January 2018 and had a final incorporation deadline in September 2019 (European Commission, 2015).

The PSD2 fundamentally changes the payments chain (or net), the business models of the commercial banks, the use of personal data and the customer's expectations and behavior. The key changes lodged by the PSD2 are: expanding the scope of payments to include non-EEA currencies for intra-EEA payments; mandating the use of the Shared Payment Charge SHA charging option for all intra-EEA payments, irrespective of the currency; standardizing the Complaint handling; setting the minimum standards for Strong Customer Authentication and paving the way for openness of banking by allowing the third party providers to enter the market. The last point is probably the most interesting for all actors in the market. What PSD2 actually does to promote openness of the banking ecosystem is the requirement for banks to open up their databases and permit an open access to third party providers (TPPs), which, by leveraging the available data, would become the new market players. They will shake up the finance and banking market to the core and will be able to conduct many operations which were exclusive to banks (of course the banks themselves are allowed to provide the same services as the new TPPs). The PSD2 foresees two types of TPPs: Account Information Service Providers (AISPs) and Payment Initiation Service Providers (PISPs) (Deutsche Bundesbank, 2018).

2.1. Main security aspects: Articles 97 and 98

Articles 97 and 98 of the Payment Service Directive 2 are crucial for security - one of the most important issues and concerns of PSD2 (around 70% of the population would not trust a third party service provider as much as they do in the banks) (Accenture, 2016). Article 97 lays out the foundation for secure payments by demanding strong customer authentication provided a string of conditions are met. However, a better understanding of the Article 97 requires explaining first what constitutes strong customer authentication. The Article 4 (30) of the Directive reads: “an authentication based on the use of two or more elements categorized as knowledge (something only the user knows), possession (something only the user possesses) and inherence (something the user is) that are independent, in that the breach of one does not compromise the reliability of the others, and is designed in such a way as to protect the confidentiality of the authentication data” (European Parliament and European Council, 2015a). This means that, when operating in his/her account, the user will have to provide at least two things, for example the password (something he/she knows) and the fingerprint scan (something he/she is); or a verification code sent to his mobile phone (something he/she possesses) paired with a login code or an answer to a security question (something he/she knows). The non-exhaustive lists of elements for all three categories were listed in an Opinion published by EBA on 21 June 2019. Besides, a voice recognition, retina and iris scan, hand and face geometry etc. are also included as possible elements of the inherence category. Apart from passwords and security answers, PIN codes, pass-phrases or memorized swiping paths stand for other possible elements of the knowledge category. As regards to the possession elements (other than receiving a one-use code on their mobile phones), users can also deploy their digital signature, scan a QR code, scan a card through a card reader or provide a proof of possession by using device binding (European Banking Authority, 2019). It's also worth mentioning that the European Banking Authority does not

consider card numbers, expiry dates and CVV numbers as elements belonging to both the knowledge and possession categories (Ecommerce Europe, 2019). It is allowed to use one device for both authentication and transaction, but the risk of deploying such multi-purpose devices (like tablets or smartphones) need to be mitigated by separate secure execution environments and mechanisms ensuring that such devices have not been altered or used in a fraudulent manner (MasterCard, 2018). Article 97, paragraph 1, states that the process will be required in three cases: when the customer accesses his payment account; when he/she initiates an electronic payment transaction; and when he/she conducts an action throughout a remote channel which may imply a risk of payment fraud or other abuses. Furthermore, in paragraph 2, the Article demands a strong customer authentication based on dynamic linking to a specific amount and a specific payee, and in paragraph 3, it demands an adequate security measures for protecting the confidentiality and integrity of the service users. Paragraph 4 states that the paragraphs 2 and 3 should always apply when payments are initiated through PISPs, whilst the paragraph 1 and 3 apply in case the user requires information throughout the AISP (European Parliament and European Council, 2015b).

Article 98, on the other hand, serves for a quite different purpose, i.e. laying a foundation, rather than regulating. The first paragraph of this article states that “EBA shall, in close cooperation with the ECB and after consulting all relevant stakeholders, including those in the payment services market, reflecting all interests involved, develop draft regulatory technical standards addressed to payment service providers ...” (European Parliament and European Council, 2015c). This means that the PSD2 and the article thereof would not regulate the requirements for Strong Customer Authentication (SCA), exemptions from Article 97, the requirements for confidentiality and integrity of users which the security measures have to comply with and the requirements for common and secure open standards of communication between all parties involved. Rather, the Article stated all things needed to address and handed over the responsibility by means of creating a Commission Delegated Regulation to the European Banking Authority (EBA). The EBA complied with Article 98, devised the Commission Delegated Regulation (EU) 2018/389 and put it into force on 27 November 2017 (European Commission, 2017). In the second chapter, the Regulation develops the security of online payments by setting strict rules for the authentication codes and dynamic linking. It also sets the rules for independence and mitigating the risks of SCA elements (knowledge, possession, inherence), while creating requirements and rules for their usage. The third chapter deals with the exemptions from SCA and lists the cases where SCA will not be required by the service providers. The exemptions are banded together in a way that each group is examined in its own article. The exemptions from SCA, through the articles 10 to 18, are listed as follows: accessing the balance of payment account or checking the transactions executed in the last 90 days; contactless payment of no more than 50 Euros, while having no more than 150 Euros of cumulative contactless transactions from the date of the last SCA and no more than 5 transactions since the last SCA; making a transaction at an unattended terminal for parking fees or public transport; making a transaction to a trusted beneficiary included in the list of trusted beneficiary by the payee himself/herself; paying for a recurring transaction, except for the first of each individual payment; credit transfers between different accounts of a same natural or legal person; remote electronic payments not exceeding 30 Euros, while having a cumulative remote electronic payment on previous transactions totaling 100 Euros since the last SCA application and no more than 5 consecutive low-value remote electronic payments without the SCA application; secure corporate payment processes and protocols available to payers who are not consumers, and where the authorities are convinced that these processes and protocols have at least the same level of security (as required by the PSD2), while transactions identified by the service provider are low risk according to the monitoring mechanisms of Article 2 of the Regulation (European Parliament and European Council, 2015c).

2.2.The new players- Third Party Providers (TPPs)

The Account Information Service Providers (AISPs) stands for the first type of newly created TPPs as a result of PSD2. AISPs are essentially aggregators of financial data for the customers. They sit between the user and various banks and financial entities relating to that user. Using the open Application Program Interfaces (APIs) that the banks are obliged to provide, AISPs, with the customer's permission, pull out the entire customer's financial data and then show it in a consolidated manner in their respective app or web platform. Using the entire data, these new players can also provide a financial or investment advice to their customers, or make an analysis of the customer's behavior and help them with their budgeting or spending. Historically, the banks have used a similar interface (SWIFT/MT940/MT942) in order to exchange transactions and balance information between themselves. With the new regulative, non-bank entities will now be allowed to replicate this functionality and become AISPs (Barclays, 2019). This kind of services can be provided by both banking and non-banking entities. The latter are not allowed making any transaction unless they have a permission to act as PISPs (Figure 1).

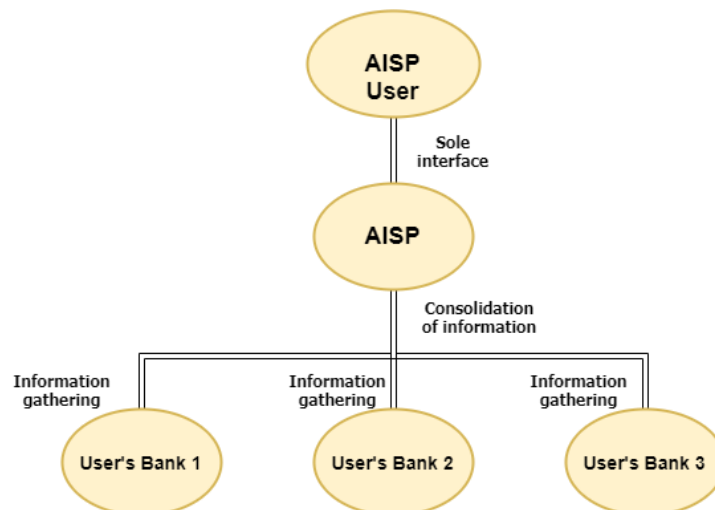


Figure 1. A graphic representation of how AISPs aggregate the user's data from different banks
Source: Authors' own representation.

PISPs (Payment Initiation Service Providers) are the second type of entities appearing at the financial market. They act as intermediaries in the payment process, i.e. they appear between the customers and their respective banks and facilitate the movement of funds. PISPs will become the only needed payment interface for their customers. When customer uses the PISP's application or web interface, he/she is in a position to initiate a payment from his/her account to any other account, without the need to visit both the bank or the its digital platform. Basically, the Directive allows for the non-banking entities to perform banking functions and skip certain steps in the payment process (as done before) (Barclays, 2019) (Figure 2).

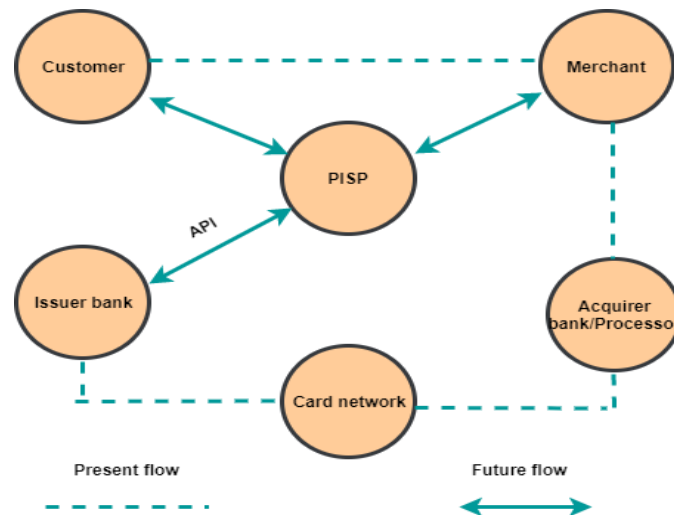


Figure 2. A graphic representation of how PISPs will change the flow of the current payment chain
Source: Authors' own representation.

3. Emerging business models

There are numberof ways businesses can compete in the newly created open banking environment. Strategy&, a business strategy consulting company, part of the PriceWaterhouseCoopers group, made a thorough analysis (Strategy&, 2016) and identified 6 business models (in banking) that companies have implemented so far showinghow the changes produced by PSD2 can be put into practice using tactical management (PetrevskaNechkoska, 2019). All six companies represent a prime example of a first-mover FinTech or bank that has already embraced open infrastructures and APIs, and have started generating value (linked to the PSD2 adoption)before anyone else.

The first example is Buddybank, an Italian modular digital bank (a subsidiary of UniCredit)based on modules from third parties. It has been launched on 29 January 2018;it is an app made exclusively for iOS smartphones and only available to UniCredit customers owning a MasterCard debit or credit card. It is based on domestically developed front end and API in Italy, and provides banking services through connections with partners. Buddybank provides quick and easy services to its customers, like digital storage of cards, which eliminates the need for a physical card and all associated risks.It also provides a free 24/7 access to a concierge and a possibility tosolve certain banking issues, such as the card replacement and transactions management in just a few seconds (Flynn, 2018).

N26 is a German direct bank starting in 2016 as a complementary bank and third-party interface powered by Wirecard's backend. It obtained a banking license in July 2016, and changed the names to N26(from Number26). It laid hold of a modular approach by integrating many APIs from partners and grew into the first pan-European direct bankproviding services in 22 EU countries. N26transforms its users' smartphone into a paying instrument, and provides its customers withcomplete and instant control over the entire credit and debit card functions.Customers may also sendmoney to their trusted contactsimmediately, with no need for having IBAN data. In 2016, Vincent Hauptert, a computer scientist who was able to easily extract the credentialsofthe bank's 33,000 customers, has found a number of security issues for N26.The bank has resolved these issues and thanked him publicly (Ghosh, 2016). However, in March 2019, N26 was a victim again, and this time through a malicious phishing attack leaving a huge number of users with account and data problems. The worst victim was

stolen 80 000 Euros from his account, whilst the bank had a very hard time responding to this crisis (Schlenk, 2019). This raised the question about the bank's too rapid growth making it incapable to cope with the digital security architecture (Jauernig, 2019).

Treefin is another German company which, unlike N26, serves as an AISP. It helps customers manage their investments, insurance policies and bank accounts by employing APIs that integrate multiple data sources into the free mobile app. The app analyzes the customer's data and provides an advice for optimizing the financial returns (Finconomy, 2017).

Satispay is an Italian company that uses APIs to provide P2P payment solutions. It is founded in 2013 and currently has around 500 000 users (Spini, 2019). The users of the free app are able to: send money to other people; make purchases in physical and online stores that are registered users of Satispay; pay vehicle taxes; and pay even for the Italian public services through the "pagoPa" system (Loda, 2018). Using the new PSD2 legislative, Satispay was able to simplify the data integration processes and create a standardized customer identification process. However, the Brexit situation has forced Satispay to move its headquarters from London to Luxembourg (La Repubblica, 2019).

Open Bank Project (OPB) is a German company (established in 2010) that provides an API-driven compliance toolkit for financial institutions. It basically means that banks and other entities can employ OPB to build infrastructure and standardize their work so they could comply easily with the PSD2. OPB also runs a community of developers working on APIs. The set of tools that OPB offers is comprised of: a dedicated interface; an API catalogue; SCA and exemptions tools; monitoring and compliance tools; security measures; a TPP registry, and a publicly available PSD2 sandbox (Open Bank Project, 2019).

The last example is Figo, a German B2B banking-as-a-service provider. Using the banking API, it provides a platform for data exchange by consolidating data from banks, credit card companies and other financial entities, and then offers it to FinTechs, third-party companies of other banks. It also offers services to banks choosing not to build an in-house infrastructure through a specially designed API which helps them to easily synchronize with the PSD2 requirements and implement the needed changes. It also offers the FigoRegShield, a full solution for PSD2 compliance and functionality for AISPs and PISPs (Figo, 2019).

Our investigation resulted in several other functional models of FinTech ecosystems. One example is the Projective Group Belgium, which is incorporating B-Hive, The Glue, SmartFin, Scale-Ups Europe and Epoch XX (Projective, 2019) to cover the necessary components for realising the PSD2 endeavours with clients. Other examples include subsidiaries that are outsourced, such as Exellys Belgium (Exellys, 2019) and the members of the European Payments Consulting Association (EPCA) (European Payments Consulting Association, 2019).

4. Banks' approach and responses

Strategy&, part of the PriceWaterhouseCoopers network, carried out another extensive research (Strategy&, 2016) into the PSD2 and its implications on banks. They interviewed senior executives from around 30 banks on the topic of PSD2 implementation and its impact on the banks' future. The most of executives had a mixed to negative perception about PSD2, with 88% believing that the Directive's implementation will affect their banks significantly. However, not many of them were sure neither about the exact effects nor about the direction in which their respective bank should float to answer accordingly. About 50% of the interviewees admitted they have a strategy initiative that should start very soon, though very few know the exact role of PSD2 in these initiatives and how it could help them creating new business models. The Strategy& analysts were actually able to distinguish between three particular mindsets with respect to PSD2: the threat mindset, the wait-and-see mindset,

and the catalyst mindset. The proponents of the threat mindset look at PSD2 as a test for their tactical response and compliance. They believe that PSD2 would rather be a source of expenditure, and they will probably have to defend their customer interface from the new competition by lowering prices. The second group of executives proved to be patient and still unable to devise proper ways to use the Directive in value creation. Their response is: complying with the Directive, waiting for major changes to occur, and then looking for an appropriate opportunity to expand their market reach and use the PSD2 to their own advantage. The third mindset sees the PSD2 in a broader context of global financial disruptions and perceives the Directive as just another catalytic force that thrusts the banking towards the ultimate goal of inevitable openness of this sector. These executives respond to changes and admit that the time for doing so is already deep in motion. In short, the Strategy & finds that the catalyst mindset is the only viable approach to PSD2. If banks don't want to find themselves subject to service commoditization and competitive marginalization, they have to respond promptly by creating new business models, embracing collaboration with their new partners and being open to the exchange of data via the application programming interfaces (APIs).

When it comes to actual implementation of a technical solution, a Miracl survey (conducted on around 70 top-tier European banks) shows that the approaches for complying with PSD2 are almost equally divided. Most banks (37.5%) have decided to build an in-house solution for compliance, one third has not made their decision yet, whilst 29.2% are ready to buy a technical solution directly (Miracl, 2017).

5. An EU country and PSD2: the case of Croatia

Croatia, as the newest EU member state and as a country that is geographically, economically, culturally and politically very close to North Macedonia, will serve as the best comparison benchmark for implementing and applying the Payment Services Directive 2.

Croatia adopted its national counterpart of PSD2, The Payments Act ("Zakon o platnom prometu", published in "Narodne Novine" no.66/2018) on 10 August 2018 and entered into force on 28 July 2018 (Narodne Novine, 2018). However, several articles were exempted and given a later date of implementation. Article 30, paragraphs 3 and 5, which refers to information provided by the payment service provider to the payment receiver after payment, will enter into force on 14 September 2019, and Article 48, paragraph 8, which makes a reference to the refunding rights for payments in Croatian Kunas (already authorized), will enter into force on 28 July 2020 (Eurofast, 2019).

The first example of new players in financial market of Croatia was the Swedish company "Instantor". This company has started to cooperate with "Ferratum", a Croatian small loans company, at the beginning of 2018. "Instantor" was charged with checking the financial background and credit score of the loan applicants. This was made by signing in the respective bank's online banking system and granting access to "Instantor" (Ivezić, 2018). Therefore, the company had to negotiate with each bank on the rights of access to customer data, but with the Payments Act entering into force, every FinTech entity, including Instantor, will automatically be entitled to this right. As of 10 May 2019, there is only one registered PISP entity in the Register of payment and electronic money institutions in Croatia, and no registered AISP entity (Hrvatska Narodna Banka, 2019). Given that only a short time has elapsed since the opening of market and that 37% of Croatian citizens are not ready to use payment services from entities other than banks (Hrvatska Udruga Banaka, 2018), 69% believe that banks are more capable to provide satisfactory level of user data protection and that 33% would never agree to provide their personal financial data to non-banking entities (PricewaterhouseCoopers, 2017), it is more than clear why there is no substantial movement in the market. However, when it comes to banks themselves offering these newly available services, Croatia may soon notice some new products on the market. In October 2017, the Croatian National Bank (HNB) created a taskforce,

which was obliged to produce a facilitating platform for developing innovative payment products and tackling the issues to implement “instant payments” into the Croatian financial system. The core members of this taskforce consist of seven Croatian banks and FINA (Croatian Financial Agency), aided by many other professionals in the fields of law, IT, cyber-security, finance and consumer rights. According to the Governor of HNB, the ultimate goal of this taskforce is to unify the various operations that will arise in the payment industry as a result of the multidisciplinary nature of PSD2 and its implementation. By the end of 2019, there will be some offer available on the market, whilst the Croatian citizens will be able to use payment products that Croatian banks will start offering (Eurofast, 2019).

6. EU candidates and PSD2: the case of North Macedonia

As a candidate country for EU accession, the Republic of North Macedonia was not obliged to implement the PSD2 and adopt national legislation ahead of the common deadline for all EU member countries. Therefore, the competent authorities and lawmakers (theoretically) have more time and space at their disposal to draft the text and adopt the national PSD2 legislation. Taking into account the current situation in digital banking and e-commerce in North Macedonia (i.e. not keeping up with the European standards and advancements), the late, rather than early introduction of PSD2 can be much more valuable, as the latter may lead to hasty and chaotic implementation.

North Macedonia currently operates under the Payments Act (Закон за платниот промет) from 2007 along with a wide range of complementary acts and regulations (Macedonian government gazette, 2007), which came under scrutiny in the past mainly for the lack of harmonization with the EU law, (especially with the Directive on settlement finality in payment and security settlement systems (98/26/EC)). In early 2018, the National Bank of the Republic of North Macedonia (NBRNM) drafted a Law on Payment Services and Payment Systems to overcome the harmonization problem and align with both the PSD2 and the ‘Electronic Money Directive’ (2009/110/EC). This new law is supposed to liberalize the market for payment services in North Macedonia and put into practice the needed mechanisms for starting up PISPs and AISPs (National electronic registry for regulations of the Republic of North Macedonia, 2019). It will guarantee the finality of payments, minimize the systemic risks of the payments system, and will also introduce the new payment instruments (e.g. direct loans). The initial date for the start of legislative procedure was 30 June 2019, but the Government of North Macedonia has postponed the process until 30 September 2019. The Government has also promised to hold three public debates on the draft document, pointing to the large number of interested financial institutions and entities that would like to participate in the law-making process (Government of the Republic of North Macedonia, 2019).

In terms of the situation in practice, the NBRNM, besides being the main driving force behind the draft document of the national law, works together with the Ministry of Finance to develop the national payment services market. With the aim of creating an environment that welcomes new players, NBRNM has created both a taskforce and a creative hub, working closely with the relevant financial institutions and already established domestic FinTech companies. With this collaboration, NBRNM wants to help other entities to better understand the forthcoming changes and help them prepare. But, NBRNM also wants to learn from them, especially from the FinTech companies, on how the new business models will be actually put into practice and what the NBRNM needs to change or implement, besides the new law, in order to help them to grow and thrive in the future (National Bank of the Republic of North Macedonia, 2019).

Although there are no PISP or AISP companies currently operating in North Macedonia, Seavus, a Macedonian company with international presence and clientele, works on developing IT solutions for

the foreign PISP and AISP companies. In June, Seavushas announced its partnership with the Swedish Marginalen Bank and that the companywould like to implement the PSD2 technical solutions.Seavus will also provideTPP management for the bank, management of the bank's APIs and their usage by the TPPs, as well as the ideas fornew ways to take advantageofthe PSD2 (Seavus, 2019).

7. Conclusion

Our attempt to observe an EU directive and its path to reality results in arich foundation for analysis on the triggers, responses and emergent effects across the EU and broader banking ecosystem. This paper attempted to portray, systematise, analyse and discuss recent developments on a trajectory to synchronisation and synergy of EU and non-EU stakeholders and collaborates in terms of banking related to PSD2. The EU developments with regards to PSD2 are visible, but uneven, and with moderate tempo resulting in extensions for reconfiguration and compliance, while the FinTech is leading its way; as a non-EU country, North Macedonia denotes awareness, work in progress and moderate tempo as well. To wrap up with our question, whether North Macedonia is ready to comply with the PSD2, we could say that the country has the needed capacity,capability, and readiness to align with the required legislation, but with no visible timeframe in practice. Even though the Government announced that it will start the process by 30 September, there is still no information available to the public and no actual date (or timeframe) by which it could be assumed that the law will be enacted in the Parliament. At the same time, the question of actually putting the new law into practice arises, since the Macedonian economy is still heavily reliant on the traditional methods of banking and commerce, whilethe mindset and consumer behavior of the majority of Macedonian citizens are not really welcoming to the modern and innovative payment services.Indeed, this conservative approach has to a certain extentsafeguarded the banking sector of the country on the wave of recent global financial crisis.Nevertheless, the North Macedonia's banking systemis expected to be in line with the EU developments and open banking ecosystem. Efforts to predict when and how the PSD2 will affect the economy of North Macedonia at this stage are still considereda non-deterministic, complex venture.

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INVESTMENT POLICY OF PENSION COMPANIES IN BULGARIA

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Abstract:

Pension funds are part of the social insurance system. The pension fund is managed by a Pension Insurance Company (PIC). Each company can operate a universal fund, a professional fund (for first and second category employees), a voluntary pension fund, and a voluntary fund under professional schemes. Undoubtedly, the world's population is aging. There are in-depth studies of the possible effects that population aging may have on financial markets and especially on public finances. In response to the aging process at the turn of the century, a global wave of pension reforms has been triggered. Pension companies and pension funds are in the focus of public attention. In the paper are discussed issues related to the investment policy of the Funds. The methods of analysis and synthesis, induction and deduction are used in the report.;

Key words: *pension funds, pension companies, investment policy, restrictions, PAYG-system*

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Because pension companies accumulate a lot of money through the funds (the resource of society), it is important to disclose how this resource is invested in complying with regulatory requirements for profitability and risk.

The purpose of this paper is to conduct an empirical study whether pension companies manage the money of society according to the principle of minimal risk and optimal profitability.

Bulgarian authors who carried out a survey in the field of the pension system are Danevaⁱ, Hristoskovⁱⁱ, Milev,ⁱⁱⁱ Dimitrov^{iv}.

The hypothesis, which the author takes as basic, is that there are reserves to optimize the investment policy implemented by the pension companies in Bulgaria. This statement assumes that:

- only one part of the different types of investments are in compliance with the restrictions imposed by law;
- the investment portfolio of the funds is of medium risk ;
- investment returns are optimal, but only for certain periods;
- the methodology for monitoring the portfolios of pension funds is not fully disclosed.

In order to have a possible discussion on the investment policy of pension companies, some clarifications need to be made about the nature of the funds and the nature of the pension companies

Theoretical review of the investment policy of pension companies

The Firstly - About the type of investments.

In order to protect the rights of insured persons, pension companies have to comply with certain restrictions, as shown in Table 1:

Table 1. Investment Fund Restriction

N	Investment instruments	Investment Fund Restrictions% of Assets (<or =)
1.	Securities issued or guaranteed by the Bulgarian State, the liabilities of which constitute government debt	No percent limit
2.	Debt securities with a specified credit rating guaranteed by international financial organizations	10%
3.	Bonds issued by a local authority of a Member State; bonds issued by a local authority of a third country as defined by an Ordinance; bonds issued by a third-country local authority which bonds are Investment Credit Rating	15%
4.	Corporate bonds issued or guaranteed by banks with more than 50 percent state ownership authorized to performance bank activities under the law of a Member State to finance long-term and medium-term infrastructure projects	10%
5.	corporate bonds admitted to trading on: a regulated market in a Member State; official stock exchange market in a third country	30%
6.	deposits which in one bank may not exceed 5 per cent of the Fund's assets	25%
7.	shares other than shares of a collective investment undertaking: traded on a regulated market in a Member State;	25%

N	Investment instruments	Investment Fund Restrictions% of Assets (<or =)
	traded on an official stock market or on another organized market in a third country	
8.	shares offered under the initial public offering under the law of a Member State for which a prospectus has been approved and published requiring an order the shares to be accepted and to be admitted to trading on a regulated market in a Member State for a period no longer than 12 months from their issue;	2%
9.	bonds offered under an initial public offering under the law of a Member State for which a prospectus has been approved and published requiring the acceptance of bonds and admission for trading on a regulated market in a Member State for a period no longer than 12 months from their issue;	2%

Source: (Social Security Code, 2018)^v

In accordance with the requirements of Social Security Code, funds can be invested in the following financial instruments:

1. *Debt securities issued or guaranteed by:*
 - (a) a Member State the liabilities of which constitute a public debt or its central bank;
 - (b) the European Central Bank or the European Investment Bank;
 - (c) a third country as defined by an ordinance of the Commission, the liabilities of which consist of sovereign debt or its central bank admitted to trading on a regulated market in a Member State or on an official stock exchange market or in another organized market in a third country, operating regularly, which is recognized and is publicly available;
 - (d) a third country other than those referred to in point (c), the liabilities of which consist of the sovereign debt or its central bank admitted to trading on a regulated market in a Member State;
 - (e) international financial organizations, in which case the securities have to have an investment credit rating;
2. *Bonds issued by:*
 - (a) a local authority of a Member State;
 - (b) a local authority of a third country designated by a co-ordination order, in which case the bonds have to have an investment credit rating and be admitted to trading on a regulated market in a Member State or on an official stock exchange market; on another regulated market in a third country that operates regularly, which is recognized and is publicly available;
 - (c) a local authority of a third country other than those referred to in (b), in which case the bonds have to have an investment credit rating and be admitted to trading on a regulated market in a Member State;

Corporate bonds issued or guaranteed by banks with more than 50 per cent state ownership authorized for banking under the law of a Member State to finance long-term and medium-term infrastructure projects for which the decision of the General Meeting of Shareholders and the offer to sign a bond loan is agreed to be admitted and is admitted to trading on a regulated market in a Member State within no more than 6 months from their issue

Corporate bonds admitted to trading on:

 - (a) a regulated market in a Member State;
 - (b) an official market in a stock exchange or another organized market in a third country that operates regularly, which is recognized and publicly available, and the bonds have to have an investment credit rating;

Bank Deposits with a minimum credit rating that are authorized to operate on the territory of a Member State; *Shares* other than shares in a collective investment undertaking, as well as in rights or warrants.

Investment property in EU Member State. According to the Social Security Code, in the table are defined the categorical restrictions for investment with the cash assets of the pension funds in the following financial instruments:

- Securities that are not fully paid;
- Investment of funds in securities issued by the pension insurance company managing this fund;

Secondly - Concerning the risk of the formed portfolio.

In Ordinance 34 of the Financial Supervision Commission are defined requirements related to risk reduction in investment.

According to this normative act, the pension insurance company may conclude transactions in the name and on account of a fund managed by it for supplementary pension insurance only if it is aimed at reducing the investment risks related to the assets of the fund.

These transactions must be consistent with the objectives and strategy for managing the investment risks identified in the investment policy of the supplementary pension fund, including the policy for their reduction.

The pension company may conclude a specific transaction in the name and on behalf of a supplementary pension insurance fund managed by it, provided that in the term agreed upon by the transaction:

1. it holds a hedged asset in the portfolio of the fund when the settlement of the obligations under the transaction envisages its physical delivery;

2. Maintains cash and / or fast liquid debt securities in the Fund's investment portfolio at a level ensuring the current settlement of the transaction liabilities and the necessary liquidity on the maturity of the transaction - when settlement of the liabilities is made in cash.

The person responsible for preparing the proposals for the conclusion of the transactions and the analysis of those transactions on the risk profile of the fund's portfolio, the person responsible for approving the transactions and the person responsible for controlling the risk of assets of the fund, the risk of hedging instruments and the assessment of their effectiveness, as well as the risk of the fund's investment portfolio, can not be the same persons.

The person responsible for preparing the transaction proposals and analyzing the impact of the transactions on the risk profile of the Fund's portfolio must:

1. identify the risk associated with the relevant asset of the Fund and the risk associated with the hedging instrument;

2. analyze the amount of risk associated with the particular asset of the fund, and to prepare a rationale for the extent that is predicted to be reduced;

3. assess the impact of the hedging instrument on the level of risk of the Fund's investment portfolio;

4. determine the sources of information that will be used in assessing the hedging instrument and choose the method that will evaluate its effectiveness;

5. assess the counterparty's compliance with the hedging transaction;

6. verify the existence of the selected regulated securities market in a specific list;

7. prepare in writing a reasoned proposal for conclusion of the hedging transaction to the person responsible for its approval.

Thirdly - Indicators on the level of an investment risk

The investment risk is related to the possibility (probability) that the achieved profitability deviates from the expected. Indicators of investment risk measurement in the management of pension fund assets the standard deviation from the yield and the Sharpe coefficient are adopted.

Standard Deviation is a statistical measure of scattering the values of a random value around its average arithmetic or expected value and is denoted by the Greek letter sigma σ . In the portfolio theory, the standard deviation is considered to be one of the main indicators for measuring the risk of the investment portfolio.

The standard deviation of a pension fund is characterized by the volatility in the yield obtained by the asset management of the fund, as measured by the daily fluctuations in the value of one share of the pension fund. Higher values of the standard deviation mean higher volatility of the yield achieved around its average or expected value (r) and therefore a higher risk.

If it is assumed that the yield of a pension fund is a random quantity described by normal distribution and its parameters do not change significantly, then in a sufficiently large number of cases in the intervals $(r \pm \sigma)$, $(r \pm 2\sigma)$ and $(r \pm 3\sigma)$ will fall respectively 68,2%, 95,5% and 99,7% of its specific values. $(r \pm \sigma)$, $(r \pm 2\sigma)$ and $(r \pm 3\sigma)$ will fluctuate respectively 68,2%, 95,5% and 99,7% of its specific values.

This can be illustrated with the following example: if the expected return of the fund is 12%, the value of the standard deviation is 3%, with a probability of 0.682, it can be expected that the achieved yield will take values in the range from $r - \sigma$ to $r + \sigma$. In summary, in 68.2% of cases, the yield will be in the range of 9% to 15%.

When comparing the disclosed investment results of pension funds, should be both of the yield obtained and the standard deviation of the yield should be taken. For example, if two funds have achieved the same return for a given period but have different values for the standard deviation, the fund assets with a lower standard yield deviation value were managed more efficiently because yields were achieved at a lower risk.

The Sharpe ratio is an indicator that compares the yield achieved with the management of an investment portfolio and the risk assumed to achieve that return. The formula

$$S = (r_p - r_f) / \sigma_p,$$

is used, where:

S is the Sharp ratio;

r_p - average return;

r_f - the average risk-free return;

σ_p - standard deviation of portfolio returns.

The construction of the indicator is based on the assumption that it is justified that the investment risk should be taken only to realize a profitability exceeding the so called " risk-free return. The mathematical Sharpe coefficient represents the ratio of the yield obtained over the risk-free premium to the standard deviation of the yield, that is, the Sharpe Index shows the amount of the remuneration received (risk premium) per unit of risk. When comparing two funds with different Sharp coefficient values, the higher-value fund provides higher return per unit risk.

In determining the investment performance of pension funds, as the risk-free yield value is perceived the Eonia index (effective interest rate on overnight deposits in euro), that is calculated and disclosed daily by the European Central Bank.

The pension insurance companies invest the insured persons' money in compliance with the following basic principles:

- Profitability and reliability: Achieving maximum yield at a selected relatively low risk level. In order to ensure a minimum return, specific reserves are formed in each fund.

The funds of the reserve are part of the net assets of the respective fund. In order to form this reserve, it is necessary that the achieved profitability is more than 40 per cent higher than the average yield achieved for the respective type of pension fund or exceeds by 3 percentage points the average - whichever is greater (the profitability above that percentage is earmarked for a reserve from the Fund). The value of the reserve may not exceed 1 per cent of the net asset value of the Fund.

The funds in the reserve are recorded and accumulated in a separate account, which is kept in levs and in units. The allocation of these amounts to the reserve is made by the pension insurance company on the first working day following the day of declaring the minimum profit by the Financial Supervision Commission.

When allocating funds in the reserve, the number of units in the reserve account increases and the value of one unit is reduced.

The number of units is determined by dividing the amount in leva by the value of one unit at which the greater of the two values (indicated above) is reached. When the amount of the reserve exceeded the limit of 1% of the net assets of the fund at the end of the business day preceding the day of the reserve, the reserve shall only be allocated to the part of the limit. The funds of the reserve are invested and reported separately from the own funds of the pension company.

- Diversification: the use of a wide range of investment instruments to prevent large losses, analogous to popular wisdom, "never put all eggs in one basket". Diversification is: sectoral, geographic, and asset classes:

- Diversification by economic sector - When choosing asset classes and regions where to invest, it is good to think about the different economic sectors where we can put our money. Technological companies are leaders in yields over the past 20-30 years, but they have experienced the largest decline during the economic crisis. In order to have a balanced portfolio, other industries such as pharmacy, finance, energy, consumer goods, mining, manufacturing, machine building and others should also be considered. Of course, the sectors of the future, such as the use of biometrics, biotechnology, space travel, etc., should not be forgotten.

- Diversification by geographic sectors - Unlike in recent years, Bulgaria now has access to investments in almost the entire world - from the US and Canada, from Asia to Europe. Each region has its own specifications and path of development. The geographical distribution of assets will limit our losses if a country or group of countries have any economic difficulties. If all the money is invested in one country, the savings could decrease relatively quickly. Such problems have influenced (and most likely will continue to have) Great Britain after Brexit.

- Diversification by asset classes - This is the most common division of the investment portfolio. Although many markets are linked and there are different classes of assets in which to invest. For example, they are bonds of companies, deposits, loans, investment goods, real estate and many others. The old understanding was that it is enough to have only shares and bonds in your portfolio to make a good diversification, but things have changed a lot in the recent years and now new assets such as P2P, ETFs, Cryptocurrencies and more are in demand.

- Investments according to the law: strict compliance with the requirements of the Social Insurance Code, aiming at higher security of the funds of the insured persons.

Methods and analyses

Information will be used from official pension fund sites. In order to be a representative sample, the data of 5 funds out of a total of 9 will be used, i.e. 55% of total data volume. The data will be observed for 5 consecutive years- 55% of the total data volume. The data will be tracked for 5 consecutive years.

Table 2. Applied limits for financial instruments (2014)

Pension fund	Debt securities issued by the Bulgarian state (without limitation)	Government Securities Issued and Guaranteed by a Third State, (10%)	Bonds issued by a local authority of an EU Member State; Bonds issued by a local authority of a third country as defined by an Ordinance; Bonds issued by a third country (15%)	Corporate bonds issued or guaranteed by banks with more than 50 percent state participation authorized to carry out banking activities under the law of a Member State (10%)	Corporate bonds admitted to trading on: a regulated market in a Member State; official stock exchange market in a third country (30%)	Deposits such as investment in deposits in one bank may not exceed 5 per cent of the Fund's assets (25 %)	Shares other than shares of a collective investment undertaking: traded on a regulated market in a Member State; traded on an official stock exchange market or another organized market in a third country exceeds the 25% limit of only one fund and this is CCB force (25%)	Shares offered under an initial public offering under the legislation of an EU Member State for which a prospectus has been approved and published requiring an order to accept the shares and to be admitted to trading on a regulated market in a Member State ; (2%)	Bonds offered under an initial public offering under the law of a Member State of the EU for which a prospectus has been approved and published requiring the admission of the bonds and their admission to trading on a regulated market in a Member State within a time limit - more than 12 months after issue; (2%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Toplina	-	45,00%	1,13%	-	11,26%	4,58%	9,23%	-	-
Saglasie	1,91%	1,29%	2,05%	4,36%	24,38%		-	-	-
CCB - sila	4,33%	23,94%	-	-	8,33%	1,40%	26,22%	1,23%	
Pensionno osiguritelno institut	39,59%	-	-	-	-	14,33%	20,92%	-	-
NN pensionno osigurjavane	11,64%	23,09%	-	0,83%	0,04%	4,00%	-	-	-

Table 3. Applied limits for financial instruments (2015)²

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Toplina	55,53%	3,10%	0,21%	-	18,00%	2,94%	2,43%	-	-
Saglasie	9,40%	-	-	-	8,90%	-	-	-	2,15%
CCB - sila	-	-	-	-	-	0,80%	-	-	-
Pensionno osiguritelno institut	39,59%	-	-	-	-	11,58%	21,43%	-	-
NN pensionno osigurjavane	19,30%	28,05%	-	5,09%	-	-	-	-	-

Source: (Financial Supervision Commission, 2015)

2 The columns in the table are the same.

Table 4. Applied limits for financial instruments (2016)³

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Toplina	46,45%	14,47%	15,00%	-	12,18%	-	6,13%	-	-
Saglasie	2,74%	2,83%	-	18,61%	6,92%	-	39,85%	-	-
CCB - sila	6,05%	27,04%	5,24%	-	4,68%		26,07%	1,53%	-
Pensionno osiguritelen institut	23,49%	32,52%	-	-	-	12,23%	-	-	-
NN pensionno osigurjavane	19,31%	24,45%	-	-	0,49%	0,00%	-	-	-

Source: (Financial Supervision Commission, 2016)

Table 5. Applied limits for financial instruments (2017)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Toplina	28,56%	-	3,28%	19,03%	7,82%	-	16,47%	-	-
Saglasie	20,65%	6,40%	-	-	4,51%	-	19,20%	-	-
CCB - sila	5,45%	24,91%	-	1,04%	2,90%		28,43%	-	-
Pensionno osiguritelen institut	24,09%	-	-	-	-	9,90%	29,20%	-	-
NN pensionno osigurjavane	18,69%	24,93%	-	6,58%	0,58%	-	32,17%	-	-

Source: (Financial Supervision Commission, 2017)

Table 6. Applied limits for financial instruments (2018)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Toplina	46,78%	2,89%	-	-	10,53%		16,78%	-	-
Saglasie	20,65%	6,40%	-	-	4,51%	-	19,20%	-	-
CCB - sila	28,32%	-	-	2,05%	8,56%		32,37%	-	-
Pensionno osiguritelen institut	22,33%	-	-	-	2,33%	7,83%	34,99%	-	-
NN pensionno osigurjavane	50,36%	6,99%	-	-	6,30%	1,37%	30,21%	-	-

Source: (Financial Supervision Commission, 2018)

³ The columns in the table are the same.

From the tables (Table 2, Table 3, Table 4, Table 5 and Table 6), the following conclusions can be made: For 2014, investments in the legally required limits for financial assets are reported. There are no restrictions on debt securities issued by the Bulgarian state. Government securities are debt financial instruments issued by the executive to cover the needs of financial funds.

As a form of government debt they are used to:

- budget deficit financing;
- financing of investment projects and specific programs’
- refinancing of government debt in circulation on the maturity date or before that date provision of payments under required government
- guarantees support the balance of payments of the country.

These securities are believed to be highly secured and there is no risk to pension funds and the retirement funds. The observed data ranged from 1.91% to 39.59%.

Regarding “Government Securities Issued and Guaranteed by a Third State”, excess over the norm is available for the Pension Found Toplina, CCB Sila and the Pensionno Osiguritelno Institut. The highest is the excess of Toplina AD. The main reason for this is the lack of transparency in the disclosure of data. Numbers are disclosed in common with other types of government securities, not to the requirements under the Social Security Code.

Similarly, corporate and municipal bonds are jointly disclosed. In the latter case, they should be arranged separately for years, even if some have not been invested, i.e. have zero values. Otherwise, the consumers of information will be misled and will not be able to make their decisions about making funds in the form of pension contributions.

With regard to "Shares other than shares of a collective investment undertaking: traded on a regulated market in a Member State; traded on an official stock exchange market or another organized market in a third country exceeds the 25% limit of only one fund and this is CCB sila (excess of 1.22%).

For 2015, the requirements for this indicator are strictly respected by all funds. The Financial Supervision Commission has disclosed with instructions checks on the activities of the Funds, including whether investment restrictions are respected.

For the same year, the only non-normative indicator is "government securities issued or guaranteed by third countries". NN pensionno osigurjavane did not meet the restriction. The indicator is higher by 18.05%. The main reason here is also the blurring of information, inaccurate presentation of the data by indicators according to the required ordinance.

For 2016, there is a deviation of the indicator "Shares other than shares of a collective investment enterprise" in "Saglasie" and "CCB - Sila". Fund “Sagalsie” has exceeded the set norm with 14.85% and the second pension fund with 1.07%.

For "Corporate bonds issued or guaranteed by banks with more than 50 per cent state participation authorized to carry out banking activities under the law of a Member State" there is a deviation of 8,61% for the” Saglasie” Fund indicator.

Doubts remain about the government securities issued or guaranteed by third countries. There is also a deviation in 4 of the funds, but for the reasons outlined above.

Pension Fund "Toplina" reports a certain deviation of 9.03% for the fourth indicator in 2017. The seventh indicator shows a minimum deviation for “Pensionno osiguritelno institut” and “CCB sila”. 2 funds again violated the limits for 2 indices.

For 2018, the picture improves. A deviation was observed in 2 funds in the seventh indicator with minimum values of 7.37% and 9.99%.

It is worth to make a note that the funds almost do not invest in bank deposits. The main reason for this is the almost zero return of this type of financial instruments. According to Bulgarian National Bank data, the annual yield varies from 0.10% to 0.50% for deposits according to their maturity.

Obviously, control must be stricter to meet the constraints. The supervisory activity, which the FSC, through the Insurance Supervision Department, exercised over the activity of the supervised entities is the control

over the legality of the activities of the pension insurance companies, the supplementary pension insurance funds and the custodian banks under the CSR. Supervision is carried out from distance and through on-the-spot checks. Documentary checks are also carried out on complaints of insured persons and signals from the pension insurance companies. The distance control is based on the financial statements and reports on the activity of 9 pension insurance companies (PIC), 28 additional pension insurance funds (APIF) and 8 custodian banks with the following periodicity of presentation: daily - for the activity of the APIF and the custodian banks; monthly, quarterly and annually - for the activity of PIC and APIF. The distance control takes place in three main directions - daily control, periodic control and monitoring of the information and advertising activities of the PIC.

It turns out that for the period under investigation acts of administrative violations were issued by FSC.

For violations of the Social Insurance Code for 2018, 2 acts for administrative violations have been drawn up and 1 penalty decree was issued, the amount of the sanction being 4380 levs.

For violations of the same Code for 2017, 10 acts^{vi} for establishing administrative violations have been drawn up and 3 punitive decrees have been issued, the total amount of sanctions being BGN 20 500. The comparatively small number of punitive decrees is due to the preventive effect of the sanctions imposed during the previous reporting periods, which have an educational and warning deterrent effect on the persons. For violations of the Social Insurance Code for the period 2014-2016, 89 acts for establishing administrative offenses were drawn up and 42 punitive decrees were issued, the total amount of sanctions being BGN 1800 000.

It is obvious that pension companies have the least violations in the last year of the surveyed period.

Although there is a certain non-compliance with the required norms, sanctions still have a positive effect on the insurance market.

Conclusion

Based on the analysis of real data on hypothetical assertion, the following conclusions are reached:

1. In certain cases, the disclosed data is summarized and does not exactly meet the criteria disclosed in the Social Security Code. This gives rise to "fuzzy", asymmetric information as to how much investment restrictions are respected;
2. The money invested in the pension funds does not always guarantee high profitability for the future pensioners. For the last year under review there is a negative profitability;
3. The hypothesis is proofed that at higher risk related to higher profitability . This is particularly pronounced for fund" Saglasie";
4. Sectoral diversification is good for all pension funds;
5. With regard to the geographic diversification of assets, it is not possible to make a clear analysis and to complete the information because 40% does not disclose specific information. What is declared is only to comply with the regulatory requirements in this respect;
6. Diversification by asset classes is optimal. There is no risk at this indicator.
7. There is no useful information about running the company-wide monitor of assets. Useful information should include data on how to conduct the monitoring, the frequency and type of control bodies (internal).
8. The hypothesis disclosed by the author is confirmed in all 4 positions.

As a general conclusion, it may be stated that more will is required to disclose transparent information on companies' sites. It is advisable for pension companies to prepare an investment policy which is consistent it with the inflationary or deflationary processes and the central bank management .

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A NEW DIGITAL AGE IN FINANCE: BLOCKCHAIN AND SMART CONTRACTS

Danchov Petrov¹

Abstract:

Digitalization in finance is an irreversible process, which manifests itself in many different dimensions. Blockchain is an innovative technology that can significantly increase the operational effectiveness of key processes in the financial services industry by reducing costs, enhancing the security and transparency of transactions, and speeding up the settlement process. The idea of smart contracts' implementation in blockchain is suitable for financial transactions, where a link between fulfilling contractual terms and performing actual transactions is established. The 'blockchain - smart contract' combination forces the execution of all transactions in accordance with the contract terms and leaves a door, wide open for the automation of key processes. What makes using a 'smart contract' beneficial is its ability to eliminate mediation from third parties, such as agents or trustees. The invasion of digital technology is expected to bring dramatic changes in the nature of financial intermediation. This research paper is focused on assessing the expected degree of blockchain penetration and its impact on selected key segments of the financial industry (e.g. global payments, trade finance, capital market trading, syndicated lending, insurance and compliance). Barriers and challenges to the new application's wide spreading are also analyzed. Based on this research, conclusions about the expected degree of applicability of blockchain in the financial sphere are drawn, and proposals for the initial steps in this direction are made.

Key words: *blockchain, smart contract, distributed ledger, financial services*

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Introduction

Blockchain technology has legalized its presence in the financial sphere with the appearance of the first decentralized cryptocurrency. The terms “blockchain”, “smart contract” and “distributed ledger”, completely unheard of until a decade ago, are not only gaining a growing popularity these days, but are also quite daringly changing “the rules of the game” and are seriously threatening the centuries-old foundations of financial intermediation. It is typical for technologies that are still in their embryonic, or early-development stage to be the focus of attention of experts and specialist community. As is the case with every new technology, blockchain capacities have not been fully explored. Research carried out by Janaviciene & Fomin based on data from 58 relevant articles, indicates the growing interest of the scientific community towards blockchain application in the context of economics, management and finance (Janaviciene & Fomin, 2019, pp. 310-320). The research focus of the present paper covers the following questions: is blockchain able to cause dramatic transformations in the financial service sphere, which segments are likely to be affected and what is the nature of expected changes?

Undoubtedly, the appearance of blockchain technology has generated a surge of high expectations. At present the debate about the future of this innovative technology extends over a wide range of issues – from skepticism concerning inflationary over-expectations to euphoric visions that what is to come will surpass our boldest fantasies. In the spirit of apocalyptic scenarios, Deutsche Welle broadcast a documentary about blockchain technology, with the provocative title “The end of banking as we know it?” (Deutsche Welle, 2019). A publication in the renowned journal “Harvard Business Review” however, proclaims blockchain as the technology that “could slash the cost of transactions and reshape the economy” (Iansiti & Lakhani, 2017). In the “White paper” series of the World Economic Forum in 2018 experts evaluate the effect of blockchain’s push on global trade over the next decade at the whopping amount of 1 trillion US \$ (WEF, 2018, p. 7). The cumulative size of investment in blockchain start-ups exceeded 1.5 billion US\$ as early as 2017, and forecasts predict that in 2025 the added value of blockchain business will increase to 176 billion US\$ (Growth of Blockchain Technology..., 2018). Experts expect the new technology will reform the financial services industry, just as the Internet and social networks have transformed the world of communications over the last two decades (Perez, 2015; Swan, 2015). The effectiveness of blockchain technology has never been questioned, as it “accelerates the movement of assets across the world in seconds and at minimal transaction costs” (EVERY, 2016). Apart from allowing the so-called peer-to-peer transfers, blockchains eliminates the need for intermediaries in performing settlement or clearing (Woods et al., 2017).

Blockchain-smart contracts performance

Blockchain uses encryption and complex mathematical algorithms for irrevocable records and data synchronization protected by eventual manipulation. The functional entity of blockchain can be described as a distributed ledger (DL) with supported identical copies of multiple computers, controlled by various users. What adds to the attraction of DL is the possibility for many users to share a generally accessible and constantly audited database (Casey et al., 2018). In the sphere of financial service industry the concern for credibility, confirmation and storage of information on performed transactions, are usually the responsibility of institutional intermediaries, who carry out clearing and settlement. The database they support is centralized and has a controlled access to information. The idea of using DL is about the history and the comprehensive transaction chronology being accessible and visible on-line by all authorized participants in the network (Buitenhek, 2016, pp. 111-119). Every participant in a transaction possesses a valid copy of the records in the network, which may, for

example, refer to the ownership of a given asset and the complete chronology of the deals performed with the said asset. The system of functioning of the register is absolutely decentralized and contains information that can be traced over time, about each particular transaction (Petrasic&Bomfreund, 2016). Another important advantage of blockchain is the acceleration of settlement and the time necessary for performing transactions. This results in a substantial reduction of transaction costs, as they are performed directly (peer-to-peer) between corresponding parties, without the need for validation or other type of interference by a trusted third party (Infosys Consulting, 2016).

The underlying principle of a DL-based blockchain is the shared storage of information, which leads to a practically zero-risk data loss. Transaction security is achieved by means of the processes of authorization and encryption. Should a particular node in the system fail, information will not be lost, but will be fully and entirely preserved, as every other participant has a copy of absolutely the same database. Besides, the DL also stores transaction chronology, and not just the closing balances, which protects the system against manipulation or falsification of data. Transaction validity is verified through a digital signature of the transaction participants. Signed transactions are arranged in separate blocks, where each block in the chain is assigned a unique hash code that is computer-generated following a complex mathematical formula. Changes performed on transactions will change the hash-code of the block they are stored. Further, on these changes are simultaneously reflected in all blocks along the chain. Thus, an eventual change will be first immediately registered, and second, instantly detected and traceable by all participants in the network (Petrov, 2019). One of the most substantial advantages to using blockchain in banking is the automation of the Know Your Customer (KYC) process. The average length of performing KYC activities and onboarding clients at present takes credit institutions over 26 days (Thomson Reuters, 2017). This period can be drastically shortened by using a digitized database. Participants can carry out KYC activities in real time, establishing the digital identity of the corporation through the DLT base functionality (McWaters et al., 2016).

Productivity of the technology can be multiplied by the ingenious combination of blockchain and smart contracts. The idea of implanting smart contracts into blockchain fits fine with financial deals where there is an interconnection between executing contractual terms and performing real transactions. It was Nick Szabo who first introduced the term “smart contract” and used the comparison with a vending machine to illustrate the principle of their functioning (Szabo, 1997). In the context of blockchain technology smart contracts are computer programs, recorded in DL, which are automatically performed by all nodes in the network. What makes using smart contracts valuable is the possibility to eliminate third parties – intermediaries such as agents or trustees. The blockchain – smart contract combination speeds up the execution of transactions in accordance with contractual terms. This minimizes the likelihood of conflicts appearing between parties and creates the prerequisites for payment processes automation. The autonomy, built in the basis of smart contracts allows for them to function on their own, without the need for routine control over the proper and correct execution of contract clauses. Apart from being autonomous, smart contracts are also self-sufficient, which means they do not depend on financing by their issuers (Van Oerle&Iemmens, 2016). From our expose, so far it is clear that a smart contract is a sequence of self-executing contractual engagements, which function through computer-generated codes for contractual terms of the “if-then” type models. A major advantage of theirs is the fact they provide higher security and possibility to track down legally valid transactions, which also considerably facilitates the work of regulatory bodies (Petrasic&Bomfreund, 2016). Apart from automated performance of real transactions, smart contracts “take over” the functions of the central register, as it is not necessary to employ an intermediary agency to perform clearing and settlement by independent information about transaction confirmation. Instead, a smart contract can be programmed to manage the whole cycle – from negotiating to closing the deal without human interference, while at the same time regulators receive up-to-date information about the activities performed.

Results and discussion

In which spheres of the financial service industry are there prerequisites for blockchain application? Based on the analysis of the specific peculiarities of the new technology, it can be claimed that the said technology could find an appropriate field of application in segments which suffer from problems like heavy load of document turnover between participants, predominantly manual transaction processing, delayed settlement, the presence of a chain of intermediaries, existing possibility for various parties to change terms and conditions and lack of transparency in the negotiation process. Following this approach, in the forthcoming text there have been selected certain specific segments of the financial industry, which are expected to be targeted by blockchain. Table 1 synthesizes problematic spheres within the said selected segments and the expected positive effects of blockchain application.

Table 1

Comparative profile of the current state within selected segments and expected effects of blockchain application

Status quo at present	With blockchain application
<i>Trade finance</i>	
Heavy procedures Complicated documentation Multiple stakeholders involved Burdensome document turnover between parties Manual transaction processing	Automation of key processes Automatic clause refreshment Operational security Reducing time and costs Accelerated supplies Eliminating superfluous intermediaries
<i>Global payments</i>	
Serviced by a third party clearing mechanism Heavy procedures: initiating payments, accounting, transaction coordination, closing balances High costs Prolonged payment process	Tracing the entire transaction history Clarifying all participants roles Reduced operating costs High degree of security in processing Quicker transaction execution Greater clarity and transparency
<i>Capital market trading</i>	
Availability of various clearing and settlement systems High counterparty risk Availability of a chain of intermediaries with certain transactions Awkward issuance procedures Slow and ineffective transaction reporting	Acceleration and facilitation of contract execution Reduced counterparty risk Higher effectiveness and transparency Conceptual change in issues, clearing, settlement and reporting More effective investment and data storage management
<i>Syndicated lending</i>	
Low degree of transparency in banking syndicate formation Unclear and non-transparent pricing Much too slow settlement High service costs Manual document processing	Increased transparency Reducing transaction procedure complexity Increased operational effectiveness Automating compliance procedures and fighting money laundering Improved KYC procedures

Manual data synchronization	
<i>Compliance</i>	
Difficulties in processing a growing information transfer	Providing reliable up-to- date information
Difficulties in data synchronization	Source of funds easily traced
Difficulties in AML processing	Minimization of manual data processing

Basic instruments of *trade finance* such as Letters of Credit, Bills of Exchange and Commercial Papers are at present characterized by cumbersome procedures, complicated documentation, multiple engaged stakeholders, heavy document turnover between the parties involved, and predominantly manual transaction processing. The advantages of blockchain in an industry where short-term trade intermediation is evaluated at 6-8 trillion US\$ a year are unquestionable (Tayeb & Lago, 2018). The application of blockchain and smart contracts would certainly have a positive impact on time and resource costs by means of procedure simplification through their automation. Part of the chain of intermediaries, such as numerous correspondent banks, becomes superfluous, which results in a higher operational efficiency and cost reduction (Deloitte, 2016).

In the sphere of *global payments* an advantage of blockchain is the possibility for every participant in the payments to trace the entire transaction chronology and the roles of all the parties involved. Contemporary payment systems achieve that at the expense of high costs of uncoded data exchange and messages between participants in the payment process. Interbank payments at present rely on servicing through a clearing mechanism provided by a third party. Clearing and settlement intermediation makes the payment process longer and more expensive, as this requires the performance of activities like data storage, coordination, initiation, confirmation, execution and transaction reporting, etc. (Guo & Liang, 2016). The process of data exchange in DL is considerably alleviated in terms of administrative procedures and manual information processing, which considerably lowers operating costs. In addition, payment process is much more secure and speedy, owing to the encrypted identification of participants and the impossibility for intentional data manipulation.

Contemporary *securities trading* is based on a large number of clearing and settlement systems. A survey by Goldman Sachs Investment Research (2016) shows that capital markets can save costs of 6 billion US\$ a year by applying blockchain. The survey is limited to four cash instruments, therefore the real amount of costs saved is expected to be higher. Transactions using blockchain could radically transform capital markets trade, which is based on standard requisite instruments, i.e. maturity, nominal value, coupon, payment date, etc., which in turn can be a smart contract components. This will bring about revving up and facilitating the execution of negotiated agreements between the parties involved in the deals. Derivative contracts are also built on specific parameters which can be transformed into a smart contract with algorithms for calculating Mark-to-market value, margins, options and conditions for exercising. In the case of swaps and OTC (over-the-counter) derivatives, where every contract is unique, their specific algorithm can be “embedded” in separate smart contracts. The use of DL could be beneficial in trading certain hybrid instruments, such as CoCo type bonds (contingent convertible bonds), which are characterized by a complicated structure, combining elements of debt financing and equity (Deloitte, 2016). Blockchain conceptually changes issuing, the processes of notification and renewal of current balances, balance sheets, clearing, settlement and reporting, which increases the effectiveness of investment management and information storage. A number of studies seem to share the view that there will be favourable conditions for the application of blockchain in the *syndicated loan market* (Rutenberg & Wenner, 2017; Turner, 2016; Anupam et al., 2016; Padmanabhan & Komma, 2016). These expectations are based on the existence of factors, which

at present have a negative impact on the efficiency of the said market, and namely: the low degree of transparency in the processes of bank syndicate formation and loan pricing, the much too slow settlement and high costs of administrating and servicing syndicated loans (Anupam et al., 2016). Using the DL architecture of blockchain technology, banks can combine into single block diverse tasks such as local regulations, KYC or anti-money laundering. Banks within the syndicate will benefit from the increased transparency of deals, reducing deals complexity, cutting the time and costs of researching the customer and compliance with local regulations. In general, the benefits of introducing blockchain for the participant banks in syndicated loans can be summed up in the following components – higher security, reducing the time for transaction execution, lower transaction costs and increased operational effectiveness (Petrov, 2018).

Last, but not least, the application of blockchain is expected to rationalize the activities of the authorities and institutions in the sphere of *regulations and compliance*. Maintaining compliance with standards and regulations has turned into a routine for financial institutions. Audit, tax reports, stress-tests and harmonizations of activity with regulatory requirements are an essential part of the functioning of today's financial market. The ever increasing transfer of information, coming from various sources, subjects and channels makes it difficult to process this information and its synchronization by regulatory bodies. Blockchain could substantially alleviate the work of regulatory and supervisory bodies by always providing updated and reliable information about performed transactions (Goldman Sachs, 2016). One of the socially significant benefits for supervision from the implementation of the new technology, is associated with the function of “counteracting money laundering”. Regulators will be able to easily trace the origins of funds and transaction history in DL without having to require and process multiple declarations and reports to be submitted by transaction participants.

Conclusions

Despite the expected positive effects blockchain application, there are certain concerns, generated by the disruptive potential of the new technology, which cause some anxiety among financial intermediaries. There are all the reasons for blockchain to be classified among the type of technology, which are able, with an enviable boldness and ease, to change “the rules of the game” and drive the existing major “players” out of the market in today's financial industry. The appearance of disruptive technologies, such as blockchain, could be interpreted as a threat against the status quo of the so called “systemic” market actors and thus meet their fierce resistance. There are other unsolved problems facing the wide-scale application of blockchain, of technological, legal and ethical character. The challenges in this aspect can be summed up as follows:

- A legal framework is necessary, so that regulatory bodies could exercise their supervisory functions more easily;
- Clarity seems to be missing about how conflicts arising between counterparties will be resolved. Although records in DL are credible and irrevocable, should, for example, a dispute occur between two banks, or there is litigation, it is not clear how these will affect the status of their transactions.
- Automation of KYC activities can be achieved if there is mutual understanding and agreement among partners concerning the building of a uniform rating system.
- The cost-benefit assessment of using the technology may vary considerably among financial players. This can question the benefits of cooperation between participants and the return on investment in the technology.
- When computer algorithms replace the human factor, there are many issues of moral and ethical character which remain “hanging”.

The successful overcoming of obstacles facing the implementation of the technology is a challenge and a prerequisite for an evolutionary jump in financial services. From this view point, a number of steps can be taken in the following order: test pilot projects in real market conditions within selected segments of the financial service industry; create the necessary legal regulatory infrastructure for blockchain functioning; start initiatives for building a uniform rating system which should allow an automated KYC process.

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**EVALUATING DATA ANALYTICS ADOPTION IN SELECTED
COMPANIES OF THE FINANCIAL SECTOR IN THE REPUBLIC OF
NORTH MACEDONIA**

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Abstract:

Data analytics has become one of the driving forces for digital transformation efforts of companies around the world (Keary, 2019). Nowadays, in a highly digitized environment, companies generate data across different sources which is increasing rapidly in volume, variety and velocity. There is no doubt that companies can use these datasets for creating a more efficient services that deliver a more targeted customer experience. Hence, the importance of data analytics has become essential for organizations to find new opportunities and gain new insights to run their business efficiently.

Emerging literature and the empirical evidence suggest that companies from the financial services sector have a lot to gain by adopting data analytics (minimize risks, detect fraud, improve credit risk management, improve marketing activities in real time etc.).

In spite of that, companies in the country are still in the early stages of adoption of data analytics technologies. This research is a pilot study and represents the first attempt to assess the data analytics adoption maturity in selected companies of the financial sector in the country.

The methodology used in this research for evaluating data analytics adoption is based on Maturity Model for Data and Analytics (IT Score for Data and Analytics) (Gartner, 2017), since it best describes maturity levels in service sectors. The assessment is founded on interviewing managers using questionnaire that guides respondents through all dimensions and levels proposed by the model.

In the model four measurement areas are analyzed: Strategy, People, Governance and Technology. For each area, five maturity levels are defined: Basic, Opportunistic, Systematic, Differentiating and Transformational. Survey results confirmed that analyzed companies fully understand the benefits of data and analytics as valuable source to gain competitive advantage from data and the overall level of data and analytics maturity is set on level 2 for almost all dimensions.

Key words: *data analytics, organizational maturity, financial sector, Republic of North Macedonia*

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1. Introduction

The number of companies in all industries worldwide using and benefiting from data analytics is increasing over the past years. Data analytics, especially big data analytics and predictive analytics, as a form of advanced analytics are among major trends companies worldwide are embracing. There is no doubt that more companies are attempting to drive value and revenue from their data (Forester, 2017). Data science has already proved itself and its values are realized and appreciated across many different sectors and industries such as in high tech, media, telecom, retail, banking, financial services, security, healthcare, shipping and many others (McKinsey, 2016). But in spite enormous possibilities and benefits that can be gained from data, becoming a data-driven organization is not an easy trip at all. It is more evolutionary rather than revolutionary journey. Companies need to mature over different data and analytics aspects and dimensions in order to become data-driven organizations. In this context, a data-driven organization is an organization where every person who can use data to make better decisions has access to the data they need when they need it. Being data-driven is not about seeing a few canned reports at the beginning of every day or week; it's about giving the business decision makers the power to explore data independently, even if they're working with big or disparate data sources." (<https://www.infoworld.com>). Being data-driven is not only about the usage of data analytics technologies. It is a complex strategy of gaining competitive advantage of available data. But the main question for every organization is how analytically mature one organization is, in order to exploit the full potential of data and data analytics technologies. Analytical maturity refers to companies being capable to conduct their business processes to its optimal levels from the application of use-case specific applications to full-scale analytics transformations. According to the recent Gartner Survey on Data and Analytics (Gartner, 2018), most organizations should be doing better with data and analytics given the potential benefits, since organizations at higher maturity levels (ex. transformational levels of maturity) enjoy increased agility, better integration with partners and suppliers, and easier use of advanced predictive and prescriptive forms of analytics. This all translates to competitive advantage and differentiation. But, Gartner's recent worldwide survey of 196 organizations (Gartner, Inc. 2018), showed that 91% of organizations have not yet reached a "transformational" level of maturity in data and analytics, despite this area being a number one investment priority for CIOs in recent years. This confirms that the path of becoming analytically mature organization is complex socio-technological issue.

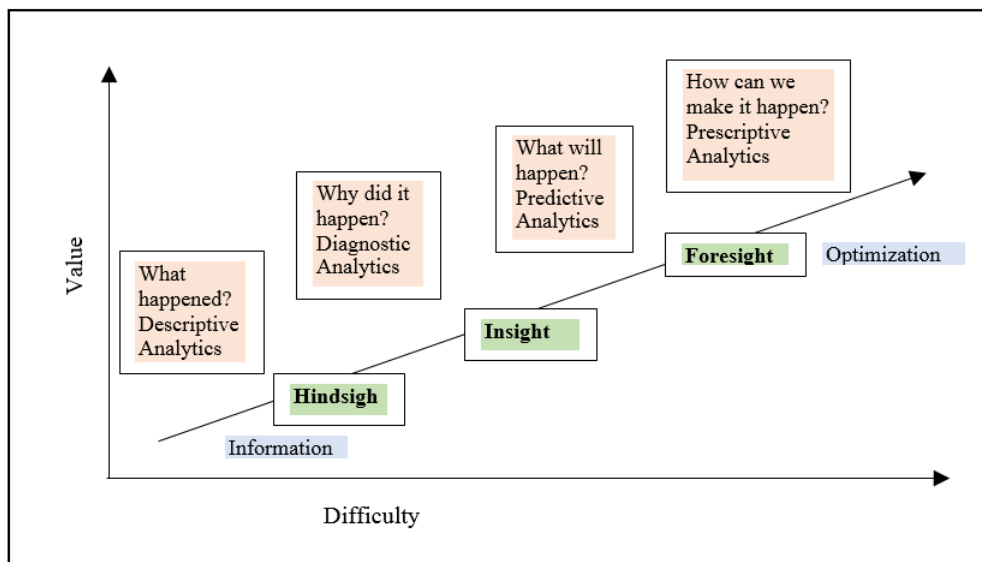
Nowadays, in a highly digitized environment, companies are overvalued with data generated across different sources (information systems), which is increasing rapidly in volume, variety and velocity. There is no doubt that they, companies can use these datasets for creating a more efficient services that deliver a more targeted customer experience. In order to find new opportunities and gain new insights to run their business efficiently, as well as to determine patterns and predict future outcomes and trends, predictive analytics, as a form of advanced analytics represent important tool companies can utilize to extract valuable information from existing data sets (historical, transactional etc.). The value chain model of analytics, developed by research company Gartner is a good way to visualize the transition between traditional business intelligence and predictive analytics. According to Koch, 70% of high-performing companies are integrating real-time predictive analytics into their business operations (Koch, 2015).

Figure 1. The value chain model of analytics

Source: Gartner.com

Since the essence of industry competition is changed, competing effectively means developing capabilities for storing, processing, and translating the data into actionable business insights. The most significant changes driven by data science are reported in high tech, media and telecom, finance, consumer and retail (McKinsey, 2016).

In the banking and financial services sector, through data analytics, institutions can monitor and assess large amounts of customer data and create personalized/customized products and services specific to individual consumers (<https://www.osganalytics.com>). Leveraging data



technologies will not only help financial institutions maximize the value of data but will also help them gain competitive advantage, minimize costs, convert challenges to opportunities, minimize risks, detect fraud, improve credit risk management, improve marketing activities in real time etc. According to the latest Worldwide Semi-Annual Big Data and Analysis Spending Guide, worldwide revenues for big data and business analytics will go up to more than \$203 billion in 2020 (<https://www.osganalytics.com>). The applications for data analytics are significantly growing day by day because of various innovations in the field. Out of this \$130 billion market share, the banking sector leads revenues with a contribution of \$17 billion in 2016. (Data Analytics in Banking and Financial Services Report, 2017).

Quantitative finance is an area in which leading finance institutions and firms are adopting advanced data technologies towards gaining actionable insights from massive market data, standardizing financial data from variety of sources, reducing the response time to real-data streams, improving the scalability of algorithm and software stacks on novel architecture. The three natures of Big Data (volume, velocity and variety) are used as tools in order to understand the pitfalls and possibilities of new technologies towards financial services (Fang and Zhang, 2016). The logical question to be pass is – How data science can benefit banking industry? Namely, there are five benefits for the banking industry (www.pwc.com).

- Better customer targeting and ensuring growth – by understanding clients and by using analytics of their transactions resulting in higher levels of retention and acquisition.
- Enhancing risk assessment – by advanced early-warning systems banks can lower the risk and become aware of fraud more quickly.
- Improving productivity and decision making – for example better placement of ATMs and how much cash is required at each ATM.

- More business opportunities – for example, sharing data with other companies, with customer consent.
- Digital banks- internet-based banks – the trend is here to stay, and there are possibilities for analysing real-time data.

All authors that are researching data-driven analytics for financial services underline the importance of solid data management foundations. Egetoft, a senior solution architect of the Financial Services Industry Unit at SAP, explains that by capturing and leveraging massive volumes of data, financial services companies can capitalize on new data-driven business opportunities. Only after successfully completed first step i.e. creation of a solid data management foundation that supports the analysis of both enterprise data and Big Data, Financial institutions can begin implementing machine learning algorithms to support automated decision-making and data-driven process optimization in order to generate insights that create better customer experiences, improve operational efficiency, and drive sales. Machine learning algorithms can enable customer-facing use cases, optimize risk controls and business outcomes, automate business processes, improve operational efficiency and enable self-service analytics for everyone (for workers across all levels).

The financial sector is certainly an exciting industry to analyze regarding digital transformation as it poses new opportunities and capabilities that were previously unimaginable as little as decades ago. The importance of data analytics in the banking and financial services sector has been realized by the established banks that have already started reaping the benefits. According to Data Analytics in Banking and Financial Services Report, 2018, a leading industry survey conducted for 20 banks across EMEA region revealed that there were certain improvements, which if worked upon could deliver great returns (for example, in one of the banks through analytics false discount patterns were corrected leading to 8% increase in revenues within few months) (Data Analytics in Banking and Financial Services Report, 2018).

2. Literature review

The real application of analytics in companies is still in its initial stages and strongly differ (Lismont et al., 2016). Analytics in companies matures differently from different aspects/dimensions and in different parts of an organization (departments). That means that in practice, the maturity path of an analytical organization is not the same and straightforward in all dimensions and departments. It is not unfamiliar that analytics is differently propagated throughout companies as they mature with a larger focus on department-wide or organization-wide analytics and a more advanced data governance policy (Lismont, 2017).

According to the Data and Analytics Global Executive Study and Research Report (2018) prepared by MIT Sloan Management Review, innovative and analytically mature organizations make use of data from multiple sources: customers, vendors, regulators, and even competitors. By using all the data available, organizations are ready to empower the process of decision making in different business aspects.

Mainly consulting groups advocate different analytics maturity models/frameworks. One of the latest is the Analytic Processes Maturity Model (APMM) for evaluating the analytic maturity of an organization (Grossman, 2018). The APMM identifies analytic-related processes in six key process areas, defined as: 1) building analytic models; 2) deploying analytic models; 3) managing and operating analytic infrastructure; 4) protecting analytic assets through appropriate policies and procedures; 5) operating an analytic governance structure; and 6) identifying analytic opportunities, making decisions, and allocating resources based upon an analytic strategy. Based on this model, the APMM framework of Grossman (2018), organizations can differ i.e. reach five maturity levels

defined as: level 1 -organizations that can build reports level 2 -organizations that can build and deploy models; level 3 -organizations that have repeatable processes for building and deploying analytics; level 4 -organizations that have consistent enterprise-wide processes for analytics; and level 5 - enterprises whose analytics is strategy driven. This framework uses the Capability Maturity Model - CMM that is the basis for measuring the maturity of processes for developing software (Grossman, 2018).

Another approach which provides estimation of analytics maturity i.e. analytical maturity levels differs organizations in three major categories based on their relative level of sophistication in adopting analytics i.e. 1) the Analytically Challenged organizations display limited analytical capabilities; 2) Analytical Practitioners largely use analytics to track and support performance indicators; and 3) Analytical Innovators incorporate analytics into virtually every aspect of their strategic decision-making, including gleaning data from a variety of sources such as direct measurement and sensors, industry data, and third parties (Ransbotham and Kiron, 2018, p.7).

According to the defined methodology, the calculation of the Analytics Core Index, based on the organization's core analytics capabilities in three major areas like: (1) ingesting data (capturing, aggregating, and integrating data); (2) analyzing data (descriptive analytics, predictive analytics, and prescriptive analytics); and (3) applying insights (disseminating data insights and incorporating insights into automated processes) is possible. The Analytics Core Index is calculated by assessing how effectively the organization performs these seven analytics-related tasks and activities: 1. Capturing data, 2. Aggregating/integrating data, 3. Using descriptive analytics, 4. Using predictive analytics, 5. Using prescriptive analytics, 6. Disseminating data insights and 7. Incorporating analytics insights into automated processes (Ransbotham and Kiron, 2018, p.9). The assessment is based on a five-point scale ranging from very ineffective to very effective. This means that organizations that make effective use of a wide range of data sources — from different types of technologies and different types of entities, such as customers, vendors, competitors, and publicly available sources — are more likely to use analytics to generate higher levels of customer engagement and gain a competitive advantage than organizations that use fewer sources of data. (Ransbotham and Kiron, 2018, p.9).

Another maturity model widely used, especially in the service sectors is Maturity Model for Data and Analytics by Gartner, which explains the evolution of data and analytics efforts of companies by taking steps in four areas: strategy, people, governance and technology. Organizations are under increasing pressure to improve their analytics capabilities. Using this maturity model will enable data and analytics leaders to develop an organizational and technological roadmap. For each area, five maturity levels are defined: Level 1: Basic, Level 2: Opportunistic, Level 3: Systematic, Level 4: differentiating and Level 5: Transformational. This model is the basis for our research since it best describes data and analytics maturity in service sectors.

3. Methodology and results

Models of maturity are designed to help organizations take a comprehensive approach to digital transformation. In general, digital transformation at the global level is strongly expressed in the service sectors especially in the finance sector (Westerman and McAfee, 2012) and service industries are recognized as leaders in digital transformation projects worldwide. This counts for the financial sector in the country as well.

This survey was conducted in the banking sector in the country which is one of the most advanced service sectors and hence represent a benchmark concerning the digital transformation. The concentration of the banking sector remains high, since three of the commercial banks (largest banks) account for more than 60% of total assets in the banking system. Behind these three large banks, the

market is still highly fragmented but it has undergone a significant transformation over the past years and a majority of the local banks having been acquired by foreign investors.. Therefore, our sample of four banks can be considered as representative for this pilot study, having in mind that it comprises largest banks in the country.

According the defined methodology based on the Maturity Model for Data and Analytics (IT Score for Data and Analytics) (Gartner, 2017) four different aspects of digital maturity are assessed. This model suggests that companies can evolve their capabilities for greater business impact in data and analytics by taking simple steps in the four areas: strategy, people, governance and technology. If one organization wants to maximize the value of its data assets, they must improve maturity levels in these specific areas, by moving through five levels of maturity in each area: basic, opportunistic, systematic, differentiating and transformational. The first area is *Strategy*. A good data and analytics strategy starts with a clear vision. In this context, vision can be defined as the business value that data and analytics can bring. This model, suggests that an initial coordination with IT and business leaders is needed in order to develop a holistic BI strategy. Then, a short-term roadmap with achievable goals, clear milestones, performance measurements and monitoring should be created. The second one - *People*. This area imposes the importance of data scientist skills. It states that a company should anticipate upcoming needs and ensure that the proper skills, roles and structures exist, are developed or can be sourced to support the work identified in the strategy. If one company has limited analytics capabilities in-house, it is better to strive for a flexible working model by building virtual BI teams that include business-unit leaders and users. The third area is *Governance*. This area refers to the governance program. Most organizations with low BI maturity don't have a formal data governance program in place. Governance should be considered as the "rules of the game." Those rules enable the organization to balance opportunities and risks in the digital environment. The models suggests that a company should start by creating an inventory of its information assets, where they are located and who uses them. Then, a so called "an agreed-to" framework for working with the data should be established. The last is *Technology*. The last area which is considered as the basic enabler on data and analytics adoption in companies is technology itself. But acquiring new technology although essential, it is not the only thing that will lead companies to reach transformational levels of maturity in data and analytics. To improve analytics maturity, a company should create integrated analytics platforms that extend its current infrastructure to include modern analytics technologies. Organizations with limited technological resources and a scarcity of analytics talent should consider packaged applications that best fit requirements and company culture for a quick start.

These four areas are measured through five levels of maturity: level 1 – *basic*, level 2 - *opportunistic*, level 3 - *systematic*, level 4 - *differentiating* and level 5 – *transformational*.

The suggested maturity model which defines data and analytics adoption level of an organization through four areas and 5 levels of maturity is illustrated in Figure 2.

Level 1 Basic	Level 2 Opportunistic	Level 3 Systematic	Level 4 Differentiating	Level 5 Transformational
<ul style="list-style-type: none"> Data is not exploited, it is used D&A is managed in silos People argue about whose data is correct 	<ul style="list-style-type: none"> IT attempts to formalize information availability requirements Progress is hampered by culture; inconsistent incentives 	<ul style="list-style-type: none"> Different content types are still treated differently Strategy and vision formed (five pages) 	<ul style="list-style-type: none"> Executives champion and communicate best practices 	<ul style="list-style-type: none"> D&A is central to business strategy
<ul style="list-style-type: none"> Analysis is ad hoc Spreadsheet and information firefighting Transactional 	<ul style="list-style-type: none"> Organizational barriers and lack of leadership Strategy is over 100 pages; not business-relevant Data quality and insight efforts, but still in silos 	<ul style="list-style-type: none"> Agile emerges Exogenous data sources are readily integrated Business executives become D&A champions 	<ul style="list-style-type: none"> Business-led/ driven, with CDO D&A is an indispensable fuel for performance and innovation, and linked across programs Program mgmt.. mentality for ongoing synergy Link to outcome and data used for ROI 	<ul style="list-style-type: none"> Data value influences investments Strategy and execution aligned and continually improved Outside-in perspective CDO sits on board

D&A = data and analytics; ROI = return on investment

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Figure 2. Maturity Model for Data and Analytics (IT score for data and analytics)

Source: Gartner

We surveyed managers from four banks (the biggest on the country). Higher level managers were approached and they were asked to tick different characteristics of different levels that apply to their companies. Average level was assessed by the research team. The results of the survey confirm that analysed companies fall somewhere around level 2 or 3 for almost all dimensions. More precise, results for each dimension are shown in the table below.

Table 1: Survey results

	<i>Strategy</i>				<i>People</i>				<i>Governance</i>				<i>Technology</i>			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
<i>Level 1 Basic</i>																
<i>Level 2 Opportunistic</i>	●															
<i>Level 3 Systematic</i>		●														
<i>Level 4 Differentiating</i>																
<i>Level 5 Transformational</i>																

Concerning the first pillar, *strategy* analysed banks are between level 2-opportunistic and level 3 – systematic (two banks are on level 2 and two banks on level 3). This means that they have formulated clear strategy and vision towards data and analytics and they make attempt to formalize information availability requirements. Still there is no uniform content/data types, but different content types are still treated differently. In the banks on level 2, data and analytics efforts are still managed in silos. For the score of the analysed banks in the second area – people it can be concluded that the answers are more dispersed meaning that there are banks at level 1, 2 and 3. This reveals that the data and analytics progress is hampered by organizational culture and inconsistent incentives which are typical

in this stage of development. In one bank, which is on level 1-basic, this result means that there is no data consistency but people are still arguing about whose data is correct. For the third area - *governance* for the analysed banks, it can be concluded that the answers are more homogenous meaning that all banks are at level 2 – opportunistic. This result means that, although analytics is not an ad hoc matter, there is no clear governance model of data and analytics efforts. There are organizational barriers and lack of leadership still present. For the fourth pillar – *technology*, three out of four banks are on level 2 - opportunistic and one on level 3 – systematic. This reveals that mostly banks are using data with better quality, not only transactional data. Exogenous data sources are readily integrated.

Regarding this results, it can be concluded that the overall data and analytics maturity score for the analysed banks is level 2- opportunistic. The results reveal that mostly the banks in our sample, have individual business units that pursue their own data and analytics initiatives as stand-alone projects, but there is no common structure across them. Low maturity can be the result of limited budgets, lack of vision and skills, inexperience in strategic planning and deployment, or primitive or aging infrastructure. Organizations in the early stages of data and analytics maturity often do not have the ability to exploit advanced analytics. They struggle to deal with poor data quality, inconsistent processes and poor coordination across the enterprise. Low maturity severely constrains leaders who are attempting to modernize BI. But, what is suggested is that organizations with low BI maturity can learn from the success of more mature organizations to speed up modern BI deployment and take their data and analytics capabilities to the next level (Gartner, 2018).

The IT Score for data and analytics is designed not only to identify the current level of analytical maturity, but also to discover the organization’s capacity in data analytics adoption. This model can serve as a tool to define strengths and weaknesses in data analytics adoption in order to define a roadmap for moving the organization towards achieving higher maturity levels. According to the Gartner’s model, a synergic strategic effort in these four areas: strategy, people, governance and technology, should provide company with capability to move faster towards higher maturity levels and reach analytics capabilities for greater business impact. In order to mature faster, a company should focus on the following:

Develop holistic data and analytics strategies with a clear vision. Organizations with low data maturity is characterized with lack of enterprisewide data and analytics strategies and clear vision. Business units undertake data or analytics projects individually, which results in data silos and inconsistent processes. Data and analytics leaders should coordinate with IT and business leaders to develop a holistic data and analytics strategy. They should also view the strategy as a continuous and dynamic process, so that any future business or environmental changes can be taken into account.

Create a flexible organizational structure, exploit analytics resources and implement ongoing analytics training. Enterprises must have people, skills and key structures in place to foster and secure skills and develop capabilities. They must anticipate upcoming needs and ensure the proper skills, roles and organizations exist, are developed, or can be sourced to support the work identified in the data and analytics strategy. With limited analytics capabilities in-house, data and analytics leaders should strive for a flexible working model by building “virtual data analytics teams” that include business unit leaders and users.

Implement a data governance program. Most organizations with low BI maturity do not have a formal data governance program in place. They may have thought about it and understand the importance of it, but do not know where to start. Analytics leaders can consider governance as the “rules of the game.” Those rules can support business objectives and also enable the organization to balance out the opportunities and risks in the digital environment. Governance is also a framework that describes the decision rights and authority models that must be imposed on data and analytics.

Create integrated analytics platforms that can support a broad range of uses. Low-maturity organizations often have primitive IT infrastructures. Their analytics platforms are more traditional and reporting-centric, embedded in ERP systems, or simple disparate reporting tools that support limited uses. To improve their analytics maturity, the model suggests that data and analytics leaders should consider integrated analytics platforms that extend their current infrastructure to include modern analytics technologies.

The limitation of the research methodology is the subjectivity that is expected in assigning the levels by the managers-respondents. Overestimating the levels of maturity is possible and has to be on researchers minds all the time. However, this bias is present in every methodology of this type and to confirm the conclusions about the level of maturity different method of analysis should be accompanied.

4. Conclusion

Data science needs to be a fundamental component of any digital transformation effort of companies from different size and industry. Leading organizations in every industry are wielding data and analytics as competitive weapons. It is estimated that by 2022, 90% of corporate strategies will explicitly mention data as a critical enterprise asset and analytics as an essential competency (Gartner, 2019). Data and analytics will become the centerpiece of enterprise strategy, focus and investment. Still, many companies worldwide continue to struggle under the weight of traditional business models and analog business process that discount the potential of data and analytics. Others recognize their potential but cannot make the cultural shift or commit to the data management and advanced analytics skills and technology investments necessary to realize that potential (Gartner, 2019).

Evaluation of data analytics adoption by assessment of data and analytics maturity level helps organizations to strategize and transform. From our research, we can conclude that the overall level of data and analytics maturity of analysed companies/banks from the financial sector can be set on level 2 – opportunistic. For successful digital transformation an organization should build its data and analytics competency on a proper level. The originality of this research derives from the specific characteristics and development of the banking sector in the country. Financial sector, as a whole, is one of the most advanced service sectors in the country and hence represents a benchmark concerning digital transformation. Results of this survey provide useful information needed to design a roadmap for migrating towards higher maturity levels. The insights gained from this analysis can help managers formulate their analytics strategies and achieve competitive advantage from data. The road to achieve higher levels of maturity across all dimensions is hard, its an evolutionary rather than revolutionary effort, and it will take full management commitment in order to maintain competitive. This research is the first attempt to analyze data and analytics maturity organizational maturity in the banking sector in the country. Knowing where organization is on this journey will help managers/strategists to adopt highest analytics maturity level - transformational i.e. the highest level that would enable organizations derive maximum business benefits from data and analytics and achieve better competitive positions. Further research can include more companies from this sector as well as other industries in the country (telecommunication, insurance, retail, health etc.) since this model can be used to measure and describe their data analytics efforts.

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DIGITAL TRANSFORMATION IN FINANCIAL SERVICES

– THE CASE OF THE NORTH MACEDONIA –

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Abstract:

Digital transformation is in fact an integration of digital technology into all areas of a business, fundamentally changing the way of operating and delivering value to customer. It is also a cultural change that requires organizations to continually challenge the status quo, experiment, and get comfortable with failure.

Financial services industry in the Republic of North Macedonia is in essence still traditional, conservative industry, but is evolving. Banks strive to keep pace and fit in the new digital era by investing more and more funds in new products and financial innovations, as well as sponsoring software development conferences and new technologies.

The purpose of this paper is to show how the country is keeping up with the new modern technological and innovative processes in the financial sector to improve services. In the same, no one can neglect major factors that influence the development of digital transformation in financial services, such as: legislation, economic stability, secure financial sector and the stable purchasing power of citizens.

Through comparative analysis, we will try to show the impact of factors on the development of digitalization in the financial sector in Republic of North Macedonia. With a help of appropriate econometric model we try to find answer to the dilemma how independent variable factors influence the dependent factor.

Key words: *digital transformation, financial services, North Macedonia.*

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Introduction

Digital transformation is one of the fastest-growing sectors in the global financial services nowadays. Having in mind the previous, it can be said that the financial services industry in North Macedonia is in essence still traditional, conservative industry, but from the other side it has been evolving. Banks strive to keep pace and fit in the new digital era by investing more and more funds in new products and financial innovations, as well as sponsoring software development conferences and new technologies.

Hence, there are some constraining factors that hamper digitalization in South East Europe, including North Macedonia, such as the following:

- negative effects caused by the financial crisis (they decrease the ability of banks to innovate), and
- mentality of the population which still does not show a sufficient level of confidence in online activities.

The role and significance of digital transformation

Digital transformation is supported by relatively solid infrastructure for digitization in North Macedonia which is readily available at satisfactory level. For example, 76% of households in North Macedonia had access to internet in 2017 vis-à-vis 85% in the EU. On average, bank deponents have two payment accounts in North Macedonia. However, only 7% of payment accounts held by the households can be used for electronic payments, while this share is relatively higher in regard of legal entities (29%). The latter initiated 51% of the credit transfer in electronic way, while the households initiated electronically only 20% of their credit transfers in 2017. The companies usually initiate their payments by using computers, while households rely mainly on computers (92% of electronic credit transfers), mobile phones (7% of electronic credit transfers) and ATM (1% of electronic credit transfers). In comparative context with the EU member countries, our country is lagging behind given that 91% of credit transfers were electronically initiated in the old EU members and 86% in the new EU member countries in 2016. Regarding digital channels used for ordering goods and services, internet shoppers in North Macedonia increased by 5 p.p. during the last five years and reached 15% of the population that used internet in 2017. This is quite below the 57% of internet shoppers in the EU in 2017, according to the Eurostat. Internet shopping is becoming popular among all age groups, but the young internet users have the highest share of online shoppers among internet users.

The sound legal framework is important for private service providers to develop secure and efficient payment services. Also, it is important for the authorities themselves in order to keep the confidence of users in the regular functioning of the payment system.

The development of payment services is a continuously evolving dynamic process, driven by technological advances. Market players design new services that better adapt to users' needs in order to expand their business. In doing so, they try to balance the new opportunities the market opens up with the financial regulation they have to comply with. However, private players want to maximize their profits and may not have the right incentives to reach a socially viable equilibrium.

In this sense the regulator monitors the development of the market and technological advances to be able:

- to foster innovation (and better customer experience);
- to strike the right balance between security and efficiency;

- to adapt the regulation to new services;
- to put in place effective consumer protection measures;
- to ensure fair competition among market players;
- to avoid regulatory arbitrage etc.

The new regulatory framework in North Macedonia which already has reached an advanced stage of drafting, aims at balancing safety and creativity. In order to protect consumers and maintain financial stability, the new framework envisages licensing regime for the non-banking payment service providers as well as an appropriate safeguarding measures for client's funds. Moreover, it intends to allow already established companies or start-ups that aim to provide payment services to be involved in other business activities allowing them to diversify the business risk and freedom to grow.

Analysis of digital transformation in the financial services

For the purpose of the analysis, in this paper we create a modest model. As independent variables in the model we determine: legislation, economic stability, secure financial sector and citizens' purchasing power like factors influencing digital transformation. From the other side the digital transformation is seen as a dependent variable for the period 2010-2018.

So, the model is the following:

$$Y = (c) + \beta_1 + \beta_2 + \beta_3 + \beta_4 + u, \text{ where:}$$

y = digital transformation

β_1 = legislation

β_2 = economic stability

β_3 = secure financial sector

β_4 = purchasing power of the citizens

u = eventual error (residual).

Digital transformation = constant (c) + legislation + economic stability + secure financial sector + purchasing power of citizens + u.

Since our model encompasses several factors that influence the digital transformation, it is a multiple regression model. Having in mind this, the next step is to examine whether the model meets the basic assumptions of the multiple regression model and whether it can be used to predict future movements.

Model rating

Firstly, we present a table where from one can easily identify the values of the dependent variable and the factors (independent variables) that affect them over a given 8 years period.

Table 1. Dependent and independent variables

year	Digital transformation in financial services	Legislation	Economic stability	Secure financial sector	Purchasing power of citizens
2010	2.5	1.2	3.7	3.9	2.8
2011	5.9	1.4	3.2	8.2	4.6
2012	1.6	0.5	3.2	2.7	4.4
2013	6.5	3.2	5.0	0.4	5.0
2014	8.6	2.3	4.3	7.4	6.1
2015	6.0	3.3	3.5	2.6	5.0
2016	2.3	1.6	2.5	2.1	6.9
2017	4.4	3.9	2.5	3.0	6.8
2018	4.6	2.7	2.8	2.9	5.9

The numbers of dependent variables are expressed as average values. They are retrieved from the site www.mkbudget.org. Using these data and values expressed as rates, and with a help of the Eviews program, we develop few econometric models.

Picture 1. Model rating

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.084118	2.008160	-4.025635	0.0158
LEGISLATION	1.052573	0.288815	3.644451	0.0219
ECONOMIC_STABILITY	1.743737	0.352774	4.942931	0.0078
SECURE_FIN_SECTOR	0.550255	0.104928	5.244127	0.0063
PURCHASING_POWER	0.467350	0.260444	1.794436	0.1472

R-squared	0.951865	Mean dependent var	4.711111
Adjusted R-squared	0.903729	S.D. dependent var	2.288255
S.E. of regression	0.709989	Akaike info criterion	2.453045
Sum squared resid	2.016335	Schwarz criterion	2.562614
Log likelihood	-6.038703	Hannan-Quinn criter.	2.216595
F-statistic	19.77476	Durbin-Watson stat	2.386557
Prob(F-statistic)	0.006728		

$$\text{Digital transformation} = -8.084118 + 1.052573 + 1.743737 + 0.550255 + 0.467350.$$

The t-statistic is calculated automatically as the ratio between the estimated coefficient and its standard error. If the t-statistics of the computer result and the econometric model of Eviews are greater than the selected critical value, then the estimated coefficient is said to be statistically significant. It is a proof that the coefficient is different from 0.

It should also be noted that in a case of a higher t-statistic, then the smaller P value (probability) of a given variable would be, and vice versa, the lower t-statistic value, corresponds with the higher P-value.

However, the higher P-value is, the less significant independent variables would be, or more precisely, if the P-values are greater than 0.05 (5%) then the variables are non-significant. It means that anything less than 0.05 is significant, and vice versa, anything greater than 0.05 is not significant if:

- coefficients <0.05 are significant and

- coefficients > 0.05 are not significant.

In our case only the value of the purchasing power of the citizens is greater than 0.05, for this purpose we will set all the factors in correlation to determine which factor is insignificant and to exclude it from our model.

Multicollinearity can be derived from a single independent variable where if we discover and reject the model it can be specified. We can determine this by applying the model of correlation between the specified independent variables.

Picture 2. Correlation

Correlation				
	LEGISLATION	ECONOMIC...	SECURE_FI...	PURCHASI...
LEGISLATION	1.000000	0.093917	-0.301160	0.504260
ECONOMIC_STABILITY	0.093917	1.000000	-0.008887	-0.389302
SECURE_FIN_SECTOR	-0.301160	-0.008887	1.000000	-0.097742
PURCHASING_POWER	0.504260	-0.389302	-0.097742	1.000000

From the Picture 2 it can be seen that the highest degree of correlation between the independent variables has been found in the case of purchasing power of citizens and the legislation. It signals to us that one of these two variables can be rejected from the model. To get the right solution, we go back to Figure 1 and try to see which of the two variables has the highest P-value. It will have the least signification and could be excluded from our model.

The purchasing power of the citizens has a P-value of 0.1472 which is greater than the P-value of the legislation (0.0219). Consequently, the purchasing power of the citizens as a factor can be excluded from the model, because the model itself estimates that citizen's purchasing power as a factor is insignificant.

In order to see if our decision to dismiss the purchasing power of the citizens is the right choice, we compare the second way of expressing the relationships between the factors by presenting these two factors as independent variables.

Picture 3 Legislation – dependent variable

Equation: LEGISLATION_DEPENDENT Workfile: DIGITAL TRANSFORMATION I... _ □ ×

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: LEGISLATION
Method: Least Squares
Date: 10/12/19 Time: 12:17
Sample: 2010 2018
Included observations: 9

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.693265	3.015905	-0.561445	0.5987
ECONOMIC_STABILITY	0.447555	0.508260	0.880562	0.4189
SECURE_FIN_SECTOR	-0.107210	0.155239	-0.690610	0.5206
PURCHASING_POWER	0.529660	0.326388	1.622791	0.1656

R-squared	0.409849	Mean dependent var	2.233333
Adjusted R-squared	0.055759	S.D. dependent var	1.131371
S.E. of regression	1.099376	Akaike info criterion	3.328465
Sum squared resid	6.043142	Schwarz criterion	3.416121
Log likelihood	-10.97809	Hannan-Quinn criter.	3.139305
F-statistic	1.157471	Durbin-Watson stat	2.978324
Prob(F-statistic)	0.412215		

Picture 4. Purchasing power of citizens – dependent variable

Equation: PURCHASING_POWER_DEPENDE Workfile: DIGITAL TRANSFORMATIO... _ □ ×

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: PURCHASING_POWER
Method: Least Squares
Date: 10/12/19 Time: 12:19
Sample: 2010 2018
Included observations: 9

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.050289	2.137574	2.830446	0.0367
LEGISLATION	0.651340	0.401370	1.622791	0.1656
ECONOMIC_STABILITY	-0.691415	0.520892	-1.327368	0.2418
SECURE_FIN_SECTOR	0.035600	0.179469	0.198362	0.8506

R-squared	0.450968	Mean dependent var	5.277778
Adjusted R-squared	0.121549	S.D. dependent var	1.300748
S.E. of regression	1.219135	Akaike info criterion	3.535262
Sum squared resid	7.431451	Schwarz criterion	3.622918
Log likelihood	-11.90868	Hannan-Quinn criter.	3.346102
F-statistic	1.368980	Durbin-Watson stat	2.060204
Prob(F-statistic)	0.353176		

In Picture 3, the R-squared is expressed as an independent variable and it is 0.409849, which is smaller than the corresponding R-squared in Picture 4 where the purchasing power of the citizens is expressed as an independent variable (R-squared is 0.450963). Thus, the previous confirms our decision to remove the purchasing power of the citizens as a factor from the model. So, the new model would be:

Picture 5. New model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.256514	1.495906	-3.513932	0.0170
LEGISLATION	1.356976	0.280885	4.831079	0.0048
ECONOMIC_STABILITY	1.420604	0.364528	3.897109	0.0114
SECURE_FIN_SECTOR	0.566893	0.125595	4.513657	0.0063
R-squared	0.913116	Mean dependent var	4.711111	
Adjusted R-squared	0.860985	S.D. dependent var	2.288255	
S.E. of regression	0.853169	Akaike info criterion	2.821384	
Sum squared resid	3.639485	Schwarz criterion	2.909039	
Log likelihood	-8.696226	Hannan-Quinn criter.	2.632224	
F-statistic	17.51594	Durbin-Watson stat	1.831495	
Prob(F-statistic)	0.004390			

Model specification

A significant value in determining whether the model is well specified is R-squared, which in our model is 91.3% which is slightly higher than the normal limit of 60%.

When specifying models, a very important factor is the number of the regressors. Here we have to decide which model is better one, i.e. with how many variables (one, two or three), we could use the Akaike and Schwartz (SC) criteria for that purpose.

In the first case, as an independent variable, we express the first factor, namely legislation and digital transformation as a dependent variable.

Picture 6. Specification 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.310569	1.602710	1.441664	0.1926
LEGISLATION	1.074870	0.647563	1.659869	0.1409
R-squared	0.282431	Mean dependent var	4.711111	
Adjusted R-squared	0.179921	S.D. dependent var	2.288255	
S.E. of regression	2.072202	Akaike info criterion	4.488231	
Sum squared resid	30.05816	Schwarz criterion	4.532059	
Log likelihood	-18.19704	Hannan-Quinn criter.	4.393651	
F-statistic	2.755164	Durbin-Watson stat	1.797213	
Prob(F-statistic)	0.140901			

where, AIC = 4.488, and SC = 4.532.

In the following model we add the second independent variable, i.e. the economic stability, which yields the following model:

Picture 7 – Specification 2

Equation: SPECIFICATON_2 Workfile: DIGITAL TRANSFORMATION IN ...

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: DIGITAL_TRANSFORMATI
 Method: Least Squares
 Date: 10/12/19 Time: 12:27
 Sample: 2010 2018
 Included observations: 9

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.425815	2.792816	-0.868591	0.4185
LEGISLATION	0.974513	0.550706	1.769570	0.1272
ECONOMIC_STABILITY	1.454222	0.749464	1.940349	0.1004

R-squared	0.559095	Mean dependent var	4.711111
Adjusted R-squared	0.412127	S.D. dependent var	2.288255
S.E. of regression	1.754471	Akaike info criterion	4.223413
Sum squared resid	18.46900	Schwarz criterion	4.289154
Log likelihood	-16.00536	Hannan-Quinn criter.	4.081543
F-statistic	3.804194	Durbin-Watson stat	2.724130
Prob(F-statistic)	0.085710		

where AIC = 4.223 and SC = 4.289.

In the third model we include the third independently variable, i.e. the secure financial sector, with the following final model:

Picture 8 – Specification 3

Equation: SPECIFICATION_3 Workfile: DIGITAL TRANSFORMATION IN FL...

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: DIGITAL_TRANSFORMATI
 Method: Least Squares
 Date: 10/12/19 Time: 12:29
 Sample: 2010 2018
 Included observations: 9

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.256514	1.495906	-3.513932	0.0170
LEGISLATION	1.356976	0.280885	4.831079	0.0048
ECONOMIC_STABILITY	1.420604	0.364528	3.897109	0.0114
SECURE_FIN_SECTOR	0.566893	0.125595	4.513657	0.0063

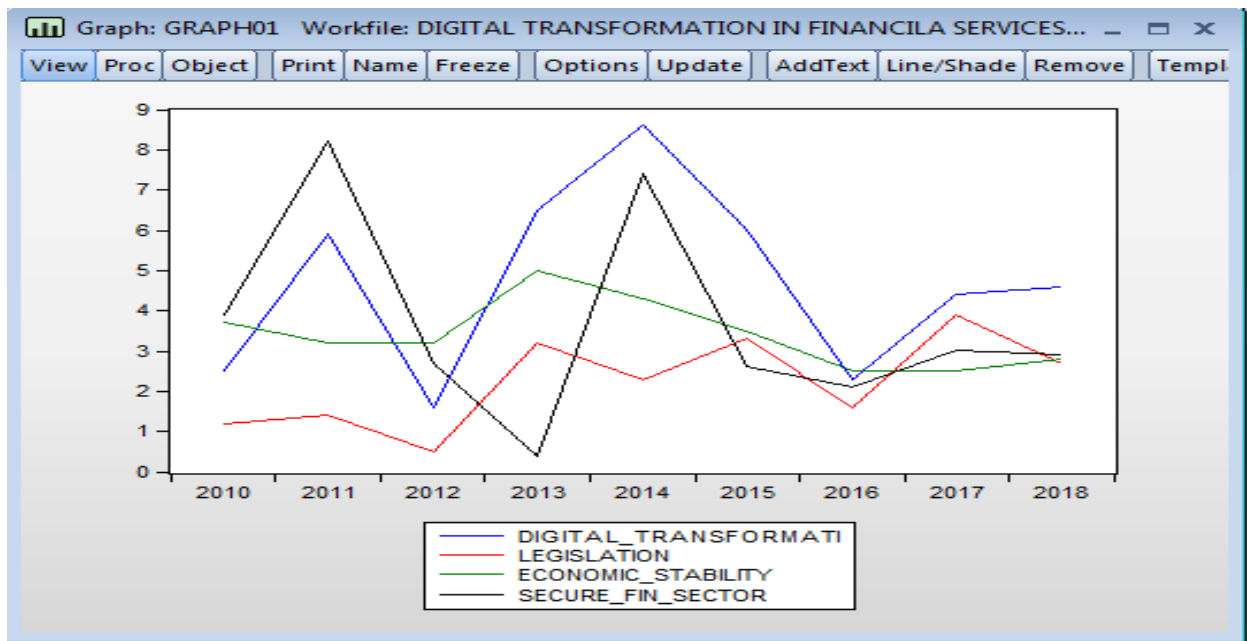
R-squared	0.913116	Mean dependent var	4.711111
Adjusted R-squared	0.860985	S.D. dependent var	2.288255
S.E. of regression	0.853169	Akaike info criterion	2.821384
Sum squared resid	3.639485	Schwarz criterion	2.909039
Log likelihood	-8.696226	Hannan-Quinn criter.	2.632224
F-statistic	17.51594	Durbin-Watson stat	1.831495
Prob(F-statistic)	0.004390		

where AIC = 2.821 and SC = 2.909

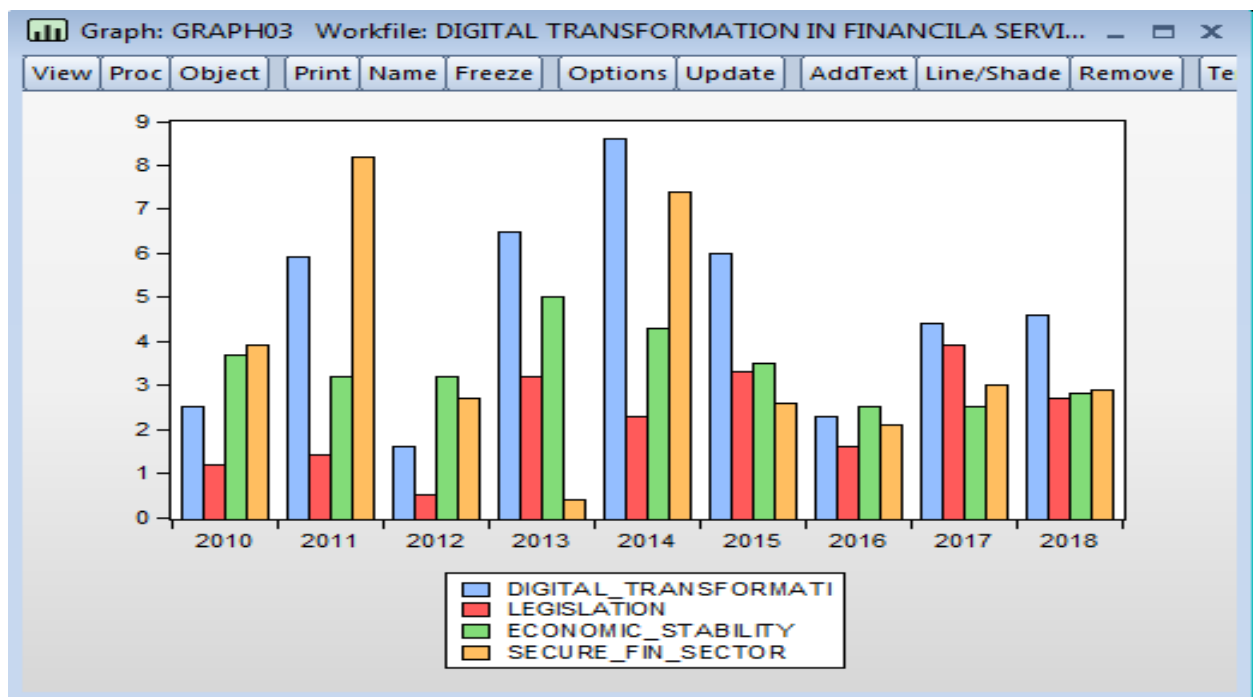
Observing the three models above, it can be concluded that the third (or last model) that includes all three independent variables has the lowest values of the Akaike and Schwartz criteria. It means it is the best model in our case where the three factors are included.

The next three graphs illustrate the variables and their movement over the 8 years period (2010-2018).

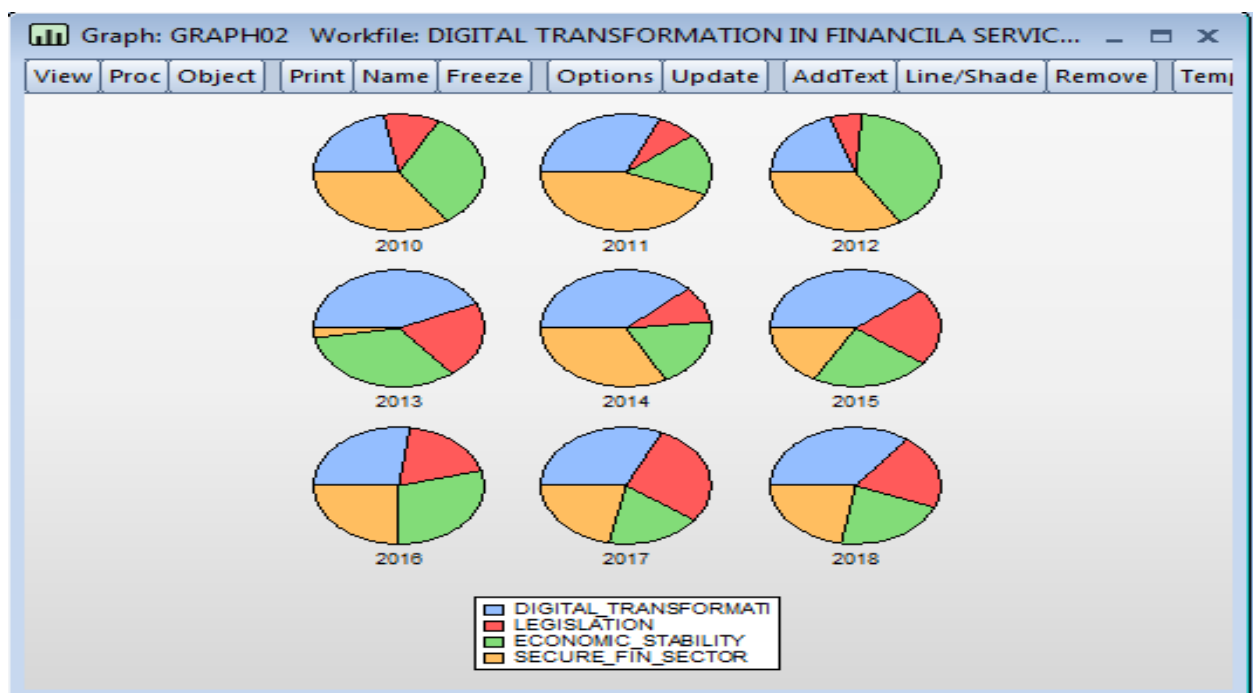
Graph 1



Graph 2



Graph 3



Conclusion

Based on the foregoing in this paper, it can be concluded that digital transformation in the financial

sector is a very important category for the development of digital technology, and any model that would enable their forecasting would be very important.

The development of payment services is a continuously evolving dynamic process, driven by technological advances. Market players design new services that better adapt to users' needs in order to expand their business. In doing so, they try to balance the new opportunities the market opens up with the financial regulation and secure financial sector they have to comply with.

Digital transformation is a kind of driver that enables banks to keep pace with customer demands. By adopting the right digital business model, banks can take advantage of open banking to unleash new business value. Being an open bank means operating like a platform company, with a business model that connects people and processes with assets and a technology infrastructure to manage internal and external users' interactions.

A sound legal framework is important for private service providers to develop secure and efficient payment services and for authorities to keep the confidence of users in the regular functioning of the payment system.

With a help of the econometric software package Eviews 6 we have constructed few basic econometric models. In our research where digital transformation is set as dependent variable, and legislation, economic stability, secure financial sector and the purchasing power of citizens as independent variables, it can be noticed that if the model is well specified, it could be a good example for forecasting. After the rejection of one independent variable which, after correlational studies, proved to be the purchasing power of the citizens, the new model met all conditions for a well-specified model and successful research.

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DETERMINANTS OF LABOUR PRODUCTIVITY IN THE REPUBLIC OF NORTH MACEDONIA WITH AN EMPHASIS ON THE ICT INDUSTRY

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Abstract:

Labour productivity as a single factor measure represents the total volume of output produced per unit of labour during a given time reference period. Labour productivity affects various stakeholders in the society such as workers, companies and the government. Hence, determining the factors that affect the labour productivity represent a challenging task. The aim of this paper is to identify the industries that are drivers of the labour productivity growth in the Republic of North Macedonia and to shed light on its main determining factors. As potential factors that affect the labour productivity we consider: the consumption of fixed capital, the average net wage, workforce characteristics, jobs' characteristics and firms characteristics at industry level. The empirical findings show that industries with higher capital intensity and higher average net wage experience the highest labour productivity. In addition, temporary work arrangements, more experienced workforce and higher shares of private companies in a given industry are associated with better performance in terms of labour productivity. In addition, the emphasis is given to the analysis of labour productivity in the ICT industry as one of the leading industries in the Republic of North Macedonia. Finally, the analysis is used as a basis for defining appropriate policy measures for increasing the labour productivity by using the potentials of the ICT that would lead to greater competitiveness and economic growth.

Keywords: *Labour productivity, wages, employment, ICT industry.*

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Introduction

The economic growth in a given country can be attributed either to increased employment or to more effective work by those who are employed. The latter effect can be described by the indicators on labour productivity. Labour productivity is an important economic indicator that is closely linked to the economic growth, competitiveness and living standard within an economy. Higher labour productivity means to produce more goods and services with the same amount of resources or to produce the same level of goods and services with fewer resources.

Labour productivity affects various stakeholders such as workers, companies and the government. For workers increased productivity can translate to higher wages and increased living standard, while in the long term would lead to job creation. For businesses, increased productivity brings higher profit, greater competitiveness and opportunity for more investment. For the government, increased productivity results in higher tax revenues and better provision of public good and services.

At an industry level, labour productivity growth is important to allow the industry to compete with other sectors of the economy for resources and maintain international competitiveness. The productivity of labour is particularly important in developing countries where there still exists a large room for improvements in a number of industries. Hence, determining the factors that affect the labour productivity and productivity growth on an industry level represent a challenging task for the academics and policy makers.

The understanding of the driving forces behind the labour productivity is important for formulating policies to support economic growth. Application of an effective economic policy amongst other things, involves increasing the productivity, which can be achieved through a variation of as many productivity determinants as it is feasible and economically beneficial. It is important to note that some sectors of the economy have traditionally had low productivity growth but are important to aggregate productivity growth. Consequently, government policies, which only focus on sectors exhibiting productivity growth, could be detrimental for the productivity growth as a whole.

Generally, the productivity improvements are not spread evenly across the economy. For example, computer hardware productivity has been rising dramatically as the price of microprocessor chips has plunged relative to their ability to perform more instructions per second. In addition, the information and communication technology (ICT) have raised the productivity or output of the people/companies using those technologies. It is a common view that the ICT industry plays a critical role in increasing the productivity and busting the economic development of a given country. Thus, increasing the ICT use by the business entities in general, would increase the labour productivity in other industries as well.

The problems of sub-optimal labour market outcomes in post-transition countries such as the low-productivity employment deserve further scientific attention due to their enormous social implications. Having in mind the above considerations, the aim of this paper is to identify the industries that are drivers of the labour productivity growth in the Republic of North Macedonia and to shed light on its main determining factors. In addition, the emphasis will be given to the analysis of labour productivity in the ICT industry as one of the leading industries of the country's economic performance. Finally, the analysis will be used as a basis for defining appropriate policy measures for increasing the labour productivity that would potentially lead to greater competitiveness and economic growth.

1. Theoretical background

Productivity is generally defined as a ratio of volume measure of output to a volume measure of input use. Alternatively, productivity is expressed as quantity of produced goods (output) divided by the units of production factors used (input). The productivity measures can be classified as single factor or multifactor productivity measures. Labour productivity as a single factor measure represents the total volume of output produced per unit of labour during a given time reference period. It is expressed as output per worker or output per hour worked. Labour productivity only partially reflects the productivity of labour in terms of the personal capacities of workers or the intensity of their effort. The ratio between output and labour input depends to a large degree on the presence of other inputs.

According to the OECD (2001), there are various productivity concepts of which the following two concern the labour productivity: Labour productivity based on gross output and Labour productivity based on value added.

The labour productivity based on gross output shows the time profile of how productively labour is used to generate gross output. When measured as gross output per unit of labour input, labour productivity growth also depends on how the ratio of intermediate inputs to labour change. Gross output based labour productivity traces the labour requirements per unit of physical output. It reflects the change in the input coefficient of labour by industry and can help in the analysis of labour requirement by industry. The advantage of this concept can be viewed in the ease of measurement and readability. In particular, the gross output measure requires only prices indices on gross output, not on intermediate inputs as is the case for the value added based measure.

The labour productivity based on value added shows the time profile of how productively labour is used to generate value added. In comparison with the previous concept, the growth rate of value added labour productivity is less dependent on any change in the ratio between intermediate inputs and labour. The purpose of using this concept is to analyse the micro-macro links such as the industry contribution to economy wide labour productivity and economic growth. From a policy perspective, value added based labour productivity is important as a reference statistic in wage bargaining.

As potential groups of factors affecting the labour productivity are considered the following: (1) the quality of the labour force, (2) the amount of capital goods employed and, (3) the efficiency with which labour, capital and other inputs are combined in the production of final goods and services (McConnell et al., 2003). Namely, improvements in output per unit of labour may be due to increased quality and efficiency of the human factor as well as other factors such as capital intensity, institutions and other conditioning variables.

The quality of labour depends on its education and training, its health and vitality, and its age-gender composition. With this regard, we assume that better educated and better trained workforce at industry level can produce more output than a less educated and/or inadequately trained one. The increase in labour quality in turn generates self-reinforcement effects through the rise of real wages. Namely, enhanced earnings allow workers to improve their health and education, which leads to further improvements in labour quality and productivity. Alternatively, according to the efficiency wage theory, the wage rate above the market clearing level will also exert an increase of labour productivity.

Regarding the quantity of physical capital, we assume that the productivity in any given industry will depend on the amount of capital equipment used. For instance, IT equipment facilitates the expansion of business activities and eases the information transactions between employees and managers which potentially leads to increase of labour productivity.

Increased efficiency encompasses: technological progress, greater specialisation as the result of scale economy, the reallocation of labour from less to more productive uses and, changes in institutional, cultural and environmental setting and its public policies.

Closely related to the productivity growth in a given market economy is the concept of 'Creative destruction'. This term is attributed to the famous economist Joseph Schumpeter who defined creative destruction as continuous process by which emerging technologies push out the old, thus increasing the productivity. As a consequence, we are witnessing a constantly changing structure of the economy. Old industries and firms which are no longer profitable close down enabling the resources to move into more productive processes. Creative destruction means that the company closures and job losses are good for the long-term well-being of the economy and can be seen from both a negative and positive perspective. For instance, the recent trend of developing IT technologies has begun to alter the manner in which businesses creates economic value and contributes to speeding up the process of creative destruction.

The process of creative destruction has been particularly pronounced during the transition process (De Loecker and Konings, 2003). According to Blanchard (1997) in the context of labour market performance, the process of transition has been mainly led by two driving forces: ownership restructuring and sectoral reallocation. These processes respectively assume a large-scale transformation of state owned firms into privatised ones and, a reallocation of a substantial part of the labour force from the manufacturing and agricultural sectors towards the expanding service sector. The later phase of transition, when the major restructuring process of the state sector finished, is represented by a so-called 'balanced path'. The main driving force of labour force adjustment in this phase is the private sector where the major entrants into new employment come from the pool of the unemployed.

1. Data

The data used for the empirical analysis is taken from the officially published reports of the State Statistical Office of the Republic of North Macedonia for the period 2011-2016. More precisely the labour productivity by industry is assessed according to the production approach in calculation of the Gross Domestic Product (GDP). Data sources used for GDP calculations are the annual financial reports from the Central Register, data from the annual statistical surveys, data from the Ministry of Finance, the Public Revenue Office and other sources. Data on the sources of value added and the cost structure of the GDP by production approach at current prices are presented by sectors according to the NACE² Rev.2 classification. The complete list of the main economic activities according to NACE Rev.2 classification is presented in Appendix 1.

Gross Domestic Product (GDP) at market prices is the final result of the production activity of the resident producer units and it is the sum of gross value added of the various institutional sectors or the various activities at basic prices plus value added, import duties less subsidies on products. Gross value added at basic prices is the basic category of GDP. It represents the balance between gross output and intermediate consumption. On the other hand, gross output is considered the value of goods and services produced in the course of one year, regardless of whether or not the whole quantity is sold or partly added to stocks.

Total employment in accordance with the European system of accounts methodology covers all persons either employed or self-employed engaged in some productive activity that falls within the production boundary of the system. Employees are defined as all persons who, by agreement, work for another resident institutional unit and receive remuneration. In accordance with the National

²NACE is abbreviated from Statistical classification of economic activities in the European Community.

Account concepts, the total number of employees covers the number of employees from the annual financial reports, and the adjusted number of non-registered employees by using Labour Force Survey data.

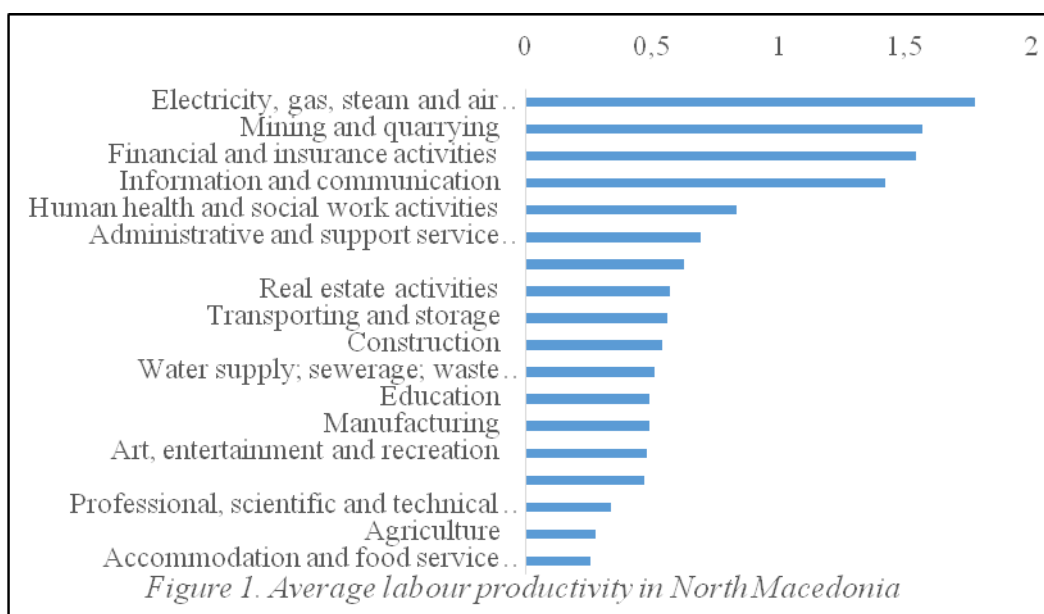
Self-employed are defined as persons who are sole owners or joint owners in unincorporated enterprises. The compensation of employees for the self-employed represents mixed income. Based on this definition, the category of self-employed includes people who run their own business, persons who pay annual lump-sum income tax to the Public Revenue Office, unpaid family workers, and persons who do not have a formally registered business and are estimated based on the Labour Force Survey.

Data on estimated employees and self-employed are obtained by comparison with Labour Force Survey data according to the domestic concept i.e. including non-residents working in North Macedonia and excluding residents who work abroad. The estimates are made by using the method of balancing the number of employees from different sources that are the basis for estimating the non-observed economy. Employment data are measured in number of persons in employment.

2. Empirical analysis

The first part of the empirical analysis consists of presenting main trends in the labour productivity in the Republic of North Macedonia at industry level. In our empirical analysis we do not include Real estate activities because they encompass imputed rents of owner-occupied dwellings. In addition, Activities of households as employers and Activities of extra-territorial organisations and bodies are not taken into account due to the fact they are outside the SNA³ production boundary. The labour productivity at industry level is assessed according to the production approach in calculation of the Gross Domestic Product (GDP) taken from the officially published reports by the national statistical offices. According to the OECD Manual on measuring productivity (2001), we separately consider two labour productivity concepts: Labour productivity based on gross output and Labour productivity based on value added.

The average labour productivity based on value added by industry in the Republic of North Macedonia for the period 2011-2016 is presented on Figure 1.



³SNA stands for System of National Accounts.

In the second part of the empirical analysis we separately estimate alternative econometric models in order to identify statistically significant factors of labour productivity. Among the factors that can potentially influence the labour productivity we consider the following: Capital intensity; wage level; workforce characteristics, jobs' characteristics and firms' characteristics. As typical workforce characteristics we consider the education, age and gender composition at industry level. The jobs' characteristics depends on the type of employment arrangement (temporary/contract) and number of hours (part-time/full-time). Finally, firm's characteristics depends on the type of ownership and size of the companies.

Increased physical capital of a firm, generally lead to increased labour productivity. In our analysis we use the consumption of fixed capital during the accounting period as a component of GDP and it is defined as a decrease in the current value of producer's fixed assets due to the physical use, obsolescence and accidental damages. When calculating GDP, the depreciation value is calculated based on the data from the annual reports of legal entities. The amount of physical capital is divided by the number of employees in each industry in order to express it per employee. The relationship between the labour productivity and the consumption of fixed capital per employee is presented on Figure 2.

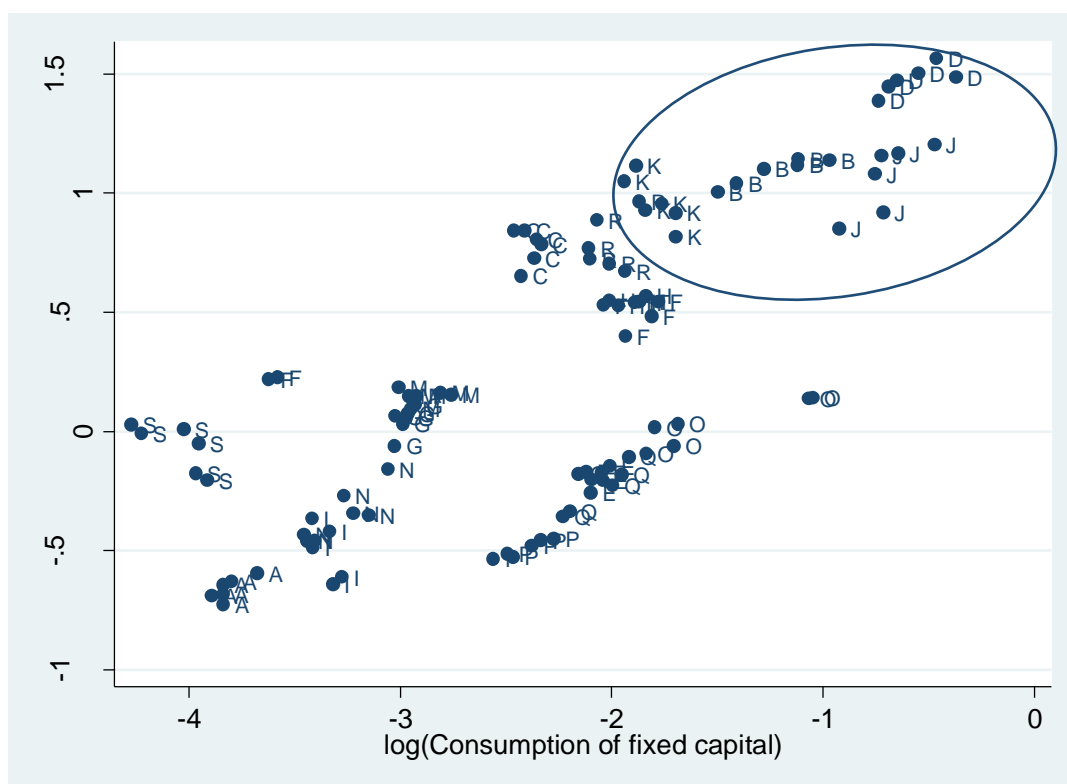


Figure 2. Relationship between labour productivity and consumption of fixed capital

The impact of the wage rate above the market clearing level according to the wage efficiency theory will increase labour productivity. There are various reasons for this phenomenon that can be generally explained by two models within the framework of the efficiency wage theory (Schlicht, 2016). For instance, the incentive-driven model states that as wage level increases, workers will be more motivated to keep their jobs and will therefore try to increase the level of their productivity. On the other hand, the gift exchange model is based on the assumption that high wages change the

relationship between an employer and an employee in the way that the employee will be more attached to the employer and will try to increase his own productivity. The relationship between the labour productivity and the average net wage is presented on Figure 3.

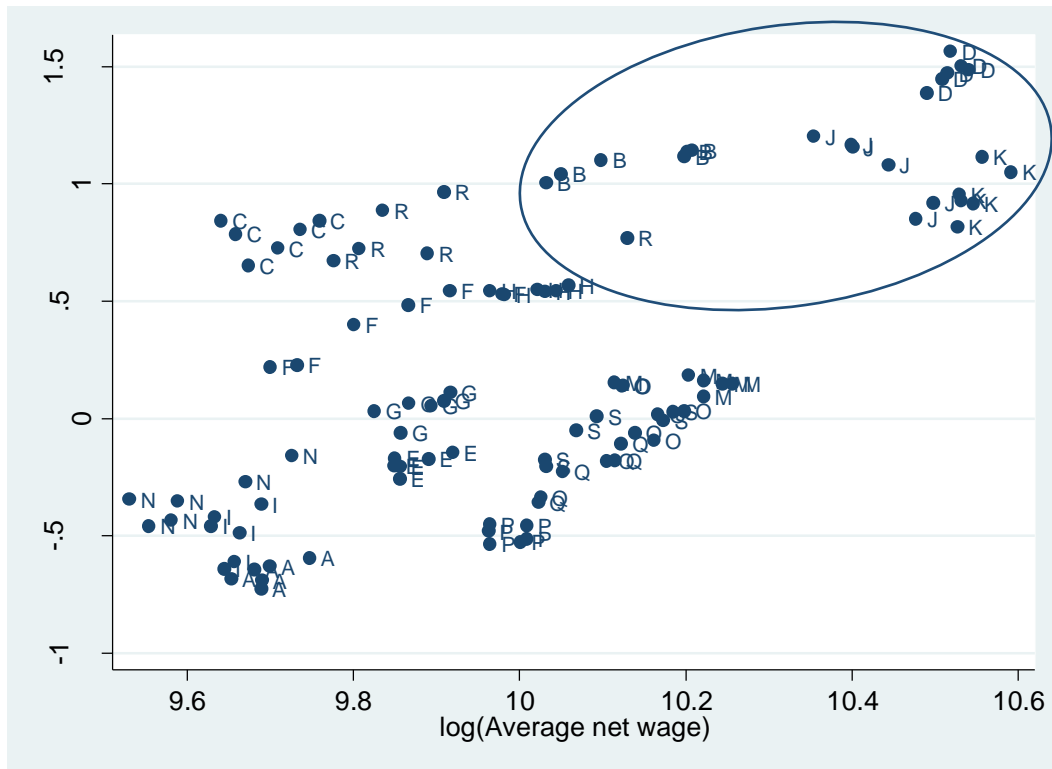


Figure 3. Relationship between labour productivity and average net wage

The effects of education, age and gender at industry level are estimated as percentage shares of workers with higher education, youth (younger than 29) and female respectively. In this way, we attempt to assess the impact of human capital on labour productivity which is widely recognised in the economic literature (Ehrenberg and Smith, 2009). According to the human capital theory, human capital contributes to the output just like other factors of production and also through technological change.

The work arrangement characteristics are assessed separately by the shares of workers with temporary and part-time contracts at industry level. As a part-time employee is considered an employed person that works fewer hours per week than a full-time employee, the latter being typically employed for 40 hours. The temporary employment is contractual employment arrangement between one employer and one employee characterised by a limited duration or a pre-specified event to end the contract. Temporary employment is sometimes called ‘contractual’, ‘interim’, ‘casual’ or ‘freelance’ and it has been recently related to jobs associated with the ‘gig economy’.

Finally, ownership and size as the most important firms’ characteristics are taken into consideration by separately estimating the shares of private and small firms at industry level. In this context, many economists believe that productivity and efficiency in the private sector is higher than in the public sector. Namely, employment of more skilled workers by private enterprises makes them superior in terms of labour productivity. Regarding the firm size, the theory supports the view that small and medium sized enterprises (SMEs) are less cost efficient than the larger one due to economies of scale, product differentiation, lack of R&D expenditures and lack of vertical integration.

In order to estimate the labour productivity model we use a panel data covering the industries according to the NACE rev.2 classification during the period 2011-2016. The model is expressed as follows:

$$\ln LP_{it} = \alpha_0 + \alpha_1 \ln K_{it} + \alpha_2 \ln W_{it} + \alpha_3 \text{Higher}_{it} + \alpha_4 \text{Young}_{it} + \alpha_5 \text{Female}_{it} + \alpha_6 \text{Temp}_{it} + \alpha_7 \text{Part}_{it} + \alpha_8 \text{Private}_{it} + \alpha_9 \text{Small}_{it} + u_{it} \dots (1)$$

where,

$\ln LP_{it}$ is the logarithm of average labour productivity expressed either as gross output or value added per employee in industry i and year t ;

$\ln K_{it}$ is the logarithm of average capital intensity per employee in industry i and year t ;

$\ln W_{it}$ is the logarithm of average net wages in industry i and year t ;

Higher_{it} is the share of employed with higher education in industry i and year t ;

Young_{it} is the share of youth employed in industry i and year t ;

Female_{it} is the share of female employed in industry i and year t ;

Temp_{it} is the share of employed in temporary jobs in industry i and year t ;

Part_{it} is the share of employed in part-time jobs in industry i and year t ;

Private_{it} is the share of employed in private companies in industry i and year t ;

Small_{it} is the share of employed in small companies in industry i and year t ;

The results of the estimated model of labour productivity based on gross output are presented in Table 1.

Table 1. Estimation results (Labour productivity based on gross output)

Variable	1	2	3	4
Constant	-3.514385** (0.015)	-2.966279* (0.095)	-2.50289 (0.142)	-2.715164 (0.108)
$\ln K_{it}$	.1491926*** (0.000)	.1584171*** (0.000)	.1598654*** (0.000)	.1526122*** (0.000)
$\ln W_{it}$	.4121958*** (0.004)	.3611058** (0.045)	.3102328* (0.073)	.3078693* (0.071)
Higher_{it}		.256007 (0.402)	.149186 (0.615)	.1360976 (0.641)
Young_{it}		-.6941478** (0.014)	-.865934*** (0.002)	-.9095157*** (0.001)
Female_{it}		.0329658 (0.912)	.1385222 (0.634)	-.0061293 (0.983)
Temp_{it}			.570326*** (0.003)	.5581857*** (0.003)
Part_{it}			-.0497593	-.1014465

			(0.879)	(0.754)
<i>Private_{it}</i>				.3712828** (0.040)
<i>Small_{it}</i>				.0648657 (0.704)
R ² within	0.3202	0.3698	0.4362	0.4653
R ² between	0.5987	0.4477	0.4795	0.6743
R ² overall	0.5883	0.4446	0.4738	0.6581

Note: p-values are in parentheses; */** indicate significance at 10/5/1 percent level respectively.

From Table 1 we can conclude that the estimated model is robust and provides results that are consistent with the theoretical assumptions. Namely, the capital intensity is the most important and statistically significant factor that determines the labour productivity. In addition, the average net wage positively affect the labour productivity. As expected, industries with higher shares of youth workforce have lower levels of labour productivity due to lower experience of younger workers. In contrast, higher shares of temporary jobs are associated with higher labour productivity assuming that temporary contracts are more characteristic for highly qualified professionals. Finally, according to the labour productivity based on gross output, higher share of private companies in a given industry is associated with higher labour productivity.

In addition, we estimate the model of labour productivity based on value added. The estimation results are presented in Table 2.

Table 2. Estimation results (Labour productivity based on value added)

Variable	1	2	3	4
Constant	-6.30454*** (0.000)	-4.248381** (0.039)	-3.521617* (0.061)	-3.665178* (0.054)
<i>lnK_{it}</i>	.2164551*** (0.000)	.2314028*** (0.000)	.2340926*** (0.000)	.2290128*** (0.000)
<i>lnW_{it}</i>	.6334906*** (0.000)	.4287921** (0.039)	.3487073* (0.067)	.3448459* (0.071)
<i>Higher_{it}</i>		.6454233* (0.069)	.4922129 (0.133)	.4892461 (0.138)
<i>Young_{it}</i>		-.6416342** (0.047)	-.8881359*** (0.004)	-.9109969*** (0.004)
<i>Female_{it}</i>		-.2097224 (0.544)	-.0596226 (0.852)	-.1243156 (0.708)
<i>Temp_{it}</i>			.8688714*** (0.000)	.8742803*** (0.000)
<i>Part_{it}</i>			.0340863 (0.924)	-.0001452 (1.000)
<i>Private_{it}</i>				.1866768 (0.353)
<i>Small_{it}</i>				.1012489 (0.597)

R ² within	0.4366	0.4775	0.4362	0.5819
R ² between	0.8319	0.7181	0.4795	0.7562
R ² overall	0.8161	0.7097	0.4738	0.7449

Note: *p*-values are in parentheses; */**/** indicate significance at 10/5/1 percent level respectively.

From Table 2 we can notice that the estimated coefficients are with approximately same magnitudes and signs as in the previously estimated model. In addition, the same variables except the variable *Private* appear as statistically significant, which confirms the robustness of the specified model.

3. The case of ICT industry

The ICT industry is one of the fastest growing sectors of the Macedonian economy, and it plays an important role in the economy as a provider of jobs and generator of exports. With an annual growth rate between 2.3 and 7.7% over the last several years, North Macedonia's Information and Communication Technology (ICT) sector is a promising area for foreign companies. The ICT sector benefits from a skilled and cost effective workforce with excellent English language skills, solid telecommunications infrastructure and low corporate tax. North Macedonia's ICT market was valued at €352 million in 2017. Hardware is the largest segment (55 percent), followed by ICT services (30 percent) and software (15 percent)⁴.

The growth of the ICT industry has been spurred by four major factors. First, on the demand side, there is a growing trend among foreign companies to outsource software related tasks and activities to lower-cost destinations thereby creating substantial market opportunities for software and IT services companies in North Macedonia. Second, on the supply side, North Macedonia has significant comparative advantages, such as lower labour costs and highly skilled human capital. Third, like in many other transition countries, the Macedonian Government recognizes the strategic importance of the software industry for the development and competitiveness of its national economy. Being a cross-cutting technology, promoting the software industry is a well-proven measure to increase productivity, efficiency and innovation as well as to facilitate industrial transformation towards a knowledge based economy. The fourth factor contributing to the importance of software exports for the development of the economy of North Macedonia is the country's limited domestic market. Thus, export becomes an issue of paramount importance for the development and growth of the software industry.

A number of international companies such as Seavus (Sweden), Netcetera (Switzerland), M Soft (France), 6PM (UK/Malta) are successfully developing software in North Macedonia for the export market and others are providing 24/7 telephone customer support for major multi-national IT companies. Many large ICT companies, such as Microsoft, Cisco, Oracle, Dell, Compaq, Hewlett Packard, IBM, Sun Microsystems, Apple, and Lotus, are present in North Macedonia via branch offices, distributors, dealers, resellers, solution providers, and business partners. This growth is spurred by large investments by the government and telecommunications companies in IT, continued spending in the financial sector, a decrease in the price of IT equipment, and a decrease in VAT for the equipment.

The labour productivity in the ICT industry compared to the aggregate labour productivity in the Republic of North Macedonia is presented on Figure 4.

⁴ Source: <http://www.investinmacedonia.com>

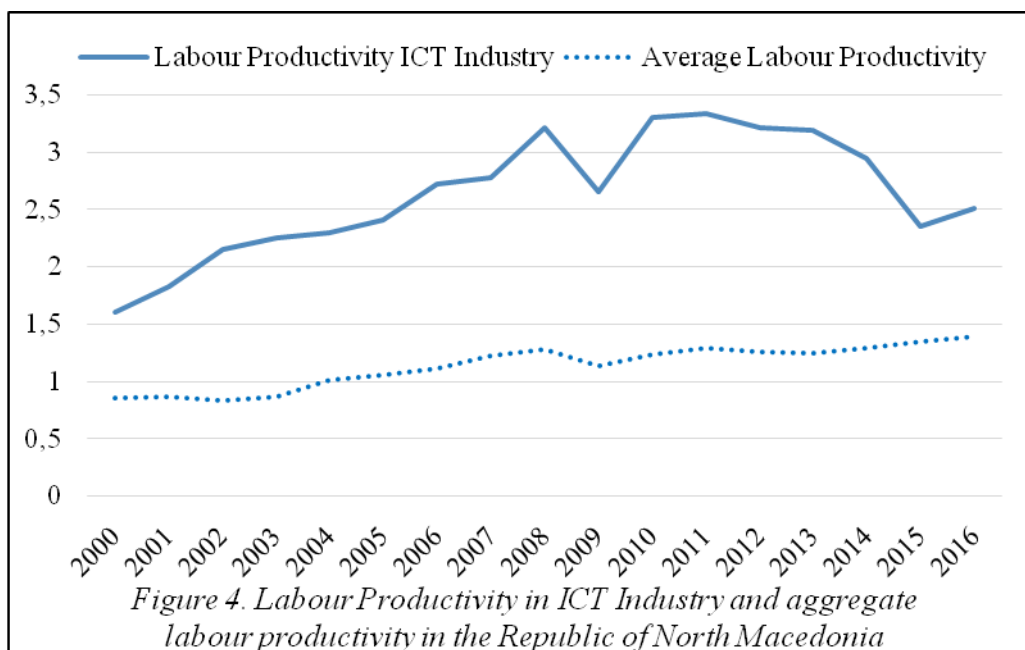


Figure 4. Labour Productivity in ICT Industry and aggregate labour productivity in the Republic of North Macedonia

From Figure 4 it is noticeable that the aggregate labour productivity during the period 2000-2016 marks a steady growing trend. However, the aggregate labour productivity in the Republic of North Macedonia still lags behind the developed OECD countries. On the other hand, although more volatile, the labour productivity in the ICT industry is considerably higher with signs for further improvement compared to the aggregate labour productivity. By taking into account the results from the previous empirical analysis, we can conclude that high capital intensity, high wage level and predominantly task-based contracts make ICT among the leading industries with respect to the labour productivity.

The role of ICT in the labour productivity of other sectors is assessed by the State statistical office of the Republic of North Macedonia. Namely, according to the obtained results in 2018, 94.4% of the enterprises used computer in their work, while 81.5% of the establishments with 10 or more employees had the fixed broadband connection to the Internet. From the total number of the enterprises, 53.9% had website/homepage, of which 89.6% provided on their website descriptions of goods or services, price lists, 51.7% had links or references to their social media profiles, and 21% provided online ordering, reservation or booking. Regarding the usage of e-commerce, 5.7% of the enterprises received e-sales orders via computer network, and 4.4% of the enterprises received orders for products or services via web-sales.

4. Conclusions and policy implications

The Republic of North Macedonia generally experiences low aggregate labour productivity compared to more economically developed countries. However, several industries make exception and are characterised with higher levels of labour productivity. Those are: Electricity, gas, steam and air conditioning supply; Mining and quarrying; Financial and insurance activities; and, Information and communication. In addition, the empirical findings show that the higher levels of capital intensity, higher wage levels, good job experience and task-based contracts characteristic for the ‘gig economy’ are the most relevant factors that influence the labour productivity at industry level.

Having in mind the results from the empirical analysis, the policies aiming to improve labour productivity in North Macedonia should be focused on: Investment in physical capital, quality of education and training; and technological progress. In this context, investment in high tech information and communication technology appears as valuable strategy for improving the workforce labour

productivity. However, the general impression is that the North Macedonia government is preoccupied with other priorities and is paying little attention to developing of the ICT sector. Up to the present, the sector has received very little support from the government that has led many companies to call for more recognition from the authorities.

The on-going government measures toward fostering ICT growth address two major challenges: innovation and human capital. The first challenge is addressed by the innovative fund, tech parks and incubators and the second challenge is mainly addressed by projects which set out to retrain human resources. Furthermore, there is a need of preparing a national framework for coordination between state institutions, the education system and the private sector, where growth opportunities would be strategically evaluated and acted upon. According to a country report prepared by the European Commission, there is a need for developing a long-term digital strategy. Namely, there is a number of barriers for further development of the ICT sector that have to be removed. In addition the policy makers on the long-term need to create much more awareness about the professional opportunities that the ICT sector provides for young professionals and their future⁵.

Although direct measures for ICT have not yet been implemented by the institutions, still the industry is rapidly growing. One very important issue that can be improved is stronger cooperation between the government and the ICT sector for introducing new taxes and regulations. For example, measures to introduce tax relief on exported services would make Macedonian ICT companies more competitive in the global market. By recognising the importance of information and communication technology for the entire economy, can lead to a true digital evolution in the country and faster economic development.

However, still needs a lot to be done to bring the country to the same level as more developed countries in the emerging Europe region. Many large ICT companies, such as Microsoft, Cisco, Oracle, Dell, IBM and Apple, are present in the Republic of North Macedonia via branch offices, distributors, dealers, resellers, solution providers, and business partners. But with an unemployment rate of 17.8 per cent, finding the right talent can be a tough challenge. There is quite a lot of demand for such services on a global level, and the real opportunity for the ICT sector is to match the demand with skilled professionals. In this context, the policy makers need to encourage cooperation between companies and universities by supporting partnership projects for the re-qualification of workers with IT-related skill profiles.

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Appendix 1

NACE Rev.2 Statistical Classification of Economic Activities

A	Agriculture
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage; waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transporting and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Art, entertainment and recreation
S	Other services activities
T	Activities of households as employers
U	Activities of extra-territorial organisations and bodies

**DOES ICT INDUSTRY EXPERIENCE JOBLESS
GROWTH? EMPIRICAL EVIDENCE FROM OECD
ECONOMIES**

Selda Gorkey*

Abstract:

The role of Information and Communication Technology (ICT) industry is of rising importance, as it highly contributes to technological accumulation, and hence economic growth in economies. Even though the expansion of any industry or economy is expected to generate employment; many studies confirm that economic growth is not always capable of creating employment. Examination of this issue, i.e. jobless growth, specifically in the ICT industry is beneficial as it requires highly-skilled labor. This study aims to empirically explore how output growth is successful at creating employment and tests the existence of jobless growth in the ICT industry in OECD economies from 1999 to 2016. The study first distinguishes the reaction of employment to output growth in the ICT industry, the total industry, and the aggregate economy; and then tests the lagged effects on employment. Then, it divides the time-period into two sub-periods: 1999-2007 and 2008-2016, to explore the impact of the 2008 Global Economic Crisis. The findings indicate significant, positive, yet quite low output elasticity of labor demand coefficients for the ICT industry and the aggregate economy. The coefficients rose slightly, and the coefficient of the total industry became significant with time lags. The findings emphasize that the impact of output growth on employment was the lowest in the ICT industry, compared to those of others. A 1% output growth yielded only 0.21% increase in labor demand, and it reached only to 0.343% after three years in the relevant industry. The findings also show that the impact of wages on ICT employment was significant, yet mostly positive, as opposed to the theory; and the impact of ICT exports was statistically insignificant. These results clarify that; even though output growth generated some employment in the ICT industry, it was not at sufficient levels and it had worsened after the 2008 Crisis, as expected.

Keywords: Jobless growth, ICT, employment elasticity, jobless recovery

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1. Introduction

Information and Communication Technologies (ICT) has been subject to many studies in the last decades, since it highly contributes to economic growth. Due to its importance, the ICT industry attracts high levels of investments in developed economies. Investments in the ICT industry lead to higher production in ICT capital goods (Niebel, 2018; Schreyer, 2000), which results in a rapid expansion of the industry (Nasab & Aghaei, 2009; Niebel, 2018). This process then boosts productivity (Niebel, 2018) in the overall economy, and contributes positively to technological, and economic growth. An expansion of an industry is expected to generate employment; however, numerous empirical studies indicate that growth is not always capable of creating employment opportunities. Negative; or positive, yet low employment generation of output, i.e. jobless growth, may signify the existence of some structural problems for economies. Jobless growth has always attracted attention in growth studies; however, it has come to the fore with studies that examine the recovery period, particularly jobless recovery, following the 2008 Global Economic Crisis (Blecker, 2016; Martus, 2016). Many factors cause jobless, and these factors differ in economies. Some of the primary reasons can be summarized as labor market rigidities; labor market regulations, tax burden; changing skill structure of employees, and technological change (Abdioglu & Albayrak, 2017; Graetz & Michaels, 2017; Telli, Voyvoda, & Yeldan, 2007).

The topic of jobless growth is examined from different, yet similar perspectives in studies. Some of those (Bhalotra, 1998; Hong, Byun, & Kim, 2016) express that, jobless growth is experienced when output increase is accompanied by a decrease in employment; however some of the studies (Abdioglu & Albayrak, 2017; Graetz & Michaels, 2017; Kannan & Raveendran, 2009; Telli et al., 2007) imply positive, yet insufficient level of employment creation of output. In addition to this, there are several studies (Akkemik, 2007; Altman, 2003; Hanusch, 2012; Wolnicki, Kwiatkowski, & Piasecki, 2006) which examine the issue by focusing on the inverse relationship between output and unemployment levels, i.e. Okun's Law.

The literature of jobless growth is rich in studies that focus on the aggregate economy (Altman, 2003; Hanusch, 2012; Telli et al., 2007; Wolnicki et al., 2006), and on the industry-level (Abdioglu & Albayrak, 2017; Akkemik, 2007; Graetz & Michaels, 2017; Kannan & Raveendran, 2009; Onaran, 2008; Thomas, 2013; Upender, 2006). However, the studies that examine specifically the ICT industry are limited. Hong, et al. (2016) empirically investigated jobless growth in the ICT manufacturing and ICT services in Korea over a time span of 1995-2009. Estimation results of this study indicate that the ICT manufacturing experienced jobless growth, and labor productivity in the ICT industry was estimated low. Graetz & Michaels (2017) examined employment creation of output for a panel of 17 economies and 28 industries and found out a weak relationship between the two. Even though this study did not directly focus on the ICT industry, it aimed to test whether the technological change was a determinant for the jobless recovery. It included the share of ICT in total capital in the empirical analysis, and it found out that technological change was not a reason for the jobless recovery.

The limited numbers of studies that focus on jobless growth specifically in the ICT industry show a literature gap on the matter. However, as ICT contributes substantially to technological change and economic growth; the employment creation capacity of output growth in the industry is worthwhile. Thus, this study aims to examine the jobless growth in the ICT industries of OECD economies over a time span of 1999-2016, in an attempt to contribute to the literature. The study first distinguishes the ICT industry from the aggregate economy and the total industry concerning jobless

growth; and then examines the impact of the 2008 Global Economic Crisis on the ICT industry. It aims to estimate the output elasticity of labor demand coefficients, using panel data analysis.

The study seeks answers to the following research questions:

- Did the OECD economies experience jobless growth in the ICT industry from 1999 to 2016?
- Was the output elasticity of labor demand different in the ICT industry compared to those in the aggregate economy, and total industry during the period examined?
- Did the 2008 Global Economic Crisis make any difference in the output-employment relationship in the ICT industry?

The rest of this study is organized as follows; section two describes the labor demand model theoretically; section three presents the data, model and variables; section four shows estimation results; and the conclusion concludes.

2. Labor Demand Model

Following Onaran (2008) and Wolnicki et al. (2006), the model of this study is based upon labor demand function, derived from Cobb-Douglas production function:

$$Q = A f(K, L) = A K^\alpha L^\beta \quad (1)$$

where Q is output, A is total factor productivity, K is capital, L is employment; and α and β are output elasticity of capital and labor, respectively.

Marginal productivities with respect to capital and labor are included in Equation (1), and then natural logarithms are taken. Finally; rearranging the terms, labor demand model is derived as follows:

$$\ln L = \gamma_0 + \gamma_1 \ln Y + \gamma_2 \ln W \quad (2)$$

W in Equation (2) denotes wages. The output is expected to positively, and wage is expected to negatively affect labor demand. γ_1 indicates output elasticity of labor demand or employment elasticity; and it presents the sensitivity of labor demand (employment) to output changes in an economy/industry (Upender, 2006). It shows the percentage increase in labor demand (employment), when output increases by 1% (Kannan & Raveendran, 2009). Hence, a negative value of employment elasticity signifies the existence of jobless growth.

3. Methodology

This study empirically analyses the existence of jobless growth in the ICT industry in 25 OECD economies[†] from 1999 to 2016 by using panel data analysis. 11 OECD economies[‡] are excluded from the study due to a lack of data. The study first examines whether the experience in the ICT industry

[†]Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, and United States.

[‡]Australia, Chile, Iceland, Israel, Japan, Korea, Luxembourg, Mexico, New Zealand, Switzerland, and Turkey.

was different than that of the total industry, and the aggregate economy in OECD economies. It then divides the period into two sub-periods – 1999-2007 and 2008-2016 – to examine the impact of the 2008 Global Economic Crisis.

3.1. Model and Variables

The study uses labor demand model to test jobless growth, following the studies of Onaran (2008), and Wolnicki, et al. (2006). Equation (2) is adjusted for panel data and the model of this study is presented as follows:

$$\ln L_ICT_{it} = \gamma_0 + \gamma_1 \ln Y_ICT_{it} + \gamma_2 \ln W_ICT_{it} + \varepsilon_{it} \quad (3)$$

where L is employment, Y is output, and W is wages in the ICT industry[§]. i denotes countries, t denotes time, and ε includes country and time-specific effects and the error term. γ_1 denotes output elasticity of labor demand, and it is expected to be positive. The impact of wages γ_2 on labor demand is expected to be negative. All of the variables are expressed in natural logarithms. Since changes in wages and output may affect the employment level by a time lag, the impact of lagged wages and output on employment up to three lags are also estimated in the study. The impact of ICT exports (X_ICT) on ICT employment was also included in *Equation (3)* to estimate its impact.

The existence of jobless growth is also estimated for the total industry, and the aggregate economy, to distinguish ICT from the others concerning jobless growth. The models for industry and, the aggregate economy are presented by *Equations (4)* and *(5)*, respectively:

$$\ln L_IND_{it} = \gamma_0 + \gamma_1 \ln Y_IND_{it} + \gamma_2 \ln W_IND_{it} + \varepsilon_{it} \quad (4)$$

$$\ln L_AGG_{it} = \gamma_0 + \gamma_1 \ln Y_AGG_{it} + \gamma_2 \ln W_AGG_{it} + \varepsilon_{it} \quad (5)$$

where L , Y , and W are employment, output^{**}, and wages. IND and TOT suffixes of variables represent the total industry^{††} and the aggregate economy, respectively. i denotes countries, t denotes time, and ε includes country and time-specific effects and the error term. All variables are expressed in natural logarithms. The impact of output on labor demand is expected to be positive, whereas the impact of wages is expected to be negative.

[§]comprises ICT manufacturing and ICT services industries. According to ISIC Rev.4, the ICT industry is the sum of the following divisions: D26 Manufacture of computer, electronic and optical products; J61 Telecommunications; and J62-63 IT and other information services. (OECD, 2019a).

^{**} Y is GDP for total employment.

^{††}According to ISIC Rev.4, the total industry is the sum of all the divisions from 01 to 99. It includes: A01-03 Agriculture, hunting, forestry and fishing; B05-09 Mining and quarrying; C10-33 Manufacturing; DE-35-39 Electricity, gas and water supply, sewerage, waste management and remediation activities; F41-43 Construction; GI45-46 Wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities; J58-63 Information and communication; K64-66 Financial and insurance activities; LN68-82 Real estate, renting and business activities; OU84-99 Community, social and personal services (OECD, 2019a).

3.2. Data

Data for all the variables in *Equation (3)* were collected from the OECD (2019b) Database. Employment in ICT (L_{ICT}) data was collected as thousand persons from the dataset, and then it was turned into an index by the author. Output in ICT (Y_{ICT}) and wages in ICT (W_{ICT}) data were collected in monetary value from the dataset. Both were then deflated and expressed as indexes. Data for ICT exports was collected from the OECD(2019c) Database in monetary value. The variable was constructed as percentages of industry exports, which was also collected from the same database as monetary value.

Data for the variables in *Equations (4)* and *(5)* were collected from the OECD Database. Employment in total industry (L_{IND}) was in thousand persons in the dataset (OECD, 2019b), and it was converted to an index by the author. Output in the total industry (Y_{IND}), wages in the total industry (W_{IND}), and industry exports (X_{IND}) were gathered in monetary value from the dataset (OECD, 2019b; OECD, 2019c). After deflating series, each was converted into indexes (2010=1). The data for the aggregate employment (L_{AGG}) was collected as an employment index with the 2015 base year, and it was converted to the 2010 base year (OECD, 2019d). Data for the aggregate output (Y_{AGG}) was collected as the GDP index(OECD, 2019e). Wages for the aggregate economy (W_{AGG}) were gathered in monetary value from the dataset (OECD, 2019f), and converted to an index after deflating series. The base years of all the indexes in the study are 2010.

Summary statistics for 25 OECD economies are presented in Table 1, which includes all the variables used in the study. It shows the number of observations, mean, standard deviation, the minimum and maximum values for each variable. Statistics for the variables are presented without natural logarithms in Table 1. (See Appendix 1 for means of variables by each economy.)

Table 1. Summary Statistics, 1999-2016.

Variable	N	Mean	Std. Dev.	Min	Max
L_{ICT}	522	96.74	15.32	53.15	169.18
Y_{ICT}	516	89.31	22.46	20.52	149.26
W_{ICT}	513	91.43	23.42	30.80	196.95
X_{ICT}	600	15.30	12.91	1.59	71.84
L_{IND}	556	98.99	7.88	70.49	126.15
Y_{IND}	548	91.76	16.43	45.21	146.61
W_{IND}	533	91.39	16.13	44.59	159.23
X_{IND}	600	84.60	29.08	16.27	146.61
L_{AGG}	584	98.90	8.09	66.07	124.31
Y_{AGG}	597	93.96	16.49	48.24	167.97
W_{AGG}	599	92.71	13.62	42.78	140.78

Notes: L , Y , and W are employment index, output index, and wage index (2010=100). Suffixes of ICT , IND , and AGG are the ICT industry, the total industry, and the aggregate economy, respectively.

X_{IND} is export index for the total industry. All indexes are calculated as 2010=100. X_{ICT} is the percentage of ICT exports in total industry exports.

Table 2 shows the correlation matrix for employment, output, wages, and exports only in the ICT industry for simplicity. Table 2 shows that ICT employment is significantly, highly and positively correlated with the ICT output level, as parallel with the theory. However, it is significantly but positively correlated with wages. This outcome is not parallel with the labor demand theory, which proposes a negative relationship between demand for employment and wages. The correlation between ICT employment and ICT exports are significant, yet low.

Table 2. Correlation Matrix, 1999-2016.

	$\ln L_{ICT}$	$\ln Y_{ICT}$	$\ln W_{ICT}$	$\ln X_{ICT}$
$\ln L_{ICT}$	1			
$\ln Y_{ICT}$	0.73*	1		
$\ln W_{ICT}$	0.69*	0.80*	1	
$\ln X_{ICT}$	0.12*	0.13*	-0.02	1

Notes: $\ln L_{ICT}$ is employment in ICT, $\ln Y_{ICT}$ is output in ICT, W_{ICT} is wages in ICT, and X_{ICT} is ICT exports. All the variables are in natural logarithms. Stars indicate significance level at $p < 0.05$.

4. Estimation Results

The results are estimated using a two-way fixed effects (FE) model. Before the estimation, all the variables are demeaned from the time dimension, and then the parameters are estimated by within estimator. The tests for heteroscedasticity, serial correlation, and cross-sectional dependence show the existence of all, hence Driscoll-Kraay standard errors are estimated for robust results.

The study first aims to examine whether the impact of output growth on employment is different in the ICT industry, compared to that of the total industry and the aggregate economy. Such examination also serves for distinguishing the three to test the existence of jobless growth. Table 3 shows the estimation results. Model (1) indicates the ICT industry, which is the main consideration of this study; model (2) indicates the aggregate economy, and model (3) indicates the total industry.

Table 3. Estimation Results: Two-way FE Models for ICT Industry, Aggregate Economy, and Total Industry, 1999-2016

	<i>Model (1)</i> <i>Response var.:</i> $\ln L_{ICT}$	<i>Model (2)</i> <i>Response var.:</i> $\ln L_{AGG}$	<i>Model (3)</i> <i>Response var.:</i> $\ln L_{IND}$
$\ln Y_{ICT}$	0.211*** [0.0336]		
$\ln W_{ICT}$	0.173** [0.0582]		
$\ln Y_{AGG}$		0.537***	

		[0.0341]	
<i>lnW_AGG</i>		-0.273***	
		[0.0426]	
<i>lnY_IND</i>			0.122
			[0.0741]
<i>lnW_IND</i>			0.0491
			[0.0870]
<i>constant</i>	-0.000528	0.00187	0.00553
	[0.00196]	[0.00210]	[0.00394]
<i>R-squared</i>	0.4035	0.3868	0.1452
<i>N</i>	423	443	439

Notes: Numbers without brackets are estimated parameters, and numbers in brackets are Driscoll-Kraay standard errors. Stars indicate the following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Model (1) in Table 3 shows that the output level and wages contributed significantly to employment in the ICT industry. The impact of output on employment; in other words, output elasticity of labor demand, was positive, yet too low. One percentage increase in output in the ICT industry could only generate a 0.21% increase in ICT labor demand in OECD economies from 1999 to 2016. According to the theory, the impact of wages on employment is expected to be negative, whereas empirical findings showed the opposite. Model (2) presents that; output level significantly and positively, and wages significantly and negatively affected employment level, as the theory proposes. However, the output level could generate low levels of employment in the aggregate economy, similar to that in the ICT industry. Estimation of the model (3) shows the findings for the total industry, which experienced insignificant impacts of both output and wages. This result signifies that the changes in labor demand could not be statistically explained by the output level and wages in the total industry.

Table 4. Estimation Results of Lagged Variables: Two-way FE Models for the ICT Industry, the Aggregate Economy, and the Total Industry, 1999-2016

<i>Response var.:</i>	<i>Model (1)</i>	<i>Model (4)</i>	<i>Model (5)</i>	<i>Model (6)</i>
<i>lnL_ICT</i>	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>
<i>lnY_ICT</i>	0.211*** [0.0336]	0.262*** [0.0459]	0.310*** [0.0619]	0.343*** [0.0741]
<i>lnW_ICT</i>	0.173** [0.0582]	0.123 [0.0683]	0.0525 [0.0826]	-0.00459 [0.0828]
<i>constant</i>	-0.000528 [0.00196]	-0.000923 [0.00164]	-0.00143 [0.00163]	-0.00274 [0.00186]
<i>R-squared</i>	0.4035	0.4127	0.3687	0.3470
<i>N</i>	423	425	424	420
<i>Response var.:</i>	<i>Model (2)</i>	<i>Model (7)</i>	<i>Model (8)</i>	<i>Model (9)</i>
<i>lnL_AGG</i>	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>
<i>lnY_AGG</i>	0.537***	0.569***	0.535***	0.414***

		[0.0341]	[0.0408]	[0.0412]	[0.0579]
<i>lnW_AGG</i>		-0.273*** [0.0426]	-0.343*** [0.0434]	-0.374*** [0.0444]	-0.331*** [0.0386]
<i>constant</i>		0.00187 [0.00210]	0.000632 [0.00224]	-0.0000442 [0.00258]	0.000494 [0.00305]
		0.3868	0.3940	0.3240	0.2107
<i>N</i>		443	443	443	442
<i>Response var.:</i>	<i>Model (3)</i>	<i>Model (10)</i>	<i>Model (11)</i>	<i>Model (12)</i>	
<i>lnL_IND</i>	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>	
<i>lnY_IND</i>	0.122 [0.0741]	0.272*** [0.0695]	0.394*** [0.0762]	0.410*** [0.0621]	
<i>lnW_IND</i>	0.0491 [0.0870]	-0.116 [0.0692]	-0.289** [0.0799]	-0.366*** [0.0668]	
<i>constant</i>	0.00553 [0.00394]	0.00525 [0.00409]	0.00505 [0.00434]	0.00510 [0.00458]	
<i>R-squared</i>	0.1452	0.1372	0.1435	0.1661	
<i>N</i>	439	440	439	436	

Notes: Models (1), (2), and (3) are estimated by explanatory variables without lags. Models (4), (7), and (10) are estimated by using the first lags; models (5), (8), and (11) are estimated by using the second lags; and models (6), (9), and (12) are estimated by using the third lags of explanatory variables. Numbers without brackets are estimated parameters, and numbers in brackets are Driscoll-Kraay standard errors. Stars indicate the following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Changes in output and wages can affect the labor market by a time lag (Akkemik, 2007). For this reason, the study also examines lagged effects. Table 4 consists of three parts: the ICT industry, the aggregate economy, and the total industry, from the top to the bottom, respectively. At each part, the first models estimate the models by using explanatory variables with no lag structure. In the second column, the models are estimated with the first lags of explanatory variables. The third column includes the second lag, and the last column includes the third lags of explanatory variables. The number of lags is limited with three, depending on the data availability in the time dimension.

The estimation results in Table 4 show that the impacts of output on labor demand were higher in the ICT, the aggregate economy and total economy by a time lag. A change in output led to gradually higher increases in labor demand by higher time lags and generated the highest increase after three periods in the ICT industry. Even though the output elasticity of labor demand coefficient reached 0.34% from 0.21% after three periods, the coefficient was still too low. In other words; despite its higher impact, an increase in output was still incapable of generating high employment by time lags. The impact of wages on employment became insignificant in the ICT industry throughout time.

The middle part of Table 4 presents estimation results for the aggregate economy. The findings show that a one percent increase in output generated only 0.57% increase after one period, and it started to decrease gradually by time lags, fell to 0.41% at the third lag. Change in wages resulted in higher effects on labor demand with time, and it generated the highest impact in the second lag. The bottom part of Table 4 indicates estimation results for the total industry. Even though, the effects of output and wages were insignificant without time lags; they turned to be significant after one period and two periods, respectively. Their impacts were higher in the third lag, and both of their signs were consistent with the theory. However, output increases did not create sufficient employment opportunities in the total industry, similar to that of the ICT industry and the aggregate economy. Output elasticity of labor demand coefficient rose from 0.27% in the first time lag to only 0.41% in the third time lag in total industry.

Table 5 shows the estimation results for only the ICT industry. Model (1) is the main model of this study, and it was also available in Tables 3 and 4. Model (13) includes an additional variable, ICT exports. The estimates indicate a statistically insignificant effect of ICT exports on ICT labor demand; and it was also estimated as insignificant by time lags, which are not included in Table 5 for simplicity. Models (14) and (15) examines the effect of industry's output and wages levels on ICT labor demand; and models (16), (17), and (18) examines the effect of the aggregate economy's output and wage levels on ICT labor demand. The output of the total industry affected ICT employment significantly only after 3 periods. Since one lagged and two lagged variables of industry output were insignificant, they are not included in Table 5 for simplicity. The changes in the aggregate output significantly increased labor demand in the ICT industry; however, the relevant impact was insignificant at the third lag. Wages in the total industry and the aggregate economy did not have any significance in the ICT labor market. An important point worth mentioning in Table 5 is that R-squared values were extremely low in Models (14-18). These values signify that; output and wage levels in the aggregate economy and total industry could only statistically explain the smaller shares of the changes in the ICT labor demand. Even though, employment elasticity coefficients of the aggregate output (0.395) in Model (17) and total industry output (0.495) in Model (15) were higher than the ICT output (0.21) in Model (1); r-squared of model (1) is higher, and the elasticity coefficient in model (1) had a higher significance level (three stars) compared to the others.

Table 5. Estimation Results: Two-way FE Model for the ICT Industry, 1999-2016

<i>Res. var.:</i>	<i>Model</i>	<i>Model</i>	<i>Model</i>	<i>Model</i>	<i>Model</i>	<i>Model</i>	<i>Model</i>
<i>lnL_{ICT}</i>	<i>(1)</i>	<i>(13)</i>	<i>(14)</i>	<i>(15)</i>	<i>(16)</i>	<i>(17)</i>	<i>(18)</i>
	<i>Level</i>	<i>Level</i>		<i>3rd Lag</i>		<i>2nd Lag</i>	<i>3rd Lag</i>
<i>lnY_{ICT}</i>	0.211***	0.204***					
	[0.034]	[0.0532]					
<i>lnW_{ICT}</i>	0.173**	0.172**					
	[0.058]	[0.058]					
<i>lnX_{ICT}</i>		0.0051					
		[0.017]					
<i>lnY_{IND}</i>			0.195	0.495*			
			[0.154]	[0.217]			
<i>lnW_{IND}</i>			0.0837	-0.224			
			[0.154]	[0.149]			

<i>lnY</i> _AGG					0.369*	0.395*	0.309
					[0.149]	[0.146]	[0.155]
<i>lnW</i> _AGG					0.0760	0.0506	0.122
					[0.151]	[0.117]	[0.091]
<i>constant</i>	-	-0.0008	-	-0.00274	0.00045	-0.0006	0.0002
	0.00053		0.00096				
	[0.0020]	[0.003]	[0.0019]	[0.0024]	[0.0001]	[0.0018]	[0.0027]
<i>R-squared</i>	0.4035	0.4038	0.0746	0.0802	0.1168	0.1129	0.1094
<i>N</i>	423	423	427	423	437	437	436

Notes:The response variable is labor demand, in the ICT industry. Models (1), (13), (14), and (16) are estimated by explanatory variables with no lags. To keep the table as simple as possible, some of the lagged models are not presented. Numbers without brackets are estimated parameters, and numbers in brackets are Driscoll-Kraay standard errors. Stars indicate the following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

To examine the effects of the 2008 Global Economic Crisis, the study divides the entire period into two sub-periods. Hence, the models in Table 6 examine the existence of jobless growth in the ICT industry separately in the pre-crisis (1999-2007), and the post-crisis (2008-2016) periods. Output elasticity of labor demand was estimated as 0.21% without lagged effects before the crisis, and it increased gradually and reached to 0.45% at the third lag. The impact of wages on ICT employment was significantly effective by lags and it was estimated -0.26% at the third time lag. The findings for the post-crisis period showed significant, yet even lower output elasticity coefficients compared to that of the pre-crisis period, as expected. The relevant coefficient was 0.085% without lagged effects, and it reached to only 0.162% by the third time lag. The impact of wages on employment in the ICT industry was significant yet positive without lags, and it became insignificant with the third time lag after the crisis. These findings clearly show that the relationship between wages and employment in the ICT industry used to be consistent with the theory before the crisis. Estimation findings for the entire period also indicated a significant and positive parameter that was not parallel with the theory, as evidenced in Model (1) in Tables(3), (4), and (5). (See Appendix 2 for estimation results for the aggregate economy, and total industry for the pre-crisis (1999-2007) and the post-crisis (2008-2016) periods).

Table 6. Estimation Results: Two-way FE Model for the ICT Industry, Two Sub-Periods: Pre-crisis (1999-2007), and post-crisis (2008-2016)

<i>Response Var.:</i>	Pre-Crisis (1999-2007)			Post-Crisis (2008-2016)		
	<i>Model (19) Level</i>	<i>Model (20) 2nd Lag</i>	<i>Model (21) 3rd Lag</i>	<i>Model (22) Level</i>	<i>Model (23) 2nd Lag</i>	<i>Model (24) 3rd Lag</i>
<i>lnL</i> _ICT	0.210* [0.0968]	0.385*** [0.0443]	0.445*** [0.0523]	0.0850** [0.0266]	0.121*** [0.0265]	0.162** [0.0486]
<i>lnW</i> _ICT	0.0519 [0.113]	-0.139** [0.0417]	-0.259*** [0.0317]	0.445*** [0.0341]	0.298*** [0.0792]	0.158 [0.0796]

<i>constant</i>	0.00244 [0.00262]	0.000953 [0.00217]	-0.000865 [0.00276]	-0.00343 [0.00316]	-0.00317 [0.00268]	-0.00400 [0.00288]
<i>R-squared</i>	0.1572	0.1812	0.2396	0.5057	0.2645	0.1776
<i>N</i>	214	210	207	209	214	213

Notes: Models (19), and (22) are estimated by explanatory variables with no lags; models (20) and (23) are estimated by using the second lags; and models (21), and (24) are estimated by using the third lags of explanatory variables. Numbers without brackets are estimated parameters, and numbers in brackets are Driscoll-Kraay standard errors. Stars indicate the following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Conclusion

This study aims to test the existence of jobless growth in the ICT industry in OECD economies. Selecting a period from 1999 to 2016, it first questions whether the relevant experience in the ICT industry is different compared to that of the aggregate economy, and the total industry. The study also examines the impact of lagged explanatory variables on ICT labor demand, since time is an important factor for the output-employment nexus.

The estimation findings show that output elasticity of labor demand was significant, positive, yet low in the ICT industry and the aggregate economy; and it was lower in the ICT industry than that of the aggregate economy. The impact of output on employment was insignificant in the total industry; however, it became significant with the first time lag. The impact of output on employment gradually increased as the number of lags increased in the ICT industry and the total industry. Empirical findings clearly showed that; even though employment creation of output is not at sufficient levels in all; it was the lowest in the ICT industry in OECD economies during the period examined. The impact of the wage level on ICT labor demand was significant, and negative, as the theory proposes; and it was higher by time lags in the aggregate economy and industry. However, it was estimated significant, yet positive without lags. The impact of lagged wages was insignificant. The findings also indicated an insignificant impact of ICT exports on ICT employment.

Finally, the entire period was divided into two periods: 1999-2007 and 2008-2016, to test the impact of the 2008 Global Economic Crisis on the ICT industry. Estimation results clearly showed that the output elasticity of labor demand coefficients was higher before the crisis in the ICT industry. For both periods, labor demand elasticity gradually increased at higher time lags. The division of the entire period into two also clearly showed important evidence for the wage-employment nexus. Lagged wages in the ICT industry affected ICT labor demand significantly and negatively before the crisis, as the theory proposes. However, the estimation results indicate significant yet positive impacts after the crisis, as opposed to the theory. The estimation findings clearly showed that the impact of output and wages on employment worsened after the crisis in the ICT industry, as expected.

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Appendix 1: Means Of Variables By Economies

Table. Means of Variables by Economies, 1999-2016.

	<i>mean</i> (<i>L_ICT</i>)	<i>mean</i> (<i>Y_ICT</i>)	<i>mean</i> (<i>W_ICT</i>)	<i>mean</i> (<i>X_ICT</i>)	<i>mean</i> (<i>L_IND</i>)	<i>mean</i> (<i>Y_IND</i>)	<i>mean</i> (<i>W_IND</i>)	<i>mean</i> (<i>X_IND</i>)	<i>mean</i> (<i>L_AGG</i>)	<i>mean</i> (<i>Y_AGG</i>)	<i>mean</i> (<i>W_AGG</i>)
Austria	103.76	106.79	109.97	9.46	96.16	90.13	94.60	85.24	97.54	94.83	95.74
Belgium	94.88	88.73	95.21	6.79	95.69	92.52	94.11	85.05	94.99	93.79	99.26
Canada	98.45	100.24	103.71	7.60	94.13	90.18	102.90	94.23	95.46	93.76	94.19
Czechia	88.00	76.92	79.80	21.89	99.40	89.37	90.05	75.16	100.16	90.81	89.31
Denmark	91.74	89.00	83.18	10.25	99.70	93.80	92.76	89.15	101.01	97.95	93.51
Estonia	96.74	82.14	83.44	23.85	110.44	98.18	95.27	77.81	108.79	96.99	84.98
Finland	99.66	95.50	90.10	23.94	96.03	90.55	88.21	93.91	97.39	92.96	92.69
France	98.65	91.58	90.65	12.23	97.42	92.72	91.95	90.79	97.94	95.55	94.55
Germany	97.89	94.35	96.09	12.33	98.24	95.78	101.31	84.86	99.60	97.91	100.75
Greece	84.24	85.37	113.55	4.93	92.93	92.94	81.60	82.65	92.68	89.27	90.93
Hungary	97.27	74.86	83.97	37.82	104.21	96.34	93.62	74.62	104.50	96.03	91.07
Ireland	97.77	107.58	82.75	37.60	96.41	92.40	88.54	92.10	96.69	97.39	86.26
Italy	95.92	94.14	92.07	5.81	96.78	95.72	92.97	91.66	97.53	97.75	96.20
Latvia	113.64	95.91	106.70	8.98	111.18	92.56	94.15	78.62	110.27	96.37	90.55
Lithuania	107.07	91.37	91.79	7.73	111.28	90.15	91.19	76.96	108.06	93.60	91.12
Netherlands	93.43	90.43	89.85	28.93	95.77	91.18	91.87	76.29	96.79	94.07	95.15
Norway	92.95	86.77	81.12	2.97	95.53	87.77	87.60	78.66	96.02	95.40	91.50
Poland	94.08	74.20	90.43	11.33	97.67	83.83	85.66	74.66	98.04	88.36	93.53
Portugal	91.01	95.40	87.72	10.52	99.56	92.34	91.07	92.21	98.43	94.07	95.44
Slovak Rep.	89.61	63.99	81.03	21.45	98.93	91.73	90.24	72.26	98.75	86.81	86.73
Slovenia	90.76	83.58	82.64	4.20	97.19	88.37	86.30	84.77	96.37	90.68	88.86
Spain	88.26	84.16	88.11	5.87	91.97	88.91	85.36	88.34	92.14	90.95	94.00
Sweden	101.84	90.10	90.61	20.17	98.54	89.03	90.57	86.27	98.45	93.47	93.91
UK	106.36	96.29	94.97	19.13	98.56	92.64	92.43	99.29	98.89	96.33	92.02
USA	109.47	102.19	106.49	26.72	101.76	95.86	99.93	89.37	101.03	93.88	95.33

Notes: *L*, *Y*, and *W* are employment index, output index, and wage index. Suffixes of *ICT*, *IND*, and *AGG* are ICT industry, total industry, and the aggregate economy, respectively. *X_IND* is exports index for the total industry. All indexes are calculated as 2010=100. *X_ICT* is the percentage of ICT exports in total industry exports.

Appendix 2: Estimation Results By Sub-Periods

Table: Estimation Results of the Aggregate Economy and Total Industry, Pre-Crisis (1999-2007) and Post-Crisis (2008-2016) Periods

Response Var.:	Pre-Crisis (1999-2007)				Post-Crisis (2008-2016)			
	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>
<i>lnL_AGG</i>	0.550*** [0.0522]	0.625*** [0.0581]	0.623*** [0.0583]	0.533*** [0.0589]	0.525*** [0.0503]	0.624*** [0.0816]	0.616*** [0.0414]	0.382*** [0.0789]
<i>lnW_AGG</i>	-0.346*** [0.0581]	-0.409*** [0.0536]	-0.391*** [0.0440]	-0.316*** [0.0309]	0.0763* [0.0326]	-0.100 [0.0503]	-0.325*** [0.0452]	-0.244*** [0.0646]
<i>constant</i>	0.00541 [0.00299]	0.00390 [0.00300]	0.00372 [0.00281]	0.00545 [0.00306]	-0.00156 [0.00148]	-0.0031*** [0.00065]	-0.0050*** [0.00070]	-0.0055** [0.0015]
<i>R-squared</i>	0.3394	0.4661	0.4924	0.4068	0.5728	0.5908	0.3819	0.1431
<i>N</i>	218	218	218	217	225	225	225	225

Response Var.:	Pre-Crisis (1999-2007)				Post-Crisis (2008-2016)			
	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>	<i>Level</i>	<i>1st Lag</i>	<i>2nd Lag</i>	<i>3rd Lag</i>
<i>lnL_IND</i>	-0.0186 [0.0439]	0.155*** [0.0285]	0.310*** [0.0169]	0.361*** [0.0484]	0.120** [0.0379]	0.326*** [0.0497]	0.457*** [0.0818]	0.408*** [0.0899]
<i>lnW_IND</i>	0.113** [0.0373]	0.0140 [0.0409]	-0.0867** [0.0292]	-0.125** [0.0347]	0.307*** [0.0528]	0.0956* [0.0433]	-0.142 [0.0725]	-0.231* [0.0966]
<i>constant</i>	0.0156*** [0.00202]	0.0147*** [0.00212]	0.0138*** [0.00228]	0.0134*** [0.00252]	-0.00269 [0.00217]	-0.00373* [0.00134]	-0.0048*** [0.000834]	-0.00497** [0.00166]
<i>R-squared</i>	0.0989	0.1637	0.2507	0.2926	0.7543	0.6971	0.3967	0.1761
<i>N</i>	217	216	215	213	222	224	224	223

Notes: Upper part of the table shows estimation results of the aggregate economy, and the below part shows the total industry. Numbers without brackets are estimated parameters, and numbers in brackets are Driscoll-Kraay standard errors. Stars indicate the following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

LABOUR MARKET IN TERMS OF THE FOURTH INDUSTRIAL REVOLUTION

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Abstract:

Recently, many studies and analysis confirmed that the world is at the beginning of a powerful process of transformation that will radically change our lives, ways of working and communicating. The Fourth Industrial Revolution is expected to improve the computerization of manufacturing industry and focuses on equipping the production with high technology. Three main goals of Industry 4.0 could be highlighted as: (1) Reduction of the human factor in manufacturing thus eliminating human errors. (2) Achieving high level of manufacturing flexibility and creating conditions for designing products that meet the specific requirements of the consumer. (3) Intensification of the production process. This paper aims to present the main trends in this field, to explain the benefits of technology and digitalization for the global economy as well as to elaborate the importance of preparing different segments of society for effects from the Fourth Industrial Revolution onto the global labor market.

This study obtains a panel data of six countries (France, Germany, Italy, Spain, UK and USA) for period between 1985 to 2017. The results have shown that information and communications technology and multifactor productivity are variables who have significant and positive impact on labor productivity while the variable average hours worked per person employed has a negative impact. Additional analysis of the demographic and socio-economic trends shows that the labor market will experience radical changes in the future.

Key words: *Fourth Industrial Revolution, labor market, ICT, MFP*

JEL Classification: *J23, O33, J2*

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1. Introduction

A series of industrial revolutions took place after the 18th century. This process began by transforming the muscle into mechanical power that led to an increase in human production through the cognitive power caused by the Fourth Industrial Revolution today.

The First Industrial Revolution lasted from 1760 until 1840 and was led by the mechanical production through the construction of railroads and steam engines. Serial production supported by electricity and the assembly line in the late 19th and early 20th century started the Second Industrial Revolution. The Third Industrial Revolution began in the 1960s and it was characterized as computer or digital revolution which was developed through semiconductors, computer networks and the Internet.

Fourth Industrial Revolution, according to Klaus Schwab, was different from the previous revolutions in three aspects: speed, width and depth and the system effect. It took 120 years for the spindle that was the symbol of the First Industrial Revolution to spread outside Europe, while the internet, in a period less than 10 years, managed to spread throughout the whole world. There are still 1.3 billion people who do not have access to electricity, or only 17% of people are fully experiencing the Second Industrial Revolution. The same applies for the Third Industrial Revolution; half of the world population, mostly the developing countries, do not have internet access (Schwab and Davis, 2018). The Fourth Industrial Revolution is not connected only with smart machines and systems, it has a larger range. There are simultaneous leaps in various areas; from sequencing of entire genomes, nanotechnology, renewable energies to quantum techniques. The basic difference of this revolution from the previous three would be the possibility of merging of these technologies and their interaction in the physical, digital and biological areas.

The scope and the width of the technological revolution that is in the process of development will cause economic, social and cultural changes with incredible proportions; that is, according to the founder of the World Economic Forum, Klaus Schwab: "The changes are so profound that from the perspective of human history there has never been a time of greater hope, or greater danger." The Fourth Industrial Revolution will have wide and different impacts on the economy, and it will be very difficult to distinguish one effect from another. That is, most of the macroeconomic variables – GDP, investments, consumption, employment, trade, inflation, etc. - will be affected by the technological revolution". Yet, the focus of this paper is discovering and quantifying the potential effects of information and communications technology (ICT) investments and total factor productivity (or multifactor productivity - MFP) on growth (in terms of productivity as its own determinant in the long run) and the employment.

It is necessary to observe the potential effects of the Fourth Industrial Revolution along with recent economic trends and other factors contributing to growth. A few years before the Great Recession began, the global economy grew at rates of 5%, and if that growth had continued it would have taken 14-15 years for the global GDP to double and millions of people to be saved from poverty. The expectations that after the Great Recession the global economy would return to the previous path of strong growth have not been fulfilled. The global economy appears to be stuck with growth of 3-3.5% which is lower than the average post-war growth rate (Schwab, 2016).

Economists Larry Summers and Nobel laureate Paul Krugman have returned to the claim of several economists, especially Alvin Hansen's statement during the Great Depression about "the decline of the century" and "constant stagnation." The "constant stagnation" describes an unsurpassed situation in which although the interest rates are close to zero, the steady decline on the demand side continues.

If proven, the assumption assumes even greater declines in global GDP growth. If we imagine a final situation in which global GDP growth drops to 2%, doubling of the global GDP will take 34 years (Schwab, 2016).

There are several reasons for the slowing of the global economy growth (wrong distribution of the income, indebtedness, demographic changes etc.). For the research of this paper it is crucial to see the changes in the labor productivity that are connected with the investments in ICT.

The labor productivity has stagnated in the last 10 years despite the achieved exponential growth of the new ICT and investments in the innovations. According to the report “The Conference Board Productivity Brief” of the research company “The Conference Board”, on a global scale, compared with the growth of the output per employee in 2017 for 2%, in 2018 it has grown for 1.9% and it is projected to be returned on 2% growth in 2019. The latest assessment continues the downward trend in global labour productivity from an average annual growth rate of 2.9% in 2000-2007 to 2.3% in 2010-2017. Also, the results of the analysis of the global labor productivity made from the same research company, confirm that effects of the productivity from the the long-awaited digital transformation are still too small to achieve permanent impact on macroeconomic level (The Conference Board, 2019). According to the data of the Bureau of Labor Statistics, the labor productivity has increased in the period from 1947-1983 for 2.8%, from 2000-2007 for 2.7% and in 2007-2018 for 1.3%.

The largest part of this decline is connected with the total factor productivity which is largely used as indicator of the income of the productivity connected with the technology and innovations. The Nobel Prize winner Robert Solow explains the long-run economic growth by looking at the capital accumulation, population growth and increases in productivity or technological progress. Later, Edward Denison splits the technological progress on its components and proves that education and technological progress in narrow sense are the most important factors for economic growth (Fiti, et al., 2008). On a global scale, the growth of total factor production, which takes into account capital investment and workforce skills and thus provides a better picture of the overall efficiency of the manufacturing process that combines capital, labor and technological progress, has declined by -0.1% in 2018, while in 2017 it increased slightly by 0.2%. The stagnation of the total factor production from the previous decade that continues in 2018 is a matter of concern, especially when it comes to the medium-term outlook of the growth. This means that modest productivity growth is still the result of the accumulation of physical capital rather than the benefits of expanded efficiency or innovation (The Conference Board, 2019).

The purpose of this paper is to examine the effects of the annual changes in the investments in ICT, MFP and the average hours worked per person employed on the annual changes in the labor productivity by taking an example from the six countries (France, Germany, Italy, Spain, Great Britain and USA) in the period from 1985-2017. Given the reviewed literature, we hypothesize the positive impact of investment in ICT, MFP and the negative impact of average hours worked per person employed on the labor productivity.

The paper is structured as following: after the introduction we have consulted the relevant theoretical and empirical literature where the theoretical background of the relation between the labor productivity growth and investments in ICT and other macroeconomic variables is explained, and papers that apply a variety of different macroeconomic variables and methodologies to US economy and more developed EU countries are also consulted. We continue with our analyses using the panel regression method to examine the impact of ICT investments, changes in MFP and average hours worked per person employed on labor productivity growth. Finally, we draw some conclusions about

the process of the Fourth Industrial Revolution and the investments in new technologies that affect labor productivity in developed economies.

2. Literature review

Technologies have undoubtedly contributed to improvement of the living standard and prosperity globally. They also continue to generate numerous negative impacts. More digital platforms are contributing for the wealth accumulation in the hands of a smaller group of people, and this is causing the workers to feel more insecure and vulnerable; techniques used in natural gas extraction continue to damage the environment and by transferring costs to marginalized affected parties the owners are becoming even richer. According to (Hicks and Devaraj, 2015, 2017), in the United States since 1990, approximately 83% of manufacturing job are lost are due to capital investments in equipment, and long-term changes in manufacturing sector employment are most linked to US factory productivity.

Most of these externalities have evolved gradually over the last 30 years, but as the Fourth Industrial Revolution progresses and changes occur much more rapidly, we will be faced with even more diverse, more complex and destructive effects of the new technologies. Well-known economists (Brynjolfsson and McAfee, 2014) have popularized the emergence of a "big separation" of the labour and the technology-driven productivity. Keeley (2015) blames technology as responsible for increased inequality because 80% of the reduced labor force contribution to national income creation in OECD countries is attributed to technological development and the public's perception that policies favor economic growth is increasingly reinforced before social cohesion and human well-being.

The slowing of the productivity between the matured economies in the last decade was dramatic, that is, the output rates by hour were halved from the average annual growth rate from 2.3% from 2000-2007 on 1.2% in the period from 2010 -2017. The productivity growth rate has further decreased on 0.8% in 2008 with chances for improvement of 1.1% in 2019. Given the longer-term outlook, the decline in productivity growth rates in mature economies seems to have reached the bottom in the recent years. However, after a significant improvement in MFP growth in 2017, mature economies in 2018 returned to levels below the average growth rate in 2010-2017 (The Conference Board, 2019). Van Ark, et al., (2003) in their paper highlighted the main reasons for lower productivity growth in Europe in the 90's than in the United States. The results indicated that that the productivity in USA increased faster than in the EU because in the United States, besides producing ICT, these technologies were used more successfully in other industries, while the EU was lagging behind in that respect. Most European economies showed significantly lower levels of investments in ICT goods and software than the United States. As mentioned above as USA's productivity growth accelerated, the EU has been slowing down since the mid-1990s. It also contradicts the fact that MFP in the US declined slightly faster in the USA than the average of other mature economies, pointing to the greater importance of the efficiency and innovation investments during this period.

H. Hall and Sena (2017) discuss about the lower concentration of research and development in Europe, they focus on discussing the changes in the industrial sector and stated the small ICT production sector as the main reason. There is a similar interest in policies for the implementation of different variants of investment in the structure of the workforce skills. Given the results of significant previous research, it becomes clear that investments in ICT are often accompanied with undertaken innovations and in cooperation with other non-ICT investments.

Akande, et al., (2017) examined the impact of ICT investment on labor productivity in 19 OECD countries. Despite the different social and economic structures, all 19 countries showed a positive impact of ICT investment on productivity. The variables, the share of total labor compensation in GDP and the strength of trade unions showed a positive but insignificant impact on productivity. On the other hand, the variable of the average annual working hours per one employee is shown to have a negative impact on labor productivity. Dimelis and Papaioannou(2011) analyzed 42 countries and provided solid evidence of a significant impact of ICT on reducing inefficiencies in the country and on increasing of the labor productivity.

Considering the previous studies and the particular importance of this issue, our paper conducted a panel regression to analyze the impacts of ICT investments, MFP growth, and average hours worked per person employed on labor productivity growth of the six developed countries for which high-quality time series are available. As we have seen above, there is a significant decline in labor productivity and ICT investments in OECD countries, and therefore there is a need to investigate the relationship between the macroeconomic variables. Existing empirical literature extensively discusses the reasons why a certain percentage of output growth was not explained by inputs, while little attention has been paid to the paradox of labor productivity. Abramovitz, (1956) and Solow (1957) argue that more than 40% of outputs was not explained by inputs which is contrary to the mainstream economics. They rather found ICT as a source of innovative capabilities and knowledge as competitive driver explaining the paradox. We believe that this study will be very useful and a basis for future research.

3. Data, methodology and analysis

In order to analyze the factors that have effect on the labour productivity panel regression model is used in this research. Data are collected for six countries (France, Germany, Italy, Spain, UK and USA) for period 1985-2017 (thirty three periods) and total number of 198 observations. Data were collected from OECD Productivity Statistics. The dependent variable, Labour productivity (LP) is measured as measured as growth in GDP per hour worked, (annual change in %), and the explanatory variables used in the model are: Information and communication technologies capital (annual change in %) (ICTC), Average hours worked per person employed (annual change in %) (AHW) and multifactor productivity (annual change in %) (MFP). Variables explained in OECD database:

- LP - Labour productivity growth is a key dimension of economic performance and an essential driver of changes in living standards. Growth in gross domestic product (GDP) per capita can be broken down into growth in labour productivity, measured as growth in GDP per hour worked, and changes in the extent of labour utilization, measured as changes in hours worked per capita. High labour productivity growth can reflect greater use of capital, and/or a decrease in the employment of low-productivity workers, or general efficiency gains and innovation.
- ICTC - Estimates of ICT capital services in the OECD Productivity Database can be broken down into three types of assets: computer hardware, telecommunications equipment and computer software and databases. Countries use different approaches to deflate ICT investment series; where constant quality price changes are particularly important but difficult to measure. To ensure comparability of ICT capital services across countries, the OECD

capital services measures are based on a common computation method for all countries and a set of harmonized ICT investment deflators.

- AHW - Average hours worked per person employed - For productivity analysis, the underlying concept for labour input is total hours worked by all persons engaged in production. These reflect regular hours worked by full-time and part-time workers, paid and unpaid overtime, hours worked in additional jobs, and time not worked because of public holidays, annual paid leave, strikes and labour disputes and other reasons.
- MFP - Growth in multifactor productivity (MFP) is measured as a residual, i.e. that part of GDP growth that cannot be explained by growth in labour and capital inputs. Traditionally, MFP growth is seen as capturing technological progress but, in practice, this interpretation needs some caution. First, some part of technological change is embodied in capital input, e.g. improvements in design and quality between two vintages of the same capital asset, and so its effects on GDP growth are attributed to the respective factor. MFP only picks up disembodied technical change, e.g. network effects or spillovers from production factors, the effects of better management practices, brand names, organizational change and general knowledge. Second, data and resource constraints hamper a precise measurement of labour and capital input, affecting MFP. Moreover, MFP also captures other factors such as adjustment costs, economies of scale and effects from imperfect competition.

All included variables are tested with panel unit root test in order to confirm or deny their stationarity. The results are presented in Table 1.

Table 1. Panel unit root tests

Variable	p-values						
	Levin, Chu t*	Lin and	Im, Pesaran and Shin W-stat	ADF-Fisher square	Chi-square	PP-Fisher square	Chi-square
Level							
LP	***0.0000		***0.0001	***0.0007		***0.0000	
ICTC	**0.0133		**0.0416	*0.0909		0.2107	
AHW	***0.0000		***0.0001	***0.0000		***0.0000	
MFP	***0.0000		***0.0001	***0.0000		***0.0000	
First difference							
LP	***0.0000		***0.0001	***0.0000		***0.0000	
ICTC	***0.0000		***0.0001	***0.0000		***0.0000	
AHW	***0.0000		***0.0001	***0.0000		***0.0000	
MFP	***0.0000		***0.0001	***0.0000		***0.0000	

*Null hypothesis is rejected at 0.1; **Null hypothesis is rejected at 0.05; ***Null hypothesis is rejected at 0.01;Source: Authors calculations.

The panel unit root tests are composed of: Levin, Lin and Chu test where the null hypothesis states that there is common unit root process in the panel variable and Im, Pesaran and Shin W-stat, ADF-Fisher Chi square and PP-Fisher Chi-square where the null hypothesis is formulated as existence of individual unit root process. The tests are performed with specification of individual intercept. As is evident of from the presented results, variables are stationary in their level, where for LP, AHW and MFP the null hypothesis for presence of unit root is rejected at 0.01, while for variable ICTS it is rejected at 0.1 and 0.05 for different tests.

Before the model was estimated, Hausman for Endogeneity or Hausman Specification Test was performed which in panel data regression is used to specify if the fixed effects model or random effects model is supposed to be used. The null hypothesis appoints for random effects model, while the alternative hypothesis specifies that fixed effects model is to be used. The results of the Hausman test in this analysis indicate Chi-Square Statistic of 5.171 with p-value of 0.1597, indicating that the null hypothesis is accepted and model with random effects is used.

The random effects approach proposes different intercept terms for each entity and again these intercepts are constant over time, with the relationships between the explanatory and explained variables assumed to be the same both cross-sectionally and temporally. The difference is that under the random effects model, the intercepts for each cross-sectional unit are assumed to arise from a common intercept α (which is the same for all cross-sectional units and over time), plus a random variable ϵ_i that varies cross-sectionally but is constant over time. Variable ϵ_i measures the random deviation of each entity's intercept term from the 'global' intercept term α . Random effects panel model is presented in the following equation:

$$y_{it} = \alpha + \beta x_{it} + \omega_{it}, \quad \omega_{it} = \epsilon_i + v_{it}$$

where x_{it} is $1 \times k$ vector of explanatory variables, but unlike the fixed effects model, there are no dummy variables to capture the heterogeneity (variation) in the cross-sectional dimension. Instead, this occurs via the ϵ_i terms. Note that this framework requires the assumptions that the new cross-sectional error term, ϵ_i , has zero mean, is independent of the individual observation error term (v_{it}), has constant variance σ_ϵ^2 and is independent of the explanatory variables x_{it} (Brooks, 2014).

Panel regression model with random effects for the analyzed data is given in the following equation:

$$LP_{it} = \alpha + \beta_1 ICTCS_{it} + \beta_2 AHW_{it} + \beta_3 MFP_{it} + (\mu_i + \epsilon_{it})$$

where the LP_{it} is the dependent variable, $ICTCS_{it}$, AHW_{it} and MFP_{it} are explanatory variables, μ_i is the unobserved random effect that varies across countries but not over time, and ϵ_{it} is an individual (idiosyncratic) error term, $i = 1, \dots, N$; $t = 1, \dots, T_i$.

Results of the random effects panel estimation are presented in table 2.

Table 2. Results of the random effects panel regression

Explanatory variables	Coefficient	t-statistic	Probability
ICTC	0.018085	3.013983	***0.0029
AHW	-0.323684	-8.490199	***0.0000
MP	0.998269	35.50252	***0.0000
α	0.409395	5.411892	***0.0000
R^2	0.887129		

Effects specification		
	SD	Rho
Cross-section random μ_i	0.046894	0.0125
Idiosyncratic random ϵ_{it}	0.416330	0.9875

Source: Authors calculations.

The findings prove that all three explanatory variable have statistically significant effect on the labor productivity. Information and communication technologies capital has positive impact onto the productivity, and similar effect is found with multifactor productivity. Average hours worked per person employed has negative coefficient with accounts for inverse relationship with the labour productivity.

The Solow-Swan model argued that an increase in capital accumulation and labor force will increase the economic growth rate, but only temporarily because of diminishing returns and once the steady-state is reached and the resources in a country are used up, the economic growth can only be increased through innovation and improvements in technology. We also tried to measure the impact of the change in total factor productivity on labor productivity growth. The rise of MFP is often attributed entirely to technological progress, but it also includes any permanent improvement in the efficiency with which factors of production are combined over time. The Solow residual is the unexplained change in output growth after calculating the effect of capital accumulation. Productivity paradox referred to a decline in the productivity growth in the United States in the 1970s and 80s despite the huge investments and rapid development in the Information Technology (Akande, et al., 2017).

We found that the growth of average hours worked per person employed has a negative impact on productivity growth. The law of diminishing returns expresses a very basic relation. As more of an input such as labour is added to a fixed amount of land, machinery, and other inputs, the labour has less and less of the other factors to work with. The land gets more crowded, the machinery is overworked, and the marginal product of labour declines.

4. Conclusion

According to the results of the analysis, the paper investigates the effects of ICT investments and their annual changes on the impact of labour productivity growth in six developed countries (France, Germany, Italy, Spain, UK, and the USA) in the period 1985-2017. Despite the different social and economic structures, all six countries show a positive response to labour productivity growth driven by investment in ICT.

The theoretical background of the problem and the empirical literature consulted have made the hypotheses presented obviously. The series of hypotheses we have outlined at the beginning of the paper are in the area of acceptance. All three explanatory variables have a significant impact on labour productivity growth. Investments in ICT as a target variable in our analysis show a positive impact on labour productivity growth. The growth of MFP, which is an indicator of the residual, that is, the share of GDP growth that cannot be explained by the growth of labour and capital inputs, also shows similar effects on labor productivity growth. On the other hand, the growth of the average hours worked per person employed show negative impacts on the growth of labour productivity. In conclusion, we can say that the model is relevant to the hypotheses presented earlier, showing that ICT investments affect labour productivity at a significant level with a strong positive impact.

This study, as we have already highlighted, presents the effects that ICT investments have on labour productivity growth at the level of national economies. They can be used by policymakers to assess potential labour productivity growth taking into account investments in ICT or other technological change, network effects and overflow effects of other factors of production, effects of better managerial skills, organizational changes, etc. Identified trends in labour productivity growth can be helpful in the process of selecting and favoring certain technological or organizational changes in individual sectors. Labour productivity has an impact on socio-economic development not only at the

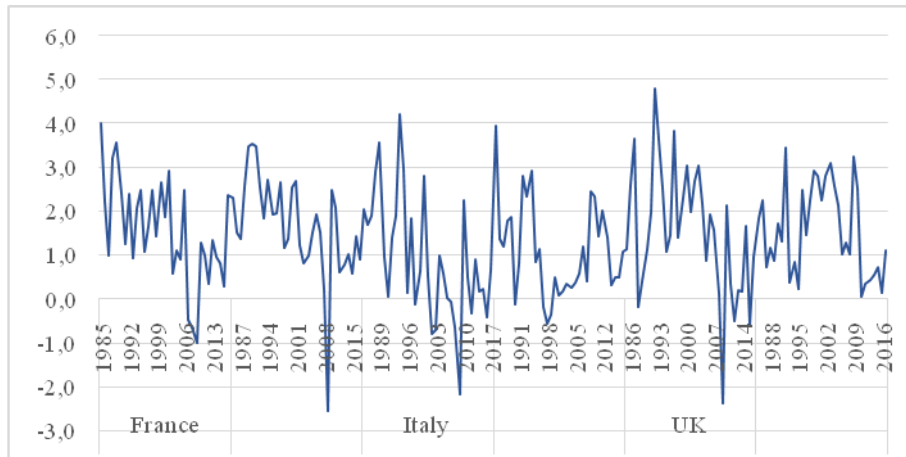
national level but also at the organizational and individual levels. Improvements in labour productivity nationally support economic growth, international competitiveness, GDP, and as a result stimulate educational, social and environmental programs.

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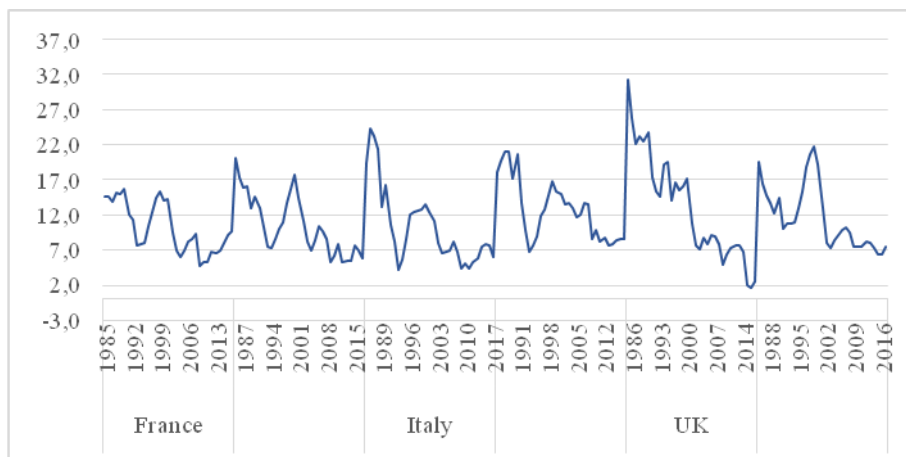
Appendix (Charts)

Figure 1. Labour productivity, annual growth rate (%)



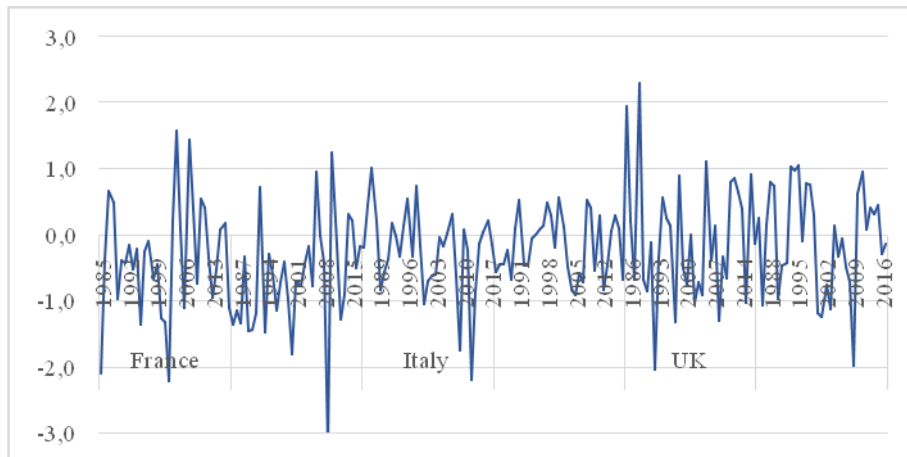
Source: OECD Productivity Statistics

Figure 2. ICT capital, annual growth/change (%)



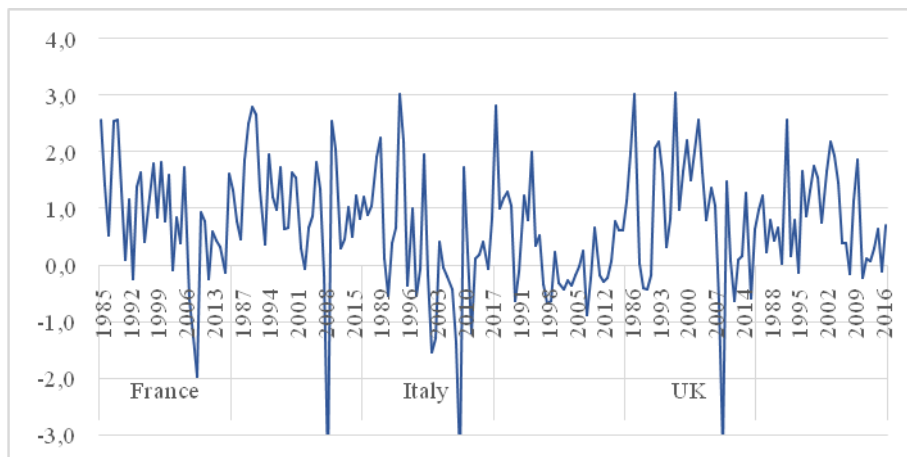
Source: OECD Productivity Statistics

Figure 3. Average hours worked per person employed, annual growth/change (%)



Source: OECD Productivity Statistics

Figure 4. Multifactor productivity, annual growth/change (%)



Source: OECD Productivity Statistics

THE RELATIONSHIP BETWEEN SMART GROWTH AND SUSTAINABLE DEVELOPMENT FROM THE EU PERSPECTIVE

İrem YALKI BERKER¹

Abstract:

The studies that focus on smart growth obviously show that countries interpret this concept in accordance with their own structures. The aim of smart growth in the US is more about planning the cities, in other words, smart cities. However, the concept is used equivalently to developing an economy based on knowledge and innovation in the EU, as it is mentioned in the Europe 2020 Report. For both of the different concepts of smart growth, the important part is that it has to include green policies to support sustainable development. Based on this fact, greenhouse gas (GHG) emissions is a crucial indicator to analyze the countries' sustainable development policies. This study aims to examine the relationship between smart growth and sustainable development in the EU. By following the EU's smart growth concept; this research mainly analyzes GHG emissions, as it is one of the main indicators of sustainable development. The study first specifies the sectors and countries with the highest share of GHG emissions in the EU, so that the sectors that need priority can be determined for policy designs. The results figure out that the energy sector has the most significant contributions to these emissions. In addition to this, the emissions of greenhouse gases and air pollutants from final use of CPA08 products are classified and their trends are examined. Direct emissions by private households has the largest share with a percentage of 19,04% in 2017. This ranking is followed by electricity, gas, steam and air conditioning with 8,57% and constructions and construction works with 7,22%. Considering all these information and the data, it is concluded that the EU should implement urgent and primary policies to reduce GHG emissions in the energy sector in order to achieve its smart growth, and hence sustainable development.

Key words: Smart growth, sustainable development, greenhouse gas emissions, the EU policies

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1. Introduction

The definition of smart growth is stated by EPA as: “*Smart growth, covers a range of development and conservation strategies that help protect our health and natural environment and make our communities more attractive, economically stronger, and more socially diverse.*”(EPA, 2019). When the literature on the concept of smart growth is examined, it is seen that countries evaluate this concept according to their needs. The EU and US have different approaches to the concept of smart growth. The aim of smart growth in the US is about smart cities and also to prevent the migration from rural to urban areas.(Naldi, Nilsson, Westlund, & Wixe, 2015). Whereas in the EU, the concept means developing an economy based on knowledge and innovation as it is mentioned in the Europe 2020 Report.(European Commission, 2010). Although smart growth is handled differently among countries, the common point is that smart growth supports sustainable development. Sustainable development has been defined in many ways, but the most commonly used definition is the one that is mentioned in the Brundtland Report, Our Common Future: “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”(Brundtland Report, 1987). As it is known, sustainable development has three dimensions: economic, social and environmental; however, as the environmental dimension has gained importance in recent years, countries need to reevaluate their policies to reach their sustainable development goals.

The goals of sustainable and smart growth are closely associated with each other which cannot be considered separately. Thus, all kinds of growth policies have to include green policies to support sustainable development. For this purpose, the study aims to determine the GHG emission levels and specify the sectors with the highest share in the EU, so that the sectors that need priority can be determined for policy designs. In accordance with this purpose, the study uses descriptive analysis as a methodology. The outline of the study is as follows: First, the paper presents recent literature then continues with the identify the concepts of smart, sustainable and inclusive growth from the EU perspective which takes place in the second section. Then the EU’s GHG emissions’ shares by sectors and GHG emissions from the final use of products are determined in the third and fourth sections, respectively; and in the conclusion section, by taking into consideration the EU’s sustainable development targets, policy recommendations are made on smart growth strategies that should be implemented. For further information, the countries must be analyzed individually. But to examine all 28 countries could be another subject for another study and is beyond the limits of this study. Therefore, the issues are evaluated based on the total data of the EU, and only the countries with the least and the most shares of the issues are pointed out.

Since sustainable development is one of the main objectives for the countries, it has been widely studied from many different aspects, so there are numerous researches on sustainable development in the literature. However, especially in the last decade, the speed of change is increasing expeditiously, so countries have to find new sustainable development models in order to achieve the acceleration and also the models have to involve smart and green policies as key factors. Otherwise, models focusing exclusively on growth will cause irreversible damage to both the economy and the environment.(International Institute for Sustainable Development (IISD), 2019). As a consequence of that, there is an ongoing debate on "the growth is really necessary?" Recent literature reviews by (Sandberg, Klockars, & Wilén, 2019) analyze the argument for green growth or degrowth using the critical social theory. The concepts have different approaches to preserve the environment. While green growth states that countries maintain economic growth in an environmental framework, degrowth does not prioritize growth and specifies that it is a more social concept. Also, the study criticizes that green growth has been dominating the literature, and besides, degrowth has not

adequately studied. Modelling for Sustainable Development: New Decisions for a New Age Report states all the models about sustainable development, also in every decision that has been evaluated, have to include environmental, social and economic parameters. In addition to the necessity of modelling, it also emphasizes the importance of understanding the connections and interactions between the countries' development goals and these parameters. (International Institute for Sustainable Development (IISD), 2019). Recently published Trade and Development Report: Financing a Global Green New Deal specifies growth rate has slowed in most developing countries, and to be able to cope with the situation, the report evaluates issues related to sustainable development in many aspects such as global trends, challenges, and finance. Furthermore, the study determines a road map for global growth and sustainable development. (United Nations Conference on Trade and Development (UNCTAD), 2019). Particularly in researches, to have variables that can be measured is a weighty matter as (Naldi et al., 2015) underline the pivotal point in their study. In order to make a literature contribution to a lack of smart growth indicators, the study states an overview of the determinants of smart growth (Naldi et al., 2015). The study addressed by (Aghion, Hemous, & Veugelers, 2009) emphasizes that it is impossible to maintain green growth without innovation and it also refers to the importance of governments' essential role on the subject. Even though not all these studies directly express the term "smart growth" as EU Report (European Commission, 2010) mentioned, they are all strictly related to the concept of smart growth. Hence, their coverage could be evaluated with the same meaning. In literature "smart growth" mainly takes place from the US perspective, which refers to smart cities, and in this context, there are several recently published papers; such as (Artmann, Inostroza, & Fan, 2019; Artmann, Kohler, Meinel, Gan, & Ioja, 2019; Wang et al., 2019). In these papers, generally, two main ideas come to the fore: one of them is inhibiting migration from rural to urban areas and the other one is creating smart cities in order to optimize resource allocation.

The growing literature on smart growth, for both of the perspectives, emphasizes the negative impacts of increasing GHG emissions on sustainable development. So, reducing greenhouse gas emissions has become one of the main goals for the countries, but due to differences in the structure of the countries, the policies they determine are different from each other. In this study, the concept has been evaluated as specified by the EU Report (European Commission, 2010).

2. Smart, Sustainable and Inclusive Growth in the EU

According to the latest Eurostat report on Europe 2020 strategies (Eurostat, 2018), Europe 2020 strategy thematic areas are as follows:

- R&D and innovation
- Education
- Poverty and social exclusion
- Climate change and energy
- Employment

All these thematic areas include at least two measurable targets which take place in different growth strategies given in Table 1:

Table 1: The Europe 2020 Growth Strategies and Its' Targets

	Targets
Smart growth	<ul style="list-style-type: none"> - Increasing combined public and private investment in R&D to 3 % of GDP - Reducing school drop-out rates to less than 10 % - Increasing the share of the population aged 30–34 having completed tertiary education to at least 40 %
Sustainable growth	<ul style="list-style-type: none"> - Reducing greenhouse gas emissions by at least 20 % compared to 1990 levels - Increasing the share of renewable energy in final energy consumption to 20 % - Moving towards a 20% increase in energy efficiency
Inclusive growth	<ul style="list-style-type: none"> - Increasing the employment rate of the population aged 20–64 to at least 75 % - Lifting at least 20 million people out of the risk of poverty and social exclusion

Source: Eurostat, 2018.

When Table 1 is examined, it is clear that all the growth strategies and their targets are strongly related to each other, hence it is impossible to analyze them separately. Another point is, in fact, one of the objectives of the study, the target that includes GHG emissions has particular importance among the other targets. The reason for this importance is that policies on GHG emissions are also at the center of the other policies which are classified into different growth strategies. So, if priority is given to policies aimed at reducing GHG

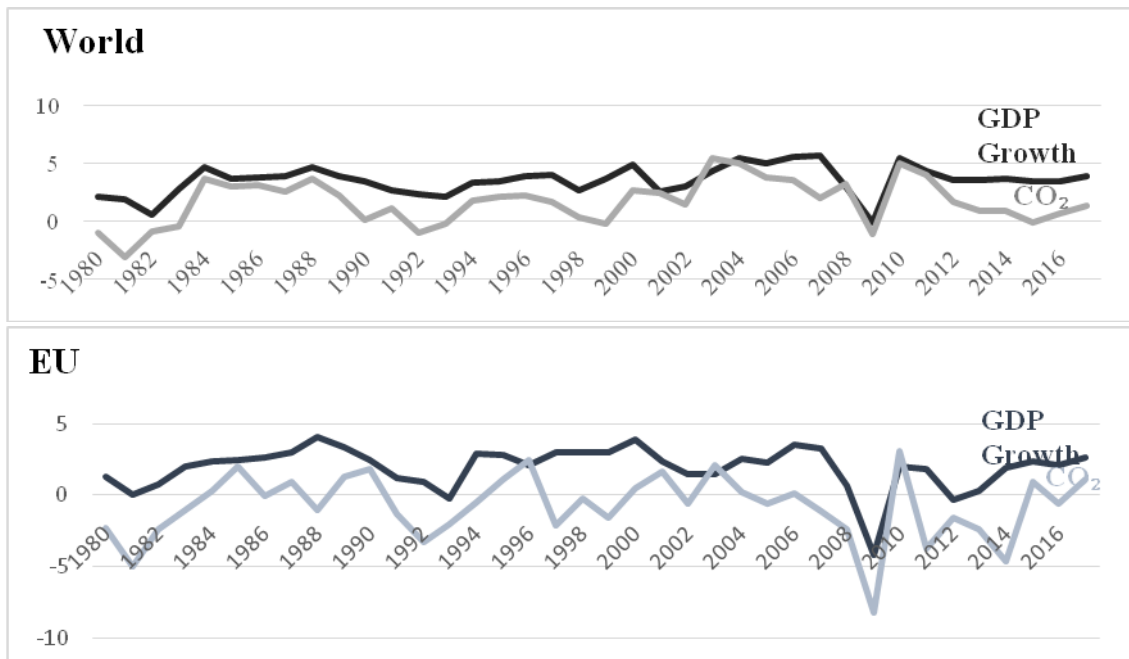


Figure 1: The Relationship Between Real GDP Growth and CO₂, Annual Percent Change

Source: IMF, 2019. & Global Carbon Atlas, 2019.

emissions, it makes a major contribution to the achievement of other targets such as creating new jobs which is about inclusive growth and creating new R&D areas to support smart growth. Despite the

situation, green growth strategies substantially ignore innovation and knowledge factors (Aghion et al., 2009).

As it is clearly seen from figure 1, the real GDP growth rate and CO₂,² show the same trend and this means every policy about CO₂, are extremely associated with the growth rate.

When the worlds' and the EU's CO₂ values over the years is analyzed, as shown in figure 2, the worlds' value is increasing rapidly, while in the EU it appears to be a decline, albeit slowly. Therefore, the EU's CO₂ share in the world is gradually decreasing. In 1980 this share was close to 24%, but in the following years, there has been a continuous decline. After 1990, the share was less than 20%, and in 2005 it was less than 15%, and the latest data for 2017, it was 9.8%, which is a very low share.

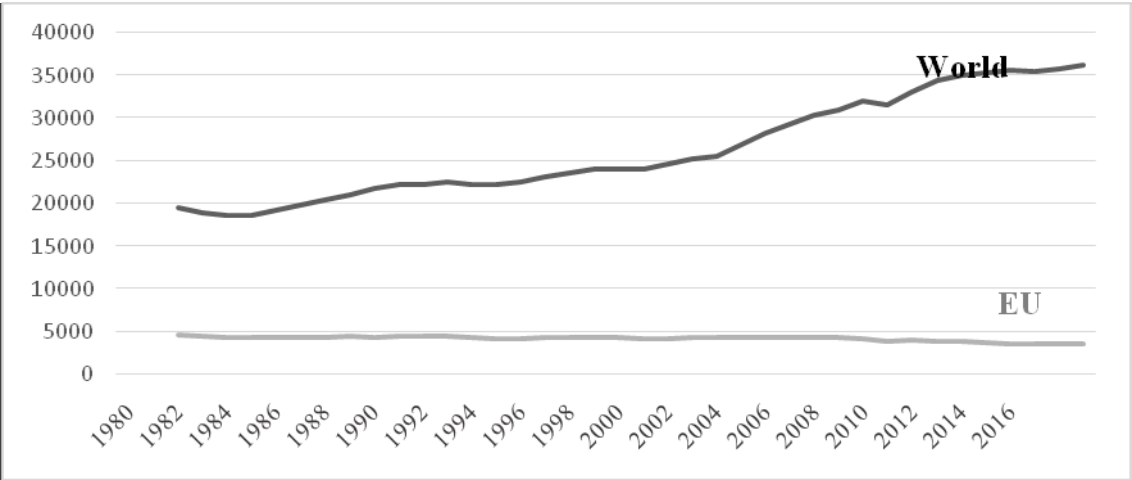


Figure 2: Territorial Emissions in MtCO₂
Source: Global Carbon Atlas, 2019.

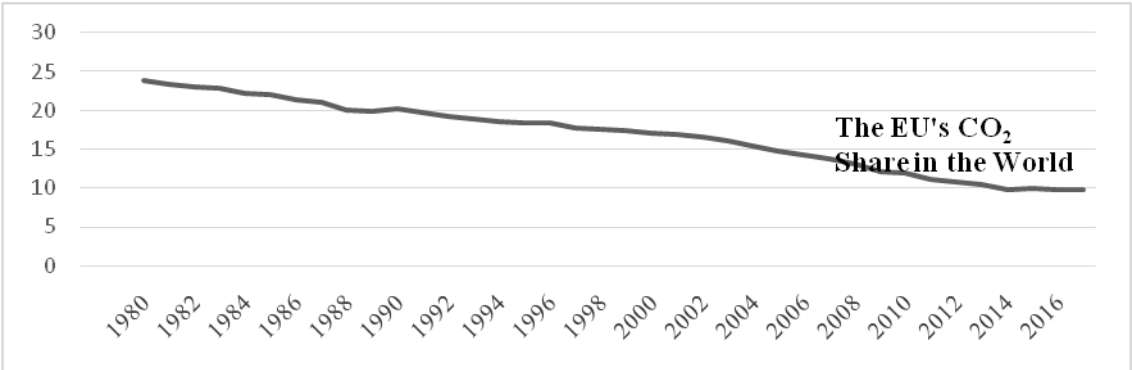


Figure 3: The EU's CO₂ Share in the World (%)
Source: Global Carbon Atlas, 2019.

The EU's one of the targets is; 20% reduction of GHG emissions compared to the level of 1990, it is seen the EU has already achieved its target, in 2016 the EU's GHG emissions

²Due to data availability, CO₂ data is used instead of GHG emissions. But it does not make a difference because CO₂ is the most weighted component of GHG emissions so in the graph it can represent GHG emissions.

were cut down by 22.4%(Eurostat, 2018). Although all these progress might seem inspired, it has to be considered that the growth rate in the EU is also slowed, especially after the global impact of the financial crisis(European Commission, 2010). As the real GDP growth rate and GHG emissions are strictly related to each other, countries have to make choices between growth or harm the environment in the short-run (Marques, Fuinhas, & Tomás, 2019). The EU has met some of its' targets with a slower growth rate, but when a higher growth rate is mentioned, is this progress will be enough in the long run?This situation reveals that a comprehensive and deeper research is needed on GHG emissions that shows its' effects on the related areas such as production process and sectors.For this purpose, in the next section, the EU's GHG emissions by source sector is analyzed.

3. The EU's GHG Emissions by Sectors

The energy sector is the cause of most of the GHG emissions in the EU.Figure4shows the EU's GHG emissions by source sector, as it is classified at the European Environment Agency, EEA.(EEA, 2019). Looking at the magnitude of this ratio,which is 73% in 2017,it seems inevitable to say,the energy sector is one of the main problems for the EU; since the energy sector is the key factor for sustainable development.This situation is forcing the economies as a form of paradox. The countries need the energy to achieve their growth rates but, on the other hand, the energy sector is the cause of GHG emissions(Ye, Fang, Li, Li, & Chang, 2019).

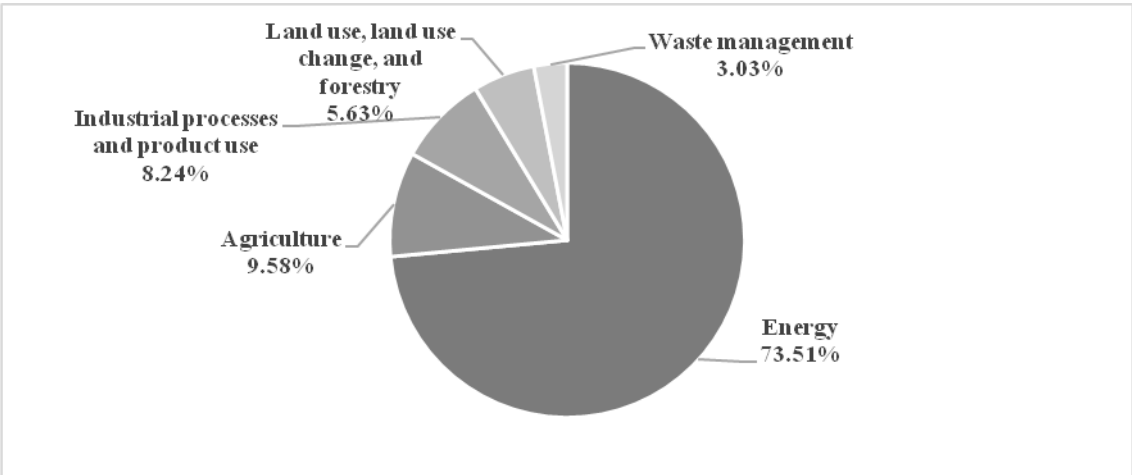


Figure 4: The EU's GHG Emissions by Source Sector
Source: Eurostat, 2019a.

The EU, despite being one of the group of countries using renewable energy the most, it remains the dominant sector, which causes the most GHG emissions. Thus, it is a priority for policymakers to change the structure of the energy sector and make it sustainable(Mangla et al., 2020); and to and to be succeeded in this evolution, innovation, in other terms smart development, is the key factor.When the other sectors' share is examined; agriculture, industrial processes and product use, land use, land use change and forestry, and waste management are following the energy sector, with a share of 9.58%, 8.24%, 5.63% and 3.03% respectively.Although these rates are for the year 2017, there is no significant change in this distribution over the years. Besides, not only the GHG emissions caused by the sectors but also the GHG emissions from the final use of products is a crucial matter in order to demonstrate the structure of the economies. Therefore, this issue is examined in detail in the next section.

4. The GHG Emissions from the Final Use of Products

All kinds of products and services produced in economies require the use of energy, which inevitably leads to an increase in GHG emissions (Aznar-Márquez & Ruiz-Tamarit, 2016), and specifying the highest shares that cause the most GHG emissions in this process, will lead the policymakers. Therefore, emissions of greenhouse gases and air pollutants from final use of CPA08 products, input-output analysis, is given in figure 5. As it is seen, there are two kinds of data, the data above includes direct emissions by private households for the year 2017. The other data does not take this factor into account. The difference between the two data is striking and devastating as well. The cause of the 19.04% GHG emissions is human beings, directly. At this point, the urgency of policies based on innovation and knowledge is seen.

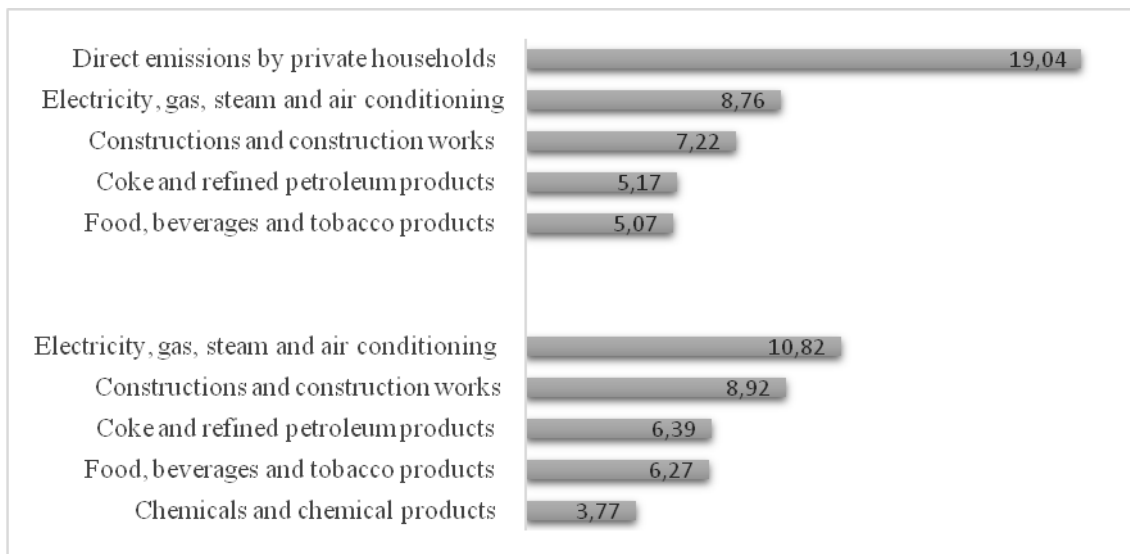


Figure 5: Emissions of greenhouse gases and air pollutants from final use of CPA08 products, input-output analysis in 2017.

Source: Eurostat, 2019b.

When direct emissions by private households does not take into account, the GHG emissions are falling down, but other factors' share does not change that means the structure of the producing is still the same. In appendix I and II, the percentages of GHG emissions from final use of CPA08 products are given. Although the rates are very low, the values they represent correspond to really high GHG emissions; and their share does not change over the years. These assessments indicate that if the EU does not change the structure, it is impossible to achieve its low carbon economy target in the long-run.

5. Conclusion

Especially, in the last decade, the concept of economic growth has changed. The meaning is not the traditional economic growth no longer, it has to be green growth. But on the other hand, industrialization, technology, energy, and other major issues related to economic growth is still a priority for all countries. GDP growth rate and CO₂ rate follow the same trend, it is a proof that they are robustly relevant, and it is not sustainable in the long run. In order to achieve their sustainable development goals, countries have to review and change their policies, so this new era leads countries to seek new development models in accordance with their economic structure. There is a solid progress

on the subject, but it is still too slow. The EU has announced, some states have reached their 2020 GHG emission targets already, it seems like a big process, but it has to be considered that the EU's growth rate is not a high value. When the EU's GHG emissions are examined by source sectors and from the final use of products, it is clearly seen that energy and direct emissions by private households are the dominant factors; and the countries, which have the highest growth rates in the EU such as Germany, UK, France, Italy, and Poland are responsible for the most GHG emissions. The main source of the problem is the structure of the model that the growth rate and GHG emissions are strongly related to each other and thus is forcing the economies to a paradox. Actually, the solution is simple, innovation and knowledge are the crucial factors on the subject. So, it reveals the EU needs an urgent new development model depends on clean technologies aiming to reduce GHG emissions, particularly in the energy sector, and it is impossible to change the structure without innovation and knowledge-based policies, in other words, smart growth. The EU's one of the smart growth targets is to increase combined public and private investment in R&D to 3 % of GDP, which is a very low percentage to change the structure of the models. The governments have to implement rigid smart growth policies urgently, in defiance of the time needed for the adaptation of the new clean technologies. The absence of the regulations focus on smart growth occurs that; based on the fact that no company wants to bear this transition cost willingly, the development model will remain the same. On the other hand, if the EU could implement these regulations, then it could take a leading role on the international stage as the policymakers are attached particular importance to sustainable development regarding all the aspects.

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Appendix I: Percentages of Emissions of Greenhouse Gases and Air Pollutants from Final Use of CPA08 Product– Input-Output Analysis (Including Direct Emissions by PrivateHouseholds)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Direct emissions by private households	17,00	19,34	18,83	17,68	18,18	18,76	18,20	18,32	19,03	19,04
Electricity, gas, steam and air conditioning	9,82	10,66	10,24	9,93	10,59	10,18	9,73	9,25	8,92	8,76
Constructions and construction works	8,46	7,79	7,57	7,70	7,24	6,96	7,17	7,11	7,17	7,22
Coke and refined petroleum products	4,32	3,99	4,09	4,59	4,70	4,52	4,41	5,28	5,16	5,17
Food, beverages and tobacco products	4,75	5,04	4,88	4,91	5,12	5,10	5,21	5,14	5,12	5,07
Chemicals and chemical products	2,79	2,46	2,74	2,81	3,00	3,00	3,03	3,09	3,02	3,05
Air transport services	2,41	2,42	2,46	2,58	2,73	2,70	2,79	2,87	2,91	2,96
Motor vehicles, trailers and semi-trailers	2,87	2,41	2,79	2,93	2,88	2,85	2,90	2,90	2,89	2,90
Land transport services and transport services via pipelines	2,20	2,35	2,24	2,33	2,34	2,37	2,49	2,51	2,53	2,55
Machinery and equipment n.e.c.	2,74	2,15	2,42	2,65	2,53	2,53	2,55	2,53	2,49	2,53
Wholesale trade services, except of motor vehicles and motorcycles	2,55	2,57	2,50	2,93	2,64	2,84	2,55	2,52	2,51	2,51
Water transport services	2,38	2,12	2,18	2,29	2,26	2,22	2,23	2,33	2,38	2,38
Accommodation and food services	2,45	2,66	2,53	2,46	2,38	2,35	2,36	2,33	2,36	2,33
Public administration and defence services; compulsory social security services	2,52	2,78	2,64	2,46	2,45	2,42	2,36	2,30	2,29	2,25
Retail trade services, except of motor vehicles and motorcycles	2,49	2,70	2,61	2,53	2,21	2,17	2,28	2,25	2,24	2,22
Real estate services	2,09	2,23	2,15	2,15	2,01	2,08	2,05	2,00	1,99	1,96
Human health services	1,86	2,05	1,99	1,94	1,96	1,95	1,99	1,96	1,94	1,92
Basic metals	2,12	1,49	1,80	2,10	1,74	1,86	1,83	1,78	1,73	1,77
Products of agriculture, hunting and related services	1,30	1,30	1,31	1,34	1,40	1,39	1,47	1,44	1,44	1,44
Scientific research and development services	1,10	1,08	1,10	1,12	1,12	1,17	1,23	1,22	1,23	1,23
Textiles, wearing apparel, leather and related products	1,42	1,25	1,30	1,34	1,29	1,29	1,27	1,24	1,21	1,21
Other non-metallic mineral products	1,16	1,01	1,02	1,05	1,10	1,10	1,21	1,17	1,17	1,19
Education services	1,20	1,32	1,27	1,18	1,16	1,15	1,16	1,13	1,13	1,11
Furniture and other manufactured goods	1,23	1,09	1,13	1,11	1,05	1,05	1,08	1,08	1,07	1,07
Computer, electronic and optical products	1,45	1,11	1,26	1,18	1,11	1,09	1,04	1,03	1,01	1,03
Fabricated metal products, except machinery and equipment	1,09	0,89	0,97	0,97	0,97	0,99	1,02	1,00	0,98	1,00
Other transport equipment	1,13	0,91	1,01	0,93	0,89	0,87	0,95	0,96	0,95	0,96
Electrical equipment	1,08	0,88	0,98	1,00	0,98	0,93	0,99	0,96	0,95	0,95
Wholesale and retail trade and repair services of motor vehicles and motorcycles	0,88	0,91	0,89	0,90	0,88	0,89	0,89	0,89	0,89	0,89
Basic pharmaceutical products and pharmaceutical preparations	0,80	0,74	0,77	0,75	0,79	0,88	0,89	0,88	0,86	0,86
Residential care services; social work services without accommodation	0,75	0,83	0,81	0,79	0,78	0,80	0,83	0,81	0,81	0,80
Computer programming, consultancy and related services; Information services	0,55	0,49	0,51	0,53	0,54	0,56	0,62	0,64	0,65	0,65
Mining and quarrying	0,68	0,55	0,61	0,55	0,70	0,71	0,68	0,65	0,62	0,64
Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other waste management services	0,55	0,60	0,60	0,60	0,57	0,56	0,63	0,62	0,62	0,62
Paper and paper products	0,57	0,54	0,57	0,57	0,63	0,62	0,62	0,61	0,59	0,59
Warehousing and support services for transportation	0,50	0,51	0,51	0,53	0,53	0,54	0,54	0,53	0,53	0,54
Rubber and plastic products	0,51	0,46	0,49	0,54	0,52	0,54	0,55	0,54	0,53	0,53
Repair and installation services of machinery and equipment	0,46	0,41	0,43	0,43	0,41	0,42	0,43	0,43	0,43	0,43
Other personal services	0,39	0,42	0,40	0,40	0,42	0,43	0,44	0,43	0,43	0,42
Insurance, reinsurance and pension funding services, except compulsory social security	0,44	0,46	0,44	0,44	0,43	0,42	0,43	0,41	0,41	0,41
Telecommunications services	0,48	0,50	0,48	0,47	0,47	0,45	0,43	0,41	0,41	0,41
Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services	0,37	0,41	0,40	0,38	0,38	0,38	0,39	0,39	0,38	0,38
Architectural and engineering services; technical testing and analysis services	0,36	0,33	0,33	0,36	0,34	0,33	0,35	0,35	0,35	0,36
Rental and leasing services	0,27	0,26	0,26	0,26	0,31	0,33	0,34	0,34	0,34	0,34
Sporting services and amusement and recreation services	0,35	0,38	0,36	0,34	0,35	0,35	0,35	0,35	0,35	0,34
Financial services, except insurance and pension funding	0,33	0,35	0,34	0,35	0,33	0,31	0,34	0,33	0,33	0,33
Natural water; water treatment and supply services	0,32	0,34	0,33	0,31	0,32	0,32	0,33	0,32	0,31	0,31
Publishing services	0,33	0,34	0,33	0,28	0,27	0,28	0,30	0,30	0,30	0,30
Travel agency, tour operator and other reservation services and related services	0,29	0,31	0,30	0,29	0,28	0,29	0,29	0,29	0,30	0,30
Services furnished by membership organisations	0,28	0,31	0,30	0,28	0,28	0,28	0,26	0,25	0,25	0,25
Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services	0,23	0,22	0,22	0,23	0,23	0,23	0,24	0,24	0,23	0,24
Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services	0,29	0,29	0,29	0,26	0,24	0,24	0,24	0,24	0,24	0,23
Legal and accounting services; services of head offices; management consultancy services	0,22	0,20	0,20	0,22	0,22	0,22	0,23	0,23	0,23	0,23
Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	0,22	0,20	0,21	0,17	0,16	0,18	0,19	0,19	0,19	0,19
Fish and other fishing products; aquaculture products; support services to fishing	0,14	0,16	0,15	0,15	0,15	0,15	0,17	0,15	0,15	0,14
Other professional, scientific and technical services and veterinary services	0,10	0,10	0,10	0,11	0,11	0,11	0,12	0,12	0,11	0,11
Services auxiliary to financial services and insurance services	0,07	0,07	0,07	0,06	0,06	0,07	0,08	0,08	0,07	0,08
Repair services of computers and personal and household goods	0,07	0,07	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
Products of forestry, logging and related services	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,06	0,06	0,06
Postal and courier services	0,05	0,05	0,05	0,05	0,06	0,05	0,06	0,06	0,06	0,06
Advertising and market research services	0,04	0,03	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Printing and recording services	0,06	0,06	0,05	0,05	0,05	0,05	0,04	0,04	0,04	0,04
Employment services	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Services of households as employers; undifferentiated goods and services produced by households for own use	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Services provided by extraterritorial organisations and bodies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Appendix II: Percentages of Emissions of Greenhouse Gases and Air Pollutants from Final Use of CPA08 Products– Input-Output Analysis (Except Direct Emissions by Private Households)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Electricity, gas, steam and air conditioning	11,83	13,22	12,62	12,06	12,94	12,53	11,90	11,33	11,02	10,82
Constructions and construction works	10,19	9,66	9,32	9,35	8,85	8,57	8,76	8,70	8,86	8,92
Coke and refined petroleum products	5,21	4,95	5,04	5,58	5,75	5,56	5,39	6,46	6,38	6,39
Food, beverages and tobacco products	5,72	6,25	6,01	5,96	6,26	6,27	6,37	6,29	6,32	6,27
Chemicals and chemical products	3,37	3,05	3,37	3,41	3,66	3,69	3,71	3,79	3,73	3,77
Air transport services	2,90	3,00	3,03	3,14	3,34	3,32	3,41	3,51	3,60	3,66
Motor vehicles, trailers and semi-trailers	3,45	2,99	3,43	3,56	3,53	3,51	3,55	3,55	3,56	3,59
Land transport services and transport services via pipelines	2,65	2,91	2,76	2,83	2,86	2,92	3,04	3,07	3,12	3,15
Machinery and equipment n.e.c.	3,30	2,66	2,98	3,22	3,09	3,11	3,11	3,09	3,08	3,12
Wholesale trade services, except of motor vehicles and motorcycles	3,08	3,19	3,08	3,56	3,22	3,49	3,12	3,08	3,10	3,11
Water transport services	2,86	2,62	2,68	2,79	2,76	2,74	2,73	2,86	2,93	2,94
Accommodation and food services	2,95	3,30	3,12	2,98	2,90	2,89	2,89	2,86	2,91	2,88
Public administration and defence services; compulsory social security services	3,03	3,44	3,25	2,99	2,99	2,97	2,88	2,81	2,83	2,78
Retail trade services, except of motor vehicles and motorcycles	3,00	3,35	3,22	3,08	2,71	2,67	2,79	2,76	2,76	2,75
Real estate services	2,51	2,77	2,65	2,61	2,46	2,56	2,51	2,45	2,45	2,42
Human health services	2,25	2,54	2,45	2,35	2,39	2,40	2,43	2,39	2,40	2,37
Basic metals	2,55	1,85	2,22	2,55	2,13	2,28	2,24	2,18	2,14	2,19
Products of agriculture, hunting and related services	1,56	1,61	1,61	1,63	1,71	1,71	1,80	1,76	1,78	1,78
Scientific research and development services	1,32	1,34	1,36	1,36	1,37	1,44	1,50	1,49	1,52	1,53
Textiles, wearing apparel, leather and related products	1,71	1,55	1,60	1,62	1,58	1,59	1,55	1,52	1,49	1,50
Other non-metallic mineral products	1,40	1,25	1,26	1,28	1,34	1,35	1,48	1,44	1,44	1,47
Education services	1,44	1,63	1,56	1,44	1,42	1,41	1,42	1,39	1,39	1,38
Furniture and other manufactured goods	1,49	1,35	1,40	1,35	1,29	1,29	1,32	1,33	1,32	1,32
Computer, electronic and optical products	1,75	1,37	1,55	1,43	1,36	1,34	1,27	1,26	1,25	1,27
Fabricated metal products, except machinery and equipment	1,32	1,11	1,19	1,18	1,18	1,21	1,25	1,22	1,22	1,23
Other transport equipment	1,37	1,13	1,24	1,13	1,09	1,07	1,17	1,18	1,17	1,18
Electrical equipment	1,30	1,09	1,21	1,21	1,20	1,15	1,21	1,17	1,17	1,17
Wholesale and retail trade and repair services of motor vehicles and motorcycles	1,06	1,13	1,10	1,09	1,07	1,10	1,09	1,09	1,10	1,10
Basic pharmaceutical products and pharmaceutical preparations	0,96	0,91	0,95	0,91	0,97	1,09	1,08	1,08	1,06	1,06
Residential care services; social work services without accommodation	0,90	1,03	0,99	0,95	0,95	0,98	1,01	0,99	1,00	0,99
Computer programming, consultancy and related services; Information services	0,66	0,61	0,63	0,65	0,65	0,69	0,76	0,78	0,80	0,80
Mining and quarrying	0,82	0,68	0,75	0,67	0,86	0,88	0,84	0,80	0,77	0,79
Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other waste management services	0,67	0,74	0,74	0,73	0,70	0,69	0,77	0,75	0,76	0,76
Paper and paper products	0,69	0,67	0,70	0,69	0,77	0,77	0,76	0,74	0,72	0,73
Warehousing and support services for transportation	0,60	0,63	0,63	0,65	0,65	0,66	0,66	0,65	0,66	0,66
Rubber and plastic products	0,61	0,56	0,60	0,66	0,64	0,67	0,67	0,66	0,65	0,66
Repair and installation services of machinery and equipment	0,55	0,51	0,53	0,52	0,51	0,52	0,52	0,53	0,53	0,54
Other personal services	0,47	0,52	0,49	0,49	0,52	0,53	0,54	0,53	0,53	0,52
Insurance, reinsurance and pension funding services, except compulsory social security	0,53	0,57	0,54	0,53	0,52	0,52	0,52	0,50	0,50	0,51
Telecommunications services	0,58	0,63	0,59	0,58	0,57	0,55	0,52	0,51	0,50	0,50
Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services	0,45	0,51	0,49	0,47	0,46	0,47	0,47	0,47	0,47	0,46
Architectural and engineering services; technical testing and analysis services	0,43	0,41	0,41	0,44	0,42	0,40	0,43	0,43	0,44	0,44
Rental and leasing services	0,33	0,32	0,32	0,32	0,38	0,41	0,41	0,42	0,42	0,43
Sporting services and amusement and recreation services	0,42	0,47	0,45	0,41	0,42	0,43	0,43	0,42	0,43	0,42
Financial services, except insurance and pension funding	0,40	0,43	0,42	0,42	0,40	0,38	0,41	0,41	0,41	0,41
Natural water; water treatment and supply services	0,38	0,42	0,40	0,38	0,39	0,39	0,40	0,39	0,39	0,38
Publishing services	0,40	0,42	0,41	0,34	0,33	0,34	0,36	0,37	0,37	0,37
Travel agency, tour operator and other reservation services and related services	0,35	0,38	0,37	0,35	0,34	0,36	0,36	0,36	0,37	0,37
Services furnished by membership organisations	0,34	0,39	0,37	0,34	0,34	0,34	0,31	0,31	0,31	0,30
Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services	0,27	0,27	0,27	0,28	0,28	0,29	0,29	0,29	0,29	0,29
Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services	0,34	0,36	0,36	0,31	0,29	0,30	0,29	0,29	0,29	0,29
Legal and accounting services; services of head offices; management consultancy services	0,26	0,25	0,25	0,27	0,27	0,27	0,28	0,28	0,28	0,29
Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	0,27	0,25	0,26	0,20	0,20	0,22	0,23	0,23	0,23	0,24
Fish and other fishing products; aquaculture products; support services to fishing	0,17	0,19	0,19	0,18	0,18	0,18	0,21	0,19	0,19	0,18
Other professional, scientific and technical services and veterinary services	0,13	0,13	0,13	0,13	0,13	0,13	0,14	0,14	0,14	0,14
Services auxiliary to financial services and insurance services	0,09	0,08	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,09
Repair services of computers and personal and household goods	0,08	0,08	0,08	0,07	0,07	0,07	0,08	0,07	0,07	0,07
Products of forestry, logging and related services	0,06	0,06	0,06	0,07	0,06	0,07	0,07	0,07	0,07	0,07
Postal and courier services	0,06	0,07	0,07	0,06	0,07	0,07	0,07	0,07	0,07	0,07
Advertising and market research services	0,05	0,04	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
Printing and recording services	0,07	0,07	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,05
Employment services	0,02	0,02	0,02	0,02	0,02	0,02	0,01	0,01	0,01	0,01
Services of households as employers; undifferentiated goods and services produced by households for own use	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Services provided by extraterritorial organisations and bodies	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

MYERSON-SATTERTHWAITE THEOREM AND ASYMMETRIC FPA AUCTIONS

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Abstract:

In this paper Myerson-Satterthwaite theorem with asymmetric First price auction (FPA) has been subject of investigation. Bilateral inefficiency trade theorem versus the efficiency of the FPA auctions in which there is supposedly no dominant strategy, where bids are private information, and are made simultaneously, where highest bid wins and winning bidder pays the winning bid. This type of auction may not be Pareto efficient (this condition requires that the item is allocated to the bidder with highest valuation). But in the sealed FPA auctions highest bidder does not know other bidders' valuations and may lose to another bidder. In the auction setting we set reserve price that causes efficiency loss and decreases probability of trade. The results are ambiguous dependent on the type of the solution method used. Three methods of solution were used: Fixed point finite difference iterations, Backward shooting method, and Constrained strategic equilibrium (C.S.E). The reserve price set was 0.5 since $\theta_s \in (0,1)$ and $\theta_b \in (0,1)$, so the buyers' value is likely to be $[0.1,1]$ and the sellers' value is likely to be $[0,0.9]$, so in such case reserve price would eliminate low bidder types. The results are ambiguous in a sense that under Backward shooting method convergence is not true, so the Myerson-Satterthwaite theorem does hold which is not case under Fixed finite difference point iterations, and Constrained strategic equilibrium (C.S.E). Phenomenon known as winner's curse occurs in a case of incomplete information.

Key words: FPA, asymmetric auctions, C.S.E, Backward shooting method, Fixed point finite difference iterations, winner's curse

JEL classification: D44

Introduction

In the Myerson-Satterthwaite setting, people have private information about the utilities for various exchanges of goods at different prices. The Myerson-Satterthwaite theorem (MS) is an important result in mechanism design theory and asymmetric information and this theorem is due to [Myerson, Satterthwaite \(1983\)](#) paper. The main result of the theorem states that there is no efficient way for two parties to trade when they have secret and probabilistically varying CDF's and PDF's, without the risk of one-party trading at loss. Proofs of this theorem are provided in the auction theory graduate textbooks such as [Khrisna \(2009\)](#) and [Milgrom\(2004\)](#). This theory relates back to most famous adverse selection problem posed as the lemons problem, as [Akerlof \(1970\)](#). Utility function of the seller and the buyer in that model are: $U_s = M + \sum_i x_i$ (seller's utility) and $U_b = M + \sum_i \frac{3}{2} x_i$, (buyer's utility) i.e. sellers' get one dollar's worth of utility from one quality-unit of used car, and the buyer's get 3/2 dollars' worth of utility from one quality-unit of used car, M is the consumption other goods than that subject of trade (their price is unitary), x_i is the quality of the i th used car. The problem is the average quality provided by the sellers which is not equal to price $\mu \neq p$; but the average quality is $\mu = \frac{p}{2}$, since the quality of lemons is $U_{ni} \sim [0,2]$. In that model buyers do not trade since their expected net gain is negative $-1/4 * p$ (they cannot trade with expected loss up to quarter of a dollar). Expected value to the buyer is the price he pays times the quality he receives in this case $\frac{3}{2} * \frac{p}{2} = \frac{3}{4} p$, while the expected trade gain is expected value minus price $\frac{3}{4} p - p = -\frac{1}{4} p < 0$. If however they are naïve and trade their loss will be $\frac{1}{4} * \frac{3}{2} = \frac{3}{8}$. As in this example the assumptions of M-S theorem are posed: Individual rationality: $U_b, U_s \geq 0$, weak balanced budget (the auctioneer does not subsidize trade). But the Bayesian-Nash equilibrium is not incentive compatible (trade participants namely seller's cheat), $\forall v'_b: U_b(v_B, v'_b) \not\geq U_b(v_B, v_b)$ and it is not ex-post Pareto efficient that the item should be given to then one that values most but here his value is not equal to the expected quality (there are costs of dishonesty). Market produces gains only for sellers and loss only for the buyers, so this trade is not efficient. This the basic motivation of this paper. A typical feature of auctions is the presence of asymmetric information (see [Klemperer \(1999\)](#), [Gibbons \(1992\)](#)), the appropriate concept therefore is Bayesian-Nash equilibrium¹, (see [Kajji, A., Morris, S. \(1997\)](#), [Harsanyi, John C., \(1967/1968\)](#)). How is this related to Myerson-Satterthwaite theorem? A trade with private preferences (known to him) may demand more favorable terms than he is in truth willing to accept, and such behavior will lessen the gains from trade or will make some to even trade with loss, [Rustichini, A., Satterthwaite, M. A., Williams, S. R., \(1994\)](#). How is this related to the auction theory? Well, founder of the auction theory is William S. Vickrey with contributions to the literature he made mostly in the 1960's and 1970's, [Vickrey \(1961, 1962, 1976\)](#). Auctions are type of games where players payoff depends on other's types of market participants, e.g. [Akerlof \(1970\)](#), and this market models where participants have information that affects other player's payoffs are called adverse selection models. Although the treatment of adverse selection in auction theory has history since 1960's, yet the largest part of the auction theory,

¹A Bayesian Nash equilibrium is defined as a strategy profile that maximizes the expected payoff for each player given their beliefs and given the strategies played by the other players. That is, a strategy profile θ is a Bayesian Nash equilibrium if and only if for every player i , keeping the strategies of every other player fixed, strategy θ_i maximizes the expected payoff of player i according to his beliefs. Or in general BNE equilibrium is a Nash equilibrium of a Bayesian game: $E u_i(s_i | s_{-i}, \theta_i) \geq E u_i(s'_i | s_{-i}, \theta_i), \forall s'_i(\theta_i) \in S_i$, where $s_i \in \Theta_i \rightarrow A_i$, and $\theta_i \in \Theta_i$ also utilities are $u_i: A_1 \times A_2 \times \dots \times A_i \times \theta_1 \times \theta_2 \times \dots \times \theta_i \rightarrow \mathbb{R}$, where $a_i \in A_i$ denotes finite action set.

puts adverse selection aside to focus on the private values case, in which every type of participants utility depends on its own type. Seminal paper in the literature of asymmetric auctions is written by [Maskin, Riley \(2000\)](#), previously bidders were risk neutral and each bidder has a private valuation different from the others (different cumulative distribution functions and probability density functions), the bidders possess symmetric information, expected payments are functions of their bids, [McAfee, McMillan, \(1987\)](#). But in reality these assumptions seem to be very strict namely the assumption of risk-neutrality of the bidders, IPV's (independence of the private values of the bidders' about the items value), lack of collusion between the buyers, and especially symmetry of the bidders' beliefs are not describing the reality at best. Relaxing of the risk-neutrality assumption was made in [Riley and Samuelson \(1981\)](#), show that when bidders are risk-averse than seller favors high-bid auction, even if he also exhibits risk aversion. [Milgrom, P., Weber, R.J., \(1982\)](#), relax the assumption of IPV independence, by reporting that if the reservation prices are pairwise positively correlated they show that English auction (is "open" or fully transparent, as the identity of all bidders is disclosed to each other during the auction) exhibits higher revenue than the high-bid auction. And about the third assumption, [Graham, D., Marshall, R., \(1987\)](#), allow for bidders to collude such as in [McAfee, McMillan, \(1992\)](#), [Graham and Marshall \(1987\)](#) especially propose that bidders' collusions are more likely to happen in the open type auction where bidders' know their identities (they can directly inspect others behavior). But the symmetric beliefs are rejected in this paper. Which means that Revenue equivalence theorem (RET) will not apply here. FPA-First price auction and SPA-Second price auction where winners pay second best price will not exert same revenues. On this topic (optimal auctions) furthermore [Myerson \(1981\)](#), designed Bayesian-optimal mechanism where it makes use of virtual valuations (virtual values are the derivative of the revenue curve). Now back to Myerson-Satterthwaite theorem. The remarkable result of [Myerson, Satterthwaite \(1983\)](#) paper is that it shows that the distributions don't matter and that the failure of efficient trade is general property. [Reny and McAfee \(1992\)](#) show the nature of the distribution of information matters, and [McAfee, \(1991\)](#) showed that continuous quantities can overturn the Myerson-Satterthwaite theorem. And now put it differently Myerson-Satterthwaite theorem says that if one demands ex-ante budget balance, and interim individual rationality then trade cannot be ex-post efficient, [Nachbar \(2017\)](#). Ex-post efficiency occurs only when buyers value is more than sellers values and opposite is not true. Strict Pareto efficiency means that $\forall v \forall x', \sum_i v_i(x) \geq \sum_i v_i(x')$. Ex-ante budget balance means that while a third party is allowed to provide a net subsidy for some types of profiles (θ_s, θ_b) , and collect net tax for the others', the third-party net transfer must be zero over expectations for v - value of the buyers and s value for the seller-post budget balance in the other hand requires, zero net transfers for all $v, s, \forall v, \sum_i p_i(s(v)) = 0$. Ex-interim individual rationality means that no agent losses from participating in the mechanism, and is ex-interim because it holds for every possible valuation of agent i .²

² More so mechanism is ex-interim individually rational if: $\forall i \forall v_i, \mathbb{E}_{(v_{-i}|v_i)} v_i(x(s_i(v_i), s_{-i}(v_{-i}))) - p_i(s_i(v_i), s_{-i}(v_{-i})) \geq 0$, And a mechanism is ex-post efficient if $\forall i \forall v_i, v_i(x(s_i(v_i), s_{-i}(v_{-i}))) - p_i(s_i(v_i), s_{-i}(v_{-i})) \geq 0_{(v_{-i}|v_i)} v_i(x(s_i(v_i), s_{-i}(v_{-i}))) - p_i(s_i(v_i), s_{-i}(v_{-i})) \geq 0$

Theorem 1.1. Revelation principle Myerson,1981

Suppose that ψ was a Bayes-Nash equilibrium of the indirect mechanism Γ . Then there exists a direct mechanism that is payoff-equivalent and where truthful revelation is an equilibrium.

Proof: $\exists \psi$ and these strategies are equivalent in direct and indirect mechanisms. Direct revelation mechanism is the one where agent reports his preferences truthfully and hence $M = \prod_{i \in \{1,2,\dots,n\}} M_i$ (messages) agents type of profiles are $\theta \in \{1,2,\dots,n\}$ and $\theta \in \Theta$, the social choice function is $f: \Theta \rightarrow X$ where outcome $x \in X$ and in a message space there is mapping $g: M \rightarrow X$. Let's notice that if bidder (player) i with type θ deviates and reports his other type θ' that that agent earns $E_{\theta_{-i}} v_i(\psi_i(\theta'_i), \psi_{-i}(\theta_{-i})) = E_{\theta_{-i}} v_i(\psi', \psi_{-i}(\theta_{-i}))$ for some ψ' and we know that (from above said):

Equation 1

$$E_{\theta_{-i}} v_i(\psi_i(\theta_i), \psi_{-i}(\theta_{-i})) \geq E_{\theta_{-i}} v_i(\psi', \psi_{-i}(\theta_{-i}))$$

So this last expression is not profitable ■.

Definition Incentive compatibility (Bayesian Incentive compatibility (BIC))

A social choice function $f: \Theta_1 \times \Theta_2 \dots \times \Theta_n \rightarrow X$ is said to be incentive compatible (IC) or truthfully implementable if the Bayesian game (is a game in which the players have incomplete information about the other players) induce by the direct revelation mechanism (is one where each agent is asked to report his individual preferences, in which case $M = \Theta$ and $f = g$) or $\mathcal{D} = (\Theta_{i \in N}, f(\cdot))$ has a pure strategy equilibrium (Bayesian-Nash equilibrium) $s^*(\cdot) = (s_1^*(\cdot), \dots, s_n^*(\cdot))$ where $s_i^*(\theta_i) = \theta_i$ and $\forall \theta_i \in \Theta$ and $\forall i \in N$.

Individual rationality (IR) axiom

First we define as in Myerson (1991), two-person bargaining problem, to consist of a pair (F, v) where F is a convex subset of \mathbf{R}^2 , $v = (v_1, v_2)$ is a vector in \mathbf{R}^2 and the set $F \cap \{(x_1, x_2) | x_1 \geq v_1; x_2 \geq v_2\}$ is non-empty and bounded. Where F is a set of feasible payoff allocations and v represents the disagreement point. F is a convex means that the players are assumed that will agree on their jointly randomized strategies so that utility allocations $x = (x_1, x_2)$ and $y = (y_1, y_2)$ are feasible and $0 \leq \theta \leq 1$ so that following expected utility allocation applies $\theta x + (1 - \theta)y$. Two-players strategic game form is given as: $\Gamma = \{(1,2), C_1, C_2, \mu, u_1, u_2\}$ where C_1, C_2 are used to denote the pure players strategies set.

Theorem 1.2 Myerson -Satterthwaite

Theorem Myerson-Satterthwaite: It is not common knowledge that if trade gains exist i.e. the supports of the CDF functions (Cumulative distributions) of traders have non-empty intersections) then no IC (incentive compatibility) and IR (individual rationality) trading mechanism can be ex-post efficient.

Proof: A trading mechanism is ex-post efficient if and only if trade occurs whenever $s \leq b$

Equation 2

$$p(s, b) = \begin{cases} 1 & \text{if } s \leq b \\ 0 & \text{if } s > b \end{cases}$$

In the previous expression $p(s, b)$ is a probability of trade which takes value 1 if trade occurs and zero if it doesn't. To prove that ex-post efficiency cannot be attained, it is enough to show that inequality (*) in the corollary hence:

Equation 3

$$\int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\min(b, \bar{s})} \left[b - \frac{1 - F(b)}{f(b)} - s - \frac{F(s)}{f(s)} \right] f(s) f(b) ds db.$$

Previous expression equals to:

Equation 4

$$\int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\min(b, \bar{s})} [bf(b) + F(b) - 1] f(s) ds db - \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\min(b, \bar{s})} [sf(s) + F(s)] f(b) ds db = - \int_{\underline{b}}^{\bar{s}} [1 - F(\theta)] F(\theta) d\theta < 0, \underline{b} < \bar{s}.$$

Previous result is proof of Myerson-Satterthwaite theorem about trade inefficiency. Some weaker efficiency criterion is Pareto optimality, one may use that criterion if ex-post efficiency does not work ■.

Furthermore one mechanism with transfers t , $p(x(s, b), t)$ where p is the probability of trade given s, b , seller and buyers ex-post utilities are given as:

Equation 5

$$u(s, b) = x(s, b) - s(p, b)$$

$$v(b, s) = bp(s, b) - x(s, b).$$

Both traders are risk neutral and there are no income effects. Payoffs are defined as:

Equation 6

$$X(s) = \int_{\underline{b}}^{\bar{b}} x(s, b) f_b(b) db; X(b) = \int_{\underline{s}}^{\bar{s}} x(s, b) f_s(s) ds.$$

Probabilities of trade are defined as:

Equation 7

$$P(s) = \int_{\underline{b}}^{\bar{b}} p(s, b) f_b(b) db; P(b) = \int_{\underline{s}}^{\bar{s}} p(s, b) f_s(s) ds$$

Incentive compatible mechanism is defined as:

Equation 8

$$IC: U(s) \geq X(s') - P(s'); V(b) \geq P(b) - X(b).$$

Individually rational mechanism (IR) is given as:

Equation 9

$$\forall s \in [\underline{s}, \bar{s}] \vee \forall b \in [\underline{b}, \bar{b}], U(s) \geq 0; V(b) \geq 0.$$

Lemma 1 (Mirrlees, Myerson)

The mechanism is IC compatible if and only if $P(s)$ is increasing and $P(b)$ decreasing, and :

Equation 10

$$\begin{cases} U(s) = U(\underline{s}) + \int_{\underline{s}}^{\bar{s}} P(s)(\theta) d\theta \\ V(b) = V(\underline{b}) + \int_{\underline{b}}^{\bar{b}} P(b)(\theta) d\theta . \end{cases}$$

Lemma 1 (proof): From previous we know that $U(s') \geq X(s') - s'P(s')$; $U(s) \geq X(s) - sP(s)$

Equation 11

$$\begin{cases} U(s) \geq X(s') - sP(s') = U(s') + (s' - s)P(s'), \\ U(s') \geq X(s) - s'P(s) = U(s) + (s - s')P(s). \end{cases}$$

If we subtract these inequalities will yield:

Equation 12

$$(s' - s)P(s) \geq U(s) - U(s') \geq (s' - s)P(s').$$

Now if we take that $s' > s$ implies that $P(s)$ is decreasing, if we divide by $(s' - s)$ and letting $s' \rightarrow s$ yields $\frac{dU(s)}{ds} = -P(s)$ and integrating produces IC(s'). The same is true for the buyer. To prove the IC for the seller it is suffice to show that following applies:

Equation 13

$$s[P(s) - P(s')] + [X(s') - X(s)] \leq 0 \forall s, s' \in [\underline{s}, \bar{s}].$$

Now from previous by substituting for $X(s)$ and $X(s')$ and by using IC(s') the following will yield:

Equation 14

$$X(s) = sP(s) + U(\bar{s}) + \int_{\underline{s}}^{\bar{s}} P(\theta) d\theta .$$

And following holds , we show that $ss' \in [\underline{s}, \bar{s}]$:

Equation 15

$$\begin{aligned} 0 \geq s[P(s) - P(s')] + sP(s) + \int_{s'}^{\bar{s}} P(\theta) d\theta - sP(s) \\ - \int_{\underline{s}}^{\bar{s}} P(\theta) d\theta = (s' - s)P(s') + \int_{s'}^{\bar{s}} P(\theta) d\theta = \int_{s'}^{\bar{s}} [P(\theta) - P(s')] d\theta . \end{aligned}$$

Where in the last expression θ is unknown parameter i.e. players type. And previous expression holds only because $P(\cdot)$ is decreasing.

Lemma Individual rationality (IR):

IC mechanism is IR if and only if : $U(\bar{s}) \geq 0 \vee V(\underline{b}) \geq 0$.And following corollary is introduced:

Corollary:

Equation 16

$$U(\bar{s}) + V(\underline{b}) = \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} \left[b - \frac{1 - F(b)}{F(b)} - s - \frac{1 - F(s)}{F(s)} \right] p(s, b) f(s) f(b) ds db \geq 0.$$

Proof : Since from IC condition we know that the following applies :

Equation 17

$$X(s) = sP(s) + U(\bar{s}) + \int_{\underline{s}}^{\bar{s}} P(\theta) d\theta.$$

And from the corollary:

Equation 18

$$\int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} x(s, b) f(s) f(b) ds db = U(\bar{s}) + \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} sp(s, b) f(s) f(b) ds db + \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} p(s, b) F(s) f(b) ds db.$$

The third term in the right side follows that:

Equation 19

$$\int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} p(\theta, b) F(s) f(b) d\theta db = \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\theta} p(\theta, b) F(s) f(b) d\theta db = \int_{\underline{s}}^{\bar{s}} p(s, b) F(s) f(b) ds db.$$

Analogously for the buyer follows that:

Equation 20

$$\int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} x(s, b) f(s) f(b) ds db = -V(\underline{b}) + \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} bp(s, b) F(s) f(b) ds db - \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} p(s, b) F(s) (1 - F(b)) ds db$$

And if we equate the both sides:

Equation 21

$$V(\underline{b}) = \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} p(s, b) F(s) (1 - F(b)) ds db - \int_{\underline{b}}^{\bar{b}} \int_{\underline{s}}^{\bar{s}} bp(s, b) F(s) f(b) ds db = \int_{\underline{s}}^{\bar{s}} p(s, b) F(s) f(b) ds db.$$

IR mechanism is proved since $V(\underline{b}) \geq 0$ ■.

Balanced budget

Transfers $t: \mathfrak{R}^2 \rightarrow \mathfrak{R}^2$ between the players are: $t(v) = \{t_1(v), t_2(v)\}$ and $t_i(v)$ is the transfer that player i receives. Now we are considering a transfer $t_i(v) = g_i(v_i) - g_j(v_j)$, where :

Equation 22

$$g_i(v_i) = \int_{-\infty}^{\infty} v_j d(v_i, v_j) f_j(v_j) dv_j$$

From previous expression clearly transfers balance. Where $d \in \{0, 1\}$ i.e. do it or not do it eg. public project, $v_{i,j} \in \{-\infty, \infty\}$, and ex-post efficiency required that :

Equation 23

$$d^*(v_1, v_2) = \begin{cases} 1, & \text{if } v_1 + v_2 \geq 0 \\ 0, & v_1 + v_2 < 0 \end{cases}$$

Also we have to note that :

Equation 24

$$v_i \in \arg \max_{\hat{v}_i} v_i d(\hat{v}_i, \hat{v}_j) + t(\hat{v}_i, \hat{v}_j)$$

VCG mechanism does not satisfy weak balanced budget condition. Vickrey-Clarke-Groves, auction is named after Vickrey(1961), Clarke (1971), Groves (1973) for their papers that generalized the idea. VCG mechanism is a direct quasi-linear mechanism.

Equation 25

$$\begin{aligned} (\chi, \hat{v}) &= \arg \max_x \sum_i \hat{v}_i(x) \\ p_i(\hat{v}) &= \sum_{j \neq i} \hat{v}_j(\chi(\hat{v}_{-i})) - \sum_{j \neq i} \hat{v}_j(\chi(\hat{v})). \end{aligned}$$

And under Groves mechanism we have :

Equation 26

$$\chi(\hat{v}) = \arg \max_x \left(\sum_i \hat{v}_i(x) \right) = \arg \max_x \left(\hat{v}_i(x) + \sum_{j \neq i} \hat{v}_j(x) \right).$$

In Groves mechanism price constraint is given as follows:

Equation 27

$$p_i(\hat{v}) = h_i(\hat{v}_{i-1}) - \sum_{j \neq i} \hat{v}_j(\chi(\hat{v})).$$

There budget balance requires :

Equation 28

$$t_1(v) + t_2(v) = (v_1 + v_2)d(v_1, v_2) + h_1(v_2) + h_2(v_1) = 0$$

Or

Equation 29

$$h_1(v_1) + h_2(v_2) = \begin{cases} -(v_1 + v_2); & \text{if } v_1 + v_2 \geq 0 \\ 0; & v_1 + v_2 < 0 \end{cases}$$

But previous cannot happen if h_i is independent of v_i . Solution is in weak incentive compatibility criterion, so truth as dominant strategy in this mechanism is merely a Bayesian equilibrium rather than a dominant strategy. Bayesian incentive compatibility (BIC) is presented as:

Equation 30

$$v_i \in \arg \max_{\hat{v}_i} E_{v_j} [v_i d(\hat{v}_i, v_j) + t_i(\hat{v}_i, v_j) | v_i]$$

And the budget balance that satisfies that is $t_1(v) + t_2(v) = 0$. One example of mechanism is second degree price discrimination with a continuum types when monopolist practices price discrimination via quantity discounts when there is continuum of types. Quasi-linear utility function is given as:

Equation 31

$$U(\theta) \equiv b(x(\theta), \theta) - t(\theta)$$

Where x is the consumption of the good and t is the amount paid to the firm or taxes to the state (for the amount x units in it). Type of the customer is drawn from a distribution: $F(\cdot); (\theta_1, \theta_2), \theta \in (\theta_1, \theta_2)$. Spence-Mirrlees condition holds at :

Equation 32

$$\frac{\partial^2 b(x, \theta)}{\partial \theta \partial x} > 0$$

Now $\frac{\partial b}{\partial x} > 0, \forall x > 0$, this follows because $\frac{\partial b}{\partial x}$ is an inverse demand curve, an inverse demand curves are positive, proof is given below:

Proof:

Let $\theta_2 > \theta_1$ and now we observe :

Equation 33

$$b(x, \theta_2) - b(x, \theta_1) = \int_0^x \frac{\partial b(z, \theta_2)}{\partial x} dz - \int_0^x \frac{\partial b(z, \theta_1)}{\partial x} dz = \int_0^x \left(\int_{\theta_1}^{\theta_2} \frac{\partial b(z, t)}{\partial \theta \partial x} dt \right) dz > 0$$

Previous expression follows from the fact that $x > 0$ and $\theta_2 > \theta_1$. Expected profit in this mechanism with transfers due to Mirrlees (1971) is given as:

Equation 34

$$\Pi = \int_{\theta_1}^{\theta_2} (t(\theta) - cx(\theta)) f(\theta) d\theta$$

In the previous expression c are the marginal costs, and t are the transfers or the amount paid to the firm or the state (taxes). For the scheme to be feasible it must satisfy IR and IC constraints. The IR constraint is simply: $U(\theta) > 0; \forall \theta \in [\theta_1, \theta_2]$. For the IC constraints we consider two arbitrary consumer types and each one is larger than the other:

Equation 35

$$U(\theta_2) \geq b(x(\theta_1), \theta_2) - t(\theta_1)$$

$$U(\theta_1) \geq b(x(\theta_2), \theta_1) - t(\theta_2)$$

Previous two expressions are known as revealed preference (RP) now if we substitute $U(\theta) \equiv b(x(\theta), \theta) - t(\theta)$ for $t(\theta)$ we have:

Equation 36

$$U(\theta_2) \geq b(x(\theta_1), \theta_2) - b(x(\theta_1), \theta_1) + U(\theta_1) = U(\theta_1) + \int_{\theta_1}^{\theta_2} \frac{\partial b(x(\theta_1), t)}{\partial \theta_1} dt$$

$$U(\theta_1) \geq b(x(\theta_2), \theta_1) - b(x(\theta_2), \theta_2) + U(\theta_2) = U(\theta_2) + \int_{\theta_1}^{\theta_2} \frac{\partial b(x(\theta_2), t)}{\partial \theta_1} dt$$

If we combine previous two expressions such as:

Equation 37

$$\int_{\theta_1}^{\theta_2} \frac{\partial b(x(\theta_2), t)}{\partial \theta_1} dt \geq U(\theta_2) - U(\theta_1) \geq \int_{\theta_1}^{\theta_2} \frac{\partial b(x(\theta_1), t)}{\partial \theta_1} dt$$

Previous implies that :

Equation 38

$$\int_{\theta_1}^{\theta_2} \left(\frac{\partial b(x(\theta_2), t)}{\partial \theta_1} - \frac{\partial b(x(\theta_1), t)}{\partial \theta_1} \right) dt \geq 0$$

By the fundamental theorem of calculus :

Equation 39

$$\int_{\theta_1}^{\theta_2} \left(\int_{x(\theta_1)}^{x(\theta_2)} \frac{\partial^2 b(z, t)}{\partial \theta \partial x} dz \right) dt \geq 0$$

For the inequality to hold it must be that $x(\theta_2) > x(\theta_1)$. This implies that inverse demand curve is positive and monotonic and differentiable ■.

Now if we set some measure ϵ (endpoint in integration) towards which all points will converge

Equation 40

$$\frac{1}{\epsilon} \int_{\theta_1}^{\theta_1 + \epsilon} \frac{\partial b(x(\theta_1 + \epsilon), t)}{\partial \theta_1} dt \geq \frac{U(\theta_2) - U(\theta_1)}{\epsilon} \geq \frac{1}{\epsilon} \int_{\theta_1}^{\theta_1 + \epsilon} \frac{\partial b(x(\theta_1), t)}{\partial \theta_1} dt$$

For previous to hold it must be that $\epsilon > 0$ so this applies as long as $\epsilon \rightarrow 0$. The limit of the left terms is given as:

Equation 41

$$\frac{\partial b(x(\theta_1), \theta_1)}{\partial \theta_1} + \int_{\theta_1}^{\theta_1} \frac{\partial^2 b(x(\theta_1), t)}{\partial \theta_1 \partial x} x'(\theta_1) dt = \frac{\partial b(x(\theta_1), \theta_1)}{\partial \theta_1}$$

And $\frac{\partial b(x(\theta_1), \theta_1)}{\partial \theta_1} \geq \lim_{\epsilon \rightarrow 0} \frac{U(\theta_1 + \epsilon) - U(\theta_1)}{\epsilon} \geq \frac{\partial b(x(\theta_1), \theta_1)}{\partial \theta_1}$, this means that first derivative of the utility functions is :

Equation 42

$$U'(x) = \frac{\partial b(x(\theta_1), \theta_1)}{\partial \theta_1}$$

Previous expression is the utility function without transfers and with transfers utility function is :

Equation 43

$$U(\theta) = U_0 + \int_{\theta_1}^{\theta_2} \frac{\partial b(x(t), t)}{\partial \theta} dt$$

Previous means that if the preference tastes are equal there will be no need of transfers and $U(\theta) = U(0)$. But since $\frac{\partial b}{\partial \theta} > 0$ it follows that $U(\theta) > U(\theta_1) \geq 0, \forall \theta$

Extension to Myerson-Satterthwaite theorem

Supposedly when there are many buyers and sellers (not just one buyer and one seller as M-S supposed) inefficiency asymptotically disappears. This is the case of private goods,

Theorem 2. Shapley-Folkman theorem ,Star (1969)

Let \mathbb{R}^L be an L dimensional Euclidean space, the let A_i denote the its convex hull for any $A \subseteq \mathbb{R}^n$, now $\emptyset \neq A_i \subseteq \mathbb{R}^n, \wedge x \in \text{con} \sum_{i=1}^n A_i$, then $\sum_{i=1}^n x_i = x, \wedge x \in \text{con} A_i, \forall i, x_i \in A_i$, for at least $n - m$ indices of i . Khan and Rath (2013)

Proof of the theorem, Zhou (1993): let $x \in \text{con}(A)$ has a representation $x = \sum_{i=1}^n y_i$ and $y_i \in \text{con}(A_i), \forall i$, and let $y_i = \sum_{j=1}^m a_{ij} y_{ij}, a_{ij} > 0, \sum_{i=1}^n a_{ij} = 1, y_{ij} \in A_i$. Constructed z vectors are given as: $z = \sum_{i=1}^n \sum_{j=1}^m b_{ij} y_{ij}, b_{ij} \geq 0, \wedge (m+n)b_{ij} \geq 0$. From previous expression $x = \sum_{i=1}^n \sum_{j=1}^m b_{ij} y_{ij}, b_{ij} = 1, \forall i$. Now, $x = \sum_{j=1}^m b_{ij} y_{ij}, x = \sum_{i=1}^n x_i, x_i \in \text{con}(A_i), \forall i$. Because there are $(m+n)b_{ij} \geq 0$ in total, there is at least one $b_{ij} \geq 0, \forall i$, and there are at most m indices i that have more than one $b_{ij} > 0$, and $x_i \in A_i$ for at least $(n-m)$ indices i . ■

Preposition :

Preposition also here is continuous function (continuity condition) i.e. the condition for continuity as given in Robbin, et al. (1987), where states that f is said to be continuous on \mathbb{R}^l if

Equation 44

$$\forall x_0 \in \mathbb{R}^l \forall \epsilon > 0 \exists \delta > 0 \forall x \in \mathbb{R}^l [|x - x_0| < \delta \Rightarrow f(x) - f(x_0) < \epsilon]$$

In the previous expression ϵ is a trimmed price space. Trimmed space is a location parameter class of probability functions that is parametrized by scalar or vector valued parameter x_0 which determines distributions or shift of the distribution. Also, if there are n commodities, and a nonnegative orthant Θ of Euclidean space E^n is introduced is introduced, then the sets $\{x : x \succ_c y\}$ and $\{x : y \succ_c x\}$ are closed. Here \succ_c are preferences of a trader in a pure exchange economy (Starr 1969). The assumption of convexity assumes that if $\succ_c y$, then $\lambda x + (1 - \lambda)x \succ_c y$, this means that any weighted average or convex combination of x and y is preferred to y , $0 \leq \lambda \leq 1$. Each trader has initial endowment bundle and starts with a positive amount of some good $x_c > 0$.

Convex hull (A convex hull is the smallest polygon that encloses a group of objects, such as points is given as:

Equation 45

$$con \equiv \left\{ \sum_{j=1}^N \lambda_j p_j : \lambda_j \geq 0, \forall j, \wedge \sum_{j=1}^N \lambda_j = 1 \right\}$$

Now if so, $\mu: \Psi \rightarrow \mathbb{R}^L$ is a countably additive measure if $\mu(\emptyset) = 0, \wedge \mu(\cup_{n=1}^{\infty} A_n) = \sum_{i=1}^{\infty} \mu(A_n)$, when $\{A_n\}$ is a sequence of disjoint pairs of sets in Ψ . The measure μ purely atomic if there is scalar measure λ such that $\lambda \ll \mu$, and if $\lambda(A) = 0$, for every measurable set for which $|\mu(A)| = 0$. And if there is a sequence $\{E_k\}$ such that $T = \cup_{k=1}^{\infty} E_k, \forall E_k \in \Psi, i = 1, \dots, m$. This is called an atomic or only positive measure (Bogachev 2007, Aliprantis and Border 2013, Halmos 2013, Hewitt and Stromberg 2013).

Theorem 3 Second Fundamental welfare theorem

Second Fundamental welfare Theorem: Given an economy such as; $(\{X_i, \succsim_i\}_{i=1}^I, \{Y_j\}_{j=1}^J, \bar{\omega})$ we assume that $\sum_i \omega \gg 0$, allocation is given with (x^*, y^*) , and a price vector $p \neq 0$, (here $p = p_1, \dots, p_n$), and this combination constitutes price quasi-equilibrium with transfers $(\omega_1, \dots, \omega_I)$, subject to the following budget constraint: $\sum_i \omega_i = p\bar{\omega} + \sum_i p y_j^*$, where:

1. $\forall j, y_j^*, \max_j p y_j^*, p y_i \leq p y_j^*, \forall y_j \in Y_j$. (firm maximizes profit by producing y_j^*)
2. $\forall i, \exists x_i \succ_i x_i^* \rightarrow p x_i \geq \omega_i$. (if $x_i \succ x_i^*$ then it cannot cost less than x_i^*).
3. And $\sum_i x_i^* = \bar{\omega} + \sum_j y_j^*$. (budget constraint)

Here we define $V_i = \sum_{i=1}^I x_i \succ x_i^*$ (strictly preferred than x_i^*) also $V = \sum V_i$, and V_i is convex due to convexity of a preference relation \succ_i , and V is convex since $\forall V_i$ are convex. Point number 2 is the only difference with the definition of price equilibrium since $p x_i \geq \omega_i$ is quasi-price equilibrium (weak inequality). Definition of preference relation and preference properties are given below.

Definition : Preference relation \succsim is a relation $\succsim \subset \mathbb{R}_+^L \times \mathbb{R}_+^L$. With properties $x \succsim x, \forall x \in \mathbb{R}_+^L$ (reflexivity), $x \succsim y, y \succsim z \Rightarrow x \succsim z$ (transitivity), \succsim is a closed set (continuity), $\forall (x \succsim y), \exists (y \succsim x)$ (completeness), given $\succsim, \forall (x \gg 0)$ the at least good set $\{y: y \succsim x\}$ is closed relative to R^L (boundary condition), A is convex, if $\{y: y \succsim x\}$, is convex set for every $y a y + (1 - \lambda)x \succsim x$, whenever $y \succsim x$ and $0 < \lambda < 1$, Mas-Colell, A. (1986). This theorem holds if preferences are convex i.e.: The set $A \subset \mathbb{R}^n$ is convex compact and nonempty set if $\lambda x + (1 - \lambda)x' \in A, x, x' \in A \wedge \lambda \in [0, 1]$. There is a theorem that gives sufficient conditions for the existence of hyperplane separating sets, that is the Separating hyperplane theorem. In geometry hyperplane of an n dimensional vector space V is a subspace of a $n - 1$ dimension, or equivalently of codimension 1 in V . In geometry, the hyperplane separation theorem is a theorem about disjoint convex sets in n -dimensional Euclidean space.

Theorem 3 Separating hyperplane theorem

Definition of a hyperplane : Hyperplane in \mathbb{R}^n can be described by an equation $\sum_{i=1}^n p_i x_i = \alpha$, here vector $p \in \mathbb{R}^n$ is a non-zero price vector, and α is scalar (Simon and Blume 1994, Yu and Phillips 2018)

Equation 46

$$H(p, \alpha) = \{x \in \mathbb{R}^n | p \cdot x = \alpha\}$$

Separating hyperplane theorem: Let's suppose that $B \subset \mathbb{R}^n$ is a convex and closed set and $x \notin B, \exists p \in \mathbb{R}^n, p \neq 0, \alpha \in \mathbb{R}, p \cdot x > \alpha, p \cdot y < \alpha, \forall y \in B$. Convex sets $A, B \subset \mathbb{R}^n$ are disjoint $A \cap B = \emptyset, \exists p \in \mathbb{R}^n, p \neq 0, p \cdot x > \alpha, p \cdot y < \alpha, \forall y \in B$. Then there is a hyperplane

that separates A and B , leaving them on different sides of it. In support of this theorem if $B \subset \mathbb{R}^n$ is convex and $x \notin \text{int}B, \exists p \in \mathbb{R}^n, p \cdot x \geq p \cdot y, p \neq 0$. If A and B are convex, $0 \notin A - B, A \cap B = \emptyset$. Let's say that $S \in \mathbb{R}^m$ if z^* is a boundary point of set $S, \exists p \neq 0, z \in S \rightarrow p \cdot z \leq p \cdot z^*$

Proof lemma 3.1 :if S is a closed and convex set ³, $x \in S$, and if b is the boundary of this set, then there exists scalar $\alpha \neq 0$ such that: $x \in S \rightarrow \alpha x \leq \alpha b$. Previous theorem ($S, \exists p \neq 0, z \in S \rightarrow p \cdot z \leq p \cdot z^*$, where p is an m -dimensional price vector) holds if $m = 1$, this theorem is also true when $m = n + 1$ (Fibich and Gavish 2011). Here $n + 1$ is the dimension of S production set. Now z is $n + 1$ dimensional vector, x is n dimensional vector and y is one dimensional scalar: $z = (y, x)$, n -dimensional set is: $X(y) \equiv \{x | (y, x) \in S\}$. Now, from these two convex sets $S, X(y)$ follows that: $(\lambda y + (1 - \lambda)y', \lambda x + (1 - \lambda)x') \in S$, and $x \in X(y^*) \rightarrow p_x x \geq p_x x^*$ ■.

Asymmetric auctions

There exists literature in the subject of asymmetric auctions namely: [Maskin, Riley \(2000\)](#), [Fibich, Gaviious \(2003\)](#), [Fibich, Gavish \(2011\)](#), [Güth, et al. \(2005\)](#), [Gayle, Richard \(2008\)](#), [Hubbard, et al. \(2013\)](#).

Basic setup of the asymmetric auction

There exist set: $\Theta = \{1, 2, \dots, N\}$, of types of bidders. And $\forall \theta \in \{1, 2, \dots, N\}$ and $\exists n(\theta) \geq 1$, which are bidders of type θ . Bidders of type θ draw an IPV for the object from CDF $F: [\omega_H, \omega_L] \rightarrow R$. It is assumed that $F \in C^2([\omega_H, \omega_L])$ and $f \equiv F' > 0$, on ω_H . The inverse of equilibrium bidding strategy, [Maskin and Riley \(2000\)](#) and [Fibich and Gavish \(2011\)](#) is given as:

Equation 47

$$v'_i(b) = \frac{F_i(\beta^{-1}(b))}{f_i(\beta^{-1}(b))} = \left[\left(\frac{1}{n-1} \sum_{j=1}^n \frac{1}{v_j(b) - b} \right) - \frac{1}{v_i(b) - b} \right], i = 1, \dots, n.$$

Solution to the maximization problem given as $\max_b U_i(b; v_i) = (v_i - b) \prod_{j=1, j \neq i}^n F_j(v_j(b)), i = 1, \dots, n$:

Equation 48

$$\sum_{j=1, j \neq i}^n \frac{f_j(v_j(b)) v'_j(b)}{F_j(v_j(b))} - \frac{1}{v_i(b) - b}, i = 1, \dots, n.$$

Bidders expected revenue in the FPA asymmetric auction is given as:

Equation 49

$$E_i(p, b_i, v_i) = k_i \int_r^{b(\omega_H)} [F_i^{-1}(\ell_i(v)) - v] \cdot \frac{\ell'_i(v)}{\ell_i(v)} \prod_{j=1}^n [\ell_j(v)]^{k_j} dv.$$

Bidder maximizes :

³ Its complement is an open set. Closed set is defined as a set that contains all of its limit points.

Equation 50

$$(\beta^{-1}(b_1)) = \arg \max_{u \in (0, \omega_h)} (v - u) \cdot [F_i(\lambda_i(u))]^{k_i-1} \prod_{j \neq i} [F_j(\lambda_j(u))]^{k_j}.$$

$\exists u = \sum_{i=1}^n u_i$, where u_i denotes the player of type i . Where in previous expressions $\ell_i(v) = F_i(\lambda_i(v))$, and probabilities of winning the reserve price auction are given as:

Equation 51

$$p_i(r) = k_i \int_r^{\omega_h} \frac{\ell_i'(v)}{\ell_i(v)} \prod_{j=1}^n [\ell_j(v)]^{k_j} dv.$$

Auctioneer expected revenue is given with the following expression:

Equation 52

$$E(p, b_i, v_i) = \omega_h - r \prod_{j=1}^n [F_j(r)]^{k_j} - \int_r^{b(\omega_h)} \frac{\ell_i'(v)}{\ell_i(v)} \prod_{j=1}^n [\ell_j(v)]^{k_j} dv.$$

As for comparison in FPA symmetric auction bids and probabilities of winning are given as:

$$\beta(v) = x - \int_{\omega_l}^{\omega_h} \left(\frac{F(y)}{F(x)} \right)^{n-1} dy. \Pr(v_i \leq \beta^{-1}(b)) = F(\beta^{-1}(b))^{n-1}$$

Expected revenue in FPA symmetric auction and maximal bid are given as:

$$E(b(v_i)) = v_i * \frac{(b_i)^{n-1}}{\left(\frac{n-1}{n-1+\alpha}\right)^{n-1}} \text{ or } EE(b(v_i)) = v_i * \frac{(b_i)^{n-1}}{\alpha^{n-1}}, \bar{b} = b(1) = 1 - \int_0^1 F^{n-1}(s) ds$$

where α is CRRA coefficient, and $\alpha = \left(\frac{n-1}{n-1+\alpha}\right) = \frac{b_i}{v_i}$ this is because $b_i = \alpha * v_i$. The CRRA utility function is given as, Arrow, 1965:

Equation 53

$$u = \begin{cases} \frac{1}{1-\alpha} c^{1-\alpha} & \text{if } \alpha > 0, \alpha \neq 1 \\ \ln c & \text{if } \alpha = 1 \end{cases}, \text{ when } \alpha = 1 \Rightarrow \lim_{n \rightarrow \infty} \frac{c^{1-\alpha} - 1}{1-\alpha} = \ln(c).$$

Elasticity of substitution is $= \frac{1}{\alpha}$, and $MRS = \frac{c_2}{c_1} = \left(\frac{p_1}{p_2}\right)^\alpha$, when $\alpha \in [0,1]$ than FPA-bid functions are in form:

Equation 54

$$b(v_i) = v - \frac{1}{F^{1-\alpha}(v)} \int_r^v F^{\frac{n-1}{1-\alpha}}(x) dx, \text{ or, when } r = 0 \Rightarrow b(v_i) = \frac{n-1}{n-1+\alpha} (v_i).$$

In the previous expression r represents the reserve price. Now, If the coefficient of risk aversion is CARA (Constant absolute risk aversion), i.e. $u(c) = 1 - e^{-ac}$, where $a > 0$, than the bidding function is given as

Equation 55

$$b(v_i) = v + \frac{1}{a} \ln \left(1 - \frac{e^{-av}}{F^{n-1}(v)} \int_{e^{-ar}}^{e^{-av}} [F(a^{-1} \ln x)]^{N-1} dx \right).$$

SPA auction NE

In SPA auctions dominant strategy is to bid truthfully i.e. $b(v_i) = v_i$. The probability to win an auction is given as: $P(v_i) = v_i$, the expected payoff if b_i wins is given as: $\frac{v_i^2}{2}$. The expected profit in SPA auction and expected revenue, [Kunimoto \(2008\)](#), are given as:

1. $E(b(v_i)) = v_i \left(v_i - \frac{v_i}{2} \right) = \frac{v_i^2}{2}$.
2. $Revenue_{(SPA, r=0, \alpha \in \mathbb{R}^+)} = F(y)^n + nF(y)^{n-1}(1 - F(y)) = nF(y)^{n-1} - (n - 1)F(y)^n$.

Or in the reserve price auction SPA auction CDF of revenue is given as;

Equation 56

$$Revenue_{(SPA, r \in \mathbb{R}, \alpha \in \mathbb{R}^+)} = r * r^{n-1} + nF(y)^{n-1} - (n - 1)F(y)^n.$$

Uncertain number of bidders

In FPA with uncertain number of bidder equilibrium bid function is given as:

Equation 57

$$\beta = \frac{(1 - p) \int_0^v x f(x) dx}{p(1 - p)F(v)}.$$

Where in previous expression $p_1(1)$ denotes the probability that player 1 believe that he will be only one present at the auction (the only participant). In a symmetric auction with only two bidders we can write $p_1(1) = p, p_1(2) = 1 - p$. CDF is given as:

Equation 58

$$F(v) = p(v - b) + (1 - p)F(\beta^{-1}(b))(v - b).$$

SPA with uncertain number of bidders will still have the same strategy and Nash equilibrium since it will not change the uncertainty of players attendance.

Back to asymmetric auction: weak and strong bidders' equilibrium

Now, let b_S be an equilibrium bid of an strong bidder and b_w is an equilibrium bid of an weak bidder. Than we have following problem to maximize: $\max_b F_w(b_w^{-1}(b))(v_S - b)$. FOC is:

Equation 59

$$\frac{f_w(b_w^{-1}(b))}{F_w(b_w^{-1}(b))} \cdot (b_w^{-1})'(b) - \frac{1}{b_S^{-1}(b) - b}$$

Strong bidder maximizes

Equation 60

$$\frac{f_S(b_S^{-1}(b))}{F_S(b_S^{-1}(b))} \cdot (b_S^{-1})'(b) = \frac{1}{v_w - b}$$

Theorem: Suppose that $F_S(v) \leq F_w(v)$, meaning that F_S conditionally first-order stochastically dominates F_w . Then when one compares FPA and SPA, both uniformly distributed following applies:

1. $\forall b_S^{-1}(b) = v_S, \because E(b_{FPA}(v)) < E(b_{SPA}(v))$ for $b_S^{-1}(b) = v_S$
2. $\forall b_w^{-1}(b) \neq v_w, \because E(b_{FPA}(v)) > E(b_{SPA}(v))$ for $b_w^{-1}(b) \neq v_w$

Proof: For purposes of the proof $b_S(v), b_w(v)$ have the same range so a matching function is defined as: $m(v) \equiv b_w^{-1}(b_S(v))$ or as a weak bidder that bids equal to strong bidder in FPA. Since from previous we know that $b_S(v) < b_w(v)$ in FPA, now we know that $m(v) = v$. The strong bidder expected payoff is given as:

Equation 61

$$E[\pi(v_i)] = \Pr(b_w(v_w) < b)(v - b).$$

Because $\Pr(v < a) = F(a)$ when distribution of values is uniform. By the envelope theorem Milgrom and Ilya 2002 value function for FPA and SPA (no bid shading) are given as:

Equation 62

$$V_S^{FPA}(v) = \int_{\omega_l}^{\omega_h} F_w(m(w)) dv. V_S^{SPA}(v) = \int_{\omega_l}^{\omega_h} F_w(v) dv.$$

Since $m(v) < v$ and that F_w is strictly increasing, the strong bidder prefers SPA. For the weak bidders expected payoff for the FPA and SPA are given as:

Equation 63

$$V_w^{FPA}(v) = \int_{\omega_l}^{\omega_h} F_S\left(\frac{v}{m}\right) ds. V_w^{SPA}(v) = \int_{\omega_l}^{\omega_h} F_S(v) dv.$$

Since $m^{-1}(v) > v$, expected payoff is higher for the weak bidder in the FPA.

Numerical example and proof of the Myerson-Satterthwaite theorem

In this part we choose 9 bidder types, there is only one bidder from each type, and these bidders draw their IPV's from for the object of the auction from their CDF $F: [\omega_H, \omega_L] \rightarrow R$. Ten selected distributions in the following order are, (see, (Johnson, Kemp et al. 2005)) :

Table 1 Bidders' distributions, boundaries and CDF's

Distributions and boundaries	CDF
exponential[0,1],	$F(x) = \frac{1 - \exp(-\lambda(x - \omega_L))}{1 - \exp(-\lambda(\omega_H - \omega_L))}$
gamma[0,1],	$F(x) = \frac{\int_0^x t^{k-1} e^{-t} dt}{\Gamma(k)}$
lognormal[0,1],	$F(x) = \frac{\int_a^x \frac{1}{z\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{\ln z - \mu}{\sigma}\right)^2\right] dz}{\int_a^b \frac{1}{z\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{\ln z - \mu}{\sigma}\right)^2\right] dz}$
Norma[01,]	$F(x) = \int_{-\infty}^x \frac{e^{-\frac{z^2}{2}}}{\sqrt{2\pi}}$

standard normal [0,1]	$F(x) = \frac{\Phi\left(\frac{x-u}{\sigma}\right) - \Phi\left(\frac{a-u}{\sigma}\right)}{\Phi\left(\frac{b-u}{\sigma}\right) - \Phi\left(\frac{a-u}{\sigma}\right)}$
power[0,1]	$F(x) = \frac{\eta}{\alpha+1} [(x+a+c)^{\alpha+1} - c^{\alpha+1}]$
Reverse power[0,1]	$F(x) = 1 - \left(\frac{b-x}{b-a}\right)^\alpha$
Uniform [0,1]	$F(x) = \frac{x - \omega_L}{\omega_H - \omega_L}$
Weibull [0,1]	$F(x) = \frac{1 - \exp\left[-\left(\frac{x-\omega_L}{\lambda}\right)^k\right]}{1 - \exp\left[-\left(\frac{\omega_H-\omega_L}{\lambda}\right)^k\right]}$

On the previous table nine types of bidders' (types of statistical distribution) selected were presented. On the second column Cumulative distribution functions of the selected distribution types were presented. In probability theory and statistics, the cumulative distribution function (CDF) of a real valued random variable X , or just the distribution function of X , evaluated at x , it is probability that: $F_x(x) = P(X \leq x)$, where $P(a \leq x \leq b) = F_x(b) - F_x(a)$, or if it is a continuous random variable CDF of a function can be presented as: $F_x(x) = \int_{-\infty}^x f_x(t) dt$ or in the case of absolutely continuous $F_x(x) = \int_a^b f_x(x) dx$. On the next table results from the Backward shooting method are explained, followed by the small explanation of the computation method used.

Table 2 Backward shooting method results, reserve price=0.5; end result: Convergence false

	b_bar	A	B	B-A		Result
0/39	0.5	0	1.00000000	1.00E+03	3	Solution not within specified tolerances.
1/39	0.75	0.5	1.00000000	5.00E+02	3	Solution not within specified tolerances.
2/39	0.875	0.75	1.00000000	2.50E+02	3	Solution not within specified tolerances.
3/39	0.9375	0.875	1.00000000	1.25E+02	2	Solution diverges to +Infinity.
4/39	0.90625	0.875	0.9375	6.25E+01	2	Solution diverges to +Infinity.
5/39	0.890625	0.875	0.90625	3.13E+01	1	Solution diverges to -Infinity.
6/39	0.882813	0.875	0.890625	1.56E+01	1	Solution diverges to -Infinity.
7/39	0.878906	0.875	0.8828125	7.81E+00	1	Solution diverges to -Infinity.
8/39	0.876953	0.875	0.87890625	3.91E+00	1	Solution diverges to -Infinity.
9/39	0.875977	0.875	0.876953125	1.95E+00	3	Solution not within specified tolerances.
10/39	0.876465	0.875977	0.876953125	9.77E-01	3	Solution not within specified tolerances.

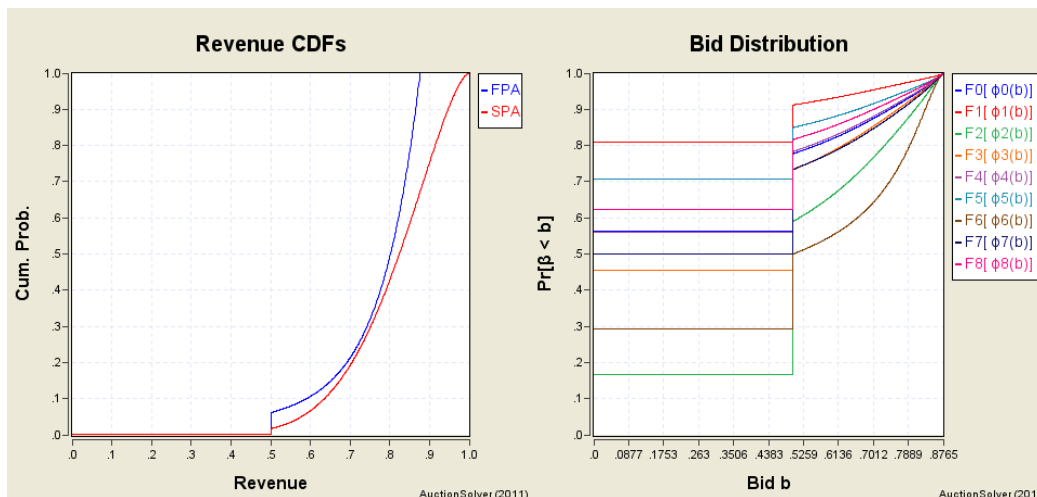
11/39	0.876709	0.876465	0.876953125	4.88E-01	1	Solution diverges to - Infinity.
12/39	0.876587	0.876465	0.876708984	2.44E-01	1	Solution diverges to - Infinity.
13/39	0.876526	0.876465	0.876586914	1.22E-01	1	Solution diverges to - Infinity.
14/39	0.876495	0.876465	0.876525879	6.10E-02	3	Solution not within specified tolerances.
15/39	0.876511	0.876495	0.876525879	3.05E-02	3	Solution not within specified tolerances.
16/39	0.876518	0.876511	0.876525879	1.53E-02	3	Solution not within specified tolerances.
17/39	0.876522	0.876518	0.876525879	7.63E-03	1	Solution diverges to - Infinity.
18/39	0.87652	0.876518	0.876522064	3.82E-03	1	Solution diverges to - Infinity.
19/39	0.876519	0.876518	0.876520157	1.91E-03	3	Solution not within specified tolerances.
20/39	0.87652	0.876519	0.876520157	9.54E-04	3	Solution not within specified tolerances.
21/39	0.87652	0.87652	0.876520157	4.77E-04	3	Solution not within specified tolerances.
22/39	0.87652	0.87652	0.876520157	2.38E-04	1	Solution diverges to - Infinity.
23/39	0.87652	0.87652	0.876520038	1.19E-04	3	Solution not within specified tolerances.
24/39	0.87652	0.87652	0.876520038	5.96E-05	1	Solution diverges to - Infinity.
25/39	0.87652	0.87652	0.876520008	2.98E-05	3	Solution not within specified tolerances.
26/39	0.87652	0.87652	0.876520008	1.49E-05	1	Solution diverges to - Infinity.
27/39	0.87652	0.87652	0.87652	7.45E-06	3	Solution not within specified tolerances.
28/39	0.87652	0.87652	0.87652	3.73E-06	3	Solution not within specified tolerances.
29/39	0.87652	0.87652	0.87652	1.86E-06	3	Solution not within specified tolerances.
30/39	0.87652	0.87652	0.87652	9.31E-07	3	Solution not within specified tolerances.
31/39	0.87652	0.87652	0.87652	4.66E-07	1	Solution diverges to - Infinity.
32/39	0.87652	0.87652	0.87652	2.33E-07	1	Solution diverges to - Infinity.
33/39	0.87652	0.87652	0.87652	1.16E-07	3	Solution not within specified tolerances.
34/39	0.87652	0.87652	0.87652	5.82E-08	1	Solution diverges to - Infinity.
35/39	0.87652	0.87652	0.87652	2.91E-08	1	Solution diverges to - Infinity.
36/39	0.87652	0.87652	0.87652	1.46E-08	3	Solution not within specified tolerances.
37/39	0.87652	0.87652	0.87652	7.28E-09	1	Solution diverges to - Infinity.
38/39	0.87652	0.87652	0.87652	3.64E-09	3	Solution not within

39/39 0.87652 0.87652 0.87652 1.82E-09 1 specified tolerances.
Solution diverges to - Infinity.

Highest Bid: $\bar{b} = 0.876520000002551$, Shooting Terminated at $b = 0.500000000002981$. ($b_{\text{underbar}} = 0.5$)

Euler method used in backward shooting solver is described as the simplest Runge-Kutta method, ODE is of the form: $\frac{dy(t)}{dt} = f(t, y(t))$, $y(t_0) = y_0$, $\frac{dy(t)}{dt} \approx \frac{y(t+h)-y(t)}{h}$, $y(t+h) \approx y(t) + h \frac{dy}{dt}$. The iterative solutions is than given as: $y_{n+1} = y_n + hf(t_n, y_n)$ or in previous expressions $x \in (x_0, x_n)$. On the next graph Revenue CDFs and bid distributions are presented under Backward shooting method.

Figure 1 Revenue CDF and bid distribution with the Backward shooting method



Next are presented results (inverse bid functions) under Chebychev Approximation and some explanation of the method:

$$x = x(b) = (b - 0.5) / 0.38906945006425353$$

Inverse bid functions

1. $\phi_0(x) = 0.359684 + 0.742969 * T[1] - 0.111041 * T[2] - 0.018979 * T[3] + 0.045910 * T[4] - 0.019714 * T[5]$
2. $\phi_1(x) = 0.400034 + 0.680654 * T[1] - 0.106074 * T[2] + 0.014502 * T[3] + 0.013428 * T[4] - 0.004174 * T[5]$
3. $\phi_2(x) = 0.399226 + 0.699775 * T[1] - 0.113911 * T[2] + 0.003953 * T[3] + 0.013566 * T[4] - 0.002641 * T[5]$
4. $\phi_3(x) = 0.350580 + 0.760549 * T[1] - 0.120452 * T[2] - 0.017967 * T[3] + 0.046234 * T[4] - 0.019976 * T[5]$
5. $\phi_4(x) = 0.352117 + 0.756530 * T[1] - 0.121779 * T[2] - 0.012382 * T[3] + 0.042888 * T[4] - 0.018589 * T[5]$
6. $\phi_5(x) = 0.382672 + 0.711359 * T[1] - 0.119968 * T[2] + 0.015069 * T[3] + 0.016516 * T[4] - 0.006692 * T[5]$
7. $\phi_6(x) = 0.402056 + 0.702233 * T[1] - 0.112901 * T[2] + 0.010328 * T[3] + 0.008493 * T[4] - 0.013409 * T[5]$

8. $\phi_7(x) = 0.345038 + 0.773671*T[1] - 0.136984*T[2] - 0.001167*T[3] + 0.035691*T[4] - 0.016898*T[5]$
9. $\phi_8(x) = 0.360848 + 0.744004*T[1] - 0.124400*T[2] - 0.000162*T[3] + 0.032328*T[4] - 0.013832*T[5]$

High Bid: $0.8890694500642535\bar{b} \approx 0.89$

About Chebyshev coefficients we pose the following theorem:

Theorem: Every function defined on $[-1,1]$, so long as it is at least Lipschitz continuous, has an absolutely and uniformly convergent Chebyshev series:

equation 64

$$f(x) = a_0 + a_1T_1(x) + a_2T_2(x) + \dots$$

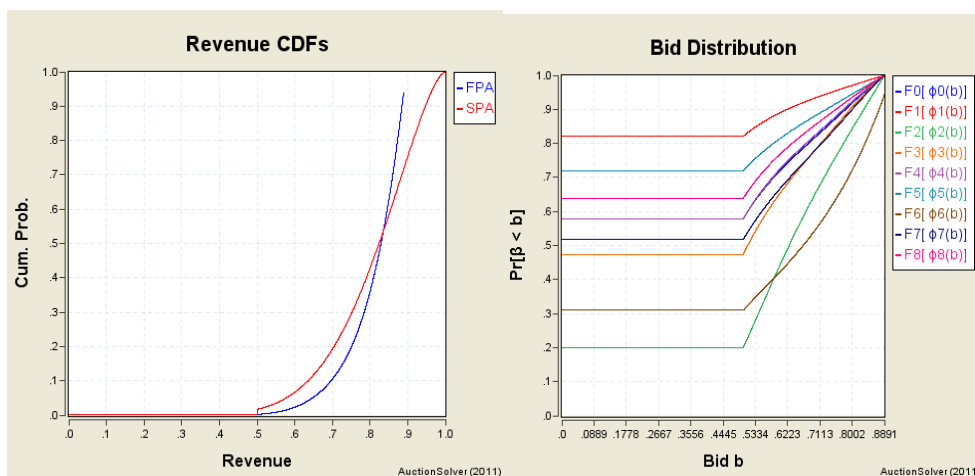
The same holds on an interval $[a,b]$ with appropriately scaled and shifted Chebyshev polynomials. The coefficients of these polynomials for a function $f(x)$ can be obtained by the following integral:

Equation 65

$$a_n = \frac{2}{\pi} \int_{-1}^1 \frac{f(x)T_n(x)}{(1-x^2)^{\frac{1}{2}}} dx$$

[Hubbard ,Paarsch \(2009\)](#) used Chebyshev polynomials, which are orthogonal polynomials and more stable. Chebyshev nodes can be computed as: $x_t = \cos\left[\frac{\pi(t-1)}{T}\right], t = 1, \dots, T$. The points $\{v_t\}_{t=1}^T = 1$ are found via transformation like this: $v_t = \frac{\bar{b} + \omega_L + (\bar{b} - \omega_L)x_t}{2}$. Graphical depiction of revenue CDFs and bid distribution follows.

Figure 2 Revenue CDFs and bid distribution with the Chebyshev Approximation



A fixed point is a point that does not change upon of a function (map), system of differential equations etc. (Shashkin 1991) . In the Newton's method the algorithm can be applied iteratively to

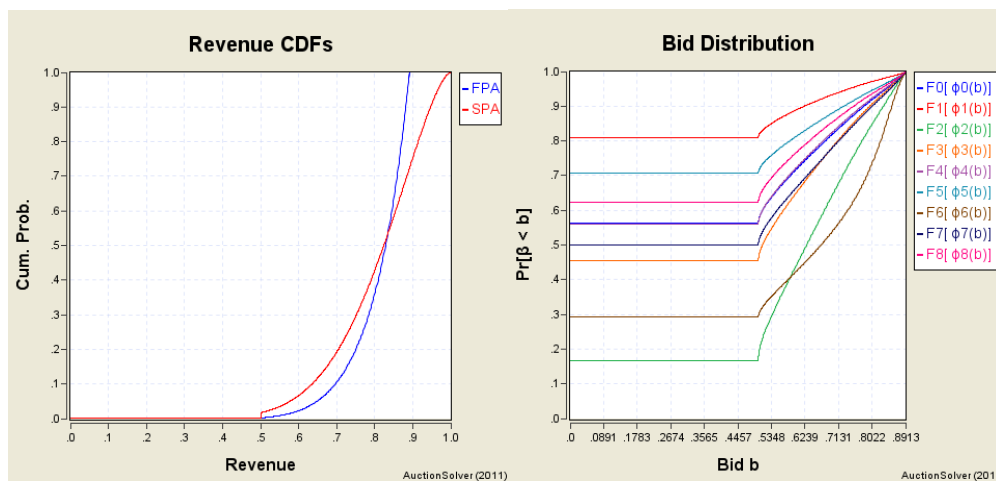
obtain: $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_{n-1})}$, if $\lim_{x_{n+1} \rightarrow x^*} \frac{f(x_n)}{f'(x_n)} = x_n$, and $x_n = x^* + \epsilon_n$, where $\epsilon_{n+1} = \frac{f''(x^*)}{2 \cdot f'(x^*)} \epsilon_n^2$.

Theorem Fixed point theorem: if $\exists f(x) \in [a, b]$, then $\exists x \in [a, b]$, and $f(x) - x = 0 \Rightarrow f(x) = x$, see (Rosenlicht 1968)

Results : convergence true

Next will finish with a depiction on a graph of Revenue CDFs and bid distribution under Fixed point iteration.

Figure 3 Revenue CDF and bid distribution with the Fixed point iteration



From the graphs one can conclude that Spence-Mirrleessingle crossing condition holds ,except in the Backward shooting method. The terms SCC (single crossing condition) refers to the requirement that the isoutility curves for agents of different types cross only once, [Laffont, Martimort \(2002\)](#). This can be defined as follows by :

Assumption :

Equation 66

$$\forall \theta \in \Theta, \forall q \in Q$$

$$\partial_{\theta q}^2 U(q; \theta) \geq 0$$

This condition translates in that higher the agent's type θ , the higher his marginal utility, that is that increase in agent's type means that the agent is willing to trade more, and this is true at all levels of quantities traded q . This means that this a requirement of a constant sign on the utility function i.e. second partial derivative $\partial_{\theta q}^2$ of the marginal utility function to be monotone in θ . That means that the agents rent is positive: $r(\theta) \geq 0$ and that $r(\theta) = \max_{\tilde{\theta}} U(q(\tilde{\theta}); \theta) - t(\tilde{\theta})$, where $t(\tilde{\theta})$ represents the current transfers. This is important for the incentive compatibility condition to holds and that is to be satisfied allocation rule and the revelation principle that is:

$$\text{Allocation rule: } f: \Theta \rightarrow A = Q \times \mathbb{R}; \theta \mapsto f(\theta) = (q(\theta), t(\theta))$$

Revelation principle:

Revelation mechanism: $(M, g): M \rightarrow A$ and $h: \Theta \rightarrow M$ where $f = g \circ h$ then it must satisfy: $\forall \theta, \tilde{\theta} \in \Theta, U(f(\theta), \theta) \geq U(f(\tilde{\theta}), \theta)$. So if Spence-Mirrlees condition holds with positive sign then $q(\cdot), r(\cdot)$ is IC only and only if:

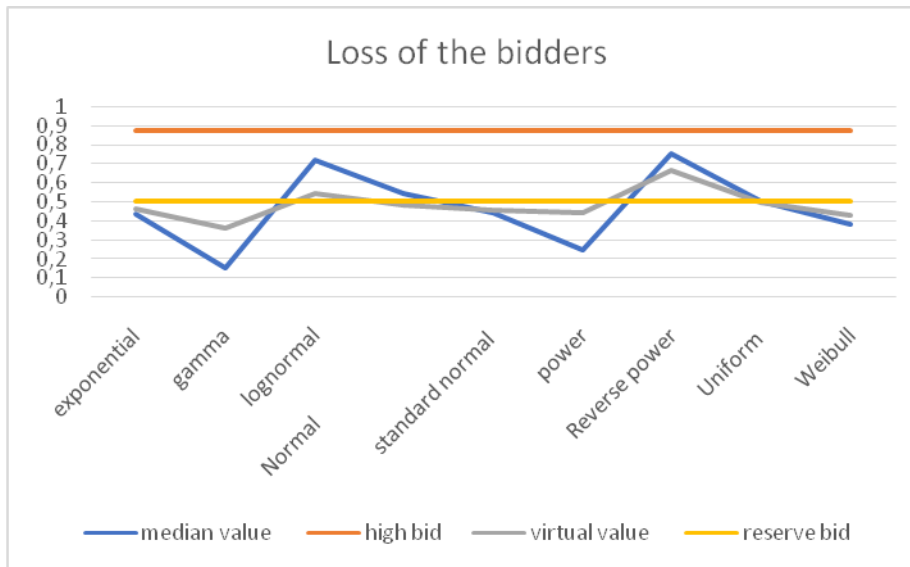
$$\begin{cases} r(q) = r(\underline{\theta}) + \int_{\underline{\theta}}^{\bar{\theta}} \partial_{\theta} U(q(s); s) ds \\ q(\theta); \Delta q(\theta) > 0 \end{cases}$$

Trade loss is depicted on the following table and graph.

Table 3 median value, virtual value and loss

Distributions and boundaries	Median value	Virtual value =0 at x=?	Loss
exponential[0,1],	0.438140	0.467503	- 0.4383800000002551
gamma[0,1],	0.154211	0.363593	- 0.7223090000002551
lognormal[0,1],	0.713734	0.547381	- 0.1627860000002551
Normal[01,]	0.539199	0.486289	- 0.3373210000002551
standard normal [0,1]	0.441771	0.458464	- 0.4347490000002551
power[0,1]	0.250000	0.444444	- 0.6265200000002551
Reverse power[0,1]	0.750000	0.666667	- 0.1265200000002551
Uniform [0,1]	0.500000	0.500000	- 0.3765200000002551
Weibull [0,1]	0.379885	0.432857	- 0.4966350000002551

Figure 4 Median distributions of value of the bidders, virtual valuations and depiction of trade loss



Virtual valuations of an agent is a function that measures the surplus that can be extracted from that agent. Virtual valuation according to [Myerson \(1981\)](#) is equal to:

equation 67

$$r(v) = (b_s^{-1})'(b) - \frac{1 - F(v)}{f(v)}$$

And $\exists n \in [b, \bar{b}] \rightarrow \mathbb{R}$ so called *revision functions* such that if another bidder i learned that $(b_s^{-1})'(b)$ was the j 's bidder valuation estimate for the object, then i would revise his own valuation by $e_j(b_s^{-1})'(b)$, so that :

equation 68

$$v_i((b_s^{-1})'(b)) = (b_s^{-1})'(b) + \sum_{\substack{j \in N \\ j \neq i}} e_j(b_s^{-1})'(b)$$

Where $(b_s^{-1})'(b) = v$, similarly seller raises his bid $s_s((s_s^{-1})'(s)) = (s_s^{-1})'(s) + \sum_{\substack{j \in N \\ j \neq i}} e_j(b_s^{-1})'(b)$, if he learned that $(b_s^{-1})'(b)$ was the vector of estimates held by the bidders. In the case of pure preference uncertainty, we have:

equation 69

$$\int_{\underline{b}}^{\bar{b}} e_j v_j f_j(v_j) dv_j = 0$$

Conclusion

Auction in most general terms is a game theoretic mechanism which allocates an object (set of objects) and is composed of set of bidders N , set of objects allocated O , a private type space S , and public type space Ξ . And where each bidder has type of distributions $\{S_i, \xi_i\} \in S \times \Xi$, and

$S \times \Xi = \sum_{i=1}^N S_i \times \sum_{i=1}^N \Xi_i$, which represents the space of all type profiles, see ([Katzwer \(2012\)](#)). In the First price auction (blind auction), all bidders simultaneously submit sealed bids, so that no bidder knows the bid of any other participant. The highest bidder pays the price they submitted, so this is how this auction differs from SPA auction, [Krishna \(2009\)](#). Effectively First price sealed bid auctions are called tendering for procurement by companies and organizations, eg. government contracts and mining leases. This contrasts to GSPA auctions (or position auctions (sponsored search on Yahoo and Google search engines) generalized by [Varian \(2006\)](#)), where winning bidder pays price offered by the second highest bidder (eg. eBay auction and Google Ads). A mining lease gives the holder the exclusive right to conduct mining operations and sell the minerals specified in the conditions attached to the lease. So how should the bidders' bid in FPSBA? They should bid lower than their valuation (shading price). And while this mechanism leads to high eCPMs (effective cost per thousand impressions, $eCPM = \left(\frac{\text{total earnings}}{\text{total impressions}} \right) \times 1,000$.) for the publishers inventory it can lead to unnaturally high prices, as buyers are forced to "guesstimate" how much their competition bid. So, in a game of incomplete information such as auction Bayesian Nash equilibrium is appropriate concept. But problem here is that: The efficient allocation cannot be achieved by ANY Bayesian Nash Equilibrium in ANY mechanism. This leads in worst case to market failure. FPSBA is not IC (incentive compatible mechanism), since there is no Bayesian-Nash equilibrium in which bidders report their true value. This contrasts basic requirement. Two (IC and ex-post PE (Pareto efficiency)) out of four basic requirements of the [Myerson-Satterthwaite theorem \(1983\)](#) are not satisfied. So, one of the parties is forced to trade at loss.

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SMEs DEVELOPMENT AND BUSINESS ENVIRONMENT IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract:

Nowadays, SMEs are backbone of the economic growth. Particularly their role can be highlighted in decreasing unemployment, significant contribution to GDP, added value and export. Since SMEs development is determined by a numerous factor of the business environment, the main aim of this paper will be to analyze the business environment in which these businesses operate and to identify the key problems in their operations. In order to achieve the aim, a survey will be conducted on a sample of SMEs in the Republic of North Macedonia. Based on the obtained results, at the end of the paper, a set of measures will be proposed for improvement of the business environment in order to foster the SMEs development.

Key word: *SMEs development, business environment*

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Introduction

The processes of globalization and the contemporary working conditions characterized by dynamic technological changes, increased competition, uncertain and risky working, create a new layout of the new balanced world and conditions for economic and total social development. The small and medium businesses with their innovation, creativity, permanent productivity and flexibility increasing, are undoubtedly a key factor for the modern world development.

The small and medium businesses play important role in opening new jobs, the competition increasing, the production increasing, etc., in order to boost the national economy development, the living standard improvement and the people's well-being.

The business environment has a crucial importance for the small and medium businesses performances and development, and because of that it deserves a special place in researching the ways of boosting their development. It includes a set of political, legal, institutional and regulatory conditions, which have an appropriate influence on the business processes.

Having in mind the above, in this study we will make an analysis of the business environment influence on the small and medium businesses in R.N. Macedonia, with a special stress on the problems they are faced to.

Literature review

SMEs play a crucial role in economic growth. As Nelson said: SMEs have an important role on many aspects, such as employment, taxes or innovation.

On a long term, compared to large companies, they contribute more to job creation and take a large share in the overall employment. Nowadays, two-thirds of newly created jobs in the EU are due to the sector of small and medium enterprises.

The costs related to job creation in SME's are significantly reduced compared with those involved in the creation of jobs in the big companies. Also, the small and medium enterprises have a major role in the creation of the GDP and the added value. They are also the key factor for the establishment of a balance on a micro and macro level. In fact, they substantially contribute for stimulation of the competition and reducing of the power of monopolies and oligopolies. In conditions of variable economic environment, the small and medium enterprises can easily adjust, quickly bring decisions and respond to the market demands, due to its flexibility, which is their key competitive advantage. According to John W. Snow, Secretary of the U.S. Treasury, they are a category full of bravery ... no one works like them and no one takes greater risks" (Savloschi&Robu 2001).

"SMEs play a unique, active and crucial role in the innovation process, technological advances and improving the high-tech information networks. (Almeida, 2004)

Based on this study, Rocha (2012) in his research (The Impact of the Business Environment on the Size of the Micro, Small and Medium Enterprise Sector; Preliminary Findings from a Cross-Country Comparison) indicated that a simplified business environment, supported by fiscal and budgetary

policies could support the development of SMEs, contributing, in this way, to improving the living conditions of households with small incomes and with fewer chances in terms of employment opportunities.

Roudaut (2006) believes that business environment influences firm performance directly. Okwu et al. (2013) in their study (Business Environment, Job Creation and Employment Capacities of Small and Medium Enterprises in Lagos State, Nigeria: A Descriptive Analysis) emphasize that the business environment in which SMEs operate has a particular, special relevance for their abilities to create jobs and provide employment opportunities.

Theoretical overview for SMEs

The theoretical aspects for the small and medium enterprises development, and generally for the enterprises as independent economic entities and carriers of the economic activities, have been a subject of research in the economic theory and practice since old times.

The last decades of the 20th century led to a change in the production philosophy in the most developed countries in the world. The era of giant corporations has been replaced by an era of small enterprises, which promote creative spirit and individualism, opposite to the standardization and globalization promoted by the big multinational corporations. Each dynamic economy finds its key for a success in the small and medium enterprises functioning.

The small and medium enterprises development is a widely spread phenomenon, both in EU and out of its boundaries. In EU, there are more than 20 million enterprises, of which 99% belong to the small and medium enterprises.

Based on the experiences and current trends in the small and medium enterprises development, it can be concluded that their contribution consists of:

- From the economic point of view, they generate economic growth, have high efficiency in working, they are a source of jobs, they decrease the import dependence, and encourage the export, and the developed capital structure (individual, family, loan, share capital etc.);
- From the technological point of view, SMEs adjust quickly to the technological discontinuity, they rapidly adopt products and technologies and test the new technologies and make technological innovations;
- From the social point of view, SMEs are an important source of employment, because more and more of the labor force is included in the production and services, there is a pleasant working environment, good relationships and social responsibility;
- The ecological value of these businesses can be seen in lower degrading of the natural environment, lower urban concentration, savings on land, energy, etc.;
- From the socio-political point of view, these enterprises allow larger number of people to become independent in their existence, i.e. the people's existence is less dependent on the state etc.

The small and medium enterprises can very easily adjust themselves to the current business conditions, which is characterized by more highlighted dynamics, technological discoveries and competition.

In fact, the basic advantages of the small and medium businesses are:

- The small and medium enterprises provide effective production. Namely, many researches confirm the fact that the small enterprises generate high profit in average;
- The small enterprises are the most dynamic sector and a creator of new jobs;
- The small enterprises are usually established in activities that are not capital intensive and show the best results in production of products where specialized knowledge and skills become evident;
- Higher flexibility and increased capacity in reacting to the market changes adjustment. The SMEs structure enables to adjust themselves to the market changes faster and better, and to the market needs and consumers preferences; to make quick and timely decisions, due to their simple and low hierarchical structure; also, due to their organizational structure, the control and other functions are carried out directly;
- The small enterprises contribute to maintaining a satisfactory level of competition. The competition as a rivalry for obtaining the consumers attention, appear in different forms, and the SMEs development itself contributes to its severity and offering more acceptable products and services to the consumers;
- Better access to the market information – SMEs have better contact with the consumers and they are aware of the new market challenges;
- The small enterprises assist the big enterprises, because they realize some functions better;
- Increased capacity for innovations: SMEs have a possibility to innovate permanently, to introduce new product, services or promotions in the market without a high risk;
- Increased ability for errors correction: due to the structure size, the small and medium enterprises are in a position to correct immediately the products and other errors;
- Direct control and perceiving of each individual cost;
- More liberal and free laws for the foreign capital entry;
- Team performance of activities;
- Higher responsibility in the working organization system;
- The workers' higher productivity – in fact, the workers' high dedication, better communication with the responsible persons, which has a positive influence on their motivation.(Tomashevich, 2010)

The business environment influence on the small and medium enterprises development – case of Macedonia

According to the World Bank Report, the business environment is defined as a sum of specific factors which influence the possibilities and encourage the business entities for productive investing, creating jobs and businesses spreading In parallel with the reforms for the business environment improving where the business entities act, the market development is encouraged too, the competition is stimulated, and the economic growth and development in general.

In many developing countries, the small and medium businesses are faced to various problems and barriers during their development. In order to develop the small and medium enterprises and to realize the entrepreneurial ideas, a macroeconomic stability is indispensable. In fact, *the stability* is the key driving factor for the development and realization of the entrepreneurial venture not only by the

entrepreneurs from the native country, but from abroad as well. The macroeconomic stability means low inflation and unemployment rate, currency stability, sustainable economic growth rates, responsible spending of the budget resources in order to eliminate the budget deficit etc. The political stability is also very important. Namely, instability is most often expressed by the frequent changes in the government, lack of political dialog, challenges at passing laws and frequent changes in the legislation, all of which cause uncertainty with the potential entrepreneurs.

The legislation influences the creation of more dynamic economy and the market participants' higher trust when conclude contracts or enter the entrepreneurial ventures that are subject to objective market criteria, and will be protected by the justice effectively acting.

The grey economy and illegal activities discourage the businesses functioning.

The economic activity regulation has a negative influence on the competitive environment creation which will enable a competition between the small and medium enterprises.

The entrepreneurs will decide easier to open or expand their business should there is a *protection of a competition*. One of the most important systematic-institutional measures for the competition and the market freedom maintaining is the anti-monopoly politics. For that reason, the anti-monopoly legislation gets a bigger role and accent. (Fiti, 2008)

Moreover, *the property rights protection and the contracts performing* encourage the initiation and development of new business ideas. Each national economy should give an opportunity to the entrepreneurs and businesses to get profit from the innovative ideas. Unsuitable protection of the property rights decreases the entrepreneurs encouraging for realization of the business ventures, mainly based on innovation and entrepreneurship.

Institutional infrastructure supports the small and medium enterprises development. Today, the institutional environment in many countries is more sophisticated, and there are many public, local and regional, i.e. non-governmental organizations for supporting their development.

The trust in the institutions that results in a protection of the property rights and the contracts execution, easier access to the justice, faster and more effective, i.e. simpler system of legal protection, also contributes to the new businesses encouraging.

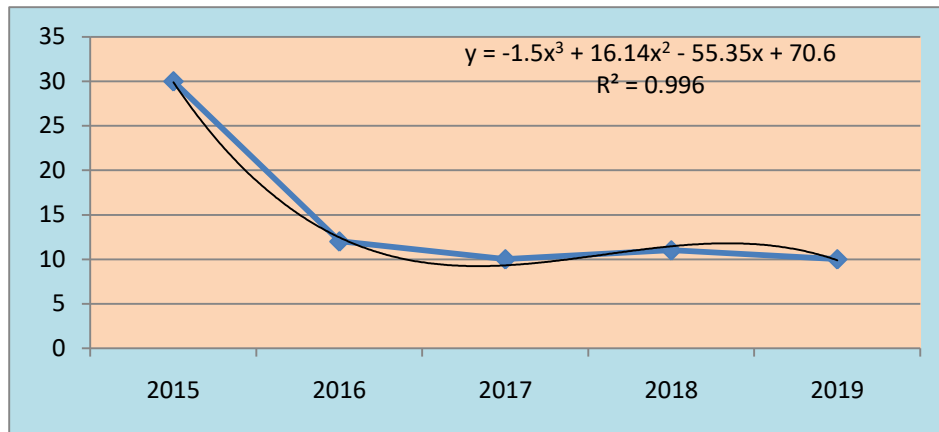
The complex administrative procedures and *bureaucratic barriers* influence the working expenses of the small and medium enterprises. The researches in this area show that there is a high correlation between the length of the procedures for business establishing and the corruption presence. The corruption increases the business expenses, discourages the entrepreneurs and decreases the people's trust in the system institutions.

In order to monitor the reforms taken by each national economy for creating better business environment and easier doing business, the World Bank publishes Doing Business Report and ranks the countries every year.

The DB rang for Macedonia is shown in table 1 and graph 1.

Table 1. DB rank for Macedonia, period 2015-2019

	2015	2016	2017	2018	2019
DB rang	30	12	10	11	10



Graph 1. Development tendency of DB rank for Macedonia, 2015 -2019

From the data, we can see the rank increasing, especially in 2016 versus 2015. Then, we can note a modest development with a slight increase, then the rank declining up to 2019. Having in mind that the parabolic / cubic trend is the most approximate to these empiric data, which can be seen by the high coefficient of determination value of 0,9969, the value of DB rank of R.N.Macedonia for 2020 can be easily forecasted, and it is 9.

Thanks to some legal and regulative changes, the economic environment in Macedonia has been significantly improved and it has been moving with a positive tendency. Namely, Macedonia is one of the countries which have realized the highest progress during the time, according to the “Doing Business”. Macedonia has a stabile and wide agenda of reforms, which is straightly directed towards improving the procedures for doing business efficiency and cost. Furthermore, it has implemented reforms in several important areas of business working regulation, enhancing the protection of investors and the trustees’ legal rights.

More detailed data on the indicators movement on which basis the conditions for doing business in Macedonia in 2019 are assessed, are given in the table.

Table 2: Indicators for doing business –Macedonia 2019

	2019
Ease of doing business rank (1-190)	10
Starting a business	47
procedures(number)	4
time (days)	14
cost (% of income per capita)	0.9
Minimum capita (% of income per capita)	0.0
Dealing with construction permits (rank)	13
procedures(number)	9
time (days)	91
cost (% of income per capita)	3.7
Getting electricity	57
procedures(number)	3
time (days)	97
cost (% of income per capita)	196.1
Registering property	46
procedures(number)	7
time (days)	30
cost (% of property value)	3.2
Getting credit (rank)	12
Strenght of legal rights index (0-12)	10
Depth of credit information index (0-8)	7
Credit bureau coverage (% of adults)	100.00
Credit registry coverage (% of adults)	40.7
Protecting minority investors (rank)	7
Extent of disclosure index (0-10)	10
Extent of director liability index(0-10)	9
Ease of sharesolders suits index (0-10)	5
Extent of shareholders rights index (0-10)	8
Extent of ownership and control index (0-10)	7
Extent of corporate transparency index (0-10)	9
Paying taxes (rank)	31
Payments (number per year)	7
Time(hours per year)	119
Total tax and contribution rate (% of profit)	13.0
Postfiling index (0-100)	56.36
Trading across borders (rank)	29
Time to export	
Documentary compliance (hours)	2
Border compliance (hours)	9
Cost to export	
Documentary compliance (US\$)	45
Border compliance (US \$)	103

Time to import	
Documentary compliance (hours)	3
Border compliance (US\$)	8
Cost to import	
Documentary compliance (US\$)	50
Border compliance (US\$)	150
Enforcing contract (rank)	37
Time(days)	634
Cost(% of claim value)	28.8
Quality of judicial processes index (0-18)	14.028.8
Resolving insolvency (rank)	30
Time (year)	1.5
Cost(% of estate)	10.0
Recovery rate (cents on the dollar)	48.0
Strength of insolvency framework index (0-16)	15.0

Source: Doing Business Report 2019

Research methodology

In order to identify the business environment influence on the small and medium enterprises development, as well as to identify the key problems they are faced to during their work, a survey was conducted. The poll was conducted in August/September 2019, comprising 130 small and medium businesses in the Republic of North Macedonia, and 92 questionnaires were received.

The survey descriptive statistics

On the basis of the analyzed data from the first group of questions, the following results have been obtained:

- From the respondent businesses, 45 were founded before 2000, while 47 were founded after 2000, which shows that the firms older than 10 years and the firms which were founded in the last 10 years, were polled approximately in the same way. The majority of the respondents, i.e. 52% are small businesses, 31 are micro, and 17% are medium businesses
- On the question “Which financing sources did you use at the business starting?”, 40% used their own savings, 35% used loans, 7% loans from relatives and friends, 10% own savings and loans from relatives and friends, and 9% used other sources.
- On the question “Which were the main problems you were faced to at the work starting?”, 22% stated the lack of capital, 15% the complex legislative, 15% high expenses, 12% gaining the buyers’ trust, 9% lack of specialized working force, 10% getting a loan, 9% lack of experience, 8% problems with the suppliers.

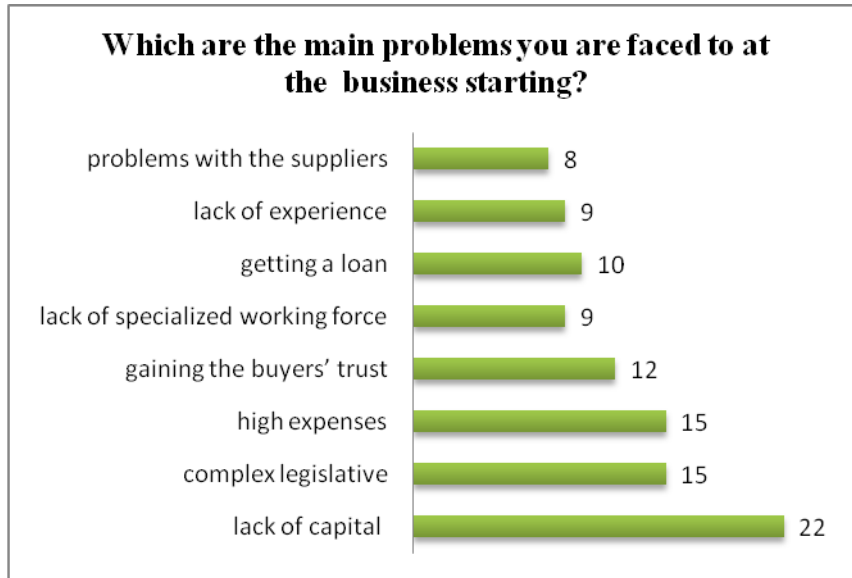


Fig. 1: Number of respondents as per the stated main problems at the work starting

By the means of independent features (χ^2 – test), and by using the statistical pack CBS, we test the following hypothesis:

H1: The main problems at starting the work do not depend on the businesses size (small, micro, medium).

With data processing and application of this non-parametric test, the following results have been obtained:

CBS-Chi-Square Analysis

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Information Entered - Observations

Number of Columns: 3
 Number of Rows: 8
 Alpha Error: .05
 Degrees of Freedom: 14
 Critical chi-square: 23.6848

	X1	X2	X3	Total
1 =	10	7	3	20

2 =	9	4	2	15
3 =	8	3	3	14
4 =	6	4	3	13
5 =	4	2	1	7
6 =	4	2	2	8
7 =	3	4	2	9
8 =	4	2	0	6
Total	48	28	16	92

Results - Expectations

	X1	X2	X3	Total
1 =	10.435	6.087	3.478	20
2 =	7.826	4.565	2.609	15
3 =	7.304	4.261	2.435	14
4 =	6.783	3.957	2.261	13
5 =	3.652	2.130	1.217	7
6 =	4.174	2.435	1.391	8
7 =	4.696	2.739	1.565	9
8 =	3.130	1.826	1.043	6
Total	48	28	16.000	92

Critical chi-square: 23.6848

Computed chi-square: 4.5581

p value: 0.9910

Conclusion: Do not Reject Hypothesis

As the estimated value of the test (4,5581) is lower than the theoretical test value (23,6848), we accept the hypothesis and conclude that the main problems at starting the work do not depend on the businesses size (small, micro, medium). It means that no matter how big the business is (small, micro and medium), at the work starting it is faced with the existing main problems. We come to the same conclusion when compare the theoretical value of $p=0,05$ to the estimated value of $p=0,9910$.

“Which are the key problems during your business working?”, 16% of the respondents stated the high taxes, 12% the frequent legislative changes, 10% the poor sale, 32% collection of receivables and liabilities, 10% the high interest rate, 10% lack of specialized working force, 10% the competition.

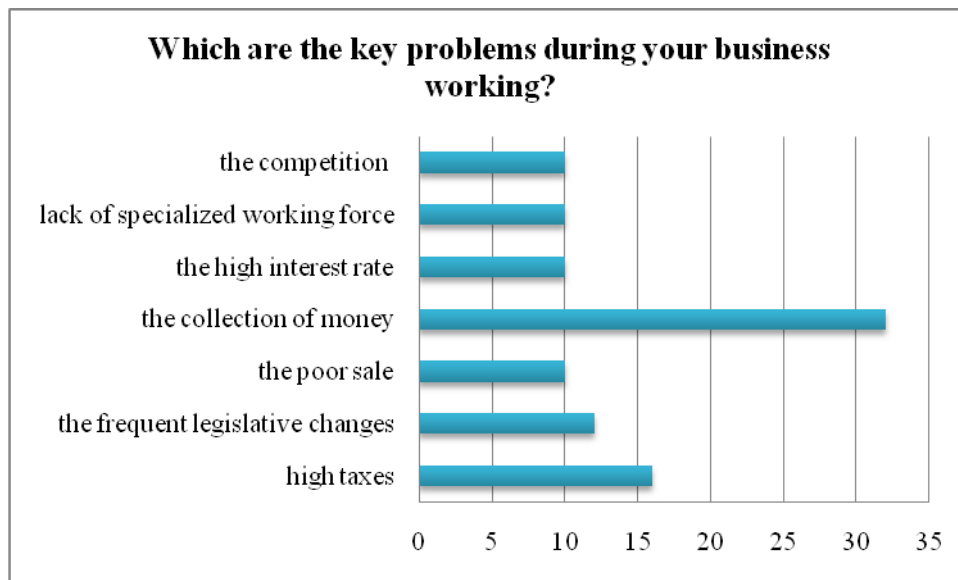


Fig. 2: Number of respondents as per the stated key problems during the work.

Also, by the means of independent features (χ^2 – test), and by using the statistical pack CBS, we test the following hypothesis:

H1: The main problems at during the work do not depend on the businesses size (small, micro, medium).

With data processing and application of this non-parametric test, the following results have been obtained:

CBS-Chi-Square CBS-Chi-Square Analysis

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Information Entered - Observations

Number of Columns: 3

Number of Rows: 7

Alpha Error: .05

Degrees of Freedom: 12

Critical chi-square: 21.0261

	X1	X2	X3	Total
1 =	9	4	2	15
2 =	7	3	1	11
3 =	4	2	3	9
4 =	16	9	5	30
5 =	4	4	3	11
6 =	4	3	2	9
7 =	4	3	0	7
Total	48	28	16	92

Results - Expectations

	X1	X2	X3	Total
1 =	7.826	4.565	2.609	15
2 =	5.739	3.348	1.913	11
3 =	4.696	2.739	1.565	9
4 =	15.652	9.130	5.217	30
5 =	5.739	3.348	1.913	11
6 =	4.696	2.739	1.565	9
7 =	3.652	2.130	1.217	7
Total	48	28.000	16	92

Critical chi-square: 21.0261

Computed chi-square: 5.8992

p value: 0.9209

Conclusion: Do not Reject Hypothesis

As the estimated value of the test (5,8992) is lower than the theoretical test value (21,0261), we accept the hypothesis and conclude that the main problems during the work do not depend on the businesses size (small, micro, medium). It means that no matter how big the business is (small, micro and medium), during the work it is faced with the existing main problems. We come to the same conclusion when compare the theoretical value of $p=0,05$ to the estimated value of $p=0,9209$.

Conclusion

The small and medium enterprises are the main factor for national economy development especially in developing countries where the processes of transitions are more and more frequent. The basic advantage of SMEs is the adaptation and the probability for transfer in the other sectors which is very important for realizing gain now a day in terms of quickly changes. The other advantage of SMEs is that the needed funding capital is smaller than the funding capital for the others enterprises, so many people can afford starting new business. SMEs participate in creating the GDP, they have an influence at the rate of employment, actually they engine job creation and they help for improving the life standard of the people, so they can have a better life in the national economy. Considering all this advantages of SMEs founding every national economy should take measures in way to improve the business climate for SMEs acting and to increase their number.

Here are some measures that should be taken in Macedonia in way to create better business environment for SMEs development.

- To provide macroeconomic stability;
- Higher fiscal transparency and presentation of information in a clear and transparent way, establishing tax mobile centers, tax relieves, tax education for the newly-established enterprises, simplifying the tax system;
- Constant, transparent and predictable appropriate legal framework;
- Anti-corruption politics strengthening;
- Building an appropriate institutional infrastructure which will offer various information, services and trainings for the small and medium businesses, and necessary financial support;
- Higher financial support through improvement of the financial resources availability for the small and medium businesses by improving the collaboration with the banks, public financial institutions and the small and medium businesses, i.e. creation of special crediting instruments, according to their needs and capacities;
- Improvement of the information on the conditions for starting a business and the relieves offered by the state through establishing centers on a local level (regional office), which would have an informative and advising role for the potential entrepreneurs, i.e. the development encouraging and realization of new ideas;
- Establishing the Ministry for small and medium businesses, which will enable harmonization of the legislation with the EU standards, improvement of the small and medium businesses competitiveness, organization of a training for entrepreneurs and employees in the public sector, the innovations promotion and development of the capacities for increasing the management efficiency in the globalized business environment;
- Improvement of the legal system and the judiciary, provision of the rule of law and protection of the private property, through fastening the legal proceedings, high professionalism, the personnel's higher technical capacities, high ability for disputes solving, project financing, fast decisions realization, improvement of the state control in the decisions execution, elimination of the subjective factor influence in the legal proceedings.

- Creation of regulations for improving electronic doing business;
- The small and medium businesses innovativeness encouraging;
- Implementation of the concept for the business entities' social responsibility;
- The entrepreneurial spirit and culture strengthening.

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THE POTENTIAL OF THE GAMING INDUSTRY FOR INVESTMENT IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract:

The video gaming industry is blooming into global industry of enormous proportions. This industry has been growing faster compared to the other entertainment industries. The video games are essential in the contemporary human day-to-day living. There are at least three reasons why video games demand serious approach: the size of the video games industry; the popularity of videogames; videogames as an example of human-computer interaction.

This paper's objective is to explore the current situation and the potential of the Republic of North Macedonian gaming industry. It is a challenge to research through limited scientific literature, non-available official data for/in the Republic of Macedonia and the constant change of this industry trends worldwide.

The methodology is based on secondary data gathered from international reports and primary data originating from domestic gaming studios, through qualitative interviews with companies, governmental and non-governmental institutions and industry experts in the North Republic of Macedonia.

The results will evaluate the potential for investment in the NR of Macedonia video games development industry. Further, it will project the growth potentials; suggest an adequate eco system for the industry and all the necessary improvements.

Nevertheless, the paper is aimed to be a valuable source for academics as an attractive new topic for research, for entrepreneurs to create and sale such products on the huge global market and governmental and non-governmental institutions to create support system.

Keywords: potential of the videogame industry, videogame market, videogame development ecosystem, support, further challenges

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Introduction

The video gaming industry is blooming into global industry of enormous proportions. This paper aims to give focus on the current situation worldwide and to evaluate the potential of the Republic of North Macedonian gaming industry. Official institutions such as the State Statistical Office of Republic of North Macedonia and the World Cyber Games Organization are used as secondary sources of information to better structure the sample and define the actions, which might be pursued. It enlists the collection methods of survey data as primary, with relevant people actively involved in the gaming industry. The process starts with overview of the importance of the video game industry.

The video game industry is mass marvel observed from economical angle. The development of the industry is staggering, so the purpose is to understand why it is an important economic sector worldwide and in the Republic of North Macedonia. The gaming industry shows serious numbers⁴:

- By 2010, the gaming industry became larger than the music;
- It became a 42 billion business. (Example: World of Warcraft makes about \$ 82 million a month, and it's needed 80 million to make the game itself);
- The average age of gamers is 20-40, which means it gets more serious than it was thought to be for children (the industry's target group is 37 year-old buyers);
- About 500,000 dollars a day turn into Second Life. In the game that is simulation of real life, there is Coca Cola and other big companies. IBM spent \$ 10 million in the development of a business in Second Life;
- 43% are women players;
- 80% of the games have no violence, as opposed to the opinion of the public.

The diversity of the industry gives options for different aspects, even playing the video games can be considered as stream of revenue, the prize pool for The International 9, the largest Dota 2 tournament of 2019, has broken the \$30 million. This is officially the largest prize pool at a single esports event ever. The current prize pool for The International 9 is over \$30 million.

A video game is, generally speaking, any game that is played with the use of computer equipment and video display. It can be played on a computer, a cell phone or a console (a terminal with a keyboard and a video display)⁵. This definition reflects the understanding of the term "digital play", not sufficient to provide real insight into such a complex medium. What's behind a good video game? Why are some games so successful and popular as the top-ranked films, and other games fail in this end? What makes video games so appealing and attracting so much attention?⁶ The video game industry has many economic aspects, including the development process, employment, the release period, advertising, marketing, and intellectual property (IP) rights⁷. Current progress in the field of games, as well as the increase in the quality and number of titles produced each year (along with the rapid evolution of changes in new game technologies), make their classification more and more

⁴ Bramwel T., "Console developers need to look at Dungeon Keeper and learn", Eurogamer, February 8th 2014.

⁵ Consalvo, M. "Cheating: Gaining Advantage in Videogames. cambridge, ma: the mit press", 2007.

⁶ Garris, R., Ahlers, R., and Driskell, J.E "Games, motivation, and learning: A research and practice model", 2002

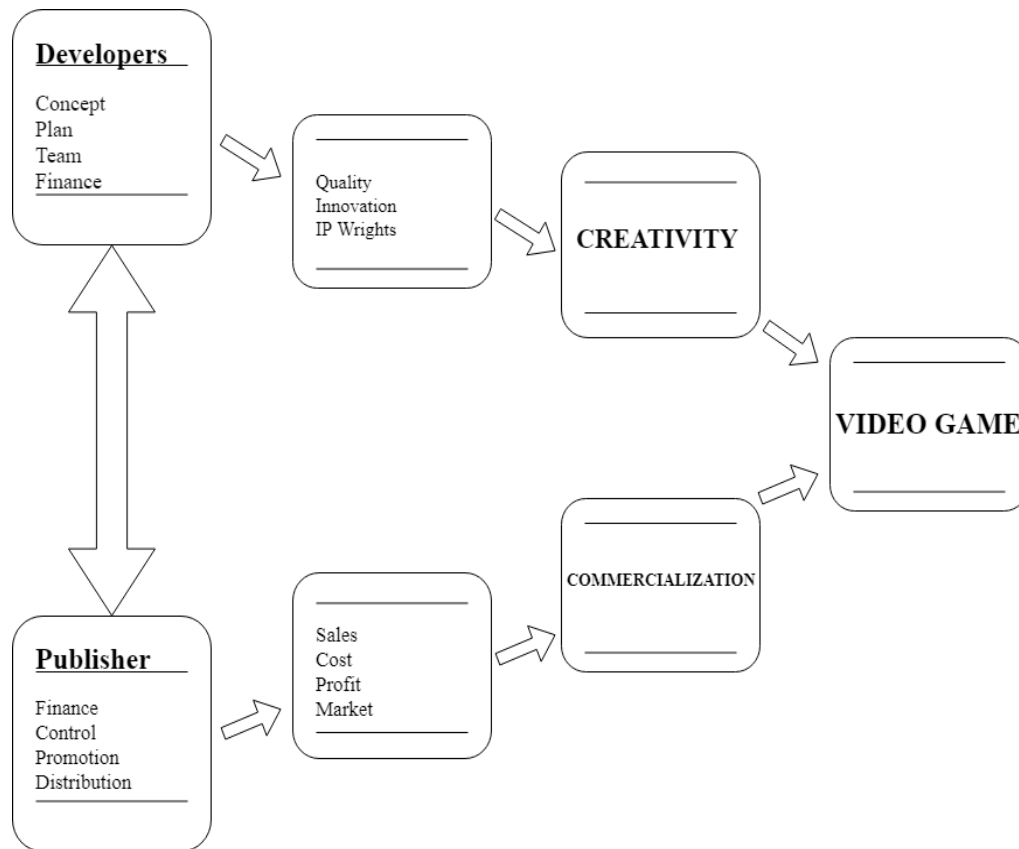
⁷ Edery and Mollick, "Changing the Game: How Video Games Are Transforming the Future of Business", 2009

difficult. However, it is interesting to observe how most of the general types of games that we can design, have some educational potential. However, which genre will best fit into a particular educational context depends mostly on several parameters, such as the learning entity, learning material, pedagogical goals, etc⁸.

Based on the review of the video game industry definition, the model provides its full perspective.

TABLE 1. MODEL OF VIDEO GAME INDUSTRY

Source: Own contribution to the definition of the video game industry



The focus is on the high growth in terms of turnover in a relatively short period and the forecast is to grow higher, so it makes the gaming market attractive for investors. Since 2012, the global gaming market had revenues of \$70.6 billion USD, since then in 2018 it generated \$137.9 billion USD in revenues and for 2021 it is forecasted to generate **\$180.1 billion USD in revenues**. The attractive revenue streams come with high investments. The cost of production for some video games is from \$100 million for “Red Dead Redemption” to \$500 million for the video game “Destiny”. In the structure of the investment, major part takes the production and distribution of video games. These two lines make the video game studios high-risk venture, because the outcome of the game depends on the positive response of video games consumers. Video game is the product of highly competitive industry, but they also have beneficial effects on players and society as a whole.⁹

⁸ Raph Koster, Will Wright, “A Theory of Fun for Game Design”, 2004

⁹ David T. A. Wesley, Gloria Barczak, “Innovation and Marketing in the Video Game Industry: Avoiding the Performance Trap”, 2010

Over the short history of video gaming industry, different models for revenue generation were developed. The new trend is digital downloads, with new on line platforms as Steam, they create the movement from PC and console gaming toward downloads and mobile gaming. Companies have discovered that revenue stream is bigger than a one-time payment for a physical commodity. The new age business model is Games as a Service (GaaS). This means that customers get the product (for price or for free), and the company continue to develop the current product, adding items and in-game market to increase customers' in-game transaction activity. Instead of being a developer-centric product, games have become player-centric.

The video games' industry has earned more revenue than the movie and music industries combined. The Global Games Market report indicates that **in the next 9 years PC and console games will register a 30% growth** although the blither future is envisioned for the mobile videogames with 51% of the turnover.¹⁰

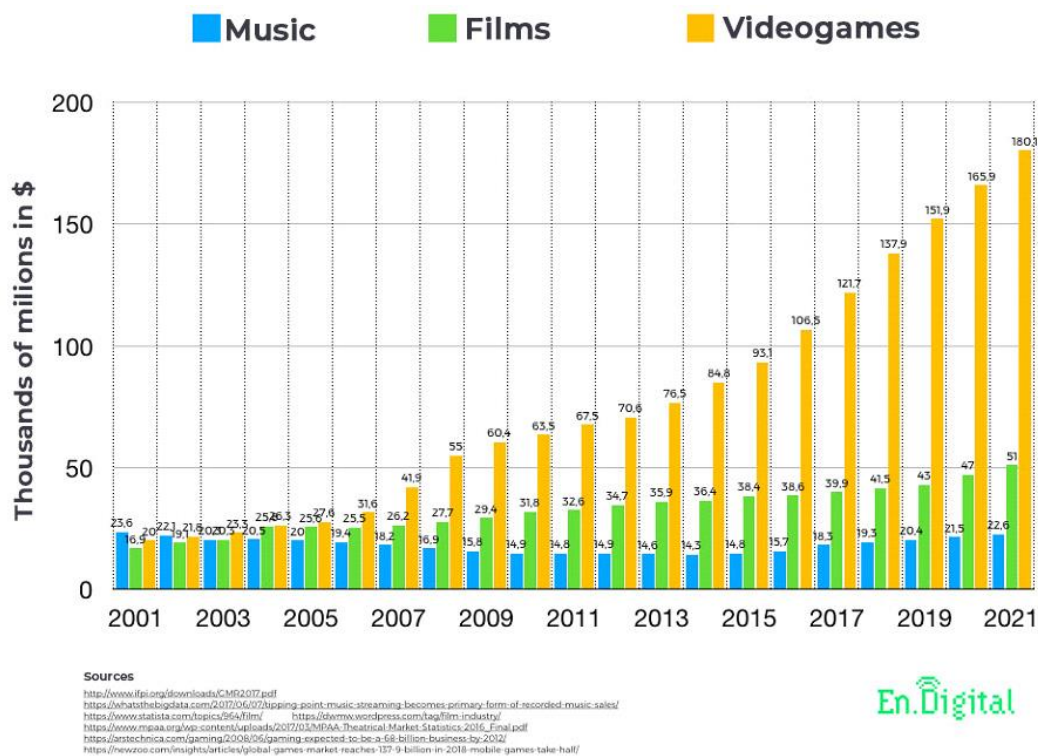


FIGURE 1. COMPARISON OF THE TURNOVER FROM IN AUDIO-VISUAL INDUSTRIES

Source: <https://lpsports.com/e-sports-news/the-video-games-industry>

Video games have the human computer interaction and are simulators particularly effective for learning certain skills. Traditional learning methods have serious shortcomings. The challenge of the game is to develop a new business strategy for the airline during a virtual day design and implementation. For example, M-NAV in the Republic of North Macedonia for Flight Controllers uses Eurocontrol's FEAST test to check the specific skills and skills necessary for this profession. Specific skills and predispositions for this candidate can also be tested through the online games at <https://www.nats.aero/careers/trainee-air-traffic-controllers/games/> and to test their knowledge of English, which is also the official language for communication in air traffic, here is a free preliminary e-test via the following link <http://www.cambridgeenglish.org/test-yourenglish/>.

¹⁰ <https://newzoo.com/insights/articles/global-games-market-reaches-137-9-billion-in-2018-mobile-games-take-half/>

Video games industry in the Republic of North Macedonia

The video game industry is a complex combination of many different spheres from the creative and IT industries. By nature, it is dual, IT sector and creative industry. There are no limits to the products and services of this industry, and this is also confirmed here, where companies in this industry are predominantly export-oriented, i.e., global industry with high competition. An analysis by a team at the UNESCO Department has found that there are 20 studios in the Republic of North Macedonia that work on video game development for almost all platforms. Some of them work and have already created their own products, and some only work (outsourcing) to companies from abroad. A second important finding is that Republic of North Macedonia has tremendous potential in the field of video game development.

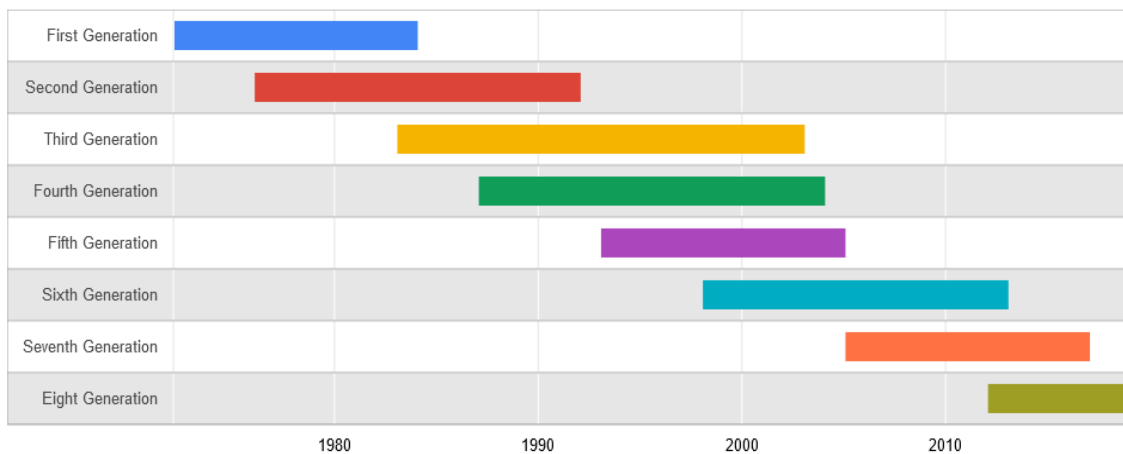


FIGURE 2 EVOLUTION OF THE VIDEO GAME INDUSTRY

Source: https://vgsales.fandom.com/wiki/Eighth_generation_video_games

The video games industry in the Republic of Macedonia starts within the Eighth generation of video games that is the current generation of video games. It consists of Microsoft's Xbox One, Sony's Playstation 4 and Playstation Vita and Nintendo's Nintendo 3DS and Wii U. The hallmarks of this generation include the fastest selling console with the Playstation 4, the decline of the handheld consoles, the first mid-generation upgrade hardware in addition to budget models and the first hybrid gaming device as a major player. The segment of PS and console in the video game industry has been in the focus of this paper.

Respondent-driven sampling is included, since there is no formal database of gaming companies in the RN Macedonia. This snowball sampling technique is therefore used to locate hidden populations. Additionally, the field study is supported by a flexible semi-structured interview, avoiding formalized questions and facilitating the collection of information.

All interviews (20 gaming studios and individuals) were conducted by a researcher in June-September 2019 time frame both in Bitola and Skopje to empirically elaborate case studies for three studios that developed video games, in order to assess the potential of the video gaming industry in the Republic of North Macedonia. For obtaining a primary data, a survey is conducted via email, telephone and personal interviews with relevant people involved actively in this area such as: game developers, game educators, gaming organizations, faculties, projects for business ideas, accelerators. There are 20 mapped studios for the period of 2006-2018 with 237 employees, including the studios for mobile games and international units operating in Skopje.

Regarding the models of investment in the Republic of North Macedonia studios for video

games is a challenge to reveal investments reports from the studios due to the lack of precise data (cost, working hours) dedicated to the video game development as a one of the projects they work on.

Kamai Media has invested own capital mixed with the 2012 Award for Best Business Idea Competition from the Business Ideas Factory project and additional grants. The competition had 104 business ideas applicants from 23 cities, most of the service, food industry, information technology and tourism and the winner was the founder of Kamai Media, Peter Koteski, with a project to develop and sell video games on the world market. The award was 10,000 euros. In 2015 for the development of the first episode of the video game Sounder, this studio was awarded with grant of 30,000 EUR by the national Investment and technology development fund. The game has been presented at a number of foreign fairs so far and has had many talks with potential partners from the US, Britain and Sweden. Since it is an exclusively innovative idea, for which there is no market example so far, and since their studio is a startup operating in Macedonia - they have failed to agree on a large multi-year project. So they switched to an episode-based game format, in 6 episodes of 20 minutes. The grant from the Fund helped them bring the first episode to the foreign digital marketplace, namely for the operating costs of the studio, visiting fairs and promoting the product. Their startup plan is to grow the company to a decent team for high quality computer games and game consoles. The team is about 7-10 developers and artists. They hope that the popularization of their game through episodes announced in collaboration with the fund will allow them to partner with a foreign distributor who will distribute their game on the world market and grow into a sustainable business.

The Workbench Entertainment developed the game "Wounded", it has the model of investment - equity capital by the team members, acting as indie studio. The game's demo videos have over 10 million views on Youtube. The game trailer released in December, 2018, has attracted a lot of interest from the worldwide gaming public, especially horror fans. Since the release of the trailer, world media relevant to the gaming industry, as well as experts in the field, have not spared the positive comments, especially emphasizing the fact that the game is made by an indie studio, with almost no budget, but with the skills, enthusiasm and individual investment of a young team. The team at Workbench Entertainment, won the sympathy through an extremely complex project delivered at a high professional level, which meets the world-wide criteria in the most attractive and exciting gaming industry - horror games. The game "Wounded" has already made its way to the world's famous Steam gaming platform and has joined thousands of other games at an extremely competitive price of €12.99 and in April is promoted with price of €6.99.

"Wounded" is a first person, adrenaline, horror game. The player manages a character named Tim, who is primarily a very worried father. The answers are in the mission of fulfilling the player into a nightmare world where reality dances with paranoia and fear, and anxiety and terror lurk in the dark corridors, "Wounded" evokes strong emotions and provides an unforgettable experience. The complete audiovisual experience complements the feeling of uncertainty and fear of the unknown, which accelerates the pulse with each subsequent scene. The audio effects are work of the world's best sound designers. In this mysterious game, the player's only weapons are his inner strength, wit, and will, making the game good for defeating fears, practicing reflexes, and making quick decisions as well as boosting self-confidence, all through carefully created challenges and quality entertainment.



Wounded is a brief horror game project with a simple story, made without any funding. The goal of this game is to bring you that old indie horror vibe back from where it all started.

Store (<https://store.steampowered.com/app/1015130>) | Hub (<https://steamcommunity.com/app/1015130>) | SteamDB (<https://steamdb.info/app/1015130>) | Site (<https://workbench-ent.com/games/wounded/>)

Developer: Workbench Entertainment (/dev/Workbench+Entertainment) **Publisher:** Workbench Entertainment (/dev/Workbench+Entertainment)

Genre: Action (/genre/Action), Adventure (/genre/Adventure), Indie (/genre/Indie)

Languages: English (/language/English), French (/language/French), Italian (/language/Italian), German (/language/German), Spanish - Spain (/language/Spanish+-Spain), Dutch (/language/Dutch), Swedish (/language/Swedish)

Tags: Horror (/tag/Horror) (26), Violent (/tag/Violent) (24), Action (/tag/Action) (23), Indie (/tag/Indie) (23), Gore (/tag/Gore) (23), Adventure (/tag/Adventure) (23), Survival Horror (/tag/Survival+Horror) (15), First-Person (/tag/First-Person) (7)

Category: Single-player, Steam Achievements, Full controller support, Steam Cloud

Release date: Feb 28, 2019

Activate Windows
Go to Settings to activate Windows.

FIGURE 3 WOUNDED DATA ON STEAM

Source: Steam spy, 2019 <https://steamspy.com/>

The structure of the investment in the Republic of North Macedonia is similar to the one that is general for the small gaming studios worldwide. In the Republic of North Macedonia case studies has been done on the studios that have published video games on Steam platform and have successfully finalized the process of game development and publishing. The interviews are done with domestic studios in Skopje, Bitola and one in Amsterdam (the owners are Macedonians but now they are living abroad) and the data are linked to the basic investment in certain video game. The data are neither exact nor supported with financial reports, covering the answers given in a range, for example what is the cost for this video game and the answers classified from 0-10,000 USD from 10,000 to 200,00USD and more. Research sorts costs by the amount of investment in such employees, who are usually a team of studio and game owners in the percentage of 60-80% of the total investment. Taking into account the average salary for programmers and designers, Republic of North Macedonia is favorable for investors in the game development. The data from the interviews with the domestic studios are presented below:

TABLE 2 INVESTMENTS IN VIDEO GAME STUDIOUS IN RNM

Source: Authors calculation based on data from the interviews

	Workbench Entertainment	Cost in \$	Structure of the investment	Team members	Time for development	Total Investment per Employee
1	Salaries	18.000	56,78%	5	12	
2	Outsourcing	9.000	28,39%	5	6	
3	Equipment	3.500	11,04%			
4	Logistics and Marketing	1.200	3,79%			
	Total cost in \$	31.700		10	18	3.170
	Dark 1					
1	Salaries	16.200	51,10%	3	18	

2	Outsourcing	1.800	5,68%	2	6	
3	Equipment*		0,00%			
4	Logistics and Marketing**		0,00%			
	Total investment in \$	18.000		5	24	3.600
	Maximus Ludos Studios***					
1	Salaries	6.000	60,00%	3		
2	Outsourcing					
3	Equipment	3.000	30,00%			
4	Logistics and Marketing	1.000	10,00%			
	Total investment in \$	10.000		3	12	3.333

The table shows that the biggest cost or investment is in the human resources, developers, programmers, 3D artist and other outsourced experts. The employees in this studios are actually the team that is connected on informal or network meetings as Global Game Jam and they are considered as owners of the studio and the game as well. The percentage varies from 60 – 80% from the total investment and points out the importance of the developers for the production of the final product. Official data for the revenues from the video game industry in the Republic of North Macedonia are not available. The Statistical office has data for the IT companies in general, so these companies are registered in that section. For this limitation, the case studies of the game development studios have been done on the studios that have published video games on Steam platform and have successfully finalized the process of game development and publishing. The data are not exact and supported with financial reports, the answers were given in a range, for example how much was the revenues for this video game and the answer was from 0-10,000USD from 10,000 to 20,000USD and more.

TABLE 3 POTENTIAL REVENUES FROM VIDEO GAMES IN RNM

Source: Own calculation based on the projection of STEAM

	Studio	Name of the video game	Time of release	STEAM estimation downloads	price \$ USA	\$USD potential
1	Endy Milojkovski	Raining Blobs	2016	20.000	9,99	199.800
2	Tesseract Interactive	Excubitor	2016	20.000	14,99	299.800
3	Koloss Kolektiv	SlimeBrawl	2017	20.000	2,99	59.800
4	Kamai Media	Sonder	2017	20.000	3,99	79.800
5	Dark 1	Odium to the Core	2018	20.000	4,99	99.800
6	Maximus Ludos Studios	Echoes World	2018	20.000	3,99	79.800
7	Workbench Entertainment	Wounded	2019	20.000	6,99	139.800
	Total estimated revenues in \$USA					958.600

The data show the potential of the gaming industry, although the realistic data are with 50% of projection.

Historical data and current situation in video game industry in the Republic of North Macedonia are not reflecting the global trend of this growing industry. There are only one studio Kamai Media in Bitola, in the range of AAA studios with more than 8-years existence that develops own engine and AAA game for the global market.

The other studios have independently developed games or so called “indie”, that is used for an individual or small group that develop a game and self-publish it without the help or financial support of an outside source (usually a publisher). Indie games are with minimal funding. Independent games have been gaining a lot of momentum in recent years and many users and developers attribute this to the indie “feel”: artistic experiments with mechanics that have never been experienced before and the mindset of freedom no money, marketing, and big business cloud the vision of the game. Many small developers release alpha- or beta- builds of their games to the public. The most famous example is the Swedish programmer Markus Persson, who released the incomplete version of *Minecraft* in May of 2009, an alpha version in June of 2010, and a beta version in December of 2010. *Minecraft* surpassed 10 million users and had generated an estimated \$33 million by July of 2011, months before its official release in November of that year. Users found and fixed bugs, created new features, and spread the popularity of the game through word of mouth. *Minecraft* has sold over 35 million copies, generated over \$250 million in revenue, and has over 100 million registered users.

The indie studios are small startups with 3-5 or 6-10 people, examples of creating video games of young enthusiasts that have shown successful appearance on the global platform Steam. The research shows that the grant scheme is open for such business as well as the innovation fund to support them for the beginning of the venture.

This paper model, for investment in video game industry, suggests that all stakeholders: Self-employment program from the Agency of employment, The Investment and Innovation fund and the accelerators Seavus, UKIM in Skopje and pre-accelerator project at FIKT in Bitola can offer logistical support. The model is ACCELERATOR FOR VIDEO GAME DEVELOPMENT that will be open for student and graduates to enter the competition for video game design. The equipment will be provided by the accelerators in a value of 10,000 USD (or grant scheme) and the Innovation fund will finance cost and salaries in 30,000 USD for one year. In total, for all accelerators to enter, there are 10 game development studios with number of employees 5 (average salary of 500 \$USA + possibility to earn from the profit of the game), or 50 students and graduates (only 10% of the number for 2018-2019). With the success rate of 70 % according the data from the self-employment program there will be 7 games published. The genre of the games will be chosen according the latest trend. The complexity of the development is in medium range and the time frame for development is 6-12 months.

TABLE 4 CALCULATION OF THE COST FOR DEVELOPMENT OF 10 INDIE STUDIOUS**Source:** Authors calculation based on the research

		employees	months	\$ USA	\$ USA	Structure	Investor
1	Salaries	5	12	500	30.000	73,17%	Innovation fund
2	Logistic		12	100	1.000	2,44%	Accelerator
3	Equipment	5		2.000	10.000	24,39%	Selfemployment
	Total investment in one studio per year				41.000	100,00%	
	Total investment in 10 studios per year				410.000		

The calculation is the optimistic option that 70% of the game developers will publish a video game with success. The investment per studio is 41,000 USD for a period of 1 year.

TABLE 5 THE POTENTIAL OF THE REVENUES ACCORDING STEAM ESTIMATION**Source:** Author calculation based on the research on the current studios

	Studio	Name of the video game	Time of release	STEAM estimation downloads	average price \$ USA	\$USD potential
1	Studio 1	Game 1	2020	20.000	6,99	139.800
2	Studio 2	Game 2	2020	20.000	6,99	139.800
3	Studio 3	Game 3	2020	20.000	6,99	139.800
4	Studio 4	Game 4	2020	20.000	6,99	139.800
5	Studio 5	Game 5	2020	20.000	6,99	139.800
6	Studio 6	Game 6	2020	20.000	6,99	139.800
7	Studio 7	Game 7	2020	20.000	6,99	139.800
	Total estimated revenues in \$USA					978.600

Total estimated revenues in \$USA	978.600
Total investment in 10 studios in \$USA	410.000
Total estimated operational profit	58%

This will create a solid base for further development of the industry, with support and in period of minimum 5 years, there will be critical mass developers of 250 young professionals.

Conclusions

The potential of the gaming industry in the Republic of North Macedonia has been evaluated in a segment of young entrepreneurs with IT and creative skills that can form a small indie studios and develop video games for Steam and other platforms. Certainly, focus actions to support and build a solid base for the gaming industry will be needed as well as successful examples that will take the lead. All of the gaming companies in RNM are micro-sized with an entrepreneurial background, including the first studios established around 2011. Despite the fact that there is a limited number of gaming companies, there is a significant opportunity for exchange on potential employees through established network among companies and communicating through events like Global Game Jam and 3D Conference.

Creating the accelerator for video game development as a proposed model for boosting the potential of this industry provides the supportive services for startups and assists and accelerates their activities. Moreover, the accelerator can support business growth opportunities for existing developers and share the experience to the new startup teams. The investment in indie studios is structured and compared with the expected revenues, while their sustainability is evaluated and future opportunities are projected.

To provide sustainable growth and innovation this model requires a relatively low cost investment by governmental and private institutions and partnerships with well-established digital distribution to create jobs for highly educated and skilled developers.

The purpose of the model is to provide a set of quantitative and qualitative data that will guide startups in their journey from idea to creating a product, to growth and expansion phases, and increase the volume of companies that can grow and compete on the international markets. It can be furthermore used as a base for creating adequate cross-sectoral curricula for educated professionals in this area. It is recommended to be dynamic and flexible to fit this industry demand.

The research detected the main obstacles for game developers in the Republic of North Macedonia as follows:

- funding sources;
- lack of adequate educational programs and, consequently, quality and educated staff;
- the problem of double taxation.

The first major obstacle is the lack of incentives for the video game development in this fast growing sector that needs to be supported by bigger investments to further accelerate its growth. Not to mention the growing game production budgets and the shortages of initial funding faced by manufacturers.

The fact that the video game industry is not being recognized by economic policy makers has been reflected as a lack of adequate staff due to a consequence of systematic education lack for game developers, both on secondary and tertiary levels of education. Recognizing the potential of this sector could therefore bring support with significant financial resources through high ROI (like in Finland, Norway, France, United Kingdom) or tax credits (Canada and USA, UK, France). Such incentives can bring advantages and savings, so the industry can compete on international level.

The situation is further complicated by stringent banking regulations that require less risk exposure, and banks are particularly reluctant to finance innovative projects, without pledging. Although there are no enterprises of high value long-lived assets, still their employees possess valuable knowledge. Since the problem of double taxation is closely related to companies operating at international level, it is regulated through bilateral interstates agreement so the domicile can only charge the tax difference.

Since it is about a rapidly growing sector with high rates of return, the state should find interest in boosting additional investments in this sector. Nevertheless, it is about a non-systematic approach that targets specific categories of entrepreneurs.

This paper has linked the theory and practical experience into a project proposal that can be developed to boost the video gaming industry, it can serve as a link among academia, business sector, the state institutions and young students and interested individuals in there industry including investors. Further, the example will serve for a case study and ecosystem for further development and attraction of EU Funds and other donors.

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**ELECTRONIC COMMUNICATION AS A PRECONDITION FOR
EFFICIENCY OF THE INSTITUTIONS AND COMPANIES IN THE
REPUBLIC OF NORTH MACEDONIA**

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Abstract:

Electronic communication facilitates the combined usage of information and communication technology and enables the transmission of large amounts of information over long distances in a short time. Internet technologies have led to significant changes in the company's business, and today they are applied in numerous branches of economy and within business functions. A prerequisite for achieving efficiency and effectiveness of the institutions, whether public or private is to respond adequately and without any delays through a developed system of electronic communication, of course, with adequate training for the staff. Electronic communication enables companies and institutions to make significant operating costs savings, efficiency in completing tasks and thus being more competitive in the market. The purpose of this paper is to show the level of the satisfaction of the managers, employees, and users of products and services in terms of business efficiency through the concrete examples and evidence as well as from the results obtained from the research carried out in the selected companies and institutions in the Republic of North Macedonia.

Key words: *eelectronic communication, efficiency, institutions, companies, North Macedonia*

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1. Introduction

Information and communication technologies today play a key role in modern society's development. They have become an essential tool in the daily lives of citizens, increasing the importance of these technologies in a rapid trend over time (*Ministry of Information Society and Administration, 2011*). Every company or institution communicates with its environment which consists of users and customers, prospective buyers, suppliers, state, competition and more. For the survival of the organization, the most important thing is the communication that makes it with users or customers. The Internet as an electronic tool enables two-way communication with users through various forums, emails, web pages and so on. The competitiveness and efficiency of companies and institutions increasingly depend on the capabilities of electronic programs and electronic communications. Information Technology (IT) has been considered as one of the most important components in the current business environment, offering opportunities for companies that successfully take advantage of its benefits (*Albertin, & De Moura, 2004*).

Effective communication is one of the key elements of any business's success. In the area of data exchange broadband technology has led to a significant improvement. The term broadband itself is used to describe high-speed Internet connections, that is, those that allow sites to open without much waiting, and emails to be sent and received quickly, with the possibility of large amounts of data being sent in addition to email. Private and public sector employees can communicate via email which directly reduces the cost of telephone and postal services.

The functioning of each element inside and outside the organization is conditioned by the nature and the system of communication. Communications are an essential tool for directing and controlling the work as well as the actions of people, individuals, and groups in the organization.

In this way, companies realize significant savings in operating costs, perform their tasks more efficiently, and become more competitive in the market. Participants in the business operation are governed by the general rules, but the business technology changes. Computers are used for easy and smooth realization of growing number of business transactions; they replaced paper, pens, and stamp. The one who wants to be successful at the local level must also meet the criteria of global competitiveness because the new knowledge-based economy does not know the geographical barriers or the boundary (*European Commission, 2003*).

Electronic communication involves doing business processes with the usage of electronic technology. On-line communication means usage of various communication technologies to pass and receive information online (*Bodo, 2003*). Electronic technology facilitates the combined use of information and communication technologies allowing the sending of large amounts of information over long distances in a short period of time. The development of the Information Society should be based on partnerships between government, civil society, the private sector, operators, local governments and the other stakeholders. Sustainable economic development is a benefit of the development of the Information and Technology Society, but at the same time, it is the driver of that process (*Ministry of Transport and Communications, 2005*). It is also an important factor in the early stages when creating a critical mass of stakeholders dedicated to the development of the Information Society.

Due to limited natural resources and poor export competitiveness produced mainly in the labor-intensive branches of the economy, Republic of Macedonia as one of its strategic commitments for its own rapid economic development, it has been clearly identified the power of human potential and the capital of knowledge to direct and use as one of its strongest support in fulfilling its purpose. This corresponds to the priority to accelerate economic growth while providing equity (in satisfying the needs and solutions to the challenges that people face, both in urban and rural areas, different ethnic

communities and equality in the right of access information) and ultimately poverty reduction (*Ministry of Finance, 2019*).

Full access to electronic communications infrastructures and information technologies ensures balanced economic development throughout the country, i.e. polycentric development that contributes to good decentralization of local self-government units, building transparent and accountable local administrations, culminating in a gradual decline of the digital divide within the state. At the same time, this leads to the relativization of borders and increased cooperation and dialogue within the Euro-region (*Ministry of local self-government, 2015*).

The purpose of this paper is to show the level of the satisfaction of the managers, employees, and users of products and services in terms of business efficiency through the concrete examples and evidence as well as from the results obtained from the research conducted in the selected companies and institutions in the Republic of Macedonia.

2. Electronic communication as a precognition for business efficiency

Information and communication technology enables globalization, as the opportunity to promote local products globally, i.e. equal participation in the global networked economy. Those who have been isolated, or have been "invisible," so far have been given a voice, by giving them the opportunity to freely express themselves regardless of their economic status, gender or location of residence (*Ministry of Transport and Communications, 2005*).

Electronic business methods enable companies to link their internal and external data processing systems more efficiently and flexibly, to work more closely with suppliers and partners, and to better satisfy the needs and expectations of their customers. E-business allows for conversations to happen quickly, faster decision-making saves time, and time is money in business (*VIT, 2010*).

Innovations in electronic communications technology spurred the Information Age, a time period featuring fluid, almost instantaneous information transmission. The digital world offers interfaces such as email, instant messaging and chat rooms that help with the simultaneous transference of information to a large number of people. For many organizations, electronic communication has become a necessity for participation in modern commerce. Electronic commerce has opened up many opportunities because it allows large-scale global collaboration (*Blalock, 2005*).

Albertin and Moura, (2004) state that the benefits of IT can therefore be defined as cost savings, productivity, flexibility, quality and innovation; these benefits can be understood as "a present" that this technology gives to the organizations. However, just as important as the present is how it is taken advantage of it in relation to business performance. *Figure 1* shows these benefits and gives examples of how they are measured.

Proportion of each Project/Infrastructure

Measured by end-user/customer

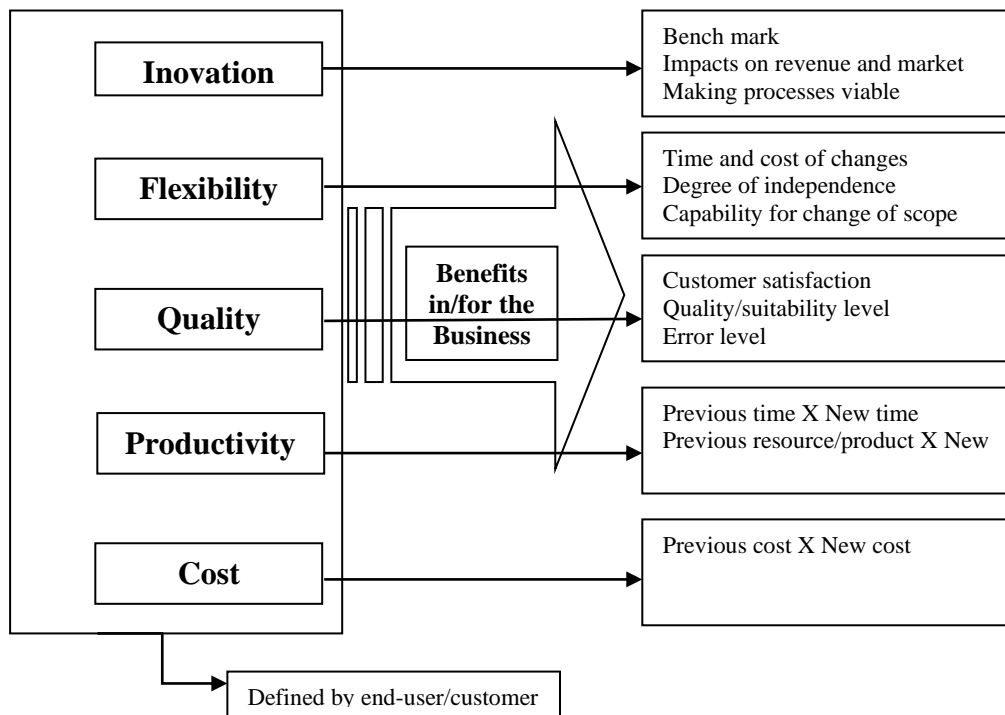


Figure 1 – Benefits offered by the use of Information Technology, *Source: Albertin and Moura, 2004.*

Having regard to the foregoing, strategic use of the ICT in business could bring benefits in several areas:

- **Support Innovation.** Organizations that want to improve their innovation capabilities and develop new products or services for the market can use cloud computing to speed up the process. This provides an important strategic advantage by enabling the organization to get new products to market quickly, ahead of the competition.
- **Improve Responsiveness.** Cloud computing enables organizations to scale up their IT resources quickly in response to changing market conditions. Organizations that offer products and services online may find it difficult to handle a surge in traffic, which could result in lost business. Adding resources from the cloud provides a strategic advantage by enabling them to respond to changes in demand, increase revenue and maintain customer satisfaction.
- **Increase Collaboration.** IT solutions that improve collaboration in an organization can provide an important competitive advantage. Issuing field service teams with smartphones, for example, enables service engineers to provide a faster, more efficient service to customers. Engineers working on a customer site can set up voice or video conference calls with product or technical experts at headquarters to discuss and resolve a complex issue, rather than delaying a repair. Offering customer superior service provides a strategic advantage by differentiating an organization from competitors.

- **Enhance Customer.** Insight collecting and analyzing data to gain greater insight into customers' needs and preferences provides a strategic advantage. By using powerful analytics software, organizations can develop customized offers and personalized communications that help to increase customer satisfaction and foster loyalty.
- **Introduce New Business Models.** Organizations can use IT to make strategic changes to their business models. A company that traditionally sold products through retail outlets might use IT to develop an e-commerce model that enables it to reach a wider market, reduce its distribution costs and offer a more convenient service to customers (*Linton, 2019*).

3. Electronic communications and information technologies in the republic of macedonia

3.1. The strategic approach of the Republic of Macedonia to the legislation and electronic communications regulation

According to the data of the State Statistical Office, in the first quarter of 2018, 79.3% of the households in Macedonia had access to the Internet at home. The participation of households with fixed broadband connection in the total number of households is 70.4% in 2018. In the first quarter of 2018, 79.2% of the total population aged 15-74 used the Internet, and 68.7% used the Internet every day or almost every day. Mobile phone or a smart phone was the most used device for access to the Internet, by 81% of Internet users in this period, and mostly among persons aged 15-24 (91.8%). 74.9% of the people used computers, laptops, smartphones, tablets or other portable devices at work. 31.6% of the people who used the Internet ordered/purchased goods or services over the internet in the last 12 months, and the majority of them (54.9%) bought clothes or sports equipment.

According to the data of the State Statistical Office of the Republic of Macedonia (*SSO, 2018a*) in 2018, 94.4% of the enterprises used computer in their work. 81.5% of the enterprises with 10 or more employees had the fixed broadband connection to the Internet. From the total number of the enterprises 53.9% had website/homepage. From them, 89.6% provided on their website descriptions of goods or services, price lists, 51.7% had links or references to their social media profiles, and 21% provided online ordering, reservation or booking. Regarding e-commerce, 5.7% of the enterprises received e-sales orders via computer network, and 4.4% of the enterprises received orders for products or services via Web- sales.

The Republic of Macedonia has committed itself to approximation to the EU regulatory framework in the field of electronic communications. As a result of that commitment, the Law on Electronic Communications was adopted in 2005, which is fully harmonized with the EU regulatory package for electronic communications since 2002, and is legal framework for the full liberalization of the electronic communications market. Existing Law on Electronic Communications (*“Official Gazette of the Republic of Macedonia” No. 13/2005; 14/2007; 55/2007; 98/2008; 83/2010; 13/2012; 59/2012; 123/2012; and 23/2013, 39/2014*) is fully aligned with the 2002 EU Electronic Communications Directives package. With a view to further development, the new legal framework should encourage and promote effective competition, investment and innovation, in particular with introducing next-generation broadband networks. The Law on Electronic Communications provides interconnection and access conditions by applying the principle of transparency and non - discrimination, the determination of operators with significant market power on a relevant market, universal provider selection service, introducing a procedure for notifying legal entities and individuals before start building public electronic communications networks and providing communication services, providing access to the services of another operator and more (*Law on Electronic Communications, 2005*).

The Agency for Electronic Communications was established by the Law on Electronic Communications (*"Official Gazette of the Republic of Macedonia" No. 13/2005, 14/2007 and 55/2007 and 98/8/2008 and 83/2010*) in 2005, as an independent regulatory body in the electronic communications markets. The Agency as a regulatory body is focused on the market, ensuring openness of public communication networks, the development and promotion of electronic communications networks and services, market analysis and the identification of operators with significant market power, tariff control, service price control, and more (*Law on Electronic Communications, 2005*). In order to regulate the electronic communications market in a systematic way, the Agency has well-defined goals to be achieved. The Agency has guidelines to achieve the goals of a competitive marketplace that will create the conditions for end-users to use the best quality and affordable electronic communication services.

On September 21, 2005, the National Assembly of the Republic of Macedonia adopted a National Strategy for Development of Electronic Communications with Information Technologies (Strategic Guidelines) prepared by the Ministry of Transport and Communications (*Ministry of Transport and Communications, 2005*). The need for adoption of this national strategy stems from the Law on Electronic Communications (*Official Gazette of the Republic of Macedonia No. 13/2005*), as well as from the basic generally accepted premises concerning the future development of the Republic of Macedonia. This strategy represents the Republic of Macedonia a top priority document with full implementation of projects, measures and the activities envisaged therein have a real opportunity to bridge the state the digital divide and in a short time make a significant jump in economic development, reducing unemployment and poverty, developing the digital economy, research and partnerships with industry (*Ministry of Transport and Communications, 2005*).

The National Strategy has a mission to include the economy of the Republic of Macedonia in the world map of networked economies, creating the conditions for the leap in developing the economy (leap-frogging) through an aggressive introduction and massively efficient use of electronic communications and information technologies, which will enable the following 5 years to bring Macedonia closer to the average of the new EU member states, as measured all the more important indicators, both in terms of ICT and purely economic indicators.

Considering that the introduction of the information society in Macedonia directly depends on the degree of supply-side development (development of communication infrastructures and technologies) and the degree of development of the demand-side (use of services and content), both strategies (National Strategy for the Development of Electronic Communications with Information Technologies and the National Strategy for Information Society Development), are a strong driver of a balanced economic process that will lead to the establishment of Information Society in the Republic of Macedonia, as by demand as well as supply (mainly broadband understood as technological service, i.e. the basis for the realization of all advanced services). The degree of development on the supply side, i.e. the development of communication infrastructures directly depends on the process of liberalization and development of competition in the market electronic communications.

In terms of service utilization, the development of broadband networks plays a crucial role through policies that will stimulate demand for different types of services. These policies can provide financial incentives, improving government services through E-government, E-health, E-education, education of citizens, developing innovative public services, providing protection systems and trust, connecting public administration, schools, hospitals, small and medium enterprises, etc.

Commitment to create a proactive environment and environment to support the development of information society is also defined in the i2010 initiative of the European Union. The National Strategy for the Development of Electronic Communications with Information Technologies is based on the i2010 initiative of the European Union: creating a single information space with an open and

competitive market offering access to electronic communications services and digital content, promoting the development of information and communication technologies as a driving force for the development of digital society, and the creation of an inclusive information society by bridging the digital divide (*Ministry of Information Society and Administration, 2010*).

3.2. Insights and experience on the prevalence of electronic communication in institutions and companies in Macedonia

The efficient, effective and professional functioning of the public administration in each country is one of the key factors for its democratic, political and economic development. The way the public sector performs its functions directly affects the quality of life of the different categories in society. The introduction of information and communication technologies is one of the key approaches in reforming public administration by using ICT tools to improve many different segments of its functioning (*Ministry of Information Society and Administration, 2010*).

While it is quite clear that ICT cannot solve all the problems in the functioning of public administration, it is a surprisingly long list in the areas in which their proper implementation can positively affect. The use of ICT in the public administration has enabled the improvement of the internal organization and efficiency of institutions, as well as the conditions for the secure storage and internal exchange of relevant data, the emergence of the Internet laid the foundations for the establishment of broad communication and direct access to each interested user to public institutions. In other words, the Internet opened the possibility to increase the availability of data through the websites of public institutions, as well as to open electronic communication channels through which users can access the data and services of public institutions at any time and from any place (*European Commission, 2014*).

Electronic communication in Macedonia has been largely implemented and is still in the process of modernization in the institutions and companies that exist to meet the needs of the citizens (consumers), like the Health Insurance Fund (HIF), Public Revenue Office (PRO), Central Register, banks and so on. With the Health Insurance Fund web portal software solution project, HIFM is among the first institutions to start implementing e-services for its insureds. The following services are available:

- For insurers - access to personal insurance and insurance data of its members, data on selected general practitioners, dentistry and gynecology for themselves and their members younger than 14 years.
- For companies - an opportunity for electronic application for health insurance for persons for whom M1 application has been received from the Employment Agency of Macedonia, electronic application for their members and registration of members. The authorized person must have an electronic health card in order to use this service.
- For health care providers - opportunity to check insurance coverage for insured persons using health services.
- For selected GPs, gynecology and dentistry - the possibility of electronic change of a chosen doctor, follow up of records of insured persons with active reports, records of logs, etc. In this way, there is no need for companies and family doctors to come to the regional offices of the Health Insurance Fund.

With the development of information technology and its application in Macedonia new trends in banking are introduced, new and improved services are offered and clients can freely choose the way they interact with the banks. Although Macedonia cannot be compared to Western European

countries in terms of the use of electronic financial services, in recent years there has been a great improvement in this regard, ie electronic banking is in continuous process of development.

The development of electronic communication in the Public Revenue Office (PRO) of the Republic of Macedonia from 2011 onwards is perceived as reducing the flow of paper documents and in increased electronic business, enriching the database and increasing the level of transparency and accountability of each individual. An electronic archive means electronic recording, storage, and deployment of all incoming and outgoing documents and registration of their internal movement. Completion of the initial design of the electronic archive (document management), the design of the deployment and monitoring of the movement of documents in the PRO (document flow management), the introduction of an electronic signature for each employee and the creation of an electronic file for each subject and an electronic file for each taxpayer.

The system of electronic registration in the Central Registry offers a fast, simple and a reliable way of realizing all kinds of registrations in the Trade Registry of legal entities. In addition, when registering a legal entity, there is a possibility to register a legal representative in the obligatory social insurance fund (pension, disability, and health insurance).

Distance learning systems, e-learning, lifelong learning and other flexible forms of learning, as well as opportunities for developing and presenting multimedia and multilingual content, are just some examples of the place of information and communication technologies in the new e-education.

4. Results from the research

To gain a better picture of the usage of electronic communication in Macedonia, as well as users satisfaction and perception of the degree of improvement of the effectiveness and efficiency of the companies and public institutions, "face-to-face", semi-structured, interviews were conducted with the citizens, the managers of the private sector companies using the electronic services, the employees, the heads of state institutions in the Republic of Macedonia, such as the Public Revenue Office (PRO), Health Insurance Fund of Macedonia, Central Registry, Banks, and others. We developed 3 types of Questionnaires: for the managers, for the employees and for the customers or users of services.

Forty respondents (managers in companies and institutions) using electronic communication tools participated in this study and were asked to evaluate the effectiveness of their company or institution with the use of electronic communications tools. They were asked to compare the level of satisfaction they have for three years (from 2016 to 2018). Their answers are systematized in *Table 1*.

Table 1. Level of satisfaction of the managers using electronic communications tools

Are you satisfied with improving the efficiency of your company's operations by using electronic communications tools?						
Year of Survey	Unsatisfied	Partly Satisfied	Satisfied	No Answer	Total	Average Rating
	%	%	%	%	%	
2016	21,4	21,2	51,3	6,1	100	3,58
2017	8	32	56	4	100	3,58
2018	7,38	33,76	57,2	1,66	100	4,21

From *Table 1*, we can conclude that from 2016 until 2018 the level of satisfaction is continuously increasing while the level of dissatisfaction is continuously decreasing, indicating that

with the introduction of electronic communication in the companies and institutions efficiency is increased from an average rating 3,58 to 4,21.

Table 2 shows the answers to questions that were an integral part of Questionnaire No. 2 that was conducted in 2019 from May to August. Questionnaire No. 2 was composed of 11 questions that were strictly related to the research topic. The respondents voluntarily filled in the questionnaire but due to the protection of personal data, their identity remained anonymous. The survey was conducted also by 40 respondents employed in institutions using electronic communication facilities.

Table 2. Level of satisfaction of the employees using electronic communication in the companies

Number	Question	n	Yes	No
			%	%
1.	Do you have experience using electronic communication in your institution?	40	65	35
2.	Has your company increased its efficiency by introducing and regularly using electronic communication in your company operations?	40	91	9
3.	Does your company regularly use electronic communication tools?	40	60	40
4.	Do you regularly communicate through electronic means of communication?		85	15
5.	Are you satisfied with the level of electronic communication in your company?	40	90	10
6.	Are you efficient in doing business using electronic communication devices?	40	82	12
7.	Do you find that your colleagues are effective in accomplishing their tasks using electronic communication?	40	78	22
8.	Do you think that working conditions improved at your company using electronic communication tools?	40	92	8
9.	Do you believe that better organization through electronic communication improves work efficiency?	40	94	6
10.	Do you feel a positive work atmosphere in your day-to-day work using electronic communication to perform your business activities?	40	95	5
11.	Do you think that increasing the efficiency of using electronic communication will increase customer satisfaction?	40	72	28

Questionnaire No. 3 shows the level of satisfaction of the customers or users of the products and services of the companies and institutions (*Table 3*). The respondents (20) were citizens who were accidentally found in the institutions and participated in the survey voluntarily.

Table 3. Level of the satisfaction of the customers

Questionnaire 3 - Survey conducted with citizens		
	YES	NO
Are you satisfied with the work of institutions that use electronic communications and electronic services?	88%	12%
Do you think that institutions are more efficient than before with the use of electronic communication?	92%	8%

The results obtained from the research indicate that the usage of electronic communication facilities in the institutions and companies in the Republic of Macedonia efficiency, as well as the effectiveness, has been increased. Besides, the survey questionnaires provided results that showed increased satisfaction of the employees and citizens in the institutions with the use of electronic communication means.

5. Conclusions

The electronic communication in the past period in the Republic of Macedonia has experienced a special expansion in retail, financial services, education, health and so on. Generally speaking, the advantage of electronic over traditional communication is related to increased quality, agility in offering and providing additional services on the one hand and reducing costs and time in conducting transactions on the other.

The advantages of using electronic communication are: better delivery of government services through fully coordinated and integrated public administration activities, improved interaction with the business sector and industry, quality and rapid response to civil needs and demands, citizen participation in building an information society, efficient government management, increased number of ICT experts and increased level of ICT literacy in public administration, open, participatory and democratic government, reduced corruption, increased transparency, increased revenues and reduced costs, new forms of evaluation and improvement of the public administration and the creation of value for society in general.

Citizens of the Republic of Macedonia have open access to government information and services and will have the opportunity to participate in building a democratic society in Macedonia through the use of the Internet, telephony and other technologies, face reduced corruption, greater transparency and increased information security in practicing their rights and obligations. Web processes should make life easier and more comfortable for citizens: they do not have to be physically present to use the services, they do not have to wait in line, there is no working time, no waste of time walking from one institution to another, there are only simple processes and forms that are logically designed.

The business sector in the Republic of Macedonia has broader and more open access to information, a better business climate, economic vitality, and will face greater transparency, reduced corruption, greater accountability and trust to the state administration in exercising its rights and obligations. In the same way cooperation between institutions that use electronic communication has been improved. It can be concluded that the development and application of e-technologies is one of the strategic priorities of the state and that their implementation is a structured and planned process that improves the functioning of the public and business sector.

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DIGITALIZATION OF SMALL AND MEDIUM ENTERPRISES IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract:

Small and medium-sized enterprises (SMEs) are a significant and a vital part of a country's economy.

SMEs in the Republic of North Macedonia are, and will continue to be, the drivers of inclusive economic growth and in the creation of productive and sustainable jobs in the future. If they want to stay competitive and have an essential role in both the domestic and international markets, they must constantly upgrade, grow, increase the number of employees, expand their range of products and services, markets, and they can achieve it if they continuously increase the degree of digitization.

Digitalization, often called to as the "fourth industrial revolution", is of vital importance to ensure competitive advantage in the global economy. Digitalization is not just about acquiring IT equipment and systems. It encompasses fundamental business dimensions.

In this paper, the key indicators of digitalization in the Republic of North Macedonia will be elaborated. Also, the level of digital transformation in SMEs and that means measuring digital intensity index will be evaluated. Based on the data obtained, a comparative analysis will be made between the level of digitalization of small and medium-sized enterprises in the Republic of North Macedonia and EU member states.

Key words: *SMEs, digitalization, business digitalization, E-business, digital intensity index (DII)*

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1. Introduction

Digital technologies enabled by ICT infrastructures continue to influence SMEs. The digital transformation through these technologies improves the business landscape by creating unparalleled opportunities to boost growth, expand jobs and accelerate innovation. Digitalization is a business process transformation including customer management, transaction, services and feedback in a complete digital environment. Businesses do not realize the full potential of digitalization, especially among small and medium enterprises (SMEs). SMEs in North Macedonia represent 88.3% of total business establishments (11.4 % including business entities with unascertained number of persons employed) in 2018 (figure 1). The majority of the SMEs were microenterprises, constituting 89.6% of total SMEs in Macedonia. Looking across key economic sector, SMEs are highly concentrated in the services sector that accounted for 32.8% of total SMEs, predominantly in the wholesale and retail trade (figure 2). The goal of Macedonian Government is to grow the economy, improve productivity, start up more entrepreneurial companies and increase employment opportunities that cannot happen without the digital transformation of the SMEs. To be completely digitalized, SMEs must re-engineer and refresh their businesses by assessing and ensuring that their business strategies, business models, processes, and infrastructures are aligned and fully integrated to support their digital transformation.

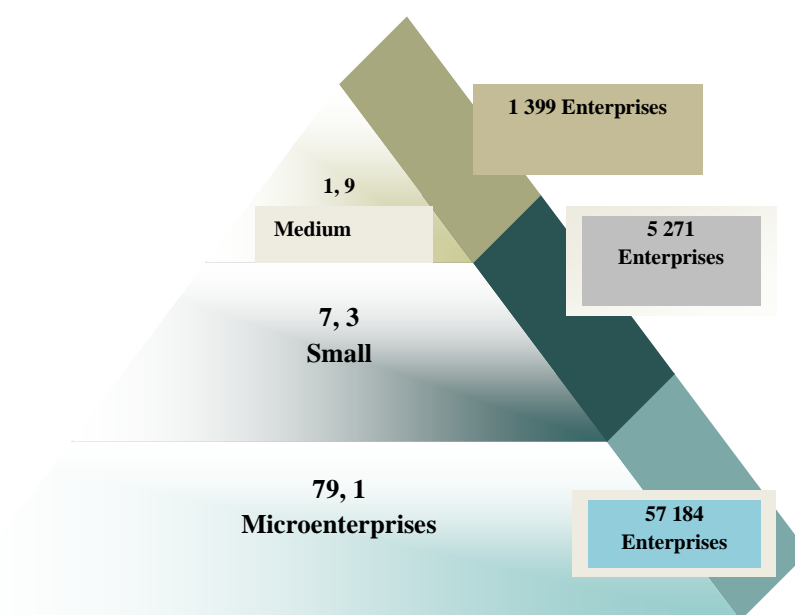


Figure 1. SMEs by sizes in Republic of North Macedonia
Source: Authors own research

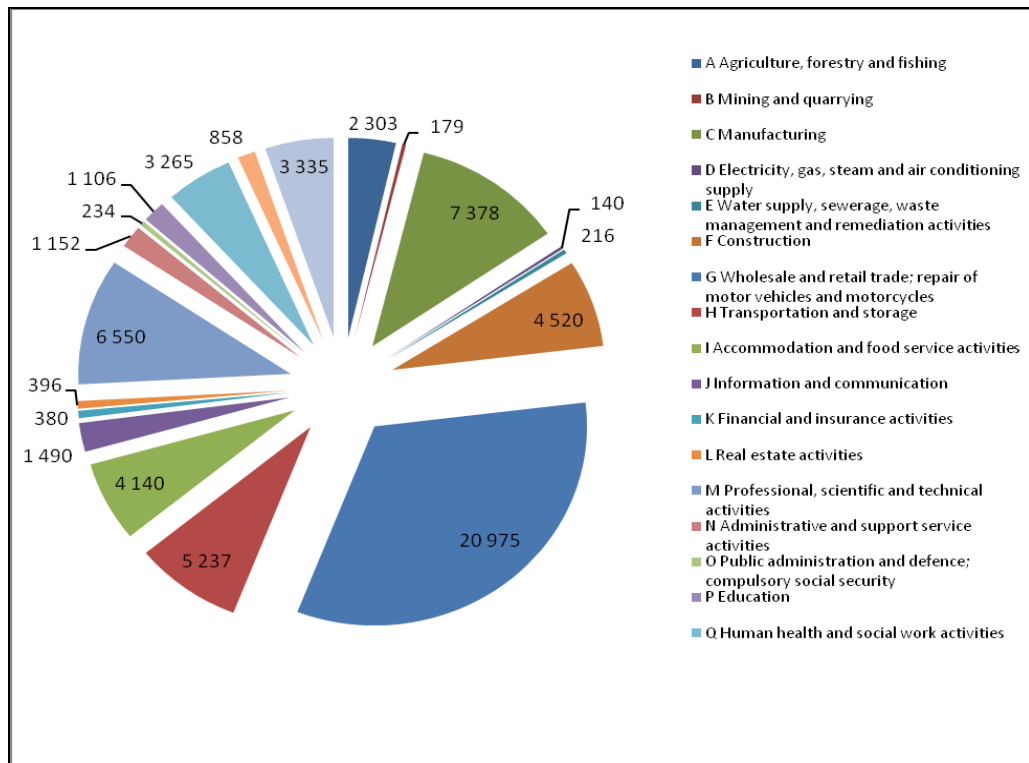


Figure 2. Number of Establishments and Percentage Share by Sector and Business Size
Source: Authors own research

2. The role of information and communication technology (ict) into small and medium companies (smes) development

The information society is a society based on the effective application of information made possible by accelerated development and the increased use of information and communication technologies (ICTs). The development and penetration of ICT into all parts of society has a major impact on economic and social change. Global communications, e-commerce and the Internet bring many benefits, even a greater development, economic expansion and democracy to the developed world. Measuring the extent of the development of the information society by following certain key indicators is a process of continuous review and improvement.

Only those SMEs that use cutting edge ICT technologies have the opportunity to enter the international market and remain competitive despite the challenges of globalization, liberalization and scientific and technical progress (Ongori. H., 2010). ICT solutions help SMEs to increase productivity and achieve better business performance. The adoption of ICT "is considered as a mean that will enable businesses to compete globally, with the aim of improved efficiency and closer relationships with customers and suppliers" (Chong et al., 2001). Therefore, the adoption of ICTs is a key requirement that enables SMEs to maintain and enhance their competitive advantage in global markets. ICT has enabled SMEs to compete on a same level with large companies.

Three levels of ICT application in SMEs can be differentiated (Matthews, P., 2007):

- Basic - minimal use of ICT;
- Significant - few applications in use; and
- Sophisticated - integration of different information systems and continuous development of already applied information technology.

The major effects of ICT application in SMEs are:

- Increasing efficiency;

- Increasing effectiveness;
- Introduction of new products / services;
- Increasing the quality of products / services;
- Increased consumer satisfaction;
- Improvement of supply chain;
- Increased and more efficient communication;
- Increase productivity;
- Increase in sales, etc.

There is a plethora of benefits from using the Internet that are notably perceived such as market development, sales and promotion efficiency, ease of accessibility and reduced cost. These benefits are important factors in the willingness of SMEs to adopt new technologies, for example, the e-commerce. Namely, the increasing development of the Internet has a dominant influence in the field of business. The Internet greatly enables better links with suppliers, consumers, increased management efficiency, improved production processes, and improved collaboration with other companies, both locally and globally. For every enterprise, using the Internet as an important competitive advantage is seen through indirect advertising, fast customer feedback, improved customer accountability, access to government data, and speeding up corporate communications and etc. This creates a networked economy in which communication and cooperation between all stakeholders is very easy.

Information and communication technology, besides enabling rapid transfer of information and continuity in production and consumption, is considered to be the driving force in the transformation of the traditional economy into a 'knowledge economy'. The networking of small and medium-sized enterprises through services such as electronic data interchange (EDI) is crucial for organizational restructuring of production. In such a system, information becomes available to all stakeholders, enterprises, suppliers and customers.

These, already appointed effects can be classified into two performance groups: financial and strategic. They are presented in the following picture:

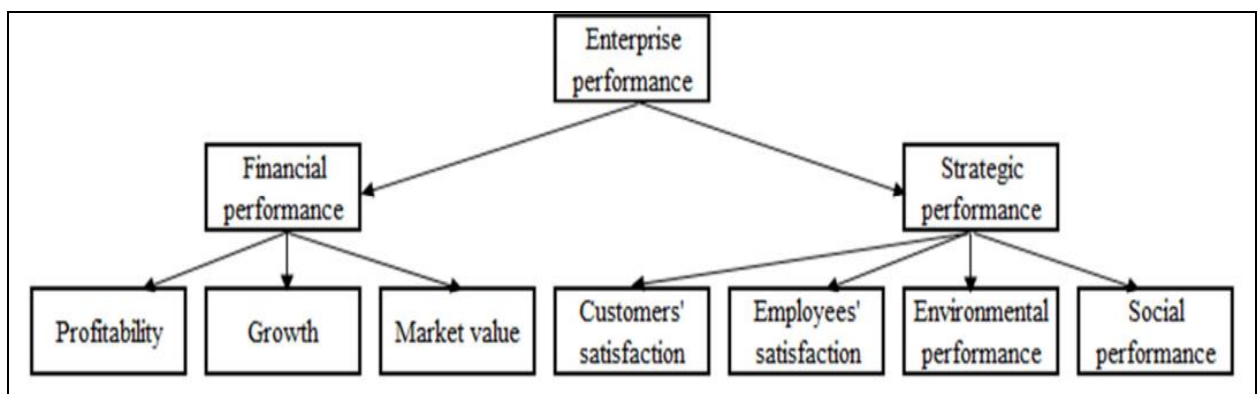


Figure 3. Performance of ICT application in SMEs

Source: Ashrafi, R., and Murtaza, M. (2008). Use and impact of ICT on SMEs in Oman. *The Electronic Journal Information Systems Evaluation*, 11(3)

However, the adoption of ICT by small and medium companies has slow response and limited progress. Namely, in spite of the aforementioned effects achieved, the percentage of ICT adoption by them is very low (Shantanu B., Soumya R. A, 2007). There are a lot of factors that influence the adoption and application of ICT by SMEs. They can be classified into 5 groups: individual,

organizational, technological, economic and environmental factors, which are shown in the following figure (Skoko H., Buerki, L. and Ceric, A., 2007):

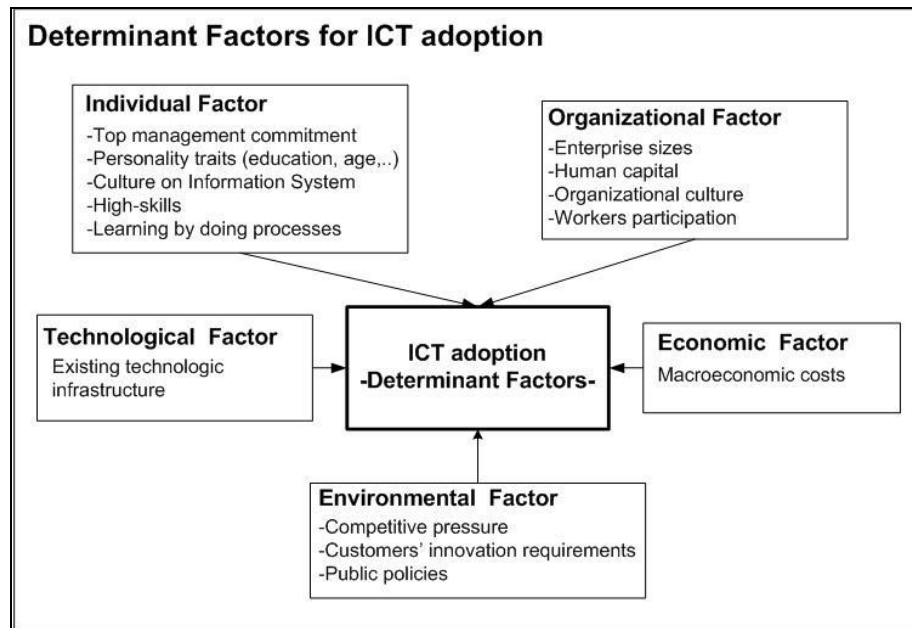


Figure 4. Determinant factors for ICT adoption
Source: Consoli, D., 2012

However, it is not only important for SMEs to adopt ICT, but to deliver the best results. Namely, the benefits/advantages of ICT depend on several variables (Consoli, D., 2012): the type of business; internal changes (e.g. reengineering process, retraining of staff etc.); and interaction between suppliers and customers.

In addition to these factors, it is important to emphasize that small and medium-sized enterprises do not fully utilize ICT potentials as large companies do. The main constraint on this is high ICT investment. In addition, there are other constraints, i.e. barriers (internal and external) to the adoption and application of ICT by SMEs, which are given in the following table (Ashrafi, R., & Murtaza, M., 2008):

Table 1. Internal and external barriers of ICT adoption

Internal barriers	External barriers
Owner/manager characteristics	Infrastructure
Firm characteristics	Social barriers
Adoption and implementation cost	Cultural barriers
Return on investment	Political, legal and regulatory barriers

Source: Authors own research

3. Benefits of SMEs Digitalization

Digitalization can be defined as “ability to turn existing products or services into digital variants, and thus offer advantages over tangible product” (Parviainen, P., Kääriäinen, J., Tihinen, M., and Teppola, S., 2017). Gartner defines digitalization as “the use of digital technologies to change a business model

and provide new revenue and value-producing opportunities; it is the process of moving to a digital business”. Digitalization changes the company’s value proposition and organizational structure. In contrast to digitization, which focuses on the standardization and automation of processes with the goal to cut cost, digitalization changes the company’s value proposition and organizational structure. Because of that, in this work, the term “digitalization” is used synonymously to “digital transformation”. Digitalization is facilitated by the improvement of information and communication technologies, like the spreading of the internet (Hartmann, P. M., Zaki, M., Feldmann, N., and Neely, A., 2016). In contrast to the positive showcases of digitalization, small and medium enterprises (SMEs) face different framing conditions on the way to digitalization. They often experience challenges when trying to innovate and their level of digitalization is still below industry average (Bley, K., Leyh, C., and Schäffer, T., 2016). There is a considerable amount of contributions on strategies helping SMEs to manage digitalization successfully. But digitalization cannot only be viewed from the internal perspective of single companies. Collaborations between companies set new resources free and lead to network effect. This results in new approaches for digitalization. Networking of SMEs is in interest of innovations of great importance not only for their success, but also to increase the economic performance of regions. In order to understand the relationship between innovation and networking, innovation can be defined as “commercially successful exploitation of new technologies, ideas or methods through the introduction of new products or processes, or improving the existing” (Simmie, J., Sennett, J., Wood, P. and Hart, D., 2002). Small and medium businesses do not have enough resources to innovate. Therefore they should take advantage of the so-called innovation networks as a tool to enter at the international market (Scott, A., 1996). Because of that, digital transformation requires an enterprise-wide change driven by digital technologies and the integration of transformation processes into every aspect of the company. This transformation should be supported at a company level by changes in culture, leadership, skills and processes, as well as at a national level by actions encompassing multiple dimensions, from the development of digital competences in the workforce to ensuring a sound environment for the creation and implementation of innovative solutions. The impact of digitalization is reflected in:

- Increase in revenues - Engagement through a company website or shifting to an e-commerce platform can increase sales by allowing SMEs to access new customers in local and overseas markets. It also allows flexibilities of time, geographical location and delivery to conduct business;
- Accessibility to wider customer base - Increased digital engagements allow SMEs to explore new markets, enabling them to compete with the bigger giants in the industry. E-commerce has provided cost-effective solutions for the companies in large cities and rural areas alike to connect and trade with customers around the world;
- Operational efficiencies - Access to e-commerce platforms allow SMEs to decrease overall expenditure by optimizing operational and marketing costs like call centers, trade shows, and individual product advertising;
- Enriched customer engagement - Data Analytics and Business Intelligence have provided opportunities for the SMEs to make better decisions by providing a deeper understanding of the customers;
- Governance challenges - All businesses aim to be more efficient & responsive by having a better control over finances, access to accurate data and acquiring new customers.

4. Integration of digital technology in SMEs in Republic of North Macedonia

Integration of digital technology can be seen through two aspects: business digitalization and e-commerce. To measure the extent of this integration, it is necessary to select the appropriate indicators

for both aspects. According to the European Commission there are 12 key indicators to measure the digital intensity index (DII), (Eurostat - European Statistical System).

In this paper the key indicators of business digitization were selected: having a website or homepage, using any social media platform, having ERP software package to share information, fastest broadband connection at least 30 Mb/s, buying medium-high Cloud Computing services, having CRM software for managing information about its clients and having CRM software for analysing information about its clients for marketing purposes. On the other hand, the key indicators of e-commerce are: e-sales, web sales, EDI sales, customer type sales (B2C, B2B and B2G) and percentage of web sales in total sales ($= /> 1$). According to the key indicators from the first aspect, the digital intensity index will be measured, and according to all indicators, the degree of integration of the digital economy in the Republic of North Macedonia (RNM) will be measured.

It should be emphasized that there is no data on individual key indicators in individual years in the State Statistical Office of NRM, as well as in Eurostat. It should also be noted that the State Statistical Office of the RNM has specific data of small and medium-sized enterprises, while in Eurostat there is general data about SMEs.

The graphs below shows the degree of penetration and speed of adoption of the different technologies, i.e. of some key indicators tracking digitalization processes in SMEs in RNM during recent years (2014-2018):

- Having a web site or homepage (in %) (State Statistical Office-Republic of North Macedonia):

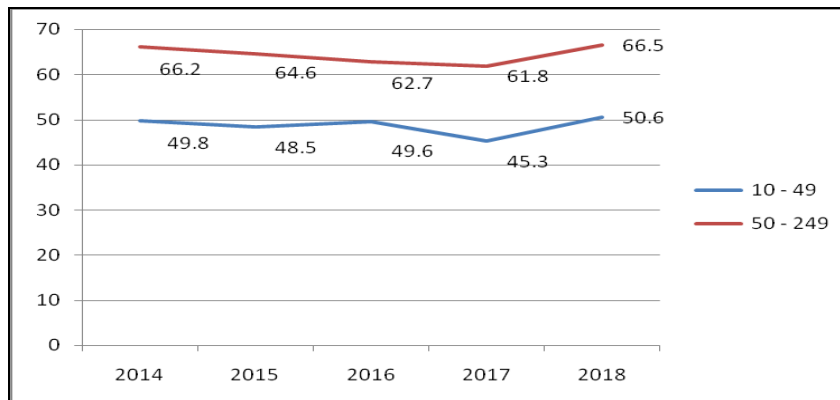


Figure 5. Having a website or homepage

Source: Authors own research

It is characteristic that this key indicator today has maintained its position at the same level as in 2014, with slight oscillations in 2015, 2016 and 2017, which means that it does not grow steadily. If we compare the percentages with those from the SMEs in EU member states, it can be concluded that SMEs in Macedonia are not lagging behind in this key indicator, as the average percentage in 2016 is 77%, in 2017 it is 76% while again in 2018 is 77%, just like in 2016. (European Commission).

- Use any social media (in %):

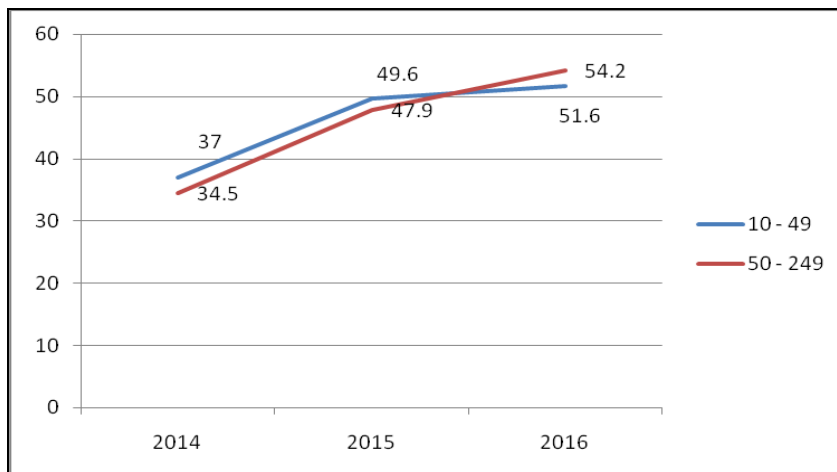


Figure 6. Use any social media
Source: Authors own research

In terms of this key indicator, when SMEs in RNM are compared to SMEs in EU countries, it is clear that they have a higher percentage of use of this indicator (the average percentage of social network used by EU countries in 2016 was 44% and in 2017 was 47 %).

- Have ERP software package to share information (in %):

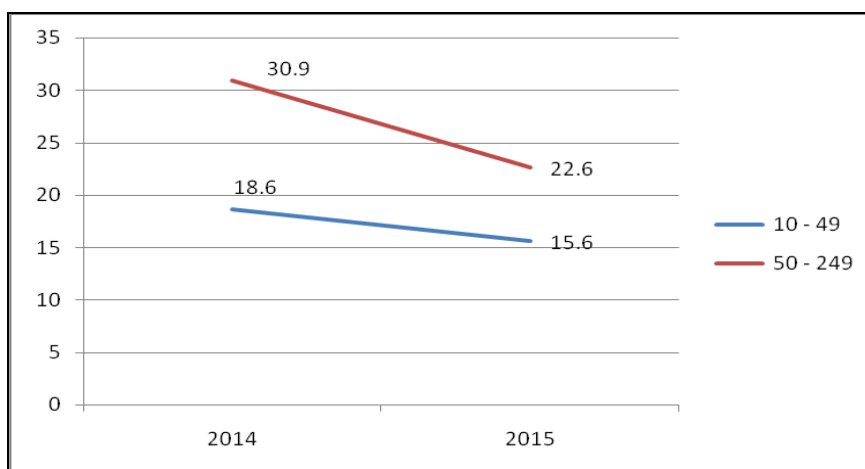


Figure 7. Have ERP software package to share information
Source: Authors own research

There is no data for this indicator for the last 3 years in the State Statistical Office for SMEs in RNM, but it can be seen from the graph that it is in decline. On the other hand, compared to EU countries, the SMEs have a lower percentage (average percentage of ERP used by SMEs in EU countries in 2016 was 34% and in 2017 was 33%).

- Fastest broadband connection is at least 30 Mb/s (in %):

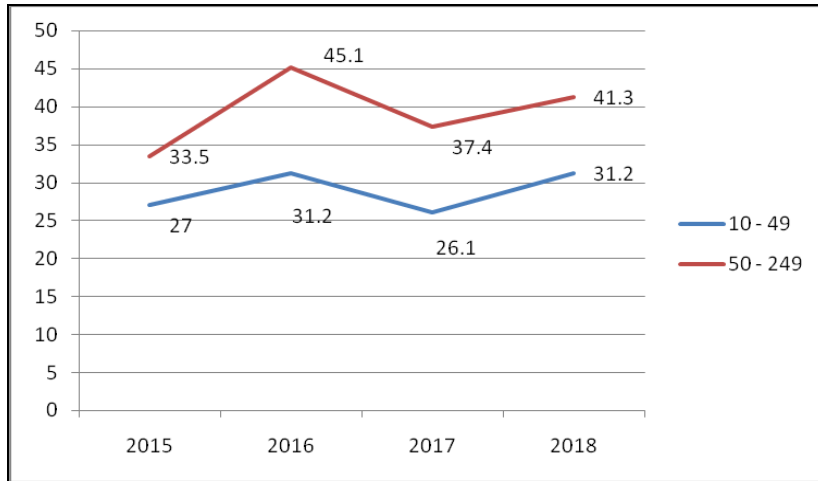


Figure 8. Fastest broadband connection is at least 30 Mb/s
Source: Authors own research

From the graph it can be concluded that the mentioned key indicator has increased in 2018 compared to 2015, but remains at the same level in 2017 and, it is slightly decreased when compared to 2016. However, this key indicator is at almost the same level of penetration compared to SMEs from EU countries in the last three years.

- Buy medium-high Cloud Computing services (in %):

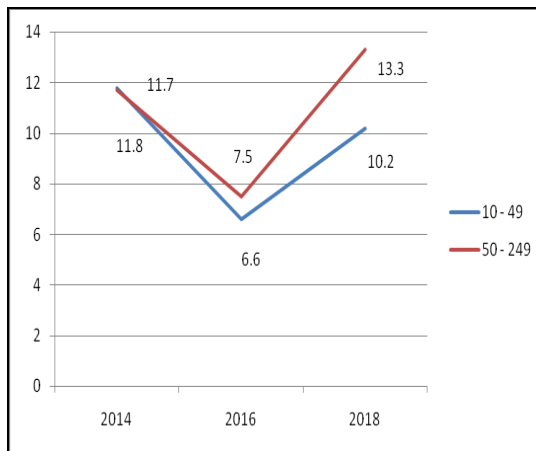


Figure 9. Buy medium-high Cloud Computing services
Source: Authors own research

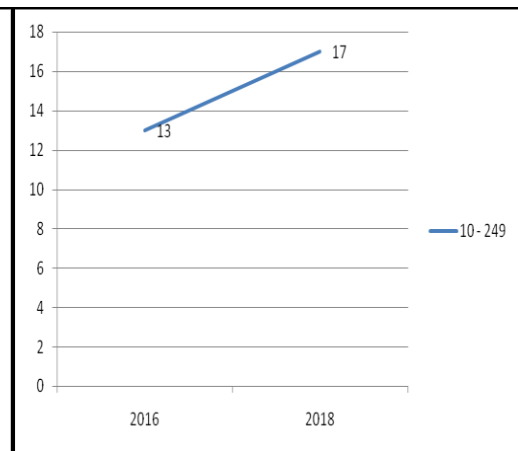


Figure 10. Buy medium-high Cloud Computing services-comparison of SMEs from RNM with SMEs from EU countries
Source: Authors own research

From the graph it can be concluded that this key indicator has increased in 2018 compared to 2014, but in 2018 there was a registered increase. This key indicator is at a slightly lower level of growth compared to SMEs from EU countries

- Have CRM software for managing information about its clients (in %):

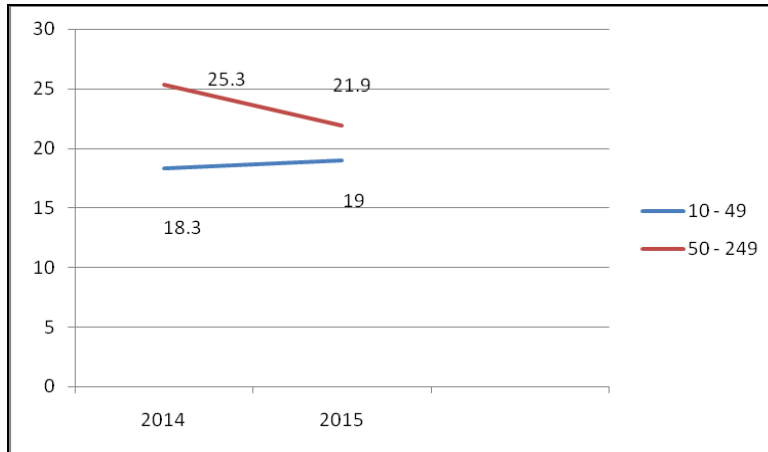


Figure 11. Have CRM software for managing information about its clients
Source: Authors own research

From the graph it can be concluded that the use of this indicator, CRM software for managing information about its clients in SMEs in Macedonia, for 2014 and 2015 does not have any significant fluctuation and particular change, because within a year the changes are insignificant, especially in the small businesses where the registered growth is 0.7%, while medium-sized businesses declined by 3.4%.

- Have CRM software for analyse information about its clients for marketing purposes (in %):

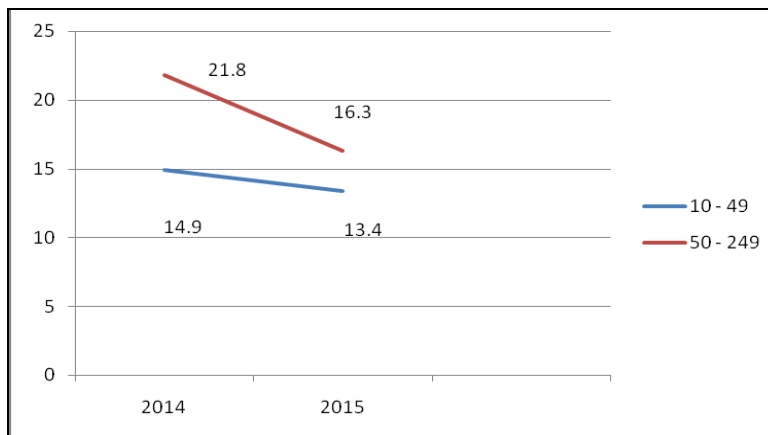


Figure 12. Have CRM software for analyse information about its clients for marketing purposes
Source: Authors own research

Regarding this indicator, it can be concluded that there is a decline in 2015 compared to 2014, and it is also at a significantly lower level of growth compared to SMEs from EU countries, which in 2016 and 2017 it was 32%.

Digitalization of business processes of SMEs varies by business, according to their specific needs and starting point. In any case, the adoption of digital technologies varies greatly depending on the size of the enterprises. Thus, for example, the percentage of large companies that purchased a cloud computing service, owning CRM software, ERP software, and so on is much higher.

As for the second aspect, i.e. electronic commerce, the larger companies are also better at exploiting its capabilities. The comparison of e-sales in SMEs in RNM and those in EU countries is shown in the following graphs (in %):

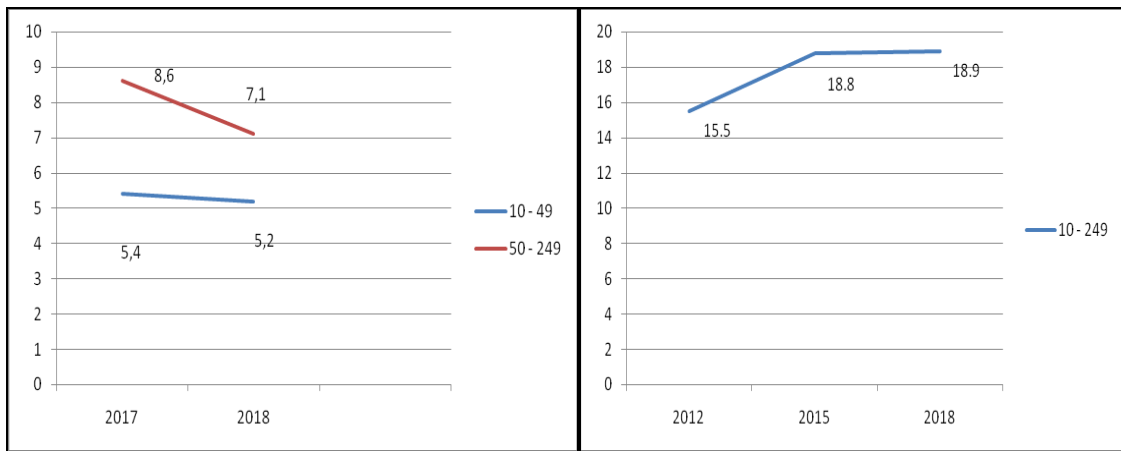


Figure 13. SMEs that had e-sales in RNM
Source: Authors own research

Figure 14. SMEs that had e-sales in EU
Source: Authors own research

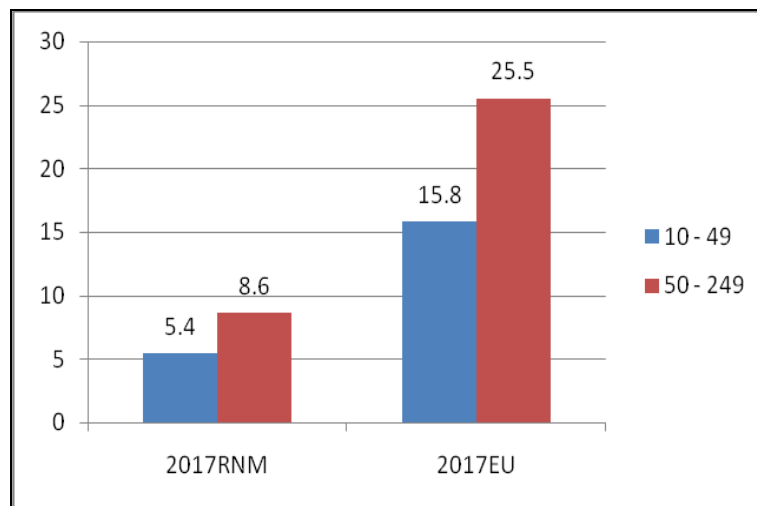


Figure 15. Comparison of e-sales in SMEs in RNM and SMEs in EU countries (in %)
Source: Authors own research

The graphs show that e-sales of SMEs in RNM in 2018 have decreased compared to 2017, while this key indicator of SMEs in EU countries is increasing. The last graph shows the difference in e-sales at SMEs in RSM and SMEs in EU countries.

C-commerce can be differentiated into two types of sales: web-selling and EDI-selling.

The development of SMEs web sales in RNM in the last two years is presented in the following graph (in %):

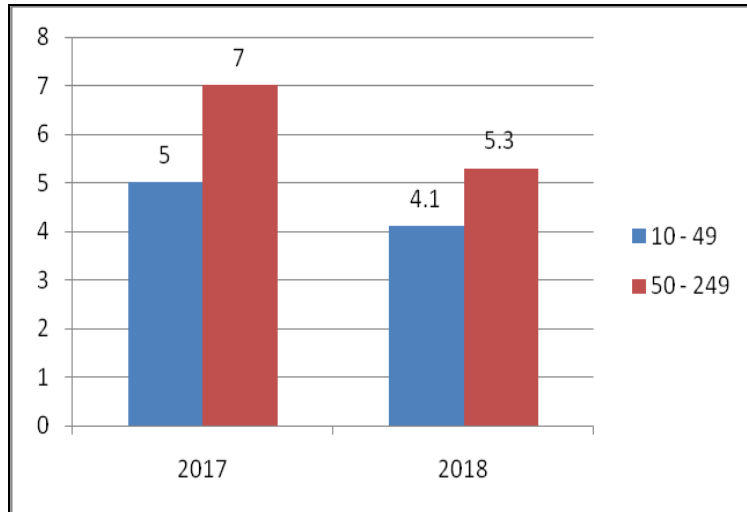


Figure 16. SMEs web sales development in RNM
Source: Authors own research

While the development of SMEs EDI sales in RNM in the last two years is presented in the following graph (in %):

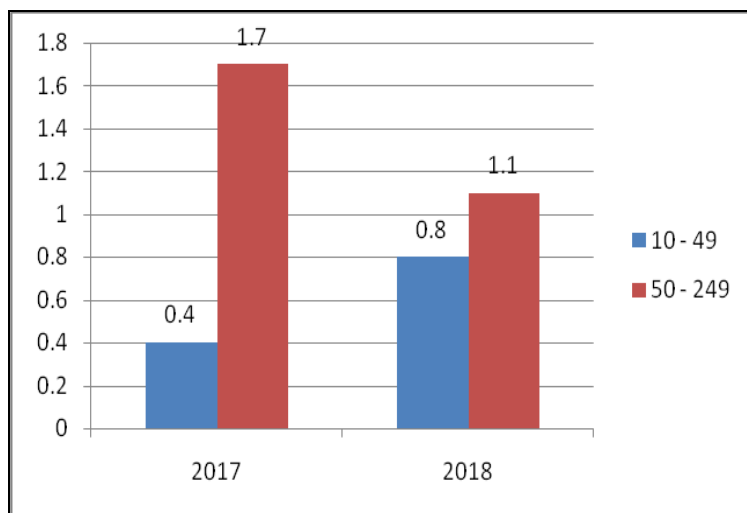


Figure 17. The development of SMEs EDI sales in RNM
Source: Authors own research

From the graphs it can be concluded that both web sales and EDI sales in 2018 decreased when compared to 2017. B2C sales in 2018 grew by 2017, while B2B and B2G sales remained unchanged during this period.

These two types of sales are presented in the following graphs (in %):

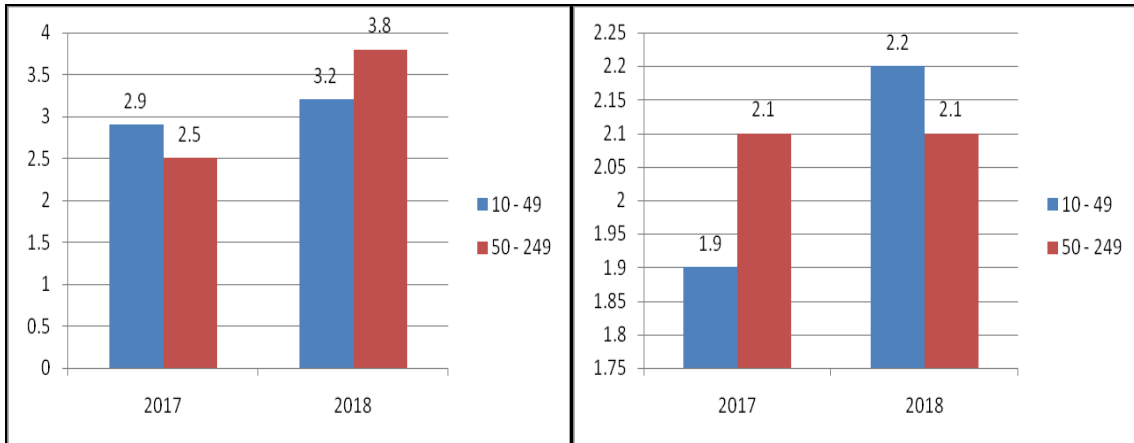


Figure 18. B2C Sales
Source: Authors own research

Figure 19. B2B and B2G Sales
Source: Authors own research

The percentage of web sales to total sales in 2018 increased compared to 2017 and it is shown in the following graph (in %):

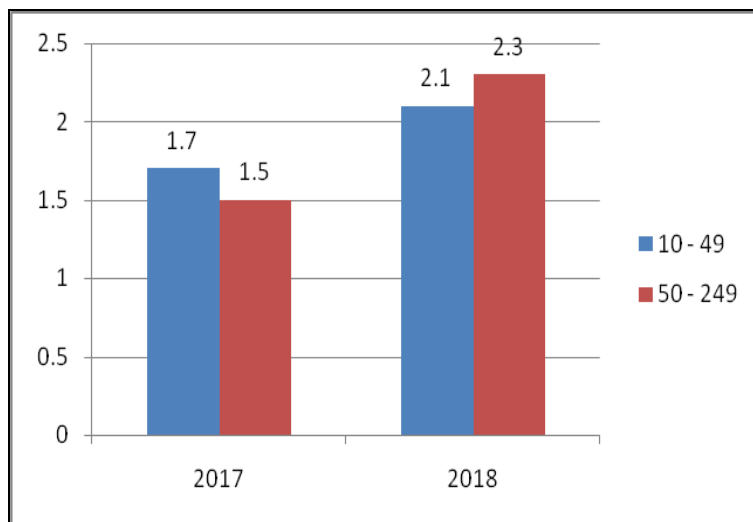


Figure 20. Percentage of web sales in terms of total sales
Source: Authors own research

Comparing the percentage of web sales to total sales (≥ 1) of SMEs in RNM and SMEs in EU for 2017, is presented in the following graph (in %):

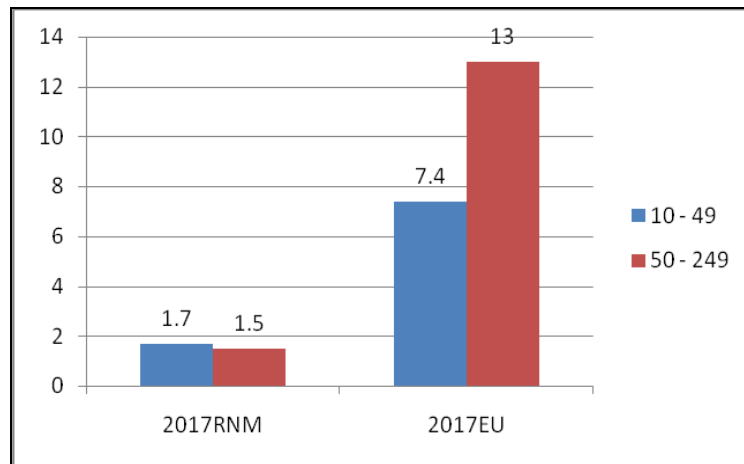


Figure 21. Comparing the percentage of web sales to total sales (= /> 1) of SMEs in NRM and SMEs in EU
Source: Authors own research

From the graphs it can be concluded that only the investment in two technologies (of selected seven) technologies (fastest broadband connection is at least 30 Mb / s) SMEs has increased in two (having a web site or homepage and buying medium-high Cloud Computing services), there is a very small growth, while in three of the technologies there is a decline (have ERP software package to share information and have CRM software to analyze information about its clients for marketing purposes), which is worrying.

Given the fact that only for two of the seven key indicators more than 50% of SMEs had invested (having more than 50% of SMEs invested in a website or using any social media site), it can be said that in RNM has many low DII (this rating is based on the percentage share of the number of indicators that meet the required criteria for investing more than 50% of SMEs in relation to the total number of indicators selected). However, in view of the fact that in the domain of e-commerce for all indicators the percentage of realization is very low by SMEs (ranges from 1.1% for EDI sales up to 7.1% for e-commerce), it can be concluded that there is no digital integration of SMEs in RNM.

Conclusion

Digital transformation offers new business opportunities and can fundamentally change business models. However, it affects the whole value chain starting from product development to sales. It requires an enterprise-wide change which is driven by digital technologies. The transformation process must be integrated into every aspect of the company.

In this paper integration of digital technology was considered, through two aspects: business digitalization and e-commerce. The key indicators of business digitization are selected: having a website or homepage, using any social media, having ERP software package to share information, fastest broadband connection is at least 30 Mb/s, buying medium-high Cloud Computing services, having CRM software for managing information about its clients and having CRM software for analysing information about its clients for marketing purposes, while the key indicators of e-commerce are: e-sales, web sales, EDI sales, customer type sales (B2C, B2B and B2G) and percentage of web sales in total sales (= /> 1). Given the fact that only for two of the seven key indicators more than 50% of SMEs have invested in, it can be said that RNM has a significantly low number of DII. However, in view of the fact that in the e-commerce domain for all indicators the

percentage of realization by SMEs is very low, it can be concluded that there is no digital integration of SMEs in RNM.

Given the fact that great importance is being attributed to digitalization for businesses competitiveness and economic growth, the digital transformation of the SMEs sector needs to be further promoted in NRM. Policymakers need to shift their efforts from SMEs computerisation initiatives towards SME digitalisation progressively. A new paradigm is needed to go beyond just computerisation towards digitalisation. Appropriate funding needs to be allocated towards digitalization and a national effort needs to be made to drive SMEs to the next level of innovation and productivity.

SMEs need to educate themselves and be informed about digital transformation and what this means for enterprises. They should invest in influential software of the overall business, and take advantage of cloud services and e-commerce to improve productivity and market share.

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**IS TRANSITION TOWARDS A SUSTAINABLE EES IN
NORTH MACEDONIA POSSIBLE TILL 2021
THROUGH IMPLEMENTING ECONOMIC REFORM
POLICIES?**

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Abstract:

Since its independence in 1991, R. Macedonia (since February 2019 the official country name is changed to R. North Macedonia) has signed and ratified major international energy sector documents such as Energy Charter Treaty, Energy Community Treaty, and the UN Framework Convention on Climate Change and Kyoto Protocol, which led to important changes in the energy-related national legislation. In January 2019, the Government of R. Macedonia adopted the Economic Reform Program 2019-2021. This program includes two important measures relevant to the electro-energetic system (EES): (M1) increasing the competitiveness of the electricity market, and (M2) promotion of renewable energy sources and energy efficiency.

The main issue analyzed herein is, whether the implementation of the afore-mentioned measures can and will assist the transition towards sustainable energy sector? By means of multi-attribute analysis with the following proposed attributes (technology, available funding, national legislation, institutional capacity, and infrastructure) in this paper, analyzed is what decision-makers should focus on when realizing the two above mentioned measures.

SWOT analysis, as a structured planning method, is applied to analyze strengths, weaknesses, opportunities, and threats arising from implementing the above mentioned two measures aiming to facilitate, promote and achieve sustainable development.

The gained results from this analysis have the potential to contribute in defining new national policies and strategies assisting smooth transition towards sustainable national EES and indicating areas where essential capital investments have to be realized. Moreover, the analysis addresses the capacity building needs for further implementation of the Economic reform program 2019-2021 that supports and facilitates transition towards a more sustainable national EES.

Key words: Multi-attribute analysis, SWOT analysis, energy policies, energy strategic planning, electro-energetic system (EES)

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1. Introduction

As a candidate country for membership in the European Union (EU), R. North Macedonia⁵ is facing the challenges of harmonizing its legislation with the corresponding EU Directives and complying with the Stabilization and Association Agreement^{6,7}. As a signatory to the Energy Charter Treaty⁸ and the Energy Community Treaty⁹, the country is further focused on harmonizing the national energy legislation with EU *acquis communautaire* with regard to the energy sector, environment, renewable energy sources (RES), energy efficiency (EE), and oil reserves.

As per the European Commission reports^{10,11,12}, since 2015 the country has made good progress in complementing the national legislation in line with the Third Energy Package¹³, but the obligations under the Energy Community Treaty⁸ are still not completely implemented. One of the main challenges in the transposing process was the opening of the electricity market. In April 2014, the electricity market for medium-size consumers was opened, while the full opening for all consumers, including the households, was scheduled for January 2015¹⁴. Nonetheless, for the time being, the country failed to fulfill the Energy Community's eligibility rules by postponing the full opening of the electricity market until 2020, preventing households and several categories of small consumers to solely choose a supplier¹⁵.

A major step towards transposing the Third Energy Package¹³ was made in May 2018, when the Assembly of the R. Macedonia⁵ adopted the new Energy Law¹⁶. In accordance with this, from the middle of 2019, a "*universal supplier*" is established (the license for universal supplying is valid for 5 years), responsible for the electricity supply of households and small enterprises. This "*universal supplier*" will be an "*electricity supplier of last resort*" for the households and small enterprises, under reasonable and clearly comparable and transparent prices set by the Energy Regulatory Commission (ERC). It shall also act as an "*electricity supplier of last resort*" for the big companies on the free electricity market but with different prices¹⁷. The Energy Law¹⁶ meets the necessary conditions for opening the electricity market and is complementary with the Third Energy Package¹³, incorporating

⁵since February 2019 the official country name is changed from R. Macedonia to R. N. Macedonia

⁶Stabilization and Association Agreement between the European Communities and their Member States, on one part, and the Former Yugoslav Republic (FYR) of Macedonia, on the other part, available at: https://eur-lex.europa.eu/resource.html?uri=cellar:3ce414a8-cc67-4879-a8cc-17b9c4745465.0007.02/DOC_1&format=PDF

⁷ Authors' comment: Since this paper includes referencing of numerous agreements, treaties, EU Directives, international and national laws and bylaws, all such references are cited as footnotes. The remaining scientific and research references are cited in the section References.

⁸The International Energy Charter – Consolidated Energy Charter Treaty with Related Documents, available at: <https://energycharter.org/process/energy-charter-treaty-1994/energy-charter-treaty/>.

⁹Treaty establishing Energy Community, available at: <https://www.energy-community.org/legal/treaty.html>.

¹⁰ Commission staff working document - The FYR Macedonia 2016 Report. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2016 Communication on EU Enlargement Policy

¹¹Communication staff working document - The FYR Macedonia 2018 Report. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2018 Communication on EU Enlargement Policy

¹² Communication staff working document – R. N. Macedonia 2019 Report. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2019 Communication on EU Enlargement Policy

¹³Internal Energy Market – European Parliament, available at: http://www.europarl.europa.eu/ftu/pdf/en/FTU_2.1.9.pdf.

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¹⁵Annual implementation report 2015/2016 – Energy Community Secretariat

¹⁶Energy law of the R. Macedonia, Official Gazette of the R. of Macedonia, No. 96 from 28.05.2018

¹⁷ Statement on security of energy supply, available at: https://www.energy-community.org/dam/jcr:86a92591-222c-4a85-b15e-cdf25e8176a5/SoS_MA_%202019.pdf

Directive 2009/72/EC¹⁸ on the common rules for the internal market in electricity for providing competitive, secure and environmentally sustainable electricity market. Directive 2009/28/EC¹⁹ on promoting the use of energy from renewable sources is fully aligned in the Energy Law¹⁶. In April 2017, the Government of R. Macedonia adopted an Action Plan amending the National Renewable Energy Action Plan (NREAP) till 2025²⁰, which is in line with the new target for a 23% share of RES by 2020, established by the Energy Community²¹.

In order to implement the obligations under the Energy Community Treaty⁹ in terms of EE, R. Macedonia has drafted a Law on EE²². Within this Law²², transposed were the Directive 2012/27/EU²³ on EE, the Directive 2010/31/EC²⁴ on the energy performance of buildings and the Regulation 2017/1369²⁵ on the establishment of a framework for indicating energy consumption. The aim of this Law²², which is expected to be adopted by the end of 2019, is to implement policies and measures included in the Third National Energy Efficiency Action Plan (NEEAP)²⁶.

As the electricity consumption demand has overtaken domestic supply, while currently, R. North Macedonia is facing limited electricity generation capacities, the country is becoming highly dependent on electricity imports (approx. 31%²⁷). Furthermore, the current condition of electricity infrastructure requires investments for its refurbishment, as well as, for the construction of new facilities. According to energy sector transition indicators developed by the European Bank for Reconstruction and Development (EBRD), on the scale from 1 to 5, R. North Macedonia has a score 3 in terms of power, and score 2+ in terms of sustainable energy²⁸. Thus, in the following period, the country has to perform an energy transition in terms of a more sustainable energy generation mix, as well as, in terms of strengthening energy security and rational energy consumption. In January 2019, the Government of R. Macedonia adopted the Economic Reform Programme (ERP) 2019-2021²⁹. This program includes two important measures relevant to the energy sector: (M1) increasing the competitiveness of the electricity market, and (M2) promotion of RES and EE.

The aim of this paper is, via applying Multi-Attribute Analysis (MAA), in particular, SWOT Analysis, to examine whether the implementation of the afore-mentioned measures can and will assist the transition towards a more sustainable electro-energetics system (EES). In the context of the planned

¹⁸Directive 2009/72/EC of The European Parliament and the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF>.

¹⁹Directive 2009/28/EC of The European Parliament and the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF>.

²⁰ Action plan amending the action plan for renewable energy sources of the R. Macedonia to 2025 with vision to 2030, adopted on 21.04.2017 by the Government of R. Macedonia, available at: https://www.energy-community.org/implementation/North_Macedonia/reporting.html

²¹ Decision of the Ministerial Council of the Energy Community - DI2018I2IMC-EnC: amending Decision 20121041MG-EnC of 18 October 2012 on the implementation of Directive 2009/128/EG and amending Article 20 of the Energy Community Treaty.

²² Law on Energy Efficiency (Draft version), published on 29.11.2018 by the national Ministry of Economy, available at <http://economy.gov.mk/doc/2500>

²³ Directive 2012/27/EU of The European Parliament and the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:en:PDF>.

²⁴ Directive 2010/31/EU of The European Parliament and the Council of 19 May 2010 on the energy performance of buildings, available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>.

²⁵ Regulation (EU) 2017/1369 of The European Parliament and the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R1369&rid=1>.

²⁶ Third National Energy Efficiency action plan, adopted on 18.07.2017, available at: <http://economy.gov.mk/doc/2110>

²⁷ Energy Regulatory Commission – Annual report 2018

²⁸ EBRD – Transition indicators by sector, available at: <https://www.ebrd.com/what-we-do/economic-research-and-data/data/forecasts-macro-data-transition-indicators.html> (accessed 09.09.2019)

²⁹ Economic reform programme 2019-2021, available at https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/north_macedonia_erp_2019-2021.pdf

ERP, the herein performed analysis addresses the crucial attributes which have the potential to either foster or impede the transition towards a more sustainable EES.

2. SWOT Analysis

SWOT analysis, as a structured planning method is used to evaluate strengths, weaknesses, opportunities, and threats involved in a certain project or in a business venture (See **Figure 1**) which are the focus of the analysis. As the analysis identifies and specifies the internal and external attributes that are valuable and harmful to achieving the objective, it is considered as a method for conducting MAA. Decision-makers can assess to which degree there is a strategic fit between internal (strengths and weaknesses) and external (opportunities and threats) characteristics of the study objective.

The SWOT analysis is applied to a variety of energy researches regarding regional energy policy, strategic energy planning, and renewable energy policy. Specifically, there have been several examples of successful application of SWOT analyses when studying RES (Iglinski, Buczkowski, Iglinska, Cichosz, & Plaskacz-Dziuba, 2015, pp. 143–157), (Lupu, 2016, pp. 1–11) and sustainable energy development (Markovska, Taseska, & Pop-Jordanov, 2009, pp. 752–756). The application of SWOT analysis is expanded to assess renewable energy policies and development on a national level (Chen, Kim, & Yamaguchi, 2014, pp. 319–329), as well as for strategic energy planning on a local level (Terrados, Almonacid, & Hontoria, 2007, pp. 1275–1287).

Here in, the SWOT Analysis is implemented via mapping it over the main focus of this paper, i.e. assessing whether the implementation of the two ERP measures (M1, M2) can and will assist the transition towards a more sustainable EES (Figure 1).

Strengths	Weaknesses
internal attributes that either facilitate or assist the country transition towards a sustainable EES.	internal attributes that impede the transition process towards a sustainable EES.
Opportunities	Threats
external attributes and potential prospects for the country that can smooth the progress towards a more sustainable EES.	external attributes that jeopardize the system reliability. Those attributes are beyond the control of the system boundaries and prove to be a risk to system stability and sustainability.

Figure 1: SWOT matrix w.r.t. assessing the two ERP measures (M1, M2) towards a more sustainable electro-energetic system (EES)

3. Case study: The Macedonian Electro-energetic System (EES) Transition towards Sustainability

3.1. Status–Quo of the Macedonian electro-energetic system

The EES in R. North Macedonia consists of electricity production plants, electricity transmission systems, electricity distribution systems, consumers having the right to participate independently on the electricity market, as well as small electricity consumers and households²⁷.

The domestic electricity generation capacities consist of different types of power plants. **Figure 2** gives an overview of the power generation plants and their share in the total installed electricity generation capacity. Compared with 2017, in 2018, the newly operating 4 small hydropower and 5 photovoltaic plants²⁷ resulted in a slight increase (by 5.71 MW) in the total installed capacity.

The R. North Macedonia is facing a limited potential for domestic electricity generation, predominantly coal-based. Therefore, currently, the EE highly relies on electricity imports. The domestic electricity demand is covered by domestic electricity production plants (around 70%²⁷), while the rest is coming from imports (around 30%²⁷). Domestic electricity production has a slight increase from 1.29% compared to 2017 and it is mainly due to the increase in electricity production in hydropower plants.

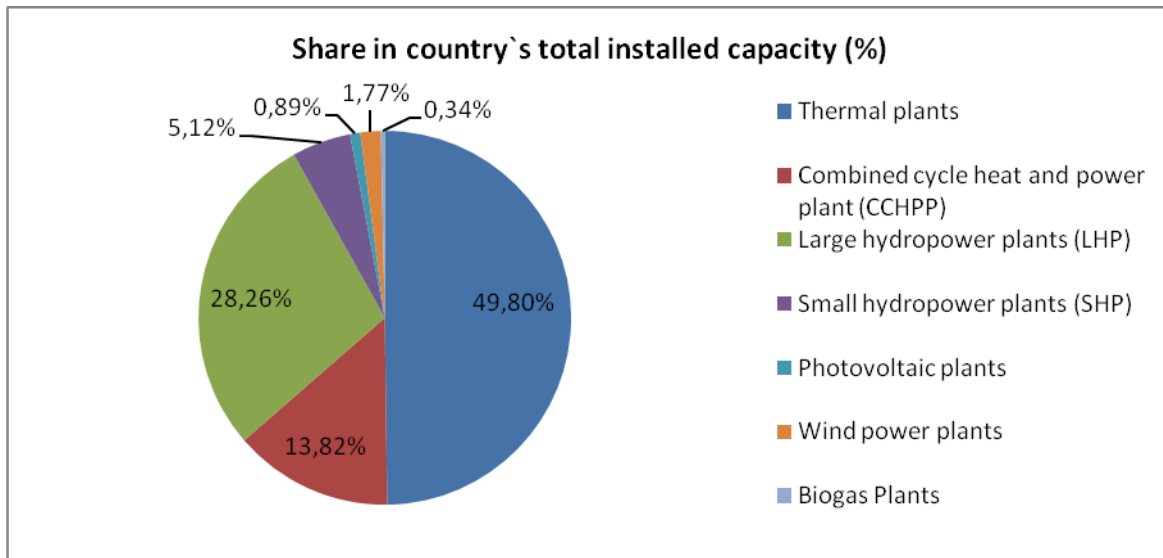


Figure 2 - Electricity production plants and their share in the total Macedonian installed electricity generation capacity (%)²⁷

Although in 2018, there is a decrease in electricity production from thermal power plants (TPP), the coal-based plant's contribution to the national energy mix is the highest. As per the World Energy Council's (WEC) Energy Trilemma Index³⁰, the country is ranked 63 with a balanced score BCB (AAA is being the best and DDD is being the worst). Through this Index, countries are rated for their ability to provide sustainable energy, considering the 3 dimensions: Energy Security, Energy Equity, and Environmental Sustainability.

3.2. The role of the Economic reform program 2019-2021 for the transition towards a sustainable electro-energetic system

Based on the identified microeconomic weaknesses, the R. Macedonia in collaboration with the European Commission and the OECD developed the ERP²⁹ 2019 – 2021 in order to provide support in shaping economic governance through identifying and addressing key economic obstacles for sustainable growth³¹. In line with the Sustainable Charter³² signed within the Western Balkans Summit (WB6) in 2016, the ERP includes two measures relevant for the electro-energetic system: (M1) increasing competitiveness of the electricity market and (M2) promotion of RES and EE. In the following section, via SWOT analysis, analyzed is what decision-makers should focus on when striving to achieve the two ERP measures (M1, M2). Thereby, considered is a set of decisive/influential

³⁰ World Energy Council (2018) - Energy Trilemma Index, available at: <https://trilemma.worldenergy.org/#!/country-profile?country=United%20Kingdom&year=2018> (accessed 09.09.2019)

³¹ Competitiveness in South East Europe – A policy outlook 2018, available at: https://www.oecd-ilibrary.org/development/competitiveness-in-south-east-europe_9789264298576-en

³² Western Balkan Sustainable Charter, available at: https://www.diplomatie.gouv.fr/IMG/pdf/sustainable_charter_joint_final_cle4a33b9.pdf.

attributes (national legislation, institutional capacities, infrastructure, available funding, market circumstances, training, knowledge, and technology, etc.).

3.2.1 M1: Increasing competitiveness of the electricity market

The pre-liberalization energy sectors in many countries, including R. North Macedonia were characterized by vertical integration demonstrating monopolistic behavior, poorly regulated prices, and unreliable infrastructure that contributed to their uncompetitiveness and unattractiveness to private investments. On the other hand, the highly competitive markets typically facilitate access to many participants, demand minimal governmental intervention in price setting and have a reliable infrastructure.

Figure 3 presents the SWOT matrix identifying crucial areas where decision-makers should put their focus to provide greater competitiveness on the internal electricity market, i.e. facilitating M1 implementation.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Legislation (Energy Law) • Unlocked universal supplier for small consumers and households • Full electricity market liberalization • Intraday, and day-ahead markets • Competitiveness in energy pricing • Over 10 years of experience in liberalized electricity markets 	<ul style="list-style-type: none"> • Weak institutional capacities • Only formal unbundling of the electricity market • Inability to achieve liquidity in isolated mode • Infrastructure quality • Interconnection transmission capacities • Lack of innovation and technology
Opportunities	Threats
<ul style="list-style-type: none"> • Prospective Governmental policies and initiatives to improve electricity accessibility and availability (s.a. boosting economic growth, increasing employment, decreasing energy poverty, increasing competitiveness in the electricity supply for final consumers, etc.) • Implementation of Capacity Allocation and Congestion Management (CACM) Regulation as a precondition for quick connection to neighboring organized electricity market 	<ul style="list-style-type: none"> • Good governance and Rule of Law • Political uncertainty and instability • Electricity import dependency • Commodity price volatility • Uncertain national/governmental sources of financing • Depletion of fossil resources for electricity production • Lack of domestic electricity generation capacities

Figure 3 - SWOT matrix for increasing competitiveness of electricity markets (M1) in the Macedonian EES

3.2.2 M2: Promoting RES & EE measures

Promotion of RES and EE in the R. N Macedonia is essential for achieving national sustainable development. Considering the constant global pressure for reducing utilization of non-RES, on one side, and the national economy's reliance on electricity, as the most used energy commodity in industry (State statistical office of R. Macedonia, 2012) on the other, diversifying the energy mix via expansion of RES has a considerable potential to improve competitiveness of the EES and thus to contribute to a more sustainable national economy. Furthermore, the country's energy intensity is higher than the average among EU member countries³¹, indicating a significant potential for EE gains across the national economy. **Figure 4** represents the related SWOT matrix for M2 where important improvement areas in the current EES are emphasized.

Strengths <ul style="list-style-type: none"> • Legislation (Energy Law, and Law on EE) • Governmental subsidies and incentives for RES & EE • Country's potential for RES (hydropower, wind, solar energy) & EE 	Weaknesses <ul style="list-style-type: none"> • Transmission grid limitations regarding RES • Limited deployment of RES • Low public awareness and education on RES & EE • Lack of innovation and technology advancement in relation to RES & EE • Lack of expertise/know-how in RES & EE
Opportunities <ul style="list-style-type: none"> • Prospective Governmental policies and initiatives to improve RES & EE applicability, accessibility, availability (s.a. economic growth, new employments, ESCO companies, public-private partnerships, etc.) • Rising rates of investment in RES & EE; • International subsidies, funding opportunities • Increased adoption of innovative and energy-efficient technologies • Improvement of air quality • Fewer expenditures in Health Insurance Funds 	Threats <ul style="list-style-type: none"> • Political uncertainty and instability • Political and economic (in)dependence of the ERC • Growing demand for electricity • Delay in establishing an EE Fund • Lack of funding for new generation capacities • Electricity import dependency • Stochastic nature of RES • Lack of institutional capacities

Figure 4 - SWOT matrix for Promotion of RES and EE (M2) in the Macedonian EES

4. Results and Discussion

As an EU accession country, R. North Macedonia is obliged to implement reforms in the energy sector and thus to adopt and implement a set of **laws and regulations related to the energy sector governance and regulation** aligned with the requirements of the EU Third Energy Package¹³. Good governance and a strong set of regulatory institutions strengthen the energy sector liberalization³¹. In

that sense, as a national institution contributory in policy formulation, implementation, and monitoring, a strong and independent ERC plays a decisive role.

However, in the past few years, as a result of political uncertainty and instability, the transition towards a transparent and liberalized energy market, through reforms in laws and regulations, generally is moving slowly. Moreover, continuous political turmoil strongly influences security, stability, availability and the readiness of the EES to function properly.

Adequate institutional and administrative capacities are a prerequisite for effective implementation of the energy sector reforms. Institutions have a wide range of responsibilities, s.a. to accomplish requirements for electricity demand and investment, to secure efficient and flexible system operation able to respond to new technologies, etc. Regrettably, a major weakness of the Macedonian energy sector, recognized in various assessment reports^{11,12,14,31}, is the weak and inadequate institutional capacities that limit the country's ability to implement compliant legislation. National institutions, not related only to the EES but to the energy sector in general, should focus on building strong institutional capacities that pose capabilities and are apt to respond to the dynamic nature of the EU energy policies.

Having the above in perspective, a fully operable and stable national legal system reinforced with adequate and applicable legislation and regulation, in both M1 and M2, are classified as Strengths although they have the potential to slide to the Weaknesses side once political instability takes over. Especially since they have a direct impact on facilitating adequate institutional and administrative capacities, which is why this category still remains among the weaknesses.

4.1 Measure 1

As a net electricity importer, the country's major concern is to provide constantly available electricity at affordable prices. All energy imports expose the country to risks outside its jurisdiction, thus electricity imports are commonly valued as negative for the security of supply (Månsson, Johansson, & Nilsson, 2014, pp. 1-14). In addition, the security of supply requires long-term sustainability of energy infrastructure in parallel with substantial infrastructure investments, thus both attributes are identified as weaknesses in the transition towards a sustainable EES.

Transmission and distribution systems, particularly in the rural areas are still vulnerable due to under-investments and low maintenance of the energy infrastructure. As per the national legislation and the current governmental policies, the country is committed (1) to foster advancements in the existing energy infrastructure, (2) to facilitate progress in the regional connectivity (notably in developing electricity transmissions inter-connector with Albania contributing to integrate R. North Macedonia into the pan-European networks), while in parallel (3) to provide increased diversity and security of supply and (4) to assist increasing long-term competitiveness and stability of the electricity market.

With regard to the purchasing power standard, average prices for industrial consumers in R. North Macedonia are higher than the country average in the EU member states³¹. The limited gas availability results in primer industry reliance on electricity (State statistical office of R. Macedonia, 2012). Nevertheless, relatively competitive electricity prices are the current driver tonational and regional competitiveness. But if they become uncompetitive, potential investors might receive a negative signal for investments, in particular due to the limited energy access for both industrial and domestic consumers.

4.2 Measure 2

The country has a strong potential for RES, in particular, hydropower, wind, and solar energy, especially due to favorable wind speeds in many locations and the high solar irradiation values^{31,33}. As per the stochastic nature of the wind, installed wind capacities should readily be compensated by other sources, which under current circumstances (limitations of the transmission and the distribution system) is one of the obstacles in terms of their wider deployment³⁴. The abundant solar and wind resources together with the decreasing investment costs for these technologies indicate that they can be an economically feasible alternative to TPP and Combined Cycle Heat and Power Plants (CCHPP). However, the currently installed capacity of these technologies remains very low (See **Figure 2**). One of the origins of this might be the lack of true subsidies for RES & EE measures, as well as the low institutional capacities to use the ready IPA and other similar EU funding instruments.

In R. North Macedonia, the major weakness is the lack of awareness among the public and private sectors for the need for EE and the use of RES. As per the Organization for Economic Co-operation and Development (OECD), the awareness-raising within the country was assessed with a score 1.5 (1 lowest – 5 highest score)³¹, which indicates that the country has already started the process of developing awareness-raising strategies and action plans, but faces significant challenges during implementation. In terms of infrastructure development, as a precondition for RES, it is important to outline that policymakers should be more active and focused on decreasing the influence of the subjective political factors, which often dominate over the objective indicators such as *infrastructure development* (Mladenovska, Lazarevska, & Lekoska Bimbiloska, 2018, pp. 86-96).

In line with the Sustainable Charter³² signed within the Western Balkans Summit (WB6), R. Macedonia has committed itself to introduce market-oriented support mechanisms for the promotion of RES (auctions and feed-in premiums). The support scheme based on a feed-in premium is expected to be introduced once the day-ahead trading platform is established. Through “*Feed-in-tariffs (FITs)*”, the public energy supplier is obliged to pay an agreed tariff³³ for the electricity generated from RES.

The 3rd NEEAP²⁶, adopted in July 2017, identifies the priorities for achieving the indicative savings target by introducing measures in the most important sectors such as the public sector, industry, commercial, energy, and transport sectors. Since Macedonia has an energy-intensive industry, a systematic approach in implementing EE measures could contribute towards significant energy savings. In terms of new RES generation capacities, lack of institutional capacities, political uncertainty, and instability, as well as the rule of law could be noted as major constraints, especially for public-private partnerships in this sector.

5. Conclusions

Energy policy which delivers a reliable, environmentally sustainable energy supply at efficient prices enhances productivity and thereby advances the competitive potential of the entire economy. The electro-energetic reform is an ongoing and intense challenge especially when it aims sustainability. It will require sustained and continuous political and institutional will if the economies are to achieve

³³3rd N. Macedonian progress report on the promotion and use of RES. Ministry of Economy. Skopje. R.N. Macedonia, May 2019.

³⁴Macedonian Academy of Sciences and Arts. (2010). Strategy for Energy Development in the Republic of Macedonia until 2030. Ministry of Economy. Skopje, Macedonia

both national and regionally shared objectives by implementing the adopted legislative and regulatory frameworks. The transition towards a sustainable EES in R. North Macedonia requires solid institutional capacities, skilled professionals, and significant transfer of know-how. It must be performed systematically, by means of comprehensive and transparent procedures and having in prospects the optimal cost-effective and environmentally-friendly solutions. Besides the economic growth, the transition will in parallel contribute towards wider environmental and social recovery. So, this paper addresses a major challenge for an admissible sustainable energy sector by identifying relevant attributes which affect the transition towards a more sustainable EES and their interrelation in the SWOT matrix.

Furthermore, this paper reveals where the main focus of the decision-makers should be in order to achieve mitigating weaknesses and threats, and their transforming into strengths and opportunities. In addition, this paper points out attributes which, in the absence of a coordinated and focused approach, have the potential to transform from strengths and opportunities into weaknesses and threats.

Thereby, since the energy infrastructure is highly capital intensive, a stable and predictable legal framework is a serious precondition for facilitating new investments required in M2 (RES & EE). In terms of M1, as trading with energy commodities is a high-income business, governmental policies and the Rule of Law are pointed out as very important in preventing mismanagement and corruptive behavior, thereby.

Having the afore mentioned in perspective, it may be concluded that the ERP (2019 – 2021) is a solidly paved road for further actions in the EES as part of the Macedonian energy sector. However, considering the current institutional, knowledge-based and investments limitations (from the beginning of 2019³⁵) it is unlikely that the ERP (2019 – 2021) shall be implemented in accordance within the projected timeframe.

List of Abbreviations, Acronyms, and Symbols

EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EES	Electro-Energetic System
ERC	Energy Regulatory Commission
EU	European Union
FITs	Feed-in-Tariffs
MAA	Multi-Attribute Analysis
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
OECD	Organization for Economic Cooperation and Development
RES	Renewable Energy Sources
SWOT Analysis	Strengths, Weaknesses, Opportunities, and Threats Analysis
WEC	World Energy Council

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DIGITAL TECHNOLOGIES AS TOOL FOR INCREASING THE COMPETITIVENESS OF THE HANDICRAFT INDUSTRY

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Abstract:

The development of Information and communication technologies (ICT) results in the disruption of the way the businesses are conducted today. They change and shift the access and mode of participation in the global marketplace. Through the establishing of P2P e-commerce model between producer/seller and consumer/customer, ICT facilitates access to the global marketplaces and enables participation of the customers in the content creation and facilitates the promotional activities. The paper is focused on the influence of digital technologies on the development opportunities of the handicraft producers – individual artisans or SMEs. Through the analysis of the opportunities provided by the online markets for handicrafts, the paper tries to explain and to suggest the entire transformation of the handicraft businesses. It is focused on the online tools enabling the handicraft producers to approach and to engage in the global markets for handicrafts. The results of the analysis suggest the opportunities that online markets provide to the handicraft producers in improving their competitiveness.

Key words: *handicraft producers, digital technologies, online markets, competitiveness*

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Introduction

Creative industries represent one of the most important driving forces of today's global economy. The contemporary economy emphasizes the importance of individual knowledge, creative approach for the innovation and application of digital technologies in economic development. In this context the UN Report on Creative Economy in 2008 has stated: "the interface among creativity, culture, economics, and technology, as expressed in the ability to create and circulate intellectual capital, has the potential to generate income, jobs and export earnings while at the same time promoting social inclusion, cultural diversity, and human development. This is what the emerging creative economy has already begun to do as a leading component of economic growth, employment, trade, innovation and social cohesion in most advanced economies" (UNCTAD, 2008)

Creative industries like handicrafts are vibrant sectors of the global economy. Better access to ICT, new digital technologies and dynamic shifts to new lifestyles associated with creative products, makes the trade-in this sector a promising avenue for future growth (Malkawi, 2007).

The Internet facilitates electronic business transactions both, nationally and internationally by enabling businesses to have easy access to a large consumer base at lower costs. Digitalization enables firms, especially smaller ones to use new and innovative digital tools to overcome barriers to growth, helping facilitate payments, enabling collaboration (OECD, 2019). The Internet is profoundly affecting almost all businesses. The various uses of the Internet by business entities include the ability to advertise, generate or otherwise perform regular business functions (Malkawi, 2007).

Digital technologies enable easier content creation and facilitate interaction among users. Social media has helped handmade goods platforms to mushroom, leading to the growing popularity of handmade products. Online platforms have provided the artisans/crafters with a channel through which they can share and spread their ideas without the need for a substantial investment. As economies undergo structural changes and shift toward more self-employment, handmade goods' share of online sales may increase dramatically.

The rapid and continuous development of e-commerce and the growing share of cross-border e-commerce are indisputable. E-commerce shapes the future of trade as it expands the market available for consumers and companies. Internet through big digital platforms links buyers and sellers, contributing to market transparency.

E-commerce, as the future of commerce, is becoming a tool and media for growing cross border trade. The paper provides insight into the global handicrafts' online markets. Thus, the first section will be presented some theoretical aspects referring to the influence of e-commerce on the possibilities for the development of the business and economy. Then, it follows the analysis of the importance and development of the handicraft industry in today's global economy. The central point of the research is the examination of the online marketplace for handicrafts and opportunities for the competitive strengthening of the crafters. In the final section, it will be suggested conclusions for the importance of digital technologies in the enhancement of handicraft businesses.

Theoretical background

Digital technologies have changed the way the economies are conducted at all. E-commerce represents an application field of ICT by which the sellers can offer products and services and the customers can order products using the internet as a platform representing a unique market. It refers to digitally enabled commercial transactions between and among organizations and individuals (Laudon and Traver, 2017). According to Albastroiu (2007): “In this new economy, knowledge and information have become the main production factors. In this context, innovation and technical progress have a major contribution to durable economic development. The electronic commerce is the key to enterprises’ competitiveness in this informational era, ensuring access to new market segments, increasing the speed of developing business, the increased flexibility of commercial policies, decreasing the provisioning, sale and advertising costs, simplifying the procedures, etc. The impact of electronic commerce upon the companies and upon society will be of great importance both as to the extent and as intensity”.

E-commerce might well embody the future of trade as it expands the markets available for consumers and companies. It results in some countries to adopt measures to encourage the expansion of e-commerce for economic development (WCO, 2018). The internet helps firms to find information more easily about new buyers in overseas markets and to advertise their products, making it easier for buyers to find them, cutting off the costly middlemen usually needed to establish trade connections (Fernandes et al. 2017).

E-commerce especially has opened a gateway of new opportunities for micro, small and medium-sized enterprises to access international markets, find new sources of demand and build value through exposure to new technologies. It is an important component of modern competitiveness (International Trade Centre, 2017).

Internet and digital technology have become a factor of production in almost any activity in a modern economy. The Internet enables very small companies and sole entrepreneurs and artisans to participate in global trade. By lowering information barriers and costs, the Internet gives rise to new opportunities for entrepreneurship and self-employment (World Bank, 2016). E-commerce leverages the cross-border trade and replaces the traditional model of trade.

Online marketplaces enable people and firms to engage in international trade. They represent a touchpoint for firms to promote and sell their products. They reduce the costs and enable the viability of trade, avoiding intermediaries in establishing trade connections or participate in costly trade fairs to market the products. Because of the less expensive nature of the Internet, the start-up costs to a company desiring to have a place on the Internet are minimal (Malkawi, 2007).

Digital technologies are a kind of “technology reemergence” (Raffaelli, 2018) creating new value for handicrafts. The reemergence of the handicraft sector could be put in correlation with the Raffaelli model for technology reemergence of the Swiss mechanical watch industry. Referring to the handicraft industry, technology reemergence of handicraft involves a redefinition of meaning and values of handicraft technology and widening the boundaries of the market for legacy technology.

Handicraft industry has undergone significant changes in any aspect of designing, manufacturing, delivering, marketing, promotion, and funding tools. Handicrafts are also not exempted from global competition and technological advancements (Venkataramanaiah and Kumar, 2011). ICT development has helped in improving efficiency, productivity, visibility and selling of handicraft products worldwide. The Internet is dramatically expanding the opportunities for peer-to-peer (P2P) e-commerce transactions across the borders.

Handicraft as a creative sector is growing and plays increasingly prominent economic and social roles. It can play a major role in community development by creating new jobs as well as fostering an environment that attracts talented workers. The export opportunity of handicrafts can contribute to creating a diversified and sustainable way of creating jobs and creating revenue. E-commerce enables one to exploit the benefits and to realize the full potential and opportunities of handicrafts especially those related to the export opportunities.

Handicraft production as a part of the creative economy has integrated the ICT technologies within the business model. It identifies new uses for technology and adapts to changing consumer behavior and expectations. E-commerce as a business model manages to re-emerge the handicraft industry to the point of sustain healthy business.

Main properties of the handicraft market

The global handicraft market has been an uprising, due to the increasing interest of people in art and culture. Handicrafts refer to products made by hand, with the help of simple tools. Handicrafts are an important productive sector and export commodity for many developing countries. According to (UNESCO, 1997): “Artisanal products or handicrafts are those produced by artisans, completely by hand or with help of hand-tools and even mechanical means, as long as the direct manual contribution of the artisan remains the most substantial component of the finished product. Their special nature derives from their distinctive features, which can be utilitarian, aesthetic, artistic, creative, culturally attached, decorative, functional, traditional and religiously and socially symbolic and significant. They are made of sustainably produced raw materials and there is no particular restriction in terms of production quantity” Handicrafts provide an ideal avenue for creative and independent entrepreneurs, they also offer opportunities for boosting employment. The growth of international markets for home accessory products and an increased interest in global handicrafts have opened up new market opportunities for handicrafts producers (Mahgoub and Alsoud, 2015)

The increasing expansion of online portals has created an opportunity for handicraft products to be more visible and accessible for purchasing. According to the Report for Handicrafts Market (IMARC, 2018), the global handicrafts market reached an impressive value of US\$ 526.5 billion in 2017. Looking forward, the market value is projected to reach approximately US\$ 984.8 billion by 2023, expanding at an annual growth rate of more than 11% in the period 2018-2023 (IMARC, 2018).

The global market for traded art craft goods has exercised an unprecedented dynamism. The magnitude and the potential of the global market for creative industry products are vast. The creative economy in general and the creative industries, in particular, are indeed opening up new opportunities for transition and developing countries to leap into high-growth sectors of the world economy and increase their participation in global trade. According to UNCTAD, on the global level, developing countries have continually been increasing their share in the world market for creative products from 58% in 2002 to 73% in 2015. On the other hand, the export from the developed countries decreases the share from 41.6% to 26.4% in the global trade. Significant growth is noticed in the share of export of transition economies to the market of developed economies. In the same period, the share of the transition economies export in the developed has been increasing from 15.79% to 43.9% (UNCTADstat)

China is the worlds’ leading exporting country of creative goods. China’s ability to supply large volume and wide range of low-cost products have pushed at the forefront of competition. With a whopping \$17.4 billion in export, it controls a 48.7% share in the world market of craft products (Table 1). The second

global player in the crafts export market in Turkey. It shows remarkable growth in the world market share from 2.3% in 2002 to 7.7% in 2015.

Table 1: Tendencies in the share of craft export by countries

Share of craft export in the leading countries in % for the period 2002-2015														
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
China	17.9	19.6	20.5	23.5	26.7	30.0	32.7	33.1	33.6	35.7	40.4	41.1	42.1	48.7
Turkey	2.3	2.7	3.1	3.9	4.2	5.0	5.2	5.5	5.6	6.1	7.2	7.3	7.5	7.7
Hong Kong	15.1	12.4	11.5	10.0	8.6	7.4	6.7	6.1	5.8	5.3	4.9	4.7	4.3	4.9
India	2.9	2.9	3.2	3.6	3.7	3.3	3.1	3.1	3.4	3.0	3.2	3.9	3.8	4.5
US	7.3	6.3	6.4	6.4	5.8	5.1	4.7	4.5	4.3	3.8	3.7	3.5	3.4	3.9
Taiwan	2.6	2.3	3.3	3.0	2.9	2.6	2.4	2.4	2.6	2.6	2.5	2.6	2.6	3.0
Germany	4.0	3.9	3.9	3.8	3.9	3.9	3.8	3.8	3.3	3.5	3.0	2.8	2.9	2.9
Italy	3.8	4.2	4.0	3.6	3.6	3.8	3.5	3.3	3.0	3.0	2.6	2.6	2.7	2.5
France	3.4	3.4	3.4	3.2	3.0	3.1	2.7	2.6	2.1	1.9	1.7	1.6	1.6	1.5
Spain	1.6	1.6	1.5	1.3	1.3	1.5	1.5	1.5	1.3	1.3	1.3	1.2	1.2	1.3
UK	2.2	2.3	2.2	1.9	1.7	1.8	1.5	1.4	1.3	1.2	1.1	1.1	1.1	1.1

Source: Calculated on the database of UNCTADstat

Table 1 reveals the growing share of developing countries in the world trade of craft products. Examining the share of the craft export in the destination economy it can be noticed a slight increase in the share of developed economy's export to the developed economies from 72% in 2002 to 75% in 2015. At the same time, there is an increase in the share of craft export from developing economies to the developing economies, i.e. the share of China's export in craft products is decreasing from 73.5 to 52.9% in the developed economies, but it is increasing in developing economies, from 25.9 to 44.4%.

Based on the value of the handicrafts and the markets they are addressed, the exporting countries can be classified in the high-end market segment, middle-market segment, and low-market segment. Countries like the USA, UK, Italy, Germany, and France have dominance in the high-end market segments and supply high-end value crafts. As major players in the medium value products are identified the former transition economies from the EU and some Asian countries like South Korea, Taiwan, Hong Kong. In the low and medium value products are identified China and India. Almost 90% of Chinese products are completely or partly machine-produced, whereas Indian products are mostly handcrafted and exemplify a high degree of craftsmanship (Frost and Sullivan, 2005).

The top 10 import handicrafts markets involve the USA, Germany, UK, France, Switzerland, Japan, Italy, Canada, and China with Hong Kong. They are accounting for almost 90% of the total world imports of crafts products (Milkin, 2017). US market exercises a steady growth of 11% in handicraft sales in the period 2009-2015. It is an opportunity for new handicraft artisans to penetrate the growing market. EU market is regarded as the second-largest market for handicrafts. According to Eurostat the EU28 market for creative products in 2016 reached €28.8 billion, meaning an increase of 46.2% against 2011.

Handicrafts marketing trends show a growing online distribution. According to the market research of global handicrafts, 35% of total handicrafts sale is conducted online (Technavio, 2015).

Analysis of the online handicraft market

Internet as a disruptive innovation leads to the re-emergence of artisanal goods. It resulted in the explosion of the market of the handcrafted products. According to Downes and Nunes (2014), artisans can now find and serve their tiny, global markets of customers. It would have been impossible for individual artisans to access to these segments in a cost-effective way before the rise of the Internet and electronic communication tools. Digital platforms cut out expensive middlemen and asset-heavy enterprises. The digital platforms like Etsy, fast becoming the leading storefront for handmade products, shows how small products can generate a big bang (Downes and Nunes, 2014). It provides a platform and marketplace tools to connect buyers and sellers, including digital storefronts and buyer-seller rating systems to establish all-important virtual reputations. Handicraft online platforms as niche platforms with well-defined market segments are a very useful and efficient tool for artisans/crafters (RSA, 2014). These kinds of online platforms help producers reach more clients and achieve sufficient scale and income generation.

Online handicrafts marketplaces are peer-to-peer platforms that sell handmade or custom made products, which are usually created by the sellers who are generally artisans and designers. As niche markets, online craft marketplaces provide valuable distribution platforms for self-employed microbusiness entrepreneurs. Online platforms for handicraft goods depend on the growth of online retail and demand for crafted items. Using the Google Trends analysis for the term “handicraft” in Figure 1, it could be found out increasing interest in handicrafts online since 2010.

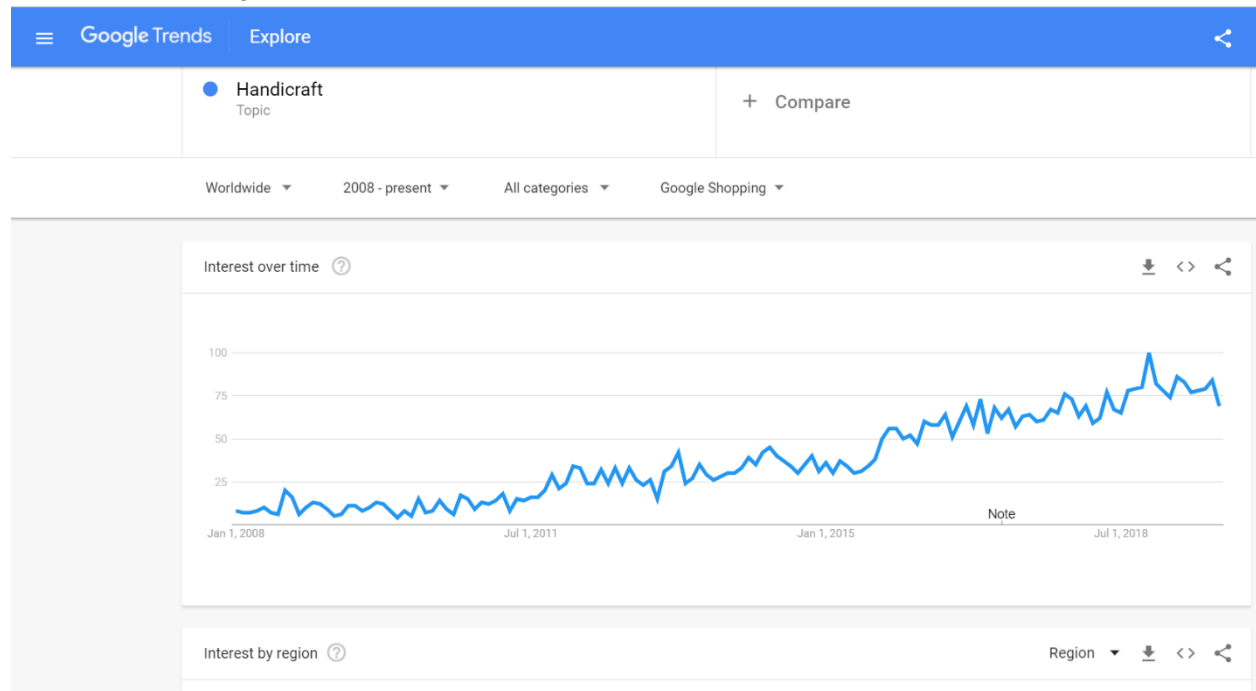


Figure 1: Google Trend analysis for “handicraft”

The online marketplaces for handicraft items are efficient and valuable tools for promotion and make the art products visible to the customers. A large number of new marketplaces have emerged enabling the people to buy and sell handmade items. The appearance and existence of these platforms are partly determined by the influence of Web 2.0 technologies, enabling people not only to be passive consumers of the content on the Internet but also to create it as active participants. Another reason for the rise of online craft marketplaces is the growing popularity of making, selling and buying handmade goods. It has been fueled in part by a new type of makers and in part by consumer desires for more authentic products. The peer-to-peer platforms as main players can be specialized for handmade products or be intended for general merchandizes. Accordingly, the broader definition of online market places concerns P2P online platforms like eBay, Amazon, and Alibaba, but the narrower definition of handicrafts online marketplaces considers the platforms like Etsy, Amazon Handmade, Artfire, Folksy, Dawanda, Zibbet. The handicraft online marketplaces sell unique goods made by individuals or microbusinesses. They are not only the selling point; at the same time, they are kind of “agora or square” of sharing and acquiring a lot of information about the customer’s needs and trends in the product designs.

Etsy is a global creative commerce online platform that builds markets, services and economic opportunities for creative entrepreneurs. Within Etsy markets, users around the world connect both online and offline to make, sell and buy unique goods. Since its launch in 2005, Etsy has become the marketplace for makers and creators. The platform engages in peer-to-peer (P2P) e-commerce model in which both the seller and the buyer are private individuals or micro-businesses (Etsy, 2017). Products are differentiated on the base of the type and price, ranging from art, clothing, jewelry and other decorative objects to arts and crafts supplies. The annual merchandise sales volume through Etsy has been steadily increasing, rising from 170 thousand USD in 2005 to 3.9 billion USD in 2018. (Statista, 2019) Over 2 million sellers service almost 40 million shoppers, with handcrafted goods from all over the world Figure 2 and Figure 3. Etsy is considered as a perfect place and venue to start handicrafts selling.

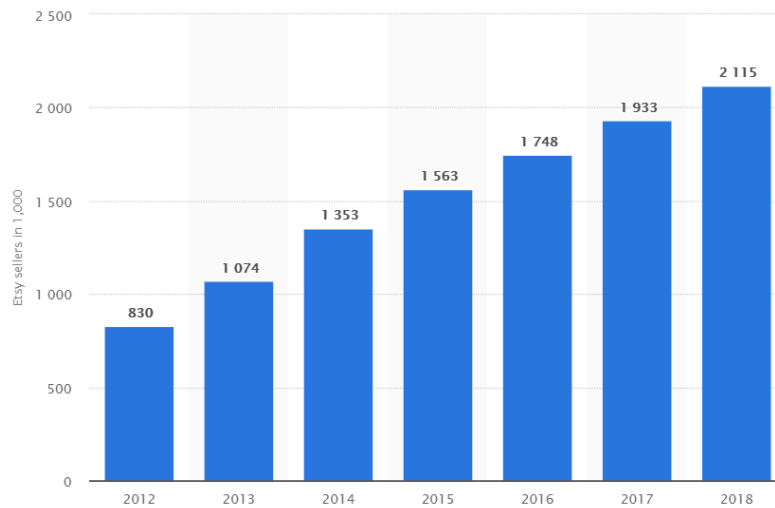


Figure 2: Number of active Etsy sellers in the period 2012 - 2018 (in 1000)

Source: Statista, 2019 <https://www.statista.com/statistics/409374/etsy-active-sellers/>

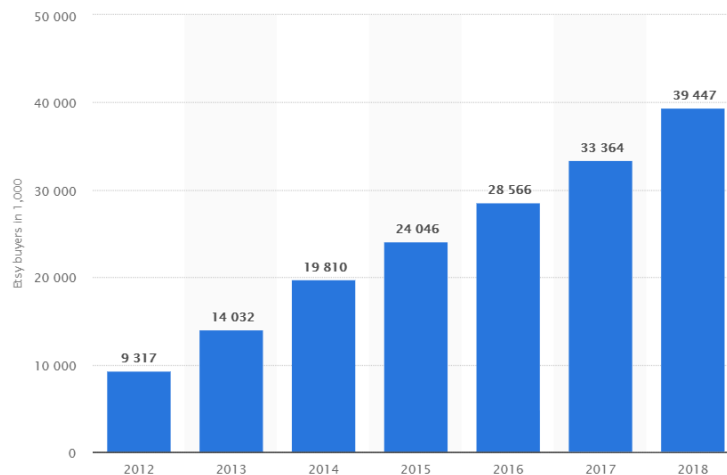


Figure 3: Number of active Etsy buyers from 2012 to 2018 (in 1000)

Source: Statista, 2019 <https://www.statista.com/statistics/409375/etsy-active-buyers/>

Figures 2 and 3 reveal a steady growing trend in the number of active sellers and buyers on the Etsy platform. In 2018, Etsy’s annual gross merchandise sales volume amounted to 3.93 billion USD, up from 314 million in product sales in 2010 (Statista, 2019).

Opportunity for increasing the competitiveness

Digital technologies enable handmade producers to differentiate against machine production. The craftsmanship becomes visible to the huge global market of handicraft products. Digital technologies have dramatically changed the online experience for producers and consumers, especially digital platforms reshape the way the producers and consumers interact and engage with each other as well as online brands. The changes in the digital economy reshape the producers’ strengths and opportunities and the consumers’ behavior in the craft market. The digital technologies influence on the development opportunities of the handicraft producers – individual artisans or SMEs by using e-commerce business model. Leverage of Internet tools like web and mobile platforms enhances the cross-border visibility, selling and delivery of the handicrafts. Digital technology results in the disruption of the business model of handicraft business. The application of digital tools provides new quality in any stage of handicraft production and selling. Digital technologies could be used and influencing the processes of designing, pricing, promoting and delivering the goods.

On that base, it can be shaped like a model of reemerging the competitiveness of handicraft producers Figure 4.

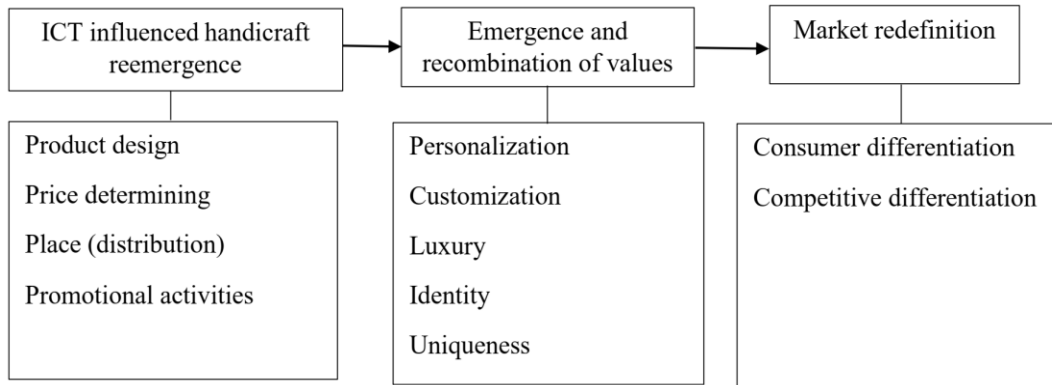


Figure 4: Model of ICT based reemergence competitiveness of handicrafts

Digital technologies empower the crafters to know much more about consumers and to be able to use the information more effectively to segment the market into an endless number of subgroups, each receiving a different price. (Laudon and Traver, 2017).

A wide range of technologies and online tools support handicraft production. Digital tools enable crafters to pursue an innovative approach to designing handicrafts. They offer buyers a choice between ready-made collections and customizable handicrafts. This means not just presenting a finished product, but a range of components that can be assembled into different designs, for instance. Personalization and customization as digital tools are two key elements of the handicraft online business model. Consumers want to design their own products. Designs that can be adapted to individual needs and preferences are growing in importance. Consumers can personalize and customize products based on their own ideas and wishes. Opportunities of the digital platforms enable artisans to pursue a strategy focused on more distinctive designs, higher quality, flexibility in pricing and customization. E-commerce through digital media offers artisans the opportunity to access global markets while maintaining local production (KPMG, 2015)

Interactivity with the customers provided by the digital tools additionally leads to the generation of sale and encourage return visitors. It is a very effective way of creating a relationship with consumers of handicraft products. So the digital platforms as a business model have the mission to create a relationship and engage the customers in designing the product or promotion content. The actual and potential consumers could be mobilized to participate during the designing of the new model or in demonstrating the process of how the handicrafts are crafted

Digital interactivity enables the craftsmanship to be distinguished against the mass manufacturing craft products. Handicraft producers can capitalize on this distinction aimed to shift handmade products toward art. The artisans can redefine the value of handmade products including luxury and craftsmanship, so the consumers could view the products as high-end art rather than commodity good (Raffaelli, 2018).

Through digital platform or web participation, the handicraft producers can recognize that not all customers provide equal value to them. Expansion of consumers' boundaries led handcrafters to differentiate customer preferences within more specific product and price segments. Digital tools enable the handicraft producers to employ distinctive price strategies to different price segments of customers as well as to implement dynamic prices. Price differentiation on high-end, mid and low-end segments enables the crafters to target and position according to the segment value.

Customers' reviews and recommendations are one of the most powerful digital tools since the majority of people trust online reviews. The reviews can drive a 10 to 50% increase in selling (Culinan, 2019).

Promotion strategy plays a major role in distinguishing handmade products and artisans. It entails the channels and media used to communicate and disseminate news, information, entertainment, and promotional messages. Social media creates new potentials for handicraft producers, shifting marketplace by diversifying the production base, expanding international markets and using content and customer comments to attract and encourage new buyers.

Digital technologies referring to the handicrafts are considered as a source of various tools of competitiveness. They enable the creation of competitiveness based on distinctive designs, quality, uniqueness, flexibility in pricing and customization.

Data mining and machine learning existing in P2P platforms help to maintain and analyze the records and data about the needs, preferences, and behavior of individual customers, so the handcrafters can send relevant and personalized information and persuasive communication (Straus and Frost, 2014).

Conclusion

Handicraft online marketplace is dominated by peer-to-peer platforms showing a steady growth of retailing and demand for crafted items. The analysis of the main online marketplaces suggests on the growing visiting and purchasing of handicraft products on the global e-platforms like Etsy.com.

Digital tools like the online platforms are becoming increasingly important especially for small handicraft producers like the artisans. Direct sales of certain types of goods on global markets like the handicrafts can be more viable when they are differentiated, or value-added through digital tools. Digital technologies could be seen as a source for the reemergence of the handicrafts producing micro and small businesses. They enable the creation of new value for handicrafts increasing their competitiveness and market growth.

The digital platforms like market creators or social online platforms offer more export opportunities especially for small, micro or sole entrepreneurs like the handcrafters. They include sophisticated ratings, more viable payment options and guarantees that can provide stronger protection for both buyers and sellers (Parker et al., 2016). Such platforms are becoming increasingly important export facilitation channels for goods like handicrafts. Online craft marketplaces open new pathways into business and promote new ways of doing business, especially to interactions between producers and consumers. Selling through e-commerce platforms opens new perspectives for sellers and consumers. It means that today's competitiveness is not connected only to the price and quality of the products but also to engage the customer in content creation.

By talking with buyers via social media, offering custom-made services and creating goods with authenticity and a personal connection, the sellers show how these changing consumer demands can be met while simultaneously retaining a business model that generates a profit (Dellot, 2014). Digital technologies are considered as a tool to reemerge and achieve new market growth of the handicrafts (Raffaelli, 2018). Instead of being supplanted by automated production, digital technology reemergence has redefined the value of the craftsmanship and boundaries of the market.

Through the model of the reemergence of handmade production as legacy technology, the paper makes visible the process of ICT based redefined competitiveness creation of handicraft products.

E-commerce opens doors and new opportunities for micro and small-sized firms to trade internationally. According to the ITC Competitiveness survey (2017), cross border e-commerce is particularly relevant for micro and small-sized enterprises from developing countries and women-owned or led, reporting the higher share of cross border e-commerce transactions

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SUSTAINABLE BUSINESS IN MODERN TECHNOLOGIES - CONTRIBUTION TO MODERN ECONOMY

Biljana Ilić¹

Abstract:

The development of information technologies is linked with the process of globalization. Information technologies caused that information spread from one region of the world to another at the speed of thought. Just like with any modern thing, in addition to the many advantages it has, it is necessary to take a look at certain disadvantages which can be overcome through time and practice. The paper focuses on the basic elements of e-commerce, pointing to contemporary discoveries and improvements to the business by developing digital or internet economy. As a result, these business styles have changed interpersonal relationships, creating a different dimension in the relationship between society, economy and the environment. The paper places an emphasis on sustainable business through the modern flows of internet or digital economy. Economics summarizes economic processes of business, and modern technologies have greatly facilitated classical business, while enabling easier communication and simpler flows of existence. By making business easier and faster, humanity has also improved the environment by reducing the costs and adverse effects that traditional business activities carried with it. Today, there is a rapid flow of information that is important for business continuity as well as for accelerating various administrative activities. The authors of the paper present three relationships in terms of information technologies, economic and environmental aspects and business sustainability.

Key words: *information technologies, modern e-commerce, business flows, economy sustainability.*

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Introduction

Information technology is part of modern technology development and it has entered in all pores of human life. It can not be possible to imagine the flow of information without using information technology, not anymore. Informatics is one of the youngest but also the most complex discipline of today. Her name is derived from Philip Dreyfus, who composed the first two letters of the French word *information* (enformasion) and the last two syllables of the word *automatique* (otomatic), 1962 (Le Garff, 1973). In German literature, the same term is used, while the word "Informatik" presented Computer Science. Computer science has become an area of education as independent scientific discipline first in the US and then in the Great Britain. By a broader definition, it mainly deals with the technical problems, while in modern economies and society it has gained abbreviated as Informatics (Buer, Gooz, 1976). The French Academy of Sciences (1966.) defines Informatics as follows: "The science of rational processing information, primarily by automatic machines, considering information as bearer of human knowledge and communication in the field of technology, economics and other social sciences". Arsac, J., a French scientist said that he did not consider this young discipline solely related to electronic data organization systems (EDOS), but as much broader and encompasses various other fields i.e. many scientific fields and disciplines (Arsac, 1970). By definition of the Inter - Governmental Bureau of Informatics (Intergovernmental Bureau of Informatics) in Rome, Informatics is a discipline that studies the phenomenon information, information systems and processing, transmission which use information for the benefit of humanity, first and foremost, but not necessarily, with assistance from EDOS. A slightly different definition is: "IT is the science of systematic and efficient information processing, primarily using automatic machines whereby information is considered the medium of human knowledge and communication, in the context of technology, economics and sociology"(Balaban, at al., 2005).

Informatics is considered to be interdisciplinary area which focus is on the study of structure, computer-based interaction of socio-technical systems. Information system can be an organized set of interrelated elements such as people, instructions for processing data, procedures or software, hardware or physical assets, while all of this elements have functions of collecting, processing, storing and distributing data, but also business supporting for major decision-makers. The development of informatics as an interdisciplinary science has helped the development of many modern ways of doing business, interaction among people, a new way of communicating, enriching the knowledge base and dissemination of knowledge, globalization ... Electronic process has emerged from this process business, but also the Internet economy, new disciplines of business and new ways of thinking and sharing information. Modern Economy, has reached a global scale, and has expanded into markets beyond national economies. Large volume of production is characterized for contemporary economy flows and production in a global context.

The man, in his "crazy race" for profit, forgot one essential component that is "the natural environment".

Because of the evidently disaster of natural balance mankind introduced a new concept of activities, Sustainable Development. Although there is no universally accepted and unique definition of sustainable development, most often cited is the one from the Future Reports: "Sustainable development is a development that meets the needs of the present generation without compromising ability of future generations to meet their own needs"(Ilic, Mihajlovic, Karabasevic, 2016) (original definition is from UN Document - Report of the World

Commission on Environment and Development: Common Future, from 1987). Is it possible for humanity to reconcile its rapid development with the capacity of the natural environment and how will be able to operate and generate profits in the future? That is a question that is realistically posed today, and it can be answered on the way: men have to find sustainability at every moment and in every undertaken activity. In the paper, author presents the link between modern technologies and the impact that they have on sustainable business as well as to the sustainability component in the modern Internet economy. E-commerce, i.e. internet economy will be explained in terms of new payment methods as well as its importance for the modern business operations.

Electronic business and models of electronic business

Electronic business have many characteristics, such as: enabling easy and fast communication, instantaneously uploading large data, easily publishing and updating multimedia documents, continuous availability, digital delivering of goods and services, direct payment through the Internet, creating virtual organizations, Electronic business plays an important role in organizational changes, paving the way for new business models, requiring a reconsideration of the basis for its execution. It enabled new business policies, turning traditional business practices and procedures, in new ideas of today's business relation. E-commerce presents a way of organizing business, based on the application of IT (Information Technologies) and Internet technologies. It covers all forms of business transactions i.e. exchange of information obtained by information and communication technologies: between businesses themselves, between businesses and clients on the market and between business and public administration (Mladenović, Jovanović, 2007). E-commerce can be defined as "buying and selling information, products and services via a computer network, supporting any type of business transaction through digital infrastructure. It is a business with no time or space constraints "(Choi, Whinston, 2000). "The more using of modern technologies in business lead to more sophisticated manner of business, to better chances for market creation, governed by the laws, approaching to the perfect or the ideal ways of business. However, at the same time IT increase the risk of trade of different types. Introducing new technologies demand increasing of social and state oversight as well as legal trade regulation" (Jovanović, 1998). Modern business that is conducted on the Internet is not only affects subcontractor i.e. participant of transactions, but also it has impact on the markets structures. Traditional understanding of trading, as well as practice indicate that the links on the market are created through the exchange of products, services and money.

E-commerce, in addition to the classic elements, adds a new one that is information. The online business has evolved into a several different technologies: production driven communication requirements, team based businesses and grouping, logistics business, desktop video conferencing, search and storage, e-mail, electronic data exchange, technical exchange data. Development of the concept of e-commerce is conditional by the influence of economic forces, consumer influence and changes in technology. "By desire to follow high tech trends, in line with the need to integrate the leading technologies of the modern workplace environment, began the process of development and application of modern electronic applications" (Jovanović, Milovanović, Radović, 2002).The e-commerce model is the first identified by IBM, that described it as an enabling business building and implementing a business model in which the catalyst changes growth, and organizational structure depending on jobs. "Model characterized by computerized relationship with partners, electronic response times, virtual structures as well as high levels automation,

contributes to business optimization processes and gaining an edge over the competition”(Stankić, 2008). Electronic business is based on deployment of Internet, Intranet and applications for group work. “Various electronic models can be found in the literature business, such as Zwas's model that differentiates layers infrastructure, core services and supported business functions” (Jae Moon, Norris, 2005). Modeling the relationship between businesses and their clients it is recognized three types of connections: the relationship between customers and business, the connection between business partners and businesses (suppliers), as well as the link between employees and businesses (Derfler, Freed, 2004). Information Communication Technology provides various opportunities to support and enhance existing i.e. building new connections. This support is not limited to quantitative indicators, but also qualitative indicators such as building and maintaining a client relationship management system and businesses. Most commonly, relationship modeling in e-commerce comes down to modeling business-client relationships. That's the way it is common e-business systems: business-to-business (B2B -business to business) and business to client (B2C - business to customer), in practice, systems also meet client-to-client (C2C-customer to customer) and client to company (C2B), B2G (business to government /enterprise - government) and G2C (government to customer). Real-world business processes can be represented by Figure 1(Mladenović, Jovanović, 2007).The two basic e-business models are the business to business model (B2B) and model business to customer (B2C) (Stojanović, 2012) Figure 2 shows the process of modern e - marketing model.

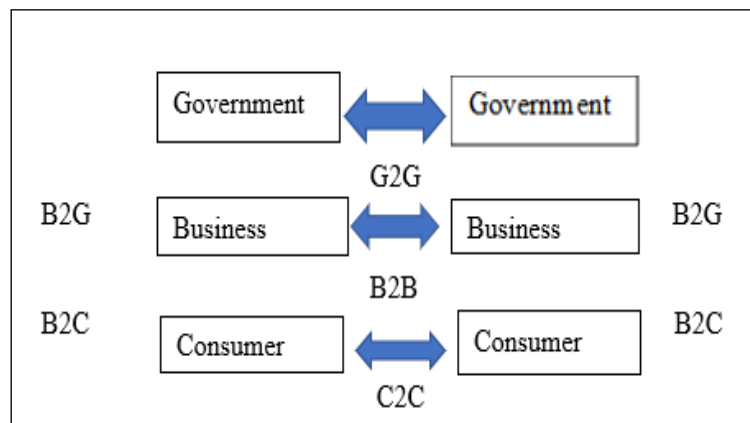


Figure1. Models of E-business
 Source: Electronic business (Mladenovic, Jovanovic)

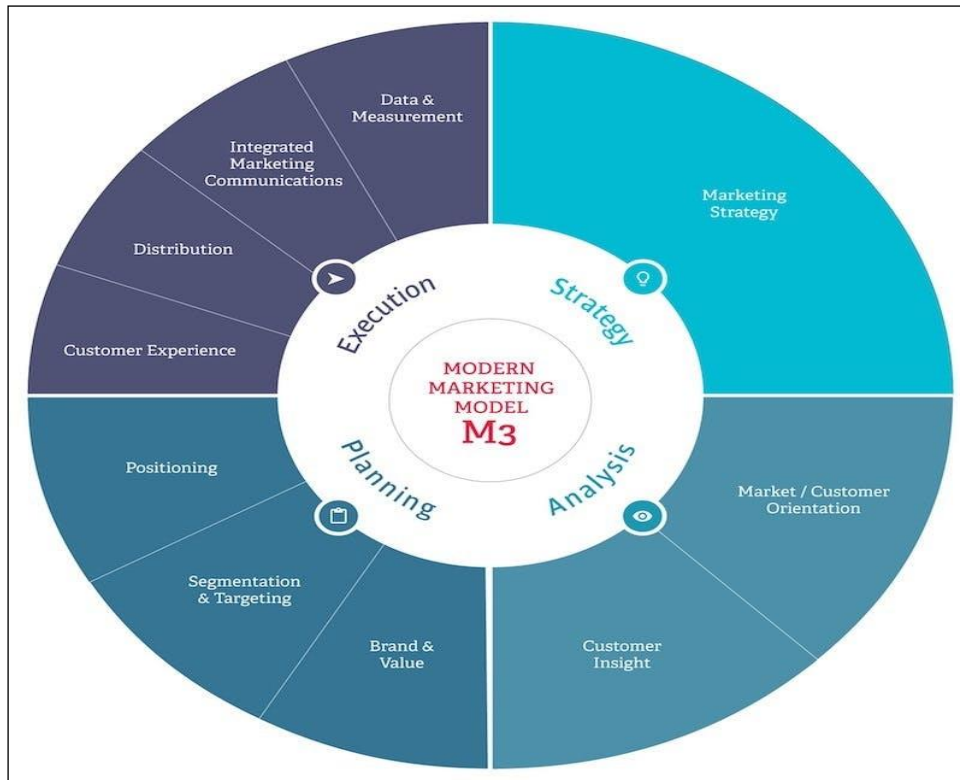


Figure 2. The process of modern marketing model

Source: Introducing the modern marketing model,

<https://econsultancy.com/introducing-the-modern-marketing-model-m3/>

From Figure 2 many relationships and ways of realizing the modern marketing model can be seen; from planning, then execution, through strategy till analysis with all steps inside these activities.

Realization of business e- models include the following relationships: Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B), Consumer to Consumer (C2C), Business to Employee (B2E), Employee to business (E2B), Electronic Communication to Governments: Business-to-government (B2G); Government-to-business (G2B); Government-to-Government (G2G); Government-to-consumer (G2C), Multi Transactions: Business to Business to Consumer (B2B2C); Peer to Peer (P2P) - Consumer to Business to Consumer (C2B2C). Business to business, or B2B, is a model of electronic business, i.e. exchange, of products, services and information between businesses, through internet technology. B2B connects all participants in business that proceeds to the finally users: suppliers, customers and distributors. B2B applications enable a business to use new technologies - business system with facilitates of transactions, sales of goods and provisions of services via the Internet; this means integration of the chain supply and on-line procurement of goods by one to other company. B2B e-commerce is characterized by high-volume enterprises trade, high net worth of goods traded, more supported electronic payment methods with respect to B2C, the previous partner enterprise consent, much higher level of information between partners, as well as more places to which information is referred, higher the level of authorization in the buying process, as well as multiple ways of taxing sales. Recent years it can be seen the development and emergence of Electronic market place (e-Markets) shopping centers, in other words a new form of organizing B2B business on the

Internet. Markets like this represent web sites where a large number of sellers and buyers, are in one place presenting their offer and demand, in a particular area (http://elektronskopolsovanje.blogspot.rs/2015/12/blog-post_52.html). Business to Customer or B2C e-business model provides a direct interface between the enterprise and the consumer. Model allows the business which is very efficient. The B2C model is useful to existing retailer's places because it allows increasing the customer base. It's on the other side beneficial to the consumer because it enables the global market to be available, wide selection and lower prices. The first online store was opened by Maxi discount Delta holding, which is also an example of a B2C business (website retailing products and services). Business to Employees i.e. B2E business model is a model that indicates a relationship, services, information and other products that business provides to its customers employees. Employees order electronically funds but also material they need to work. So, employees get it on discounts and more affordable insurance. Examples for this business are online training and online banking (Mahadevan, 2000). The Customer to Customer or C2C e-business model is a newer form of e-commerce that allows consumers to trade directly with other consumers. A company that supports these services must find the traditional way to charge for services. Service prices are relative low and charged in the form of membership fees, advertisements, etc. Government to Government or G2G model electronic business, implies that public authorities can use effectively Internet services at all levels of government, between Federal and Republican governments, as well as in the process of inter-ministerial governance. Government to Business or G2B e-business model has facilitates for exchange information between the government and businesses, i.e. legal entities.

Legal entities are government suppliers, partners in community service, government service users, and sometimes the competitors. Government communication with legal entities is a good prerequisite for increasing the efficiency of the economy. There are very important electronic document exchange systems, especially financial documents. In this way, the execution time is reduced by complex transactions on the one hand while the good ones are creating other bases for quality decision making. Government to Customer or G2C e-commerce model has put the government in a position to take advantage of the ability to exchange information electronically and improve communication with citizens, make their decisions more accessible and transparent, faster answering to citizens' demands. Government to Employees or G2E business model represents the use of information and communication technologies for better collaboration and coordination government employees: communication among employees, timely notification and flow of information, e-education that is needs in government and its services, as well as governance knowledge, etc. E-marketplaces represent new appearance of online intermediaries that effectively capture aggregate supply and demand at one location, providing customers with lower procurement costs, but also with possibility to contact with new suppliers and lower suppliers sales costs (with the ability to contact new customers). Different e-Markets models depend on organizers of the same. There are several different models of e-Markets, depending on who is their organizer: organized by one or more buyers (Driven-E Marketplaces'), E marketplaces – organized between the industrial giants, which in this Businesses mode can see the possibility of increasing the efficiency of the supply chain. Where e-Market exists, e-commerce also exists (Figure 3). From Figure 3 it can be seen that the e-commerce comprises Internet shop, but also the elements such as Web shop, Electronic exchange data and electronic fund transfer (EFT)

(<http://www.linkelearning.com/site/kursevi/lekcija/6946>).

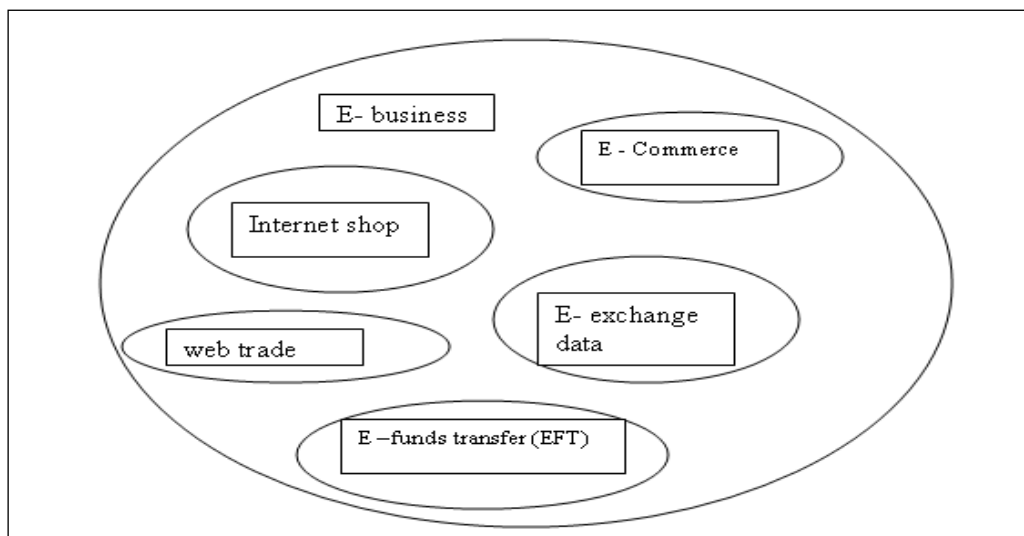


Figure 3. E business

Source: <https://www.link-elearning.com/site/kursevi/lekcija/6946>

Internet economy, payment methods and sustainability

E-commerce, as a distinguished category with its distinct penetration and dispersion, occupies an increasingly important place in the global economic trends, paving the way for a whole new form of economy, so-called internet economy. Electronic exchange data, business records based on EDI (an acronym for English words Electronic Data Interchange) and Internet enabled multinational companies to connect with their affiliates, business partners and subcontractors all over the country and all over the world. A "network economy" model is way of new sustainable economy. It saves time, money and space. Notion "Network economy", "digital economy", "and knowledge economy", are the term used for the "post-industrial society". New economy as the terms began in theory a few years ago (Milovanović, Veselinović, 2009). It is young (conditionally called) a new scientific paradigm that needs to explain the whole set of the economic, social and cultural changes that bring ICT (Information Communication Technologies), where the place of "honor" belongs to the Internet (Ćuzović, Sokolov-Mladenović, 2014). In Internet economy (as in traditional concepts of economics), can not be avoided payment methods and transactions as essence of economic relations and activities. Modern means of internet technology and payments include credit cards, debit cards, electronic check, electronic cash, and micropayments. There will be more to say about each of these forms. Payment cards are widespread today in the payment system. The beginnings of using payment cards bind to 1914 when Western Union, for its privileged users, enabled deferred payment of bills. In 1950s there were great interests for card based on on-line payment system. Representative of the first such card was the Diners and charge card, in 1950. Subsequently, Bank of America introduced the AmeriCredit card (in 1977. and it was named Visa) and later Belgium (the Euro card ...). Since then, the cards have undergone a significant evolution into their development, and they have become a significant tools of electronic payment. The use of payment cards has great potential for many reasons. These include creating a single payment system which are not limited with national and currency borders, avoiding risk of carrying cash, making the possibility of permanent

disposal cash as well as many other benefits. Cards can produce only authorized manufacturers, and each must satisfy certain characteristics and standards. It is also necessary to disable playback cards, which means that they all need to be with specified dimensions, holograms and other characteristics markings that are difficult to forge. The cards are made of plastic, while on the back it has a magnetic runway with safety data. Front of the card contains embossed information about the owner, number cards and expiration date. A special place on the card belongs to the chip. Credit card "Pay-later" is related to an account that is approved by the bank, allowing subsequently payment. It involves payment on credit, deferred payments in installments and letter of credit, whereby payment limits are approved for card issuer. The customer activates the credit line and spends the bank money of the issuer. At the end of the month, the bank issues the listing to the client, the deadline for payment of debt, interest accrued, etc.

The owner of the card pays an annual fee. There are two types of credit cards: charge and revolving cards. Charge cards allow cashless credit payment and upon the maturity of the report on the card account, the obligation is to pay the full amount, up to that point of used credit. Credit Card revolving enables cashless credit payment, and at the maturity of the report the obligation to pay only one part, (the loan used to give it accounting period). Debit cards pay-now - represents a payment model in card history with recent history and it is used in many countries. They are enabled cashless payment covered by the amount of money that already exists in the owner's account. Debit cards are most commonly used in the store, or post terminals or ATMs. An electronic check contains the same elements as well as the classic check but its being cashed and processed electronically. Electronic checks are nowadays in fully digitized version, and attempts to make the payment at any cost that have resulted in this modern business solution. By using an electronic check, bank ranks decreased, to satisfaction of banks and clients. Electronic cash represents a series numbers generated by the issuing bank and originated from the idea that in the virtual world it has the same function as the real. Generation of numbers is done by application cryptographic appropriate methods while using this method of electronic payment assumes the existence of a high degree customer anonymity and lack of intermediaries in the payment process. An electronic wallet is a special type of smart card that has special application that is support for saving electronic money. Electronic wallets in use today have memory for saving several hundred Euros. There are two currently versions in use- basic electronic cash payment systems - on-line and off-line. If there is an online connection between the bank and the seller (at the time of the sale) there are number of online cash transactions payment. If the merchant does not have a direct connection, electronic cash authentication is done on the face places; electronic cash traffic contains a number of operations, and because of that it is called off-line payment by electronic cash. All described forms of electronic payment as part of e-commerce and Internet economies and there are very popular and representative nowadays. As already mentioned in the paper, the process of modern business introduces a new dimension of business. Modern business also means caring for the environment and its protection. Environmental protection can be studied with different aspects; it involves defining problems and ways of solving them. Methods of planning, monitoring, recording, reporting and promoting are activities of the environmental protection. Notion of sustainability and the environment include many sciences that take on the attribute "green". It can be seen terms such as: green economy, green marketing, green management, and so on (Trandaflović, 2013). What do the green economy mean and how it is connected with Information technology? A green economy means sustainable economy as well as sustainable investments in business activities that not have a bad effect on the environment. New materials and information technologies will significantly

reduce the dependency on natural resources. Numerous analytical data and increasingly accurate simulations of the global ecosystem model can help to predict the availability, production and consumption of raw materials and energy (Božić, Aleksić, 2016). Talking about the achieving of sustainable development, it can not be achieved without environmental protection; because the system of sustainable development is the link between society and nature (<https://agroekonomija.wordpress.com/2012/04/23/odrzivi-razvoj/>). Modern economy is stimulating sustainability playing imported role in environmental protection - because many traditional actions such as transport, delivery, waiting and similar are accelerated by mail and information technology. Therefore the modern ways of business reduced negative impact of traditional business, contributing to quality of life (Lechner, Hummel, 2002).

Instead conclusion

In the modern world, in the business that dominates market globalization and economic regionalization modern information technologies play a very important role. Networking of business, companies and administrative, by Internet development, have contributed to much more efficient and distance business. Because of the rapid technological development that accompanies the 21st century, adopting modern technology and e-commerce at the global level is a necessity. Modern forms of business have also contributed to creation of modern economics, i.e. internet economy. Despite the many benefits that modern Information Technology brings (as well as the speed of information), it is necessary to note some disadvantages of this technology. Using of Internet means that the privacy was loosed; people are slowly alienating. There is no need to see each other and to speak few words in some place, because they already do this through modern virtual social networks. A circle of false friends is created! With all that, man of modern society uses less and less the “living” words, traditionally written; communication and explanation are reduced by computers! All mentioned, contributed to the reduction of writing and reading, as well as to disappearance of the essence of face to face human communication. The man of nowadays has become very insecure, hiding from the real world, considering that it is not so important to communicate on the traditional ways. Multimedia creates a fulfilled image living space and life in general; the men think that traditional manners are no longer needed. Anything can be done and said with just one touch of a button. But, are the modern tools safe for using? Of course, that there are not safe. Thanks to the computerized mode, in which is various information left by internet users, there has appeared a new so-called internet mafia. Name, address, telephone numbers, current locations, current accounts, as well as card numbers and electronic payments can be used instantly; an internet offender can conceal his existence on the internet in a second. When we talk about sustainable development - in line to the economic and environmental components - social component represent the third pillar of sustainability. However, it seems that man by using of modern technologies became isolated from nature and all the benefits that nature offers. Man must not forget that he was made of blood and flesh, that he is a part of nature, part of the great Universe, and that he is only little dust in Universe. On the one hand, accelerated technological development brings great benefits, while on the other hand it can be a trigger of self-destruction! Modern civilization must learn to harmonize, in other words to balance own capabilities and desires, with the capacity of the environment.

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“ECOLOGICAL AGRO-INDUSTRIAL PRODUCTION - INDICATOR FOR SUSTAINABLE DEVELOPMENT”

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Abstract:

Producers of food products are an important part of the link that emerges between the sellers 'market and the buyers' market. The agri-food sector in the region has an important role, both economic and social. On the other hand, there are some limitations that make the agri-food industry uncompetitive. Above all, the agri-food sector is marked by small agricultural economies, production for basic necessities, and a malfunctioning local market. Another aspect affecting poor performance is the lack of a high degree of mechanization and modern farming systems and technologies.

Environmental agro-industrial production is experienced as a reliable measure of nature and environment preservation, as well as an instrument for better management of the agro-food sector and forested land, as well as the boundary space of protected natural areas creating new public goods and all in the direction of sustainable development. Environmental agriculture is a mode of production that does not use fertilizers and pesticides, and fields are used for crop rotation, green manure, organic fertilizers and biological preservatives when needed.

Socially responsible agriculture is one that provides an improvement in the quality of life of farmers and consumers of their products.

The main purpose of the research in this paper is to determine the impact or impact of environmental agro-industrial production on developing consumer awareness of improving nutrition and promoting their health as one of the indicators of sustainable development.

The results of the research will help prepare a modern social marketing program that is aimed at changing the behavior of consumers, improving their nutrition, in order to improve their long-term health, all in the direction of sustainable development.

Key words: *eco-agro-industrial production, healthy food, sustainable development.*

Introduction

Sustainable development is: extended multi-faceted economic, social and environmental process. It's a concept that is built on the basis of a sustainable form of economic activities, which provide a higher level of development of the system; man-society-nature. Modern environmental compliance sustainable agricultural development in practice means striving to achieve the possible potential for a particular agro-ecological region yields a high biological value of production through proper agro technics that guarantees obtaining the highest economic returns while increasing or improving the soil (Kotler, F., Roberto, N. & Li, N, 2008).

At the beginning the so-called green marketing was a marking on the product or the company as environmentally friendly. Today environmental awareness is far more developed, so the label is no longer sufficient. The application of green marketing means meeting the needs of consumers in a way that companies will behave responsibly towards the environment and green word to include both in the process of product development and market communication. However, some companies that lesson dearly paid experiencing market big fiasco with its environmentally friendly products (Zivkovic R., 2011). These are companies wanting to produce environmentally friendly products, concentrated exclusively on product characteristics, while neglecting the needs of consumers. Sustainable development is a complete system for managing, which is characterized by perspectives for meeting the human needs of plant and animal production when at the same time preserves and improves the environment, efficient use of natural resources and supports economic life agricultural undertaking. Sustainable development means that it is: economical, effective, environmentally compliant and socially responsible (Kotler, P., Zaltman, G., 1971, pp. 3-12)

Research objectives

The goal of research conducted in this scientific paper is to determine:

- The influence of environmental Agricultural Industry production on developing consumer awareness about improving nutrition and promoting their health as one of the indicators of sustainable development;
- Are consumers in the Republic of North Macedonia informed about the nutritional characteristics of products based on food labels, is commonly consumed foods with nutritional and health claims and whether they show a greater degree of knowledge about the nutritional characteristics of the product;
- What are the attitudes of consumers in the Republic of North Macedonia in terms of health and healthy food, what is their relationship to the labels of food products and whether they have confidence in the veracity of the labels of food products; A better understanding of the attitudes and habits of consumers can serve as an important guideline for the preparation of modern social marketing program that e aimed at changing consumer behavior, improving their diet, so long-term improvement of their health, all aimed at sustainable development.

Results and discussion

Within the research in this paper covered 300 respondents from the North-West of the Republic of North Macedonia with a higher incidence of female persons and 65% of the total number of respondents, while respondents from male are represented with only 35%. Most respondents (40%) are aged over 40 years.

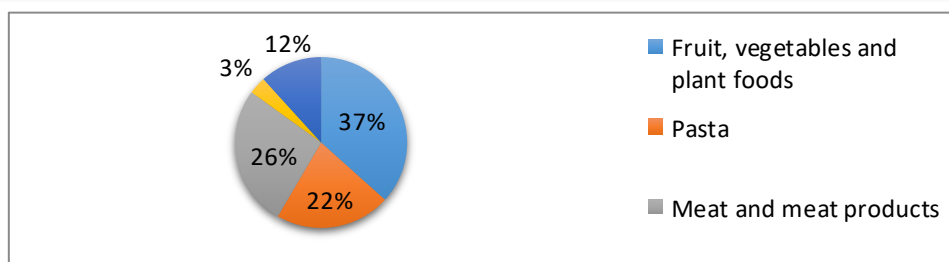


Figure 1. What is your favorite food?

Source: Author's results

The question of what is your favorite food, 37% of respondents prefer fruits, vegetables and plant foods, while 26% most like to eat meat and meat products, 22% love pasta, 12% sweet, while only 3% of respondents prefer organic food (Figure 1). Thanks to the large number of advertising campaigns on the benefits of eating fresh fruits and vegetables, and the fact that fruit and vegetables are important sources of many nutrients, low in fat and calories, rich in vitamins A, C, and E in combination to be entered every day for a strong immune system, it's no wonder that the majority of respondents as favorite foods just listed them. Organic food is produced in a strictly controlled manner in order to protect human health and the environment. Organic products are grown in uncontaminated soil and produced by methods that are not harmful to human health, the environment and natural balance. The production of organic food is legally regulated and regularly monitored to produce safe products that do not contain harmful substances. With that, they are healthier and have a higher nutritional value. The organic way of producing and processing of food gives preference to the use of naturally produced materials and products. The use of artificial fertilizers, chemical pesticides, hormones, preservatives, additives, genetically modified fruits and ingredients or other synthetic materials is minimized or in bulk is not allowed. Name organic product or organic food is given due to organic substances and methods that farmers replace these artificial substances. But here arises the problem of today, due to which the survey question about favorite foods, organic foods with the lowest percentage of representation, and it is due to the fact that today the markets are often marketed products as "organic products", but not organically grown.

For men in the modern world to keep your body and mind healthy, it is not enough to eat food labeled as healthy. Today, cravings for profit are negatively reflected and contaminate food, water, soil and air. It can also say that the world has come to the point that does not produce anything healthy from what is placed as such in the markets around us. The basic problem today is the pollution of land, water and air with pesticides, antibiotics, hormones, radioactive particles and mycotoxins, toxins and creating the very texture of the host (plant).

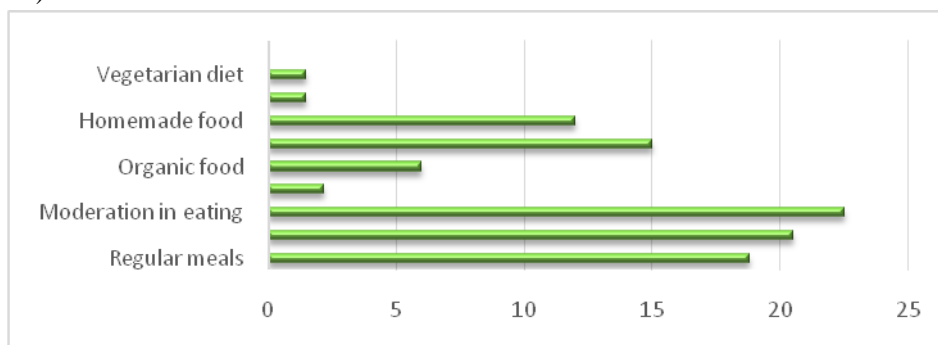


Figure 2. What qualities of food prices in particular and feel that relate to healthy eating?

Source: Author's results

From Figure 2 it is clear that most of the respondents believe that moderate and varied diet, and regular meals are key to a healthy diet, 22.5% of respondents opted for moderation in eating as an important feature for proper nutrition, 20.5% of respondents believe that it is the diversity in the diet, 18.8% of respondents highlight regular meals as the key to a healthy diet, 15% of the prepared fresh food, 12% for domestic food, 6% for organic food, 2.2% consumption of foods of plant origin, 1.5% healthy diets and 1.5% vegetarian diet, while none of the respondents not interested in taking supplements. Overloading the body leads to load the entire body. Life and life force, rather than increases, it decreases. Man spends his life force in an unnecessary effort to get rid of excess food.

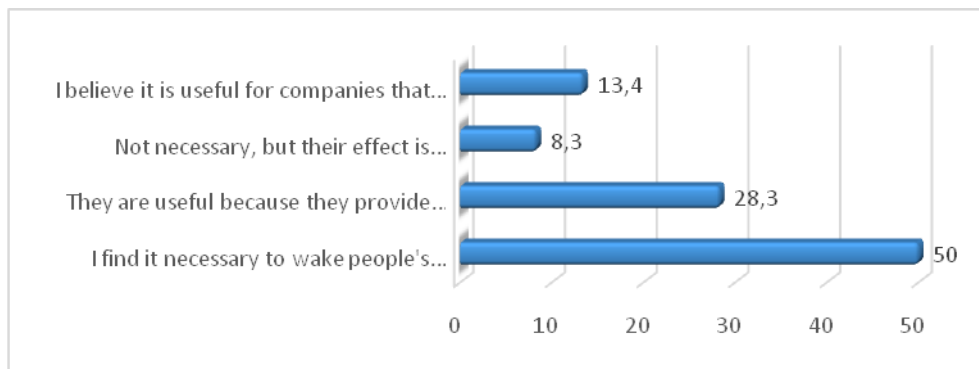


Figure 3. Do you think that marketing activities aimed at promoting healthy eating habits are beneficial to humans?

Source: Author's results

Asked whether marketing activities aimed at promoting healthy eating habits are beneficial to humans, 50% of respondents deem necessary for awakening people's awareness of healthy habits, in that way the population will be healthier which is very important for us all, 28.3% of respondents believe are useful as they provide information and message, but are not sure about their real effect, 13.4% of respondents believe they are useful for companies that produce food, but not for potential consumers, convinced that more of a marketing ploy than for people to be healthier, while 8.3% of respondents believe that the efforts, activities aimed at promoting healthy habits are not necessary, and their effect is minimal, people are stubborn and hardly change their habits, companies would mean a waste of time and money (Figure 3). It is good to know that people are already awakening awareness of the importance of marketing activities to promote healthy eating habits.

Conclusion

Developed practice of social marketing in developed countries suggests awareness for the possibility of using marketing principles and techniques aimed at creating prosperity for society and individuals as well as the indication of importance of the Agricultural Industry ecological production as a solution for a better quality of life. In the Republic of North Macedonia comprehensive social marketing programs are rare, to the point that even the promotional campaigns in this area are rare. This research is based on the recommendations of the World Health Organization concerning that food producers can play a significant role in the promotion of healthy eating and ecological production of foodstuffs by developing products with less fat, salt and sugars, which we recognize as products with nutritional and health claims, all in the direction of sustainable development. Based on research conducted on the target groups defined certain recommendations regarding the structural characteristics of social marketing program in the field of nutrition, paying attention to the general characteristics of environmental Agricultural Industry production stressed the importance of clearly defining the products, services, and pricing tactics, in order to overcome the monetary and other costs, behavioral change, and the importance of promotional activities for sustainable development. Benefiting from this kind of social marketing program is not only for vulnerable groups but also there are benefits for the state institutions, manufacturers and distributors. Accordingly, it is the active participation of all stakeholders in the creation and implementation of this program.

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USING DIGITAL METHODS FOR MONITORING ORGANIC PRODUCTION – THE EXAMPLE OF OIL-BEARING ROSE IN BULGARIA

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Abstract:

The trend towards consuming beneficial, pure and quality products has augmented in the EU and elsewhere, which has reflected in strict regulations, awareness campaigns and applying innovative ICT to monitor the supply of bioproducts.

Historical evidence suggests that oil-bearing rose cultivation in Bulgaria dates back to the 17th-18th centuries. Since then, the rose has become one of the symbols of our national identity. In certain historical periods, our country has been a leading producer and exporter to the world markets. After the Liberation War and during the Third Bulgarian Kingdom, the state initiated the registration of oil-bearing rose plantations on arable land. The first legal acts related to the oil-bearing rose industry were adopted in the 1930's and 1940's. Recently, with the expansion of organic production in Bulgaria, an electronic register (Register of Organic Farming) has been established to include operators and subcontractors who produce, process, trade, store or import organic products. Starting on August 19, 2019, controlling authorities are required to enter information about the identification of land, animals, apiaries and aquaculture operators. The organic cultivation of the oil-bearing rose must now follow the EU regulations.

The purpose of this paper is to study the dynamics of organic production of the oil-bearing rose in Bulgaria, on the basis of selected indicators. Using data from the Register of Organic Farming, we have focused on identifying both the spatial structure of production operators through the application of geographical information systems (GIS) software, and the scale of production, as well as on problems and opportunities in the sector that can facilitate its innovative and competitive development.

Key words: *organic, oil-bearing rose, production, Bulgaria*

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Introduction

The consumption of beneficial, pure and quality products is a sustainable trend observed on a European and global scale, while the market response has seen a continuous rise in organic farming. In 2017 it reached 12.6 million hectares in the EU, which is 18% of the world's total organic production areas and 7% of the total arable land in the EU (EC, 2019, p.3)⁴. Organic farming areas in the EU have increased on average by 5.6% per year for the period of 2007-2017.

Another specific tendency for the period after the world economic crisis of 2007-2011 has been the rapid development of aromatherapy, and, respectively, the increased demand for essential oils in Europe and the world, as part of the market for high-quality products and the growing use of essential oils in the light industry (cosmetics, medical, foods, etc.). Even though the world market for essential oil products is more specific and relatively limited, it is expected that by 2025 it will have grown by an average annual accrual rate of 8-11%⁵, and the world trade with aromatic products will have surpassed the level of \$9 billion (Ministry of Agriculture, Foods and Forestry 2018, p. 4)⁶.

Bulgaria, which plays an active role on the European and world market, is involved in a clearly defined process of organic farming development. Since 2012 there has been an enhanced growth both of the number of organic operators (producers, merchants, importers and exporters of organic products), and the fields. This has reflected in stricter control measures, including the creation of an electronic Register of Organic Farming for operators and subcontractors. The Register provides complete monitoring over organic production, storage and bioproduct trade in Bulgaria, with respect to the requirements and regulations of the European Union⁷. On the website of the Register (<https://bioreg.mzh.government.bg>) it has been noted that the control over rule compliance for organic production is exercised on the basis of a contract between an operator and the controlling authority. Since 19 August 2019 the controlling authorities are required to initiate the collection of data into the Register to identify land, livestock, apiaries and aquaculture units⁸.

The development of information systems has led to new horizons of research. Until recently, instruments, which had been considered strictly specific and applicable to concrete scientific areas, have now widened their field of application. In this respect geographical information systems (GIS) have played an important role. Thanks to GIS, many social-economic, natural, biological and other processes could be explained with the specific characteristics of geographical space and the adjacent systems which are an inseparable part of human existence.

Each sphere of application of GIS requires the presentation of geographical data for the territory in digital form. The developed digital model of allocation serves as the basis for the information system. Various applications by means of GIS have been created, depending on certain aims and tasks. That is why the term GIS has been used more frequently for the integration of cartography data with other multitudes of information, including demographic (Kastreva, 2011)⁹.

⁴ EU, Organic Farming in the EU – A Fast Growing Sector. EU Agricultural Markets Briefs, No 13 | March 2019

⁵ According to different researchers (Grand View Research, Markets and Markets, etc.) cited by IntelliAgro, Production of Essential Oils in Bulgaria, 2017, p. 3

⁶ Ministry of Agriculture, Foods and Forestry, Directorate of Market Measures and Producers' Organizations. Current State and Trends of Essential Oil Crops in Bulgaria. Opportunities for the Realization of Essential Oil Production on New Markets. June 2018 (in Bulgarian)

⁷ The Electronic register is maintained with respect to the regulations of Article 28, paragraph 5 of Regulation (EC) № 834/2007 and article 16a, paragraph 1, item 1 from the Law for applying the Common market organization of agriculture products in the EU.

⁸ http://cap.europe.bg/bg/taxonomy/term/8_04/09/2019_-13:41

⁹ Kastreva, P., Geographical Information Systems and Computer Mapping, 2011. Sofia, p. 17 (in Bulgarian)

The visualization of information, however, is not only one of the achievements of GIS. The users of geographic information have raised questions regarding the reliability of the obtained results, considering the importance and the statistical approach (Unwin, 1996)¹⁰. Therefore, in order to upgrade GIS functionality classical statistic tools have been used to examine processes and phenomena leading to entirely new results that explain some of the specifics of the studied unities. In spatial analyses, it is important to consider the so-called full spatial randomness (Diggle, 1983)¹¹. Spatial randomness is associated with the idea that processes have occurred as a result of random events. The GIS software that measures randomness of spatial events and processes uses the p-value. The aim of the present study is to trace in its dynamics the organic production of oil-bearing rose in Bulgaria on the basis of the number of operators, area, production volume and by applying GIS. The focus is directed towards identifying the spatial structure of production, key problems and growth opportunities for the sector seen as innovative and competitive.

A historical review of rose oil production in Bulgaria

Rose oil production is especially valuable for the economy of our country. Unofficially Bulgaria has been known as the Land of Roses. According to historical sources the growing of oil-bearing roses in Bulgaria dates back to 17th-18th centuries. Accounts for the existence of rose gardens in the Balkan lands of the Ottoman Empire were given by travelers EvliaChelebi and HadjiKhalfa. In the 18th century the British ambassador to Tsarigrad informed of rose oil production in the Kazanlak Valley that was exported and consumed in England. Similar were the records of the French consulate¹².

Rose oil production has been concentrated in the so-called Rose Valley of Bulgaria which includes areas situated south of StaraPlanina Mountains and north of SarnenaSredna Gora Mountains. The first statistical data of fields planted with roses in the region date back to March 1826, when in the districts of Kazanlak, Nova Zagora, Stara Zagora and Chirpan the authorities started measuring the areas with special ropes sent from Tsarigrad. The measurement unit was 'uvrat' (1 uvrat equaled about 0.2 hectares) and a total of 12 020 uvrats of rose gardens were measured¹³. Thus before the Liberation on our territory there were approximately 1000 ha of plants, while the quantity of rose oil produced reached up to 1000 kg per year.

During the following ages, as the Bulgarian nation was consolidating and developing, the rose became one of the symbols of our national identity. Rose oil production was the main trade of the people from the fields south of StaraPlanina Mountains. It was ethnographically documented that in the past the development of rose oil production as one of the major trades in some regions of the country had boosted the proliferation of crafts such as brazieri, tinkering, copperage, basket-making, etc.

Furthermore, after the distillation of the rose blossoms and the production of rose oil, the marc was used to produce rose brandy, or 'gyulevitsa'. The rose petals were boiled to make rose (gyulevo) jam. The symbol of the rose has been engraved in plot compositions in wood carving, mural painting, iconography, goldsmithery and stone-cutting¹⁴.

With time Bulgarian rose oil has gained popularity far beyond the boundaries of our country. The first factory for rose oil production in Bulgaria was opened in 1820 and thus, as far back as the beginning of the 19th century, the first export of rose oil was accomplished. In certain historical periods our country has been among the leading producers and exporters in the world. After the Liberation and during the Third Bulgarian Kingdom first attempts for regular statistics of arable lands with rose

¹⁰ Unwin, J., GIS, spatial analysis and spatial statistics, Progress in Human Geography, 1996, pp 540-551

¹¹ Diggle, P. J., Statistical Analysis of Spatial Point Pattern, London Academic Press, 1983, p.148

¹²Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, pp. 25-27 (in Bulgarian)

¹³Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, p. 42 (in Bulgarian)

¹⁴Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, pp. 144-151 (in Bulgarian)

plants were made. In 1906 in Bulgaria there were 22 rose production districts with a total of 210 municipalities; in 1921 rose oil was produced in 10 districts with 170 municipalities, while in the 1940s there were only 6 districts. The biggest areas of rose gardens were planted around WW1 – approximately 9000 hectares. The heavy economic crisis in post-war years (1918-1931) and the common economic recession in the 30s had a negative effect on rose oil production as well, while in the end of WW2 only 23% of the rose gardens which had been planted in 1917 survived¹⁵. In the second half of the 20th century several ministerial decrees were announced which aimed to create favorable conditions for the development of rose production¹⁶. Thus, towards 1970 the rose lands reached 1300 hectares in the Kazanlak region and 1800 hectares in the Karlovo region¹⁷. In the 1980s they reached their peak – 2000-2500 hectares, however, during the next decade the areas were substantially reduced to 6-700 hectares in 1997¹⁸. Until the end of 1989 the predominant part of the land with oil-bearing rose plants were a property of the cooperatives, all processing facilities were owned by the state, and the rose oil export was 100% monopolized by the state. After the changes in land property and the processing enterprises the profile of the rose production industry was drastically transformed. The slow process of agrarian reforms led to a significant reduction of rose gardens, followed by a gradual process of new plantations, while the old ones were renewed. Towards the end of 2004 the rose plantations in Bulgaria were around 2750ha, whereas the majority of them were owned by middle and large sized essential oil producers. Moreover, many family rose gardens of 0.5-1.0 ha were created and their share has marked a continuous growth¹⁹.

At present, essential oil industry is entirely privatized. In 2006 there were 15 active distilleries with a different work capacity. In 2017 the number of distilleries was over 50²⁰. The tendency is the rose producers to invest in and build their own distilleries²¹.

After a period of disruption in the sector due to political and social economic changes in 1989, it was only in 2008 when the total areas of rose plantations reached the size of the industrial rose farming from the 1970s and spread on approximately 3500 hectares²². In 2012 the total area of rose plantations in the country was 3700 hectares²³, and during 2013-2017 a growth of up to 4 189 hectares²⁴ was noted, which was 20% more compared to 2008.

The analysis of the Agriculture Report of 2018 shows that for oil-bearing rose the increase of harvested lands in 2017 on an annual base was 17%, while the average yield increased by 22.1%. As a result, the production increased by 43.1% (Table 1).

¹⁵Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, pp. 29-47 (in Bulgarian)

¹⁶Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, pp. 163-165 (in Bulgarian)

¹⁷Staykov, V., Perspective Essential Oil Crops. Sofia 2003, pp. 6-7 (in Bulgarian)

¹⁸Nedkov, N., Kanev, K., Kovacheva, N., Stanev, St., Djurmanski, An., Sejkova, K., Lambev, Hr., Dobрева, A. Institute of the rose and essential oil crops. Manual of the Main Essential Oils and Medicinal Crops. Kazanlak, 2005, p. 3 (in Bulgarian)

¹⁹Nedkov, N., Kanev, K., Kovacheva, N. Rose Production in Bulgaria. Journal of Agriculture (journal for professional agriculture), issue 5, 2006, pp. 9-10 (in Bulgarian)

²⁰Ministry of Agriculture, Foods and Forestry, Current State and Trends of Essential Oil Crops in Bulgaria. Opportunities for the Realization of Essential Oil Production on New Markets. Directorate of Market Measures and Producers' Organizations, June 2018 (in Bulgarian)

²¹Nedkov, N., Kanev, K., Kovacheva, N. Rose Production in Bulgaria. Journal of Agriculture (journal for professional agriculture), issue 6-7, 2006, pp. 9-10 (in Bulgarian)

²²Programme for the development of aromatic and medicinal plants in Bulgaria for the period of 2009-2013. Ministry of Agriculture, Foods and Forestry (in Bulgarian)

²³Yavashева, T., The Aromatic Gold of Bulgaria. Economics, issue 13, 2012, pp. 39-43 (in Bulgarian)

²⁴Ministry of Agriculture, Foods and Forestry, Current State and Trends of Essential Oil Crops in Bulgaria. Opportunities for the Realization of Essential Oil Production on New Markets. Directorate of Market Measures and Producers' Organizations, June 2018

Table 1. Production of essential oil crops from the harvest in 2016 and 2017

Crop	Harvested land (hectares)			Average yield (tons/hectares)			Production (tons)		
	2016	2017	Change 2017/2016	2016	2017	Change 2017/2016	2016	2017	Change 2017/2016
Oil-bearing rose	3 580	4 189	17,0%	2,49	3,04	22,1%	8 915	12 756	43,1%

Source: Ministry of Agriculture, Forestry and Foods, Annual report on the state and development of Agriculture (Agriculture report`2018)

Concurrently, the average annual harvest of rose blossom in Bulgaria is between 7.8 and 8.5 thousand tons. The record quantities of raw rose blossom produced in 2017 is closely linked to the growing investor interest to this sector. It is based on the continuous growth of the process of rose oil and the price of rose blossom. However, according to the Ministry of Agriculture and Foods, the relatively short term of rose blossoming and the lack of qualified, or sufficient workers has led to the impossibility to sell the entire harvest produced in the fields, especially during the record year of 2017 (Ministry of Agriculture and Foods, 2018, p. 6).

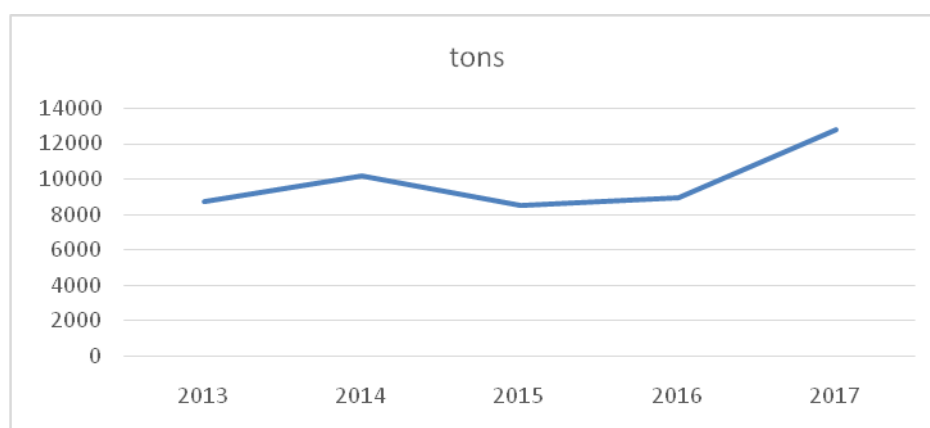


Figure 1. Dynamics in the production of oil-bearing rose in tons (2013-2017). *Source: Data provided by the Ministry of Agriculture, Foods and Forestry, Agricultural Statistics Department*

Oil-bearing roses belong to the family *Rosaceae*. In Bulgaria they are represented by several species. As a result of its work, the Institute of the Rose in Kazanlak has created four sorts of oil-bearing rose which are officially recognized and regionalized²⁵: Iskra sort – in the region of the village of Svezhen, which has a hardier root, multiple and sturdier branches; Svezhen sort – created by the same plant population from the village of Svezhen via individual selection; Eleljna sort – withstandingfrost, as the quality of the essential oil is within the limits of the Bulgarian State Standards; and Yanina sort – an erect bush withstandingfrost.

It is interesting to note that as early as the beginning of the 19th century with respect to the development of the rose industry, the first conference on rose production was held in Plovdiv (19-21 June 1906). It was organized by the Chamber of Commerce and Industry in the town, and was attended by approximately 40 rose oil producers, merchants and perfumers. The following year the

²⁵Yankulov, Y., Main Aromatic Crops. 19 Contemporary Cultivation Technologies. Sofia, 2000, pp. 64-65 (in Bulgarian)

problems related to rose production were discussed in the National Assembly and funds from the state budget were allocated to opening experimental rose fields²⁶. In the 1930s-1940s the first laws and regulations related to the branch were passed.

At present there are five distinct rose producing regions: Kazanlak, Karlovo, Strelcha, Zelenikovo and Chirpan²⁷.

The biggest rose plantations are located in the Rose Valley, in the region of Kazanlak (Stara Zagora area) – 42%, and the Karlovo region (Plovdiv area) – 41% (Kovacheva,N., K. Rusanov, I. Atanassov,2010, p.1794)²⁸. There are indications for the widening sector of rose production around the town of Strelcha (Pazardjik area), and other living areas. Out of 4067 hectares of land categorized for direct payments in 2017, 90% are concentrated in the rose production zones, where are 80% of the manufacturers.

Table 2 shows the distribution of oil-bearing rose plantations in the country.

Table 2. Land(for direct payments) with oil-bearing rose according to administrative areas(2017)

	Administrative areas	Land (hectares)	%
	Vidin	1	0,02
	Montana	7	0,17
	Sofia	79	1,94
	Gabrovo	1	0,02
	Targovishte	1	0,02
	Stara Zagora	2041	50,18
	Plovdiv	1611	39,61
	Sliven	44	1,08
	Yambol	2	0,05
	Haskovo	3	0,07
	Pazardjik	277	6,81

Source: IntelliAgro, Essential Oils Production in Bulgaria, 2017, p. 9

In 2017 there were 1164 farms which applied for assistance with direct payments for lands with oil-bearing rose. The average size of the land cultivated by them is 3.5 hectares.

As a raw material, the collected rose blossom is used on the basis of different technologies to extract the accumulated aromatic substances and obtain rose oil, rose water, rose concrete, etc²⁹. According to prior research, other than rose oil, which is used to prepare perfumes and cosmetic products, of particular value are also the blossom itself and the water, obtained as a secondary product during oil distillation. They find a wide application in the food industry (predominantly in confectionary), as well as in traditional medicine – for stomach disorders, allergic and skin diseases, eye inflammation,

²⁶60 Years of Research on Essential Oil Crops in Bulgaria. Proceedings from the Jubilee scientific conference dedicated to the 60th anniversary of the establishment of the Institute of the oil-bearing rose and essential oil and medicinal crops. Sofia 1970, p. 13-14 (in Bulgarian)

²⁷Nedkov, N, Kanev, K., Kovacheva, N. Rose Production in Bulgaria. Journal of Agriculture (journal for professional agriculture), issue 5, 2006, pp. 4-6 (in Bulgarian)

²⁸Kovacheva,N., K. Rusanov, I. Atanassov,2010, Industrial Cultivation Of Oil Bearing Rose And Rose Oil Production In Bulgaria During 21st Century, Directions And Challenges. Biotechnol.&Biotechnol. eq. 2010, 24(2) 1793-1798

²⁹ See more in Zarev, K. History of Bulgarian Rose Production. Plovdiv. 1996 (in Bulgarian)

etc. They are also used in the treatment of bile and renal diseases. The technical characteristics have shown that one kilogram of rose oil can be obtained from 2500 to 2800 kilograms of rose blossom³⁰.

In scientific literature it has been reported that the production of rose water and rose oil existed even before the 18th century, however, of limited proportions. After 1832 when a certain increase in the production was observed, the yield in Kazanlak and Karlovo reached 700 000 phials³¹. Towards the end of the 19th – the beginning of the 20th century there was a fight against counterfeit rose oil. Since 1905 the Bulgarian Customs through which rose oil had been exported were equipped with chemical laboratories to control the purity of the export. However, due to the corruptedness of the customs officers this method proved ineffective. At the first conference related to rose production in 1906 the question for enforcing control measures by the state was discussed. Only after the establishment of the Union of the Bulgarian Rose Producers, and the organization of rose manufacturing cooperatives, certain success in the fight against counterfeit rose oil was achieved. The Law for supporting rose production from 1922 also assisted these efforts. In the following decades the fight faced continuous challenges. After the establishment of the Industrial Enterprise “Bulgarian Rose” in 1948 control measures were implemented in order to guarantee the purity of the product³².

In the beginning of the 20th century perfumery and cosmetics started to use rose oil as an irreplaceable ingredient of their products. It has now found its place in the growing sector of aromatherapy. In 1944 the company “Bulgarian Rose” in Karlovo received a protected designation of origin - “Bulgarian Rose Oil”. In 1990 Bulgaria was the world’s biggest exporter of rose oil used in the perfumery industry (IBA, p. 17)³³. In 2014 the label “Bulgarian Rose Oil” was awarded a patent as a Bulgarian product included in the Register of Geographic Names, protected by the European Commission³⁴.

Thus, Bulgaria has become the second biggest rose oil producer in the world. Two to three tons of rose oil are produced annually, whereas the Bulgarian rose producers contribute to 70%-80% of the total amount of rose oil distilled in the world. Turkey is our main competitor. Out of the total amount of rose oil produced in Bulgaria, only 0.1% remains for the domestic market, while the rest is exported. Traditional buyers include leading European companies from Germany, Switzerland and France. Bulgaria exports a quality product used by brands such as Coco Chanel, Nina Richi and Christian Dior. Around 75% of the exported quantities for the cosmetic industry reach five European countries. The demand for end rose products from Bulgaria is highest in Germany, Serbia, UK, Greece and Spain, report the associations. The export for Russia amounts to 3.5% of the exported value.

Today, in the regions with heritage traditions for growing the oil-bearing rose a specific planting and processing technology is adopted that is typical for our geographical areas. Moreover, compared to the other world producers, here rose oil production technology resembles to a large extent the technology for distilling rakia (brandy). In the past, gardens were fertilized with organic materials – cow manure, straw, etc. and the production had organic features. Even though for decades the Institute of the Rose has made attempts to achieve better farming results through the use of mineral, phosphorus and potassium fertilizers, now current biological methods are in use, among which – green fertilizing. We can note that conventional production of rose oil is organized thoroughly, and the quality of the planting material, the hours of blossom picking, the speed of transportation to the distillery, as well as all phases leading to the end product are closely monitored.

³⁰Stajkov, V., Atanasov, Zh., Tanev, I., Tsachev, S. Essential Oil Crops. Sofia. 1969, p. 5 (in Bulgarian)

³¹Petkova, I., Marinov, M., Stagnation of the Development or Development of the Stagnation?(Rose production through the years between the Liberation and the Unification 1878-1885). Yearbook “Myths and Stories in Bulgaria”, National scientific conference dedicated to the 125 anniversary of the Unification of Bulgaria. Regional Historical Museum. Plovdiv, 2010, p. 191 (in Bulgarian)

³²Zarev, K., History of Bulgarian Rose Production. Plovdiv, 1996, pp. 91-99 (in Bulgarian)

³³InvestBulgaria, 2012, Agency Overview of the Bulgarian Food and Agriculture Sector
https://www.investbg.government.bg/files/useruploads/files/statchni_stranici/broshuri_sectors/food_agri_eng.pdf

³⁴Protected geographical indication “Bulgarian Rose Oil” – Regulation for implementation (EU) № 1020/2014 of the EC from 25.09.2014

Development of organic production (the example of the oil-bearing rose in Bulgaria)

The Ministry of Agriculture, Foods and Forestry (MAFF) has drawn a National Action Plan for the Development of Organic Production for the period until 2027. It includes schemes and measures for supporting farms which do not meet the criteria for assistance according to measure 11 “Organic production” within the Programme for Development of Rural Regions (PDRR). It envisions 30% of them to receive assistance according to these schemes. Conditions for sustainability of small and family biological farms are created through encouraging associations among producers. Annual participation of organic farms in the temporary employment schemes of workers is envisioned. Opportunities for free consulting services and professional training for organic farmers available at the beginning of the new programme period after 2020 have been created with respect to PDRR. Furthermore, a new Law for the Oil-bearing Rose has been introduced to the Parliament, with which a public register of rose producers and processors has been created.

Up to 2017 the share of all operators in the control system in organic production is 7.1% of the total amount of registered agricultural farmers, which, together with the growth of their absolute number (Figure 2) is a signal for the increasing importance of the sector – their share in 2007 was noted as only 0.04%.

Data shows (Figure 2) that since 2009, when the new European legislation in the area of organic production has been applied, the number of operators under control system has grown more than fourteen times. In comparison to 2007 – the year of Bulgaria’s accession to the EU – it has risen over twenty times.

In 2017 the lands under control system took a share of 3.2% of the total arable land in the country, and 3% of the total land declared as part of the Single Area Payment Scheme³⁵. According to Eurostat, Bulgaria is among the EU countries with the highest share of land in transition to organic – in 2017 this share surpasses 40% of the total size of organic land³⁶.

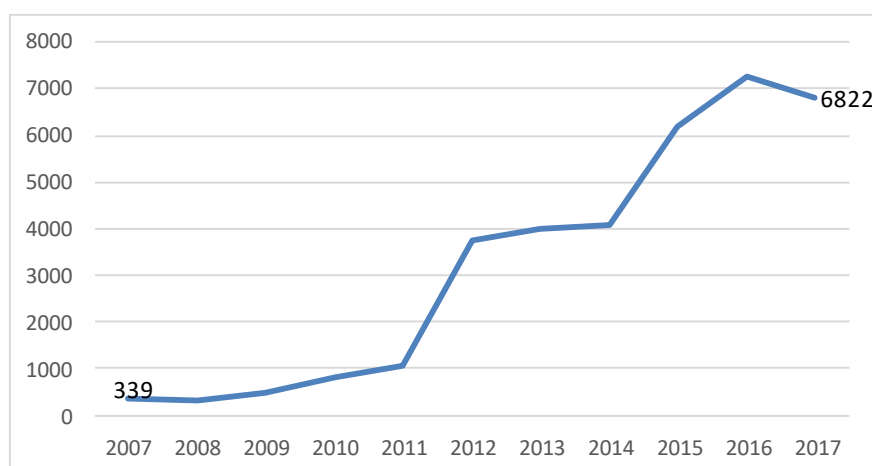


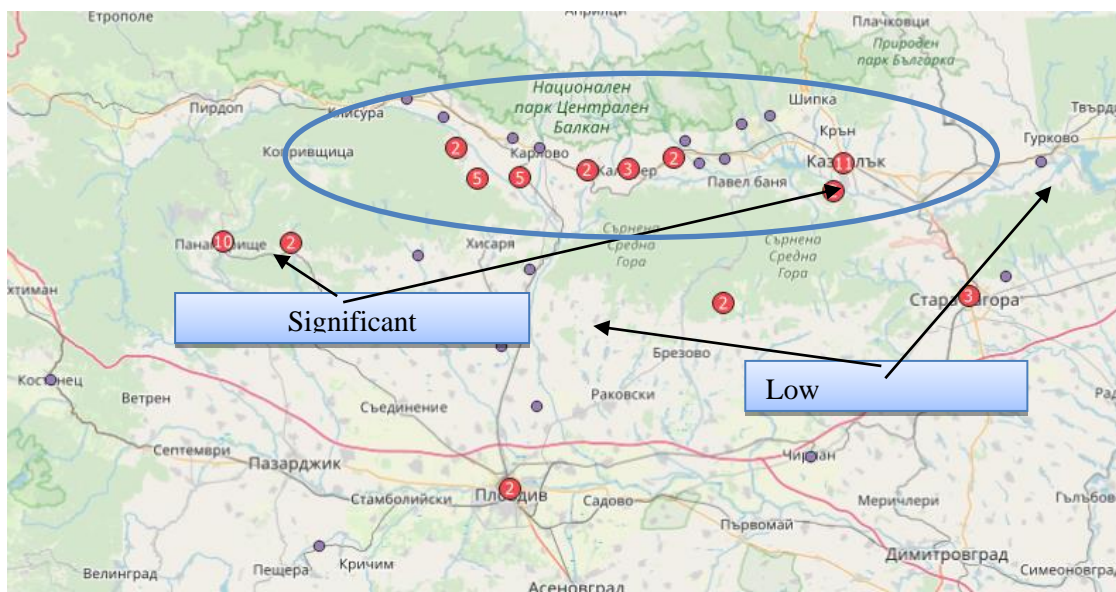
Figure 2. Number of operators in organic production

Source: Data provided by the Ministry of Agriculture, Foods and Forestry, extracted from the annual reports of the authorities controlling organic production.

³⁵ Ministry of Agriculture, Foods and Forestry, November 2018.

³⁶ EC, Organic farming in the EU - A fast growing sector, EU Agricultural Markets Briefs, No 13 | March 2019

Among the crops grown in organic way most significant is the share of land with permanent crops and industrial plants (essential oil crops, medicinal plants and spices). The share of industrial crops (including the oil-bearing rose) in 2017 was 17% and reached 22 998 hectares under control system. The areas planted with organic roses have increased from 845 hectares in 2011 to 1144 hectares in 2012, whereas the land planted with oil-bearing rose produced in organic way in 2014 has risen to 1408 hectares³⁷, and 1588 in 2015 (42% of total area cultivated with oil bearing rose). As for organic rose oil, in the Register of the producers of protected geographical indication “Bulgarian Rose Oil” 9 manufacturers in total were entered from 7 municipalities in two administrative areas. The rapid growth of organic oil-bearing rose production is a result from the new investments, incl. foreign, in the sector, increase in the prices and support from EU Structural Funds. Organic rose oil is highly rated by leading perfumery producers, such as Elizabeth Arden, Chanel, PacoRabanne, Kenzo, etc. Some studies have demonstrated the pharmacological effects of rose oil and its ingredients (Boskabady et al. 2011, cited by Chalova, Manolov, Manolova, 2017, p. 2)³⁸. Out of the 1468 kg of rose oil produced in 2015, almost 20% (283 kg) was manufactured with organic raw materials. In the spatial analysis of the places for organic production of oil-bearing rose there is no random element and distribution – the p-value has very high levels – 0.29 (ArcGis – Statistic Analysis), which is normal due to the entrepreneurship activity in the sector not based on random processes, but rather on a thorough localization analysis. On the map below appears the spatial distribution of oil-bearing rose producers who have adopted organic production tools.



Map 1. Spatial distribution of organic rose production in Bulgaria

On map 1 there are 81 points which as of October 2019 are presented by the Register of the Ministry of Agriculture, Foods and Forestry of the Republic of Bulgaria. Every organic producer must pass an obligatory inspection by an independent assessment authority and be registered in the Register of Organic Producers in Bulgaria. Based on the above image the following conclusions can be drawn:

³⁷Piperkova, N., Shirilinkova, T., Development of *Phragmidium mucronatum* in Conventional, Integrated and Organic System of Growing Oil-bearing Rose (*Rosa Damascena mill.*). Agrarian University – Plovdiv. Proceedings of the Applied Scientific Conference “Organic Farming – History and Perspectives”, vol. LX, issue 2, 2016.)

³⁸Vesela I. Chalova, Ivan G. Manolov and Vanya S. Manolova, Challenges for commercial organic production of oil-bearing rose in Bulgaria, *Biological agriculture & Horticulture*, 2017 <http://dx.doi.org/10.1080/01448765.2017.1315613>

1)The geographical zone of organic production of oil-bearing rose is situated mainly in the sub-Balkan valleys, bordered by the central ridges of StaraPlanina Mountains (to the north) and Sashtinska and SarnenaSredna Gora Mountains (to the south). The typical climate for the region is moderate and continental. Specifically, here is the home of 70% of the registered organic producers of oil-bearing rose. The zone of the largest concentration is in the vicinity of Kazanlak municipality. In this region operate 14% of all organic producers. To the west of Kazanlak a big number of small scale aggregations are observed. These small concentrations are visible in the villages of Dabene and Kliment. Apart from these concentrations along the whole length of the sub-Balkan valleys singular organic producers of oil-bearing rose are notable. There is also one other Bulgarian municipality with a high concentration of organic production. This is Panagyurishte municipality. In that region 12% of the registered producers are concentrated.

2)The GIS is used to measure so-called Average Nearest Neighbor. The Average Nearest Neighbortest compares two values:

- a) The measured average distance between neighbor objects;
- b) The expected hypothetical distance between neighbor objects.

The measurement of the Average Nearest Neighbor is calculated with the formula:

$$ANN = \frac{D_1}{D_0}$$

where

$$D_0 = \frac{\sum d_i}{n}$$

and

$$D_1 = \frac{0.5}{\sqrt{n/A}}$$

The values refer respectively to: the distance between the objects – D_1 , the number of objects – N , the zone of minimally enclosing rectangle around all object) – A . The minimally enclosing rectangle is calculated so that each point will have at least one neighbor.

If the index $ANN < 1$, the pattern exhibits clustering or grouping in the respective zone. If $ANN > 1$, then there is dispersion of objects in the respective zone. In this case $ANN = 0.3774$ which is indicative of a high degree of grouping.

It is normal to check if this high concentration in the respective region is the result of purely climatic and technical requirements, or there may be other reasons for it. The production of rose blossom is only the first step in the production of an end product. The second technological phase is subsequent processing. Manufacturers of rose blossom and distilleries are situated so that they can be near each other in order to avoid an additional weighing on the cost of the end product in case of long distance transportation of the raw material. Thus, in the sector is observed one of the most typical models of clustering in which the choice of localization conforms with the different technological phases along the whole production chain of the end product.

The cluster growth method is a priority of EU economic policy which is based on three main pillars: 1) creation of clusters as accelerators for innovation and industrial changes; 2) interregional and international cooperation in clusters, and 3) high accomplishments in clusters. This determines the five priority areas of the cluster initiatives: industrial modernization and value chains; investment directed to intelligent specialization; entrepreneurship (newly created enterprises and growing companies), growth and enhancing SMEs; interregional, international and intersectoral cooperation; excellent achievements in cluster management for a better support of SMEs.

Several main problems concerning the production of oil-bearing rose still remain unsolved. They can, however, be summarized as they appeared in a report by the Ministry of Agriculture, Foods and Forestry in 2018:

- Lack of control over ‘sort purity’ of the species of the oil-bearing rose grown in the country
- Non-sustainability and instability of the production of rose oil and oil-bearing rose products
- Impossibility and inability to satisfy the production powers of the industry with raw materials of the oil-bearing rose.
- Lack of complete legal regulation encompassing rose production and rose processing, which could be a major factor for building a single and uniform control in the sector
- Lack of full or insufficiently transparent monitoring of the separate elements from production to obtaining end products of the oil-bearing rose.
- Lack of regulation over the coordination and the relations between rose producers and rose processors of oil-bearing rose blossom.

In addition, organic oil-bearing rose production itself meets some challenges – low resistance of main rose variety to diseases and pests, less productivity during the conversion period, unstable profitability, administrative complications in provision of financial support and lack of seasonal workers.

Within the Programme for Development of Rural Areas in Bulgaria 2014-2020 organic farming is an assistance priority sector (agroecological payment, sub-measure “Organic Farming” and financial aid for transition to organic production). Exceptional assistance is also provided if needed (in 2018 exceptional assistance *de minimis* was allocated for rose producers). The aim is to enhance rose production, to preserve and stimulate this traditional and important branch for the state economy.

CONCLUSIONS

The historically established traditions, favorable natural and climatic conditions, the currently led national policy and support for the sector have defined organic rose production in Bulgaria as a fast growing branch in the last decade. The increased demand for organic products on the world market is a significant factor that determines the perspectives for developing the production of rose blossom and related products. The spatial concentration of organic production reflects to a great extent the localization of the sector in general and the transition process from conventional to organic method production. Thus, the question remains open to determine the possibilities for spatial extension not only of the range organic farms – rose producers, but as a general wider geographic distribution of the sector.

The problems identified here are related mainly to the need for stricter quality control, the extension of legislation and regulations, better coordination along the whole production chain from the raw materials to the end product. The understanding of the authors is that cluster development has no alternative because it solves on the one hand the task for using various economic powers for developing rose production itself, and also creates conditions for more balanced complex local economic development. Considering the sustainable business model of rose production based on small family farms which exercise family labor, it is important to develop and implement the policy in support of SMEs in the sector and to stimulate their optimal integration in the cluster model.

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STOCK-AND-FLOW SIMULATION MODELING FOR ASSESSING BASIC SUPPLY CHAIN OPERATIONS

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Abstract:

The supply chain is a backbone of business operations, an indispensable part of every organization, whether small or large. Effective supply chain management (SCM) is one of the most important aspects of running a successful and profitable business, leading to maximizing customer value and achieving a sustainable competitive advantage over the competitors. In the era of omnipresent digitalization, SCM is subject to intensive ICT support that transforms supply chain operations in a profound manner. The aim of the paper is to propose a basic simulation modeling framework suitable for carrying out various analyses *vis-à-vis* supply chain operations, based on the utilization of continuous stock-and-flow simulations. The resulting simulation model allows one to run various scenarios, making a plethora of ‘what-if’ analyses regarding a number of adjustable input variables. As an example of how digital transformation affects traditional supply chains, it provides a solid basis for further enhancements and inclusion of additional input and output parameters for forecasting purposes.

Key words: *supply chain, modeling, stock-and-flow simulation, Web-based simulation, InsightMaker[®]*

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Introduction

According to the process view, a supply chain represents a sequence of processes (e.g. decision making, execution ...) and flows (e.g. material, information, money ...) that aims “to meet final customer requirements and take place within and between different supply chain stages” (Van der Vorst, 2004, p. 2). Besides the manufacturer and its suppliers, supply chains may also include transporters, warehouses, retailers, and consumers, depending on logistics flows. It includes, but is not limited to, new product development, marketing, operations, distribution, finance, and customer service (Chopra & Meindl, 2012). A generic supply chain within the context of the total supply chain network is depicted in Figure 1. Each firm (e.g. manufacturer) belongs to at least one supply chain, i.e. it usually has multiple suppliers, distributors, retailers, and consumers.

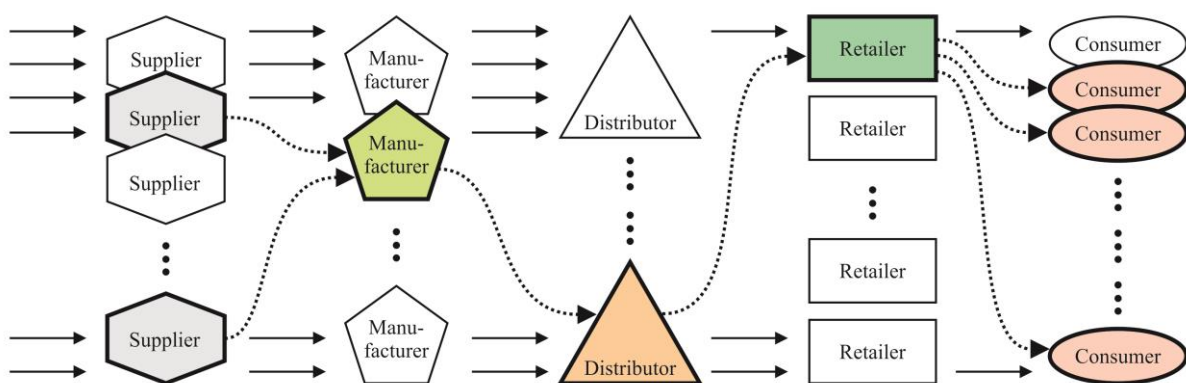


Fig. 1. Schematic representation of a single supply chain (represented with dotted lines) within a total supply chain network

On the other hand, supply chain management (SCM) is “the active management of supply chain activities to maximize customer value and achieve sustainable competitive advantage. It represents a conscious effort by the supply chain firms to develop and run supply chains in the most effective & efficient ways possible” (NCSU, 2017).

In today’s globalized markets, managing the entire supply chain in an efficient manner becomes a key factor that underpins the success of businesses. In contemporary highly competitive markets, each actor in a given supply chain copes with challenges of reducing time deadlines, inventory costs, transportation costs, and resource consumption to minimum on all levels. However, due to the conflicts/inconsistencies that exist among particular organization objectives, their decision-making processes, non-integration of their vital processes, and poor relationships/synchronization with other actors belonging to the same supply chain, a Bullwhip effect can easily emerge with an unpredictable and devastating impact on the whole supply chain. Since computer simulation permits an evaluation of the operating performance prior to the execution of a given plan, the development of simulation models for supply chain management has become a necessity (Chang & Makatsoris, 2001).

Having minded the previous definitions, the aim of the paper is to propose a stock-and-flow simulation model that would capture the basic supply chain operations among the last three actors depicted in Figure 1 (i.e. the consumers of a single retailer and one of its distributors), based on the principles of the system dynamics approach.

The rest of the paper is organized as follows. Section 2 briefly presents a literature review related to computer simulation of supply chains and the application of the system dynamics approach in

building simulation models of supply chains, in the last decade. Section 3 elaborates the common supply chain simulation approaches and focuses on the details of system dynamics. Section 4 describes the problem to be dealt with by describing the underlying causal loop diagram and formulating the corresponding SD model implemented in InsightMaker®. Section 5 evaluates the results obtained. Finally, Section 6 provides conclusions, research limitations, and future research lines.

Related Research

Due to its increased significance in recent years, computer simulation of supply chains has been put in the focus of methodologies for their analysis and assessment. The research being made in this area and being covered in this section can be roughly divided into two subcategories: (a) papers dealing with the application of computer simulation in SCM (in general) and (b) papers focused solely on the application of the system dynamics (SD) approach in modeling and simulation of supply chains. What follows is a brief overview of some of the research endeavors done in this field during the last decade. The subsequent three pieces of research belong to the first subcategory:

Hossain & Ouzrout (2012) attempted to model the trust in SCM for using Agent Modeling Language (AML) by proposing a Multi-Agent System (MAS) SCM model of trust in supply chain management. The proposed model is implemented using the Java Agent Development Environment (JADE) and the simulation results demonstrated the impact of trust in the supply chain along with the evolution of trust.

Ingalls (2014) elaborates the reasons for using simulation as an analysis methodology to evaluate supply chains, its advantages and disadvantages compared to other analysis methodologies, and points out some business scenarios where simulation can help in obtaining cost reductions that other methodologies would miss.

Sánchez-Ramírez *et al.* (2016) develop a simulation model to improve the performance of an automotive supply chain and using sensitivity analysis, they find the values that allow the supply chain to improve its order fulfillment indicator by modification of specific variables in the model such as Cycle Time, Production Adjustment Time, Delivery Time, Raw Material Inventory, and Finished Good Inventory.

What follows are some of the most prominent researches that belong to the second subcategory:

Wai & Chooi-Leng (2011) utilize system dynamics approach and the iThink® software to better understand the supply chain system of an actual semiconductor company and to find out better solutions through experimentations with a few key variables. The results of their research revealed that a company could achieve up to 25% reduction in inventory cost using computer simulations.

Feng (2012) used the method of system dynamics (SD) to model supply chain information sharing, in order to demonstrate its importance in SCM.

Mula *et al.* (2013) propose a simulation approach based on system dynamics for operational procurement and transport planning in a two-level, multi-product and multi-period automobile supply chain. They used the Vensim® simulation tool to highlight the potential of system dynamics for supply chain simulation. The effectiveness of the proposed model was validated through the comparison of the results provided by spreadsheet-based simulation, fuzzy multi-objective programming, and system dynamics-based simulation models. The simulation results indicated a reduction in inventory cost by about 10%.

Sundarakani *et al.* (2014) analyzed the environmental implications of the rapidly growing construction industry in the UAE using the system dynamics approach. By quantitative modeling of the construction industry supply chain, which helps to measure the dynamic interaction among various

factors under multiple realistic scenarios, their study provides an analytical decision framework to assess emissions of all stages applicable to the construction industry supply chain.

Hoque & Khan (2016) attempted to provide a review of the best practices and performance measuring frameworks on supply chain performance measurement in order to control and improve operational efficiency and effectiveness, as well as on the system dynamics modeling solely in the field of SCM. According to their research, despite the fact that the dynamic complexity of supply chains can be handled through SD modeling, articles that provide best practices for measuring supply chain performance using the SD approach are quite rare.

There are also a rising number of Ph. D. theses that focus on the application of SD approach to supply chains in different areas, like Li (2016), who focused on risk modeling and simulation of chemical supply chains, and Botha (2017), who used SD simulation for strategic inventory management in the automotive industry of South Africa.

Ghadge *et al.* (2018) assessed the impact of additive manufacturing implementation on aircraft supply chain networks, using a system dynamics simulation approach that revealed significant and valuable insights into the supply chain performance.

In their research based on the use of agro-straw as a typical agro-waste, Liu *et al.* (2018) utilize a hybrid approach, built on multi-objective optimization and system dynamics simulation, intended for optimizing the structure of straw-to-electricity supply chain and designing motivational mechanisms to enhance its sustainability.

Abidiet *al.* (2018) present a system dynamics simulation inventory management modeling for a multi-echelon multi-product pharmaceutical supply chain that aims to support selecting optimal operational service levels regarding the total inventory cost.

Supply Chain Simulation

As one of the several methodologies available for supply chain analysis, simulation has distinct advantages and disadvantages when compared to other analysis methodologies. Since the objective of any simulation is performance evaluation, supply chain simulation enables effective strategic planning and decision making. Customers, products, sites, and transportation modes can be defined using supply chain specific modeling constructs. Customized business logic, objects, and rules can be defined to capture the dynamics and real-world supply chain behavior. Business policies for inventory, sourcing, transportation, and production processes can be modeled, as well. Applications include: (a) supply chain network design; (b) demand planning; (c) production capacity planning; (d) inventory optimization; (e) transportation modeling; and (f) modeling of warehouse operations.

Some of the most prominent benefits/features of performing supply chain simulations may include (PMC, –):

- Creation of realistic supply chain models capturing system dynamics, resource constraints, and risk;
- Simulation of existing (as-is) and improved (to-be) supply chain network designs;
- Analysis of the performance metrics such as service level, cost, inventory level, and cycle time;
- Visualization of the supply chain in action;
- Evaluation of routing strategies and testing new strategies to predict actual costs and service levels;
- Optimization of supply chain performances.

It should be notified that supply chain simulations can be carried out by using common or dedicated/specialized commercially available software packages such as Arena[®], AutoMod[®], ExtendSim[®], ProModel[®], Supply Chain Guru[®], Simul8[®], Solvoyo[®], Tecnomatix Plant Simulation[®], and Witness[®]. In general, supply chain simulations can be also carried out by developing and running a suitable simulation model using a general-purpose programming language (e.g. Python/SimPy).

The main approaches encompass either Discrete-Event Simulation (DES) methods or continuous simulations (e.g. stock-and-flow simulations).

A discrete-event simulation (DES) models the operation of a given system as a (discrete) sequence of events in time. Each event occurs at a particular instant in time and marks a change of state in the system. Between any two consecutive events, no change in the system is assumed to occur; thus the simulation time can directly jump to the occurrence time of the next event (Robinson, 2014). Contrary to this, with continuous simulations, the system state is changed continuously over time on the basis of a set of differential equations defining the relationships for the rates of change of state variables. In trivial cases, those systems of differential equations can be solved analytically, otherwise, they are solved numerically, by using a computer and a corresponding software, either general-purpose or dedicated one (Duivesteijn, 2006; Thierry *et al.*, 2008, pp. 12–13).

System Dynamics (SD) is a methodology and a mathematical modeling and simulation technique for framing, understanding, and discussing complex issues and problems. As an approach to understanding the dynamic behavior of complex systems over time and an important aspect of the systems thinking theory, SD uses internal feedback loops, time delays, as well as stocks and flows to model the entire system. In fact, stocks and flows are the main building blocks of SD models (Ford, 1999, pp. 14–24). Contrary to Discrete-Event Simulation (DES), SD uses a quite different approach. SD is essentially deterministic by nature. It models the observed system as a series of stocks and flows, whilst state changes are continuous, resembling a motion of a fluid at a given rate, flowing through a system of reservoirs or tanks (stocks), mutually connected by pipes (flows). Stocks are variables presenting the level of accumulation. Flows go in and/or out of the stocks, thus increasing or decreasing their values with a certain rate. In essence, SD deals with the interaction of different elements of a system in time and captures the dynamic aspect by incorporating concepts such as stock, flows, feedback and delays, and thus offers an insight into the dynamic behavior of a system over time (Tang & Vijay, 2001).

Because of its great flexibility, along with its ability to combine together both qualitative and quantitative aspects of the modeled system, as well as its tendency to model and simulate the dynamics of a system at a higher, yet more strategic level in order to gain a holistic insight into the dynamic interrelations among the different parts of a complex system, SD has been applied in many different fields of study so far, including project management, system analysis, health care, supply chain management, logistics, sustainability, environmental science, etc. The SD approach has become popular in SCM during the last two decades, although it was initially introduced by Jay Forrester in 1961.

Given the accuracy of this modeling method that permits building formal computer simulations of complex systems and their use to design more effective policies, in this paper, we revert to continuous simulations based on the SD principles. Using general-purpose Web-based software in a SaaS manner, we develop a simplified simulation model capturing the basic supply chain operations.

Stock-and-Flow Simulation Model

Contemporary software solutions that support integrated supply chain operations cover a number of operations related to the cost, quality, delivery, and flexibility that arise from the very first suppliers to

the end consumers. For instance, retailers do not make explicit purchases from distributors anymore; instead, retailers' information systems automatically generate and send purchases, based on the defined minimum levels of products in their internal warehouses, and distributors automatically initiate the transportation of ordered products to retailers, based on their available resources. This is the essence of the proposed supply chain simulation model.

The underlying logic behind the proposed SD simulation model and its boundaries are concisely described with the causal loop diagram, shown in Figure 2.

Causal loop diagrams are a technique to portray the information feedback at work in the observed system. The word 'causal' refers to cause-and-effect relationships, whilst the word 'loop' refers to any closed chain of cause and effect (Ford, 1999, pp. 69–87). Causal loop diagrams are an essential tool used by the SD approach, allowing one to focus on the structure and the dynamic behavior of a given system over time. It portrays the interrelations that exist among different input and output variables, mutually connected by influence arcs that end with arrows (i.e. directed arcs), forming the causal chains and loops. Each arc has two important features: a direction and a sign. The direction of arcs actually shows the effect of a causal chain, whilst the sign denotes the nature of a change between two variables: when the sign is positive (+), the variables on both sides of the influence arc change in the same direction (e.g. an increase of the value of the variable from which the arc originates implies an increase of the variable to which the arc sinks and vice-versa), otherwise (–) they behave in the opposite manner.

The causal loop diagram depicted in Figure 2 clearly points out the inclusion of three main actors in the SD model, which are a constituent part of any supply chain: the consumers, a retailer, and one of its distributors:

- (a) *Consumers*: the consumer arrival rate (λ), the probability of buying a certain product (π), the mean quantity bought (μ), and the standard deviation of the quantity bought (σ) have all a positive impact on the total quantity bought in a particular retailer's store;
- (b) *Retailer*: the increased quantity bought leads to decreasing the quantity of a product on the retailer's store shelves. After reaching the defined minimum level on store shelves, an internal transfer of a certain quantity of the same product is being initiated from the retailer's store warehouse to store shelves. Each internal transfer of products decreases the number of products in the retailer's store warehouse. After reaching the minimum level in the store warehouse, a certain quantity of the product is being ordered automatically from one of the retailer's distributors;
- (c) *Distributor*: based on the maximum number of available transportation vehicles, the distributor assigns a certain number of these to transport (a part of) the ordered quantity of the product, based on vehicles' storage capacity. The more assigned vehicles and/or the larger the vehicles' storage capacity, the more the quantity delivered to a retailer's store warehouse. The increase of the quantity delivered to a retailer's store warehouse imposes an increase of the quantity in the retailer's store warehouse while decreasing the quantity of a product in a distributor's warehouse.

Figure 2 indicates the existence of two balancing loops, which reflect circular causality in the modeled system: the first one encompasses the processes included in the internal transportation of a product from retailer's warehouse to retailer's store shelves, whilst the second one refers to processes encompassing the transportation of a product from distributor's warehouse to retailer's warehouse. In general, a feedback loop exists when information, originating from some action, travels through a system and eventually returns in some form to its point of origin. Feedback is said to be negative (i.e. balancing) when the change fosters other components to respond by counteracting that modification. Feedback is considered positive (i.e. reinforcing) when the original change leads to modifications that

reinforce the process. Negative feedback loops are likely to counteract the disturbance and guide the systems back to equilibrium or steady state. On the other hand, positive feedback loops tend to intensify any disturbance and lead the system away from equilibrium.

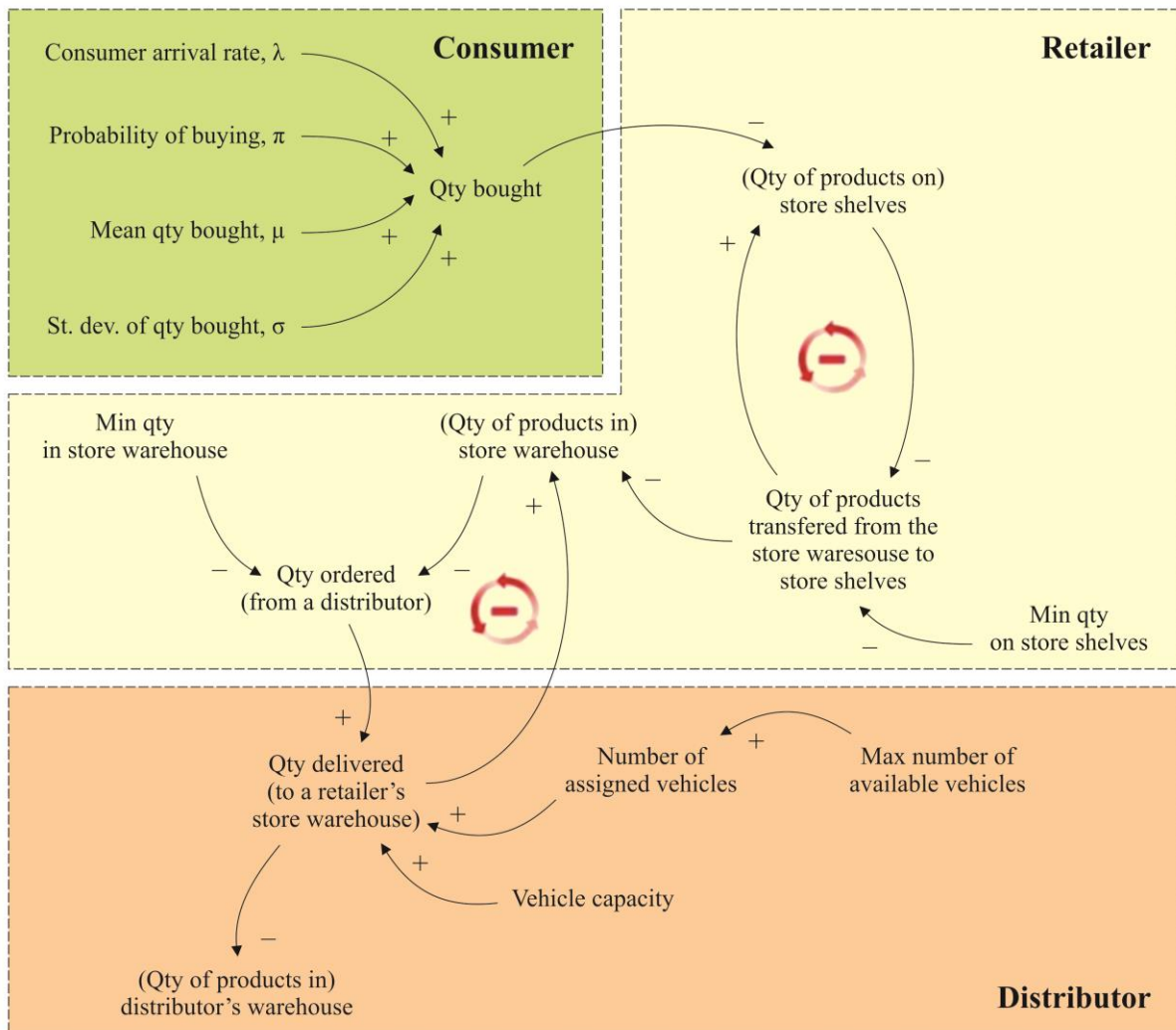


Fig. 2. Causal loop diagram depicting the logic and the boundaries of the proposed simulation model

The proposed simulation model (Figure 3) has been completely developed from the causal loop diagram using InsightMaker®, an innovative, Web 2.0-based, multi-user, general-purpose, online modeling and simulation environment, completely implemented in JavaScript, which promotes online sharing and collaborative working in a SaaS manner (Fortmann-Roe, 2014).

In Figure 3, stocks are presented with rectangles, flows with bold directed arrows, variables with ovals, whilst dotted lines, connecting two primitives, represent links, which transfer information between them.

The specifications of variables, stocks, and flows are given in Table 1, Table 2, and Table 3, respectively.

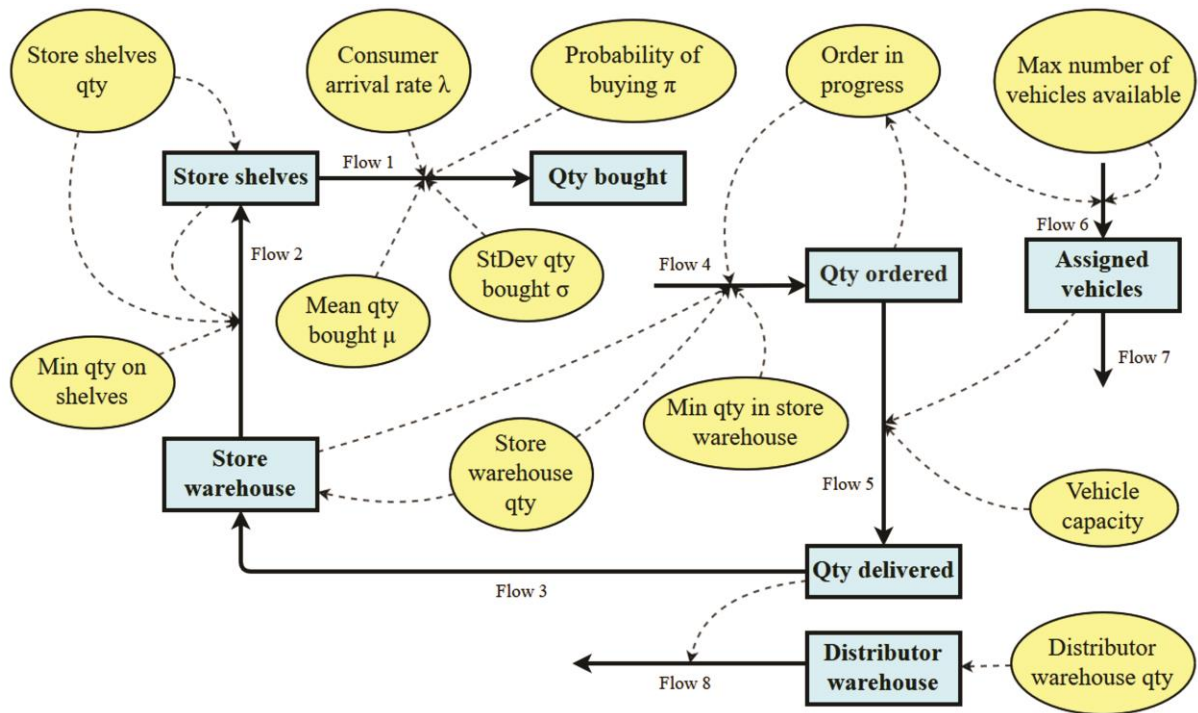


Fig. 3. Stock-and-Flow simulation model of basic supply chain operations

Table 1. Specification of variables in the SD model

Object (variable)	Unit	Initial value	Adjustable?	Min value	Max value	Step
Consumer arrival rate λ	consumers per day	200	Yes	0	1,000	5
Probability of buying π	///	0.05	Yes	0.00	1.00	0.05
Mean qty bought μ	pcs	1	Yes	0	50	1
StDev qty bought σ	pcs	0.75	Yes	0.00	1.00	0.05
Store shelves qty	pcs	50	Yes	0	100	5
Min qty on shelves	pcs	5	Yes	0	25	5
Store warehouse qty	pcs	5,000	Yes	0	10,000	100
Min qty in store warehouse	pcs	500	Yes	0	2,500	100
Order in progress	///	Prog. code	No	///	///	///
Max number of vehicles available	pcs	5	Yes	1	10	1
Vehicle capacity	pcs	25	Yes	10	100	5
Distributor warehouse qty	pcs	500,000	Yes	0	1,000,000	1,000

From Table 1, it is obvious that all variables in the SD model are adjustable, except the variable [Order in progress], which is an internal control variable; it takes its value depending on the output of the following programming code:

If [Qty ordered] > 0 Then 1 Else 0 End If

This variable performs as a semaphore: 0 = there is no ongoing purchase; 1 = a purchase is being serviced.

Table 2. Specification of stocks in the SD model

Object (stock)	Initial value	Meaning
Qty bought	0	Quantity of products being bought from retailer's store shelves by consumers at each time instance
Store shelves	[Store shelves qty]	Total quantity of products on the retailer's store shelves over time
Store warehouse	[Store warehouse qty]	Total quantity of products found in the retailer's warehouse over time
Qty ordered	0	Total quantity of products being ordered by the retailer from the distributor within a single purchase
Qty delivered	0	Quantity of products being delivered at each time instance by the distributor to the retailer within a single purchase
Assigned vehicles	0	Number of distributor's vehicles at each time instance, assigned for transporting the ordered products
Distributor warehouse	[Distributor warehouse qty]	Total quantity of products found in the distributor's warehouse over time

Table 3. Specification of flows in the SD model

Object (flow)	Expression
Flow 1	= Round(RandPoisson([Consumer arrival rate λ])*[Probability of buying π] * RandNormal([Mean qty bought μ], [StDev qty bought σ]))
Flow 2	= If [Store shelves] <= [Min qty on shelves] Then [Store shelves qty] - [Store shelves] Else 0 End If
Flow 3	= [Qty delivered]
Flow 4	= If [Order in progress] = 0 Then If [Store warehouse] <= [Min qty in store warehouse] Then [Store warehouse qty] - [Store warehouse] Else 0 End If End If

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Flow 5      = If [Qty ordered] - [Assigned vehicles] * [Vehicle capacity] > 0 Then
              [Assigned vehicles]*[Vehicle capacity]
            Else
              If [Qty ordered] - [Assigned vehicles] * [Vehicle capacity] < 0 Then
                [Qty ordered]
              Else
                0
              End If
            End If
Flow 6      = If [Order in progress] = 1 Then
              Round(Rand(0, 1) * [Max number of vehicles available])
            Else
              0
            End If
Flow 7      = [Assigned vehicles]
Flow 8      = [Qty delivered]

```

Simulation Results

Given that the time unit used in simulations is set to ‘day’, the maximum simulated time length was set up to 1,500 [days]. What follows is a step-by-step verification of the proposed SD model by presenting a series of simulation outputs that portray the dynamics of certain parts of the supply chain over time, thus proving that the modeled system complies with the general idea/specification.

Figure 4 depicts the dynamics within the retailer’s store. Due to [Flow 1], which represents the quantity of products being bought from store shelves on a daily basis, there is a continuous decrease of the product’s quantity on the shelves from its initial value to the minimum allowed one over time. Once the level of the variable [Store shelves] reaches the value of the variable [Min qty on shelves], an internal flow of products, [Flow 2], activates from retailer’s warehouse to retailer’s shelves, filling up instantly the quantity of products to the value of [Store shelves qty].

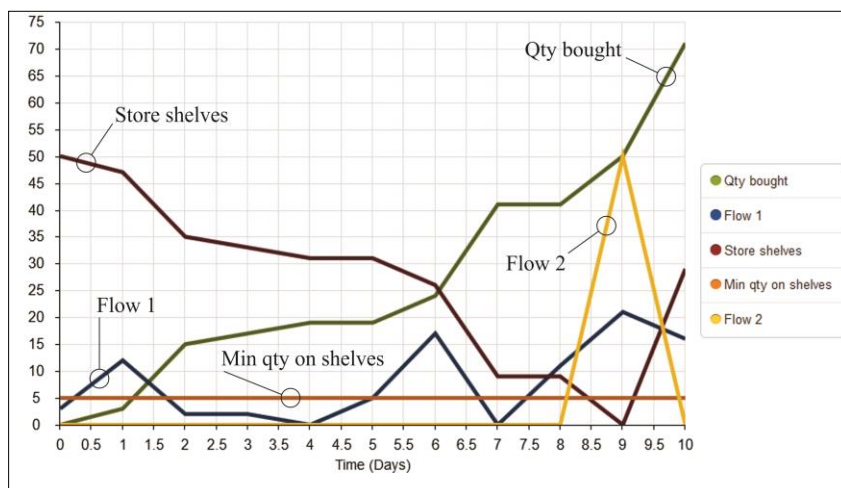


Fig. 4. The dynamics with the retailer’s store

Consecutive activations of [Flow 2] impose the level of the product in the store warehouse, [Store warehouse], to decrease slowly over time (Figure 5). In Figure 5, the primary axis represents the levels of product's quantities in the retailer's store warehouse over time, whilst the secondary axis represents the amounts of the product transferred from the retailer's store warehouse to retailer's store shelves at particular time instances, due to [Flow 2].

Once the current level of the product in the store warehouse, [Store warehouse], reaches the specified minimum, [Min qty in store warehouse], an order is being automatically generated and sent to retailer's distributor, which complements the product's quantity in the store warehouse up to [Store warehouse qty]. This behavior is repeating over time, as long as there are quantities of the product in the distributor's warehouse (Figure 6).

Figure 7 explains the role of the control variable [Order in progress]. It takes a value of 1 at the moment when a purchase to supply additional quantities of the product from the distributor is made by the retailer, and takes a value of 0 when the purchased quantities are completely transferred. In the same context, Figure 8 illustrates the role of the control variable regarding to the dynamics of assigned vehicles at each time instance, intended to transfer the ordered quantities of the product from distributor's warehouse to retailer's store.

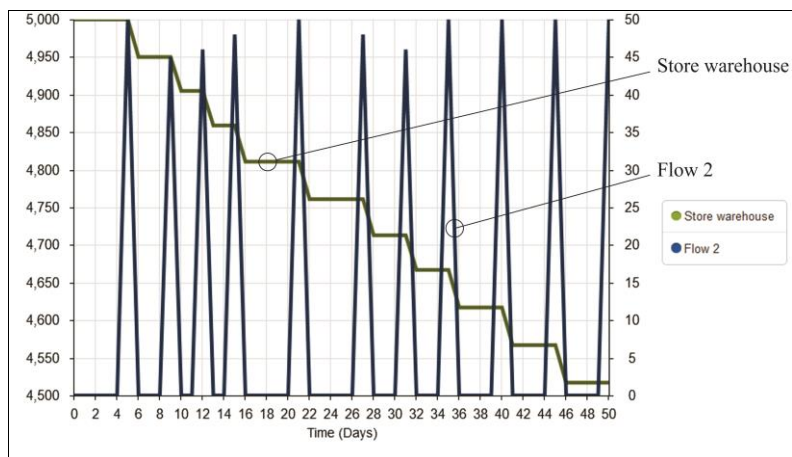


Fig. 5. Decrease of product's quantities in the retailer's warehouse as a result of many consecutive transfers of products to retailer's store shelves

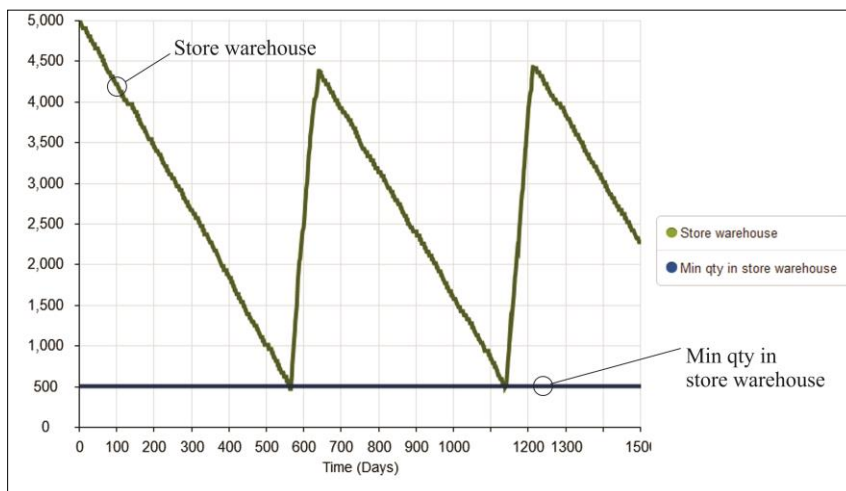


Fig. 6. Cyclic complementing product's quantities in the retailer's store warehouse over time, as a result of reaching the specified minimum

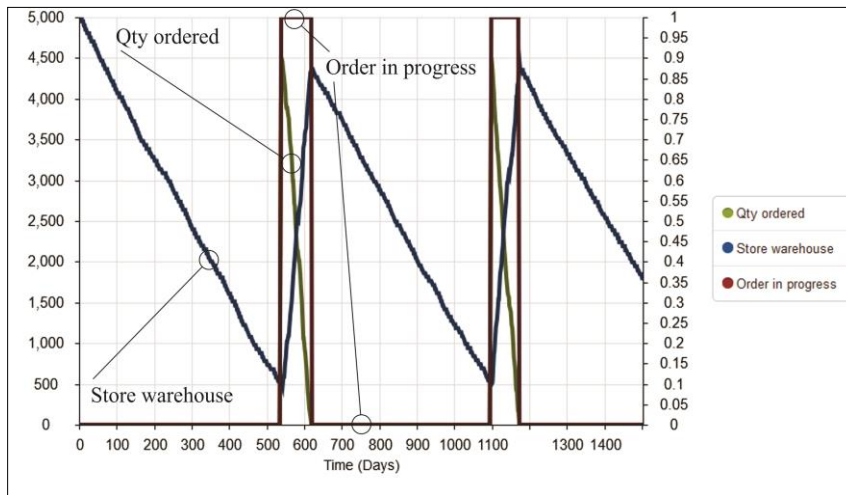


Fig. 7. Illustration of the variable [Order in progress] vis-à-vis the timing of placing and fulfilling purchases.

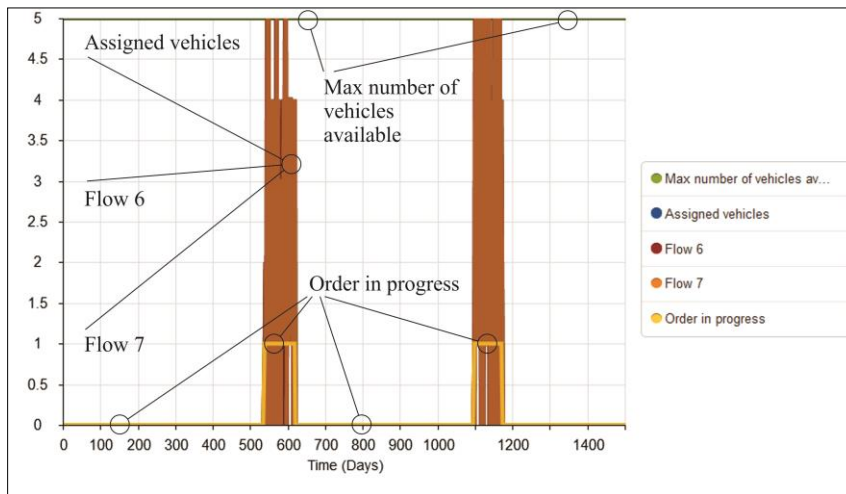


Fig. 8. Illustration of the variable [Order in progress] vis-à-vis the number of assigned vehicles

Finally, Figure 9 shows the decrease of product quantities in the distributor's warehouse over time (primary axis), as a result of [Flow 8], representing the transfer of purchased quantities to retailer's store warehouse at particular time instances (secondary axis).

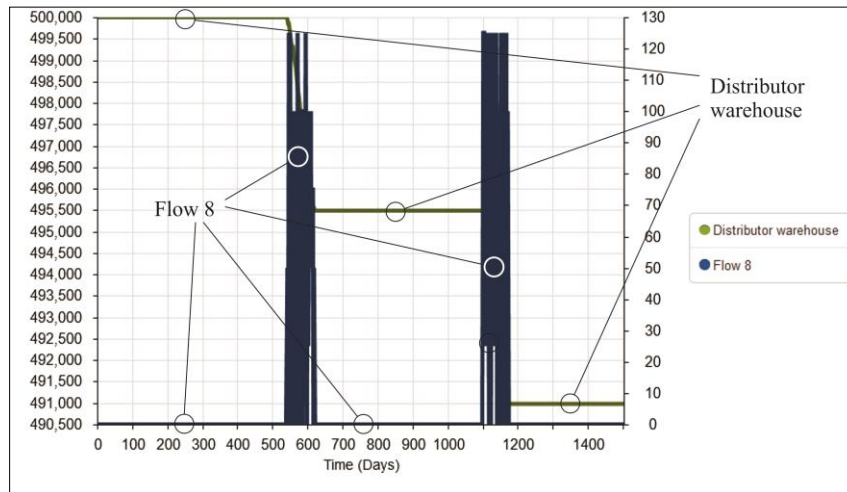


Fig. 9.Decrease of product quantities in the distributor's warehouse [Distributor warehouse] over time, as a result of [Flow 8]

Conclusion

Simulation enables the design of a supply chain and evaluation of SCM prior to the implementation of the real system, which allows one to perform 'what-if' analyses leading to 'thebest' (i.e. the optimal) decision/solution. As such, simulation of supply chains can be used to support supply chain design decisions or evaluation of supply chain policies.

The power of simulation as a methodology for analysis shows up whenever the observed supply chain is complex, dynamic, and has transient (i.e. time-dependent) performance problems. In general, simulating a supply chain can be extremely complex, because the underlying model must capture well a number of crucial business processes, including the basic material requirements planning (MRP) process, planning, and scheduling, capital acquisition, labor policies, allocation of constrained resources, etc. However, if a supply chain is modeled correctly, a supply chain simulation can show ways to increase revenues, profitability, and service levels to the customer. This can translate into large financial advantages to the company.

The proposed generic SD model allows making thorough insights into the dynamics of the modeled supply chain. Since it captures solely the basic operations among the last three actors in a supply chain (i.e. 'the last mile'), it has a number of limitations, including the following ones: (a) The supply chain refers to a single product, a single retailer store, and a single distributor; (b) The distributor uses transportation vehicles all having a same storage capacity; (c) In order to restrict the model to only three actors (i.e. consumers, retailer, and distributor), the distributor warehouse capacity is theoretically infinite (i.e. sufficiently large in practice). Contrary to verification, which was carried out as an internal process, validation of the modeled system, which is the process of assuring that it meets the needs of a customer and other identified stakeholders (i.e. its end users), was not possible to be carried out at this point, due to the fact that the proposed simulation model is generic and in an early stage of development. Yet, the model is quite flexible in two ways: (a) the 11 adjustable parameters offer a plethora of possibilities to run various 'what-if' analyses and test various simulation scenarios; (b) the SD model can be easily upgraded by including additional variables to assess various categories of interest, like costs related to human resources, transportation, storage of products, etc.

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**CRITICAL SUCCESS FACTORS IN IMPLEMENTING A KNOWLEDGE
MANAGEMENT PROJECT
IN A MICRO SOFTWARE COMPANY**

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Abstract:

Software companies are recognized as knowledge-based organizations because their employees solve creative and innovative tasks by using recent technologies. The main challenge for these companies is how to manage knowledge as the main asset in their business. This becomes even more important for micro software companies due to their recognized constraints in budget, human resources, workspace and working resources, and timelines. Critical success factors, as an indicator of management planning to achieve effective business performance, have been widely used to analyze projects' performances in software engineering. This paper presents an analysis of the critical success factors identified in implementing a knowledge identification and systematization project in a local micro software company in Serbia. After presenting a lightweight inductive method for knowledge identification and systematization that was implemented in a selected micro company, critical success factors were determined and discussed. Based on the discussion of critical success factors, lessons for further knowledge management projects are drawn. In addition, benefits for the selected company, as well as implications for the software industry and academic researchers are discussed.

Key words: *critical success factor, knowledge management, micro software company, software industry*

1. Introduction

Knowledge has become the main resource the companies use for their business success in the contemporary and changing market, which is especially true for software companies (Schneider, 2009). In order to be competitive, the companies should develop specific capabilities and recognizable way of doing things, which is based on capabilities of people working in the company (Andreu and Sieber, 2010). This fact strongly emphasizes the importance of people skills and knowledge. Since knowledge resides in people heads, and it can be lost if people leave a software organization, there is a need to implement knowledge management (KM) initiatives in software companies (Rus and Lindvall, 2002). New knowledge is usually created through development of innovative concepts and creative approaches to new situations and problem solving (Grimsdottir and Edvardsson, 2018). According to Schneider (2009) KM includes acquisition of new knowledge, transformation from implicit to explicit knowledge and back again, storage and dissemination, and applying knowledge. Hansen and Kautz (2004) suggested that the key element in KM is to evolve the current industrial practices by carefully studying it and extracting information that will help in adjusting and improving future practice.

Software engineering practice has been recognized as knowledge based practice, which requires dedication to personal experiences and skills in order to capture them and organize for future reuse (Rosqvist et al., 2003). Based on an empirical study with nineteen software experts from industry, Steen (2007) pointed out the importance of experience-based, practical knowledge for successful software engineering practice. In addition, a contemporary trend with geographically distributed software teams introduces several challenges in managing knowledge in software development, such as distribution of shared knowledge of the application domain, knowledge of who knows what in the team, durable knowledge of the software development process itself, and fleeting knowledge of whether other team members are adhering to the process (Espinosa et al., 2007). Refinement and reuse of existing knowledge in software organizations lead to practice improvement and increase the quality of products and services (Ivarsson and Gorschek, 2012). Due to the recognized constraint of small software companies (resources, team, budget, etc.), KM was implemented informally (O'Connor and Basri, 2014). Since there are usually no formal training for employees in micro and small software companies, learning occurs as self-learning and acquiring knowledge and skills while working on projects.

Knowledge management occurs in specific organizational context that influence its adoption and implementation. Success of KM initiatives and projects depends on organizational characteristics and factors that provide the context for knowledge flow among individuals (Conley and Zheng, 2009). Critical success factors (CSFs) were introduced by Rockart (1979) as an effective approach used by executives to define their needs. Critical success factors relate to managerial areas, also called minimum key factors, the organization should give special attention to successfully achieve proposed objectives and mission with high performance (Oakland, 2003). Knowledge management has been mostly adopted by large companies that have enough resources to implement KM initiatives. This causes that critical success factors (CSFs) for implementing knowledge management (KM) practice in small enterprises have been mostly derived from the studies related to larger companies and practically they do not match their real needs (Wong , 2005). A thorough understanding of CSFs is essential for the success of KM practice in organizations, but the adoption of not suitable factors can lead to not desired performances.

Based on the above discussion, we propose a research objective for this study: "What are the most critical factors in a KM project implementation in a micro software company?" The paper is structured as follows. The next section briefly outlines work on CSFs in knowledge management and their use in software engineering. The third section presents a case study with the focus on a KM project in a micro software company and CSFs for implementing a KM project. Lessons learned during the project implementation are presented in the fourth section. The last section contains concluding remarks and future research directions.

2. Critical success factors

Holsapple and Joshi (2000) proposed a descriptive framework for understanding the influences for the success of KM initiatives in organizations, with three main classes of influences: managerial, resources and environmental. Each KM initiative (episode) assumes the recognized knowledge need, requires knowledge resources and knowledge management influences, which after successful implementation results in learning and projection (basis for further innovations and development within the organization). According the Holsapple and Joshi (2000), the most important influence for KM initiative success is managerial influence, with the following four main factors:

- *Leadership*. The primary factor that influences the sharing of organizational knowledge, inspires, fosters mentoring, and engenders trust and respect by instilling a cohesive and creative organizational culture.
- *Coordination*. It relates to managing dependencies among KM activities, marshaling sufficient skills for activities execution, and integrating knowledge processing.
- *Control*. This factor ensures availability of all resources in sufficient quality and quantity for all KM activities.
- *Measurement*. It ensures valuation of knowledge resources and processors in a KM initiative, and provides the basis for evaluation of leadership, coordination and control.

Based on a detailed literature review, Wong (2005) proposed 11 CSFs for implementing KM in small and medium enterprises: management leadership and support, culture, IT, strategy and purpose, measurement, organizational infrastructure, processes and activities, motivational aids, resources, training and education, and HRM. Empirical assessment aimed at evaluating the extent of success of the proposed CSFs clearly supports the findings of the integrative literature review and indicates the appropriateness of the proposed CSFs.

Sedighi and Zand (2012) conducted a literature review on CSFs in KM and identified eight major factor's clusters that are shaped as a conceptual classification model. Clusters of factors are arranged in two basic dimensions: external (environmental) factors, and internal (organizational) factors. The external factors include macro and meso factors. Macro factors encapsulate all global factors such as legal, economic, political, technological, social, educational, and globalization factors. Meso factors relates to the market segment and industry in which the firm operates. The internal factors originate in an organization and can be classified in six categories: culture, structures and procedures, human and financial resources, technology and infrastructure, strategy and leadership, and KM process. Totally 26 internal and 9 external CSFs were identified and included in the conceptual classification model.

CSFs have gained attention from the software engineering and information systems research community, which resulted in using them in many different aspects of the practice since the 1980s (Cooper, 2009). CSFs have been used in the fields such as information systems use (Bergeron and Bégin, 1989), software development projects (Purna Sudhakar, 2012), offshore software development outsourcing (Khan et al., 2009), agile software development (Chow and Cao, 2008; Kaur and Singh, 2016), software process improvement implementation (Niazi et al., 2006), integration in global software development (Ilyas and Khan, 2015), industrial requirements engineering process assessment and improvement (Sommerville and Ransom, 2005), process modeling for enterprise systems (Rosemann et al., 2001), or knowledge based software process improvement (Chugh and Nitin, 2018).

This brief literature review reveals that there is a lack of empirical studies dealing with CSFs for KM use in software engineering, which indicates that there is a need for more research in this domain. This study aims at filling this gap and contributing to the knowledge base in this field.

3. Case study

A knowledge management project has been implemented in a micro software company as a part of the project "The development of software tools for business process analysis and improvement", which is funded by the Ministry of Education, Science and Technological Development, Republic of Serbia. The project was prepared and conducted as a joint endeavor of the company employees and the researchers from Technical faculty "Mihajlo Pupin" in Zrenjanin, Serbia.

The company has seven employees and can be classified as micro software company (European Commission, 2015). It is oriented towards local clients. The majority of daily work in the company is devoted to maintaining software business applications (Stojanov et al., 2018), which clearly suggested the importance of systematizing knowledge about software maintenance practice (Stojanov, 2019).

3.1. Knowledge management project

The aim of the knowledge management project was to identify and systematize knowledge on software maintenance practice in the company. The project implementation should not disturb everyday practice, which assumes the lightweight design of the project. For that purpose a *Lightweight Inductive Method for Knowledge Identification and Systematization (LIM4KIS)* was created and implemented in the company. The KM project was implemented as a part of software process improvement (SPI) project (Stojanov et al., 2017), which was focused on software maintenance practice. The main characteristics of the LIM4KIS method are (Stojanov, 2019):

- *It is inductive.* It starts from the real working context in the company, which ensures that the most relevant knowledge is identified.
- *It is participative.* It is based on active participation of the company employees in all project activities.
- *It is based on frequent feedback.* During the whole project, feedback to the company management and employees maintains the focus of the project activities.
- *It is based on triangulation of data.* The method uses various data sources and types of data, which ensures more comprehensive findings and the validity of the research study.

The LIM4KIS method tries to identify and systematize the knowledge possessed by the company staffs, which have the best insight into how daily tasks are performed. Since the organization staff has the best insight into the everyday practice, the method uses their knowledge and experience for the identification and systematization of the most relevant knowledge. The method requires the full commitment of the organization's management. LIM4KIS method is quite flexible, but in general it proposes the following phases in the KM project implementation:

- *Project planning.* This is the first and the most critical phase for the project success. It includes defining the clear project objective, determining the roles of the company employees and the researchers, defining data sources and methods to be used. CSFs are determined in this phase
- *Project implementation.* This phase includes several activities that can be cyclically repeated until the most relevant knowledge is not identified and systematized. These activities relate to collecting data from various sources, analyzing data, identifying knowledge and systematizing knowledge in a thematic knowledge framework.
- *Project reporting.* This phase relates to preparing the report and validating the knowledge framework.

The project implementation phase is a cycle with several activities and feedback loops aimed at identifying and systematizing knowledge on software maintenance practice, as it is presented in Figure 1. The project plans contain details about the project team, data sources, methods for collecting and analyzing data, and the project objective that drives the implementation phase.

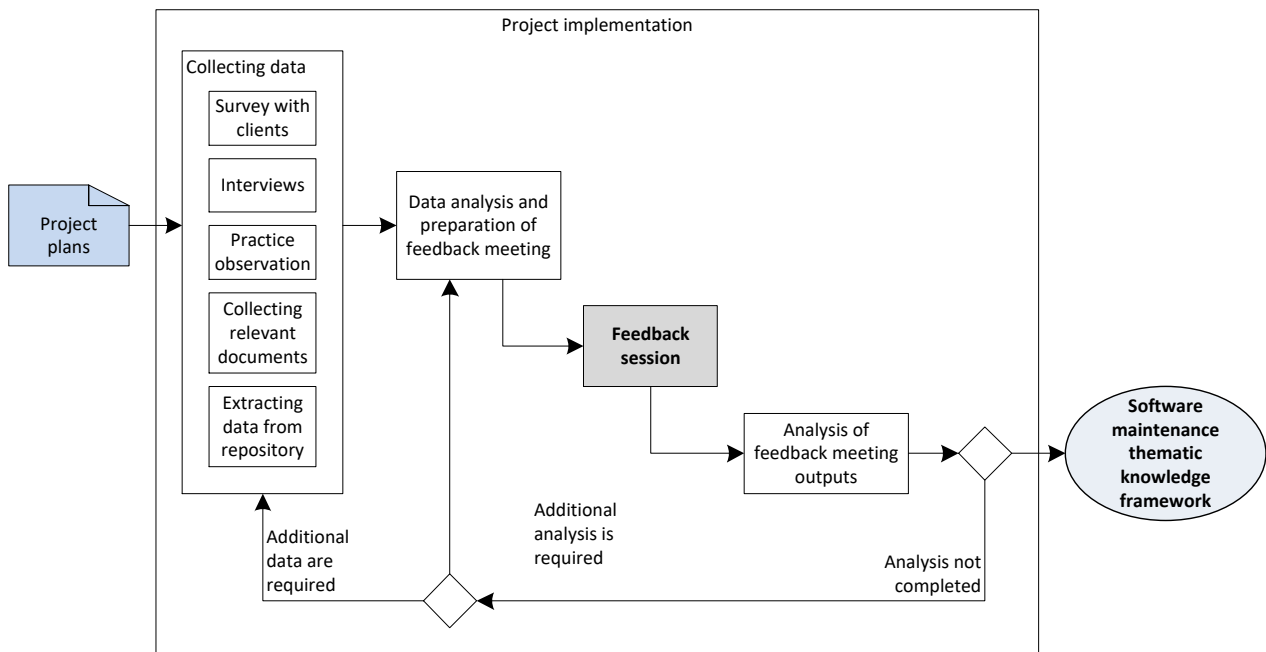


Figure 1. Implementation of the knowledge management project

The central activities in the project implementation are feedback sessions that are working meetings organized in the company. These meetings are organized for analyzing the current state of the project implementation and the issues related to data analysis. The main aim of these meetings is to provide feedback to the software company about the project implementation, which directs the next activities. Based on the analysis of the feedback session outputs, the new cycle of data collecting or data analysis activities can be initiated.

Data sources for knowledge identification include interviews with the company employees, a survey of the company clients, the notes from the everyday practice observation, the company documents, and the data extracted from the company internal repository of tasks. In addition, the transcripts from the feedback sessions were used as the data source. Due to the variety of data types, different data analysis techniques were used, both quantitative (descriptive statistics, regression analysis, and fuzzy screening) and qualitative (inductive thematic analysis).

The dominant data analysis method was inductive thematic analysis (Braun & Clarke, 2006), which was used for developing the main project output - the thematic knowledge framework on software maintenance practice. Inductive thematic analysis was performed by using different tools. The sources of qualitative data were the interviews' transcripts, the notes from the practice observation, and the transcripts from the feedback sessions. These data were prepared as MS Word documents and imported in MAXQDA software for qualitative data analysis, in which initial coding was performed. Created code system and memos were exported in rich text format, printed and analyzed in feedback session. The final stage of data analysis was conducted by using printed code schema by using pens in different colors.

The resulting thematic framework contains themes classified in three thematic areas: maintenance request process, human factor, and company business policy and organizational issues. In each thematic area, themes were hierarchically organized as the main themes, sub-themes and sub-theme topics. This thematic framework presents the current state of the practice, and it could be expected to evolve as the practice changes.

3.2. Critical Success Factors

Critical success factors for the project implementation were examined during the planning phase of the KM project. In the analysis of potential critical factors participated the company manager and leading researcher (the first author of this paper). This ensures that CSFs reflect the management and organization of the company and specificities of the KM project. In addition to determining CSFs, project planning also included

determining how these factors can be managed and assessed after finishing the project, and who will assess how CSFs were treated. The following CSFs were determined during the project planning:

- *Full support of the company management.* The project was designed based on the company needs, as a sub-project of the software process improvement project. The company management was included in the project preparation, which ensures that the project is aligned with the company business strategy and objectives. In addition, company management was included in the whole research process, especially when they should arrange access to the employees or other resources in the company.
- *Availability of the company employees based on the project needs.* Since the knowledge is personalized, it assumes active participation of the company employees in the different phases of the project implementation. The employees were used as the source of data through the interviews or the practice observations, or assisted in collecting documents or electronic data. In addition, they were included in the data validation and data analysis where appropriate.
- *Motivating the employees to actively participate in the project.* The project's objective is to identify and systematize the knowledge possessed by the company employees, and to make it available to all employees, which is very important for young and novice programmers.
- *Access to all resources in the company.* Knowledge identification assumes triangulation of various data sources, which assumes access to these sources. The company employees should assist in accessing the relevant documents, data in the repository and access to the clients.
- *Access to the company clients.* The clients participated in the survey aimed at identifying the characteristics of the company services, which was primarily used in process improvement project, but some data and findings were used in the KM project. The company management and the employees prepared clients' contact data, which helped in organizing the survey.
- *Implementing the project in a way that does not disrupt everyday activities.* The employees are dedicated to everyday tasks, which in many cases includes tight cooperation with the clients. The company employees participated in the project activities when they were free from usual tasks, and the project activities were tailored to the specific working schedule in the company.
- *Inclusion of the company employees in the data analysis.* The company employees, as the main sources of the knowledge, were also included in the data analysis, which should ensure that the identified knowledge really reflects the existing knowledge. The company employees participated in feedback sessions (working meetings), in which all project relevant issues were jointly examined. This includes data analysis activities.
- *Validation of the project findings.* The project findings should present the real knowledge about the practice. Therefore, the company management and two leading programmers validate the findings.
- *Including external researchers based on the project needs.* The complexity of the practice was reflected in the complexity of the collected data and used data analysis methods. Variety of qualitative and quantitative data analysis methods requires the researchers with different skills. These researchers were accessed at the university, and included for the specific data analysis tasks.

This short elaboration of the CSFs also includes the notes on how they were handled within the KM project. After the project implementation, the leading researcher and the company management analyzed how these factors influenced the project realization and the project findings. The analysis was performed in the company and included in the project report.

The company management full dedication and support to the project implementation was identified as the main CSF for the project success, because it influences other CSFs. Without this support the project cannot be implemented with the proposed objective and this will influence the quality of the findings. The influence of other CSFs can be more easily controlled.

Further analysis of the CSFs for the KM project implementation relates to the alignment of the identified CSFs with the CSFs reported in the literature. A brief analysis confirms a high degree of the conformance to the relevant literature, but it is important to note that each project and organizational context have own specificities, which assumes identification of very specific CSFs.

4. Discussion

Identification of CSFs helped the company management to more thoroughly prepare the KM project, and to identify possible obstacles in the project implementation. More comprehensive understanding of potential problems and obstacles in the project realization increases chances for successful project implementation. This understanding helps in preparing strategies to overcome problems and obstacles

The experience gained in this project can be used in preparing the next projects, which could ensure better project planning, more structured implementation, and more accurate validation of the project outcomes in the company.

Other micro software companies can use this set of identified CSFs as a starting point when considering the implementation of KM projects, and adapt them according to their specific needs. In addition, micro software companies can use the proposed approach for organizing a KM project and for considering CSFs specific to their internal organization and needs.

Researchers from academia can find lessons how to include examination of CSFs when preparing projects with micro software companies because their specific business model requires more intensive cooperation with the company management and employees in all phases of the projects.

5. Conclusions

The main contribution of this study is the identified set of CSFs that were managed in order to ensure the success of the KM project implementation in a selected micro company. The authors are aware that this set of CSFs is context-specific, but some common characteristics of micro software companies enable considering these CSFs when planning other projects in other companies. Due to the lack of studies reporting the use of CSFs in KM projects in micro software companies, this study contributes to the base of knowledge in this field of research.

Based on the experience gained in this study the following further research directions can be identified. The first research direction is the identification of the metrics for measuring the impacts of proposed CSFs in this study, which will lead to the refinement of these factors and measuring their importance. The next research direction relates to implementing the approach for identifying CSFs in other similar software companies and getting insight into similarities and differences. Several implementations of this approach can be used for proposing the framework with common CSFs for implementing KM projects in micro software companies.

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USING THE STATCOUNTER AS A WEB ANALYTICAL TOOL TO UNDERSTAND THE WEB VISITORS AND INCREASE THE WEB TRAFFIC

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Abstract:

The purpose of this paper is to present the opportunities that one of the most important web analytical tools, such as Statcounter, offer to companies and entities in the market, enabling them to maximize the strategic outputs of campaigns based on real data.

The accent would be put on the Statcounter, which provides detailed statistics about browser usage and real-time user traffic. For this purpose, Statcounter is used as a web analytics tool for the actual web page, observed in a period of time of one month.

Reports for traffic trends will be analyzed in this context, and also attention will be paid on analytical data related to the visitors' location, browsers, platforms, operating systems that they are using etc. Also, the most heavily visited pages would be identified, and recommendations for optimization will be stressed out, in order to achieve maximum impact by viewing the pages of the website ranked by popularity.

Key words: *web analytics, web users, stat counter*

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1. Introduction

Digital marketing is the act of promoting and selling products and services by leveraging online marketing tactics such as social media marketing, search marketing, and email marketing. "Digital marketing has become a new phenomenon that brings together customization and mass distribution to accomplish marketing goals. Technological convergence and the multiplication of devices have led to an opening of the ways in which we think about marketing on the Internet and have pushed the boundaries towards a new concept of digital marketing—user-centered, more measurable, global and interactive." [Carolina Machado, J.Paulo Davim, 2016]. In many ways, digital marketing is no different than traditional marketing. In both, smart organizations seek to develop mutually beneficial relationships with prospects, leads, and customers. But digital marketing has replaced most traditional marketing tactics because it's designed to reach today's consumers. As compared to traditional marketing, digital marketing refers to the use of methods and channels to get a proper understanding in real-time situations. This means that digital marketing gives businesses the opportunity to access the performance and effectiveness of their marketing campaigns and make adjustments accordingly.

Digital marketing is a digital identity of a company through which it presents itself in the virtual world to an enormous number of users. Thanks to a digital technology, a brand can reach each consumer with its products.[Sawitcki, 2016] The use of digital marketing in the digital era not only allows for brands to market their products and services but also offers online customer support through 24x7 services to make the customer feel supported and valued. Digital marketing provides increased advantage for brands and businesses. It is now common for consumers to post feedback online through social media sources, blogs, and websites about their experience with a product or brand.

Digital marketer must also use measurable analytics to identify weaknesses and find ways to improve performance across these channels. In this sense, company can be responsible for all aspects of a company's digital strategy or just focus on one.

According to [Bekavac, Garbin, 2015], the use of web analytics tools in business fields, as expected, is most frequent in the marketing industry.

Digital marketing goals are:

- To increase website traffic,
- For brand promotion or brand awareness,
- To improve quality of customers,
- To improve search engine ranking,
- To get best ROI result,
- To find loyal and potential customers, etc.

Every company has specific business goals. In order for a Website to be beneficial, information gathered from its visitors must not merely show what has happened in the past, but it must also be able to improve the site for future visitors. The company must have clearly defined goals for the future and use this information to support strategies that will help it achieve those goals, according to [Both, Jansen, 2009],

Why companies need to be online [Jones, Malczyk, Beneke, 2011]:

1. The market and competitors are already there. If you market and sell products or services to a middle-class clientele, you need to extend your strategy to include the internet
2. Web users expect the highest convenience and information at their fingertips. All companies need a website as their central point of contact. If your details don't come up in a web search, you will be ignored.
3. Customers are inconsistent. They will not expend a lot of energy to find you online. Even worse, if your competitor is easy to find online, your potential customers will happily turn to them.
4. Audiences want to interact with and converse about your brand and products. Give them the opportunity to do it in a mediated space, and become part of the discussion.

2. Web Analytics Tools

Web analytics tools provide better understanding of how visitors are finding the website, how they interact with it, and ultimately, how effectively the website is contributing to your business goals.

According to [Waisberg, Kaushik] web analytics is not a technology for just reporting, but a cyclical process of website optimization which, among other things, measures costs, identifies the most profitable user behavior and optimizes a website by improving performance and profitability. In this section we will shortly elaborate the most used web analytics tool on the market. Some of them provide similar data, but they have different approaches and generated different kind of data. Web Analytics provides data about the website as well as the visitors. The web analytics program will provide businesses with information about the audience, audience behavior, and campaign -related data. [Hoang , Nguyen, Trang, 2017]

Information related to the site's audience may include:

- Number of visitors to the site
- How many new people and how many people turn around?
- They come from which part of the country
- What web browser do they use?

Site behavior can include:

- What did they see when they visited the site?
- How did they get to the site?
- What content is more attractive and popular?
- How much time they spend on the site?

Information about campaign data on the site may include:

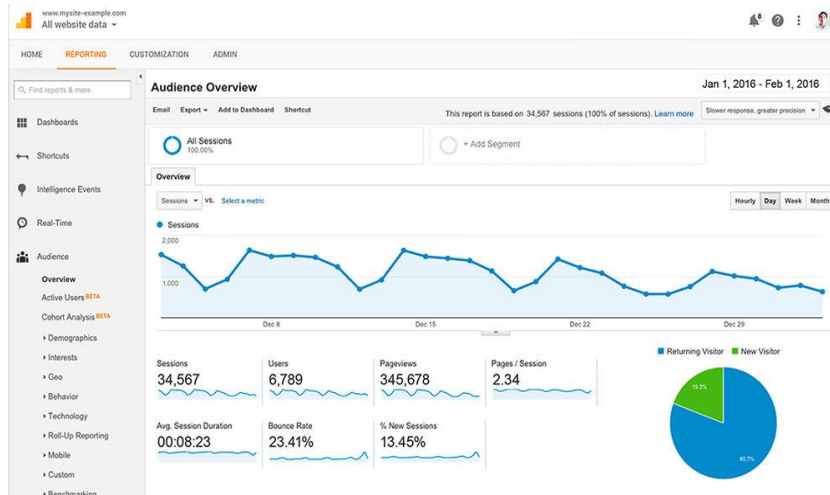
- Which marketing campaign is more effective?
- Which campaign brings more visitors to the site?
- Keywords searched by visitors can find the site

The popularity of web analytics is increasing both in the usage of web analytics and companies providing web analytics tools. New web analytic services seem to be popping up in the Internet frequently. The estimated value of web analytics market will be close to 3 billion euros in 2019. As [Nakatani, Chuang, 2011] noted the use of web analytics can be central method in creating competitive advantage in the rapidly evolving world. Carefully selecting the web analytics tools is vital as the decisions made in the selecting the tools can have long term influences for the business. From this viewpoint, it is also important to consider what web analytics service or software will be adopted.

Therefore, web analytics plays an important role in measuring the site as it measures every detail of the site.

Google Analytics. One of the most common and vastly used free web statistics tools, which provide a number of features that are useful for every kind of website, is google analytics tool. This tool tracks the web traffic source, count, on-site behavior, number of clicks, conversions and much more.

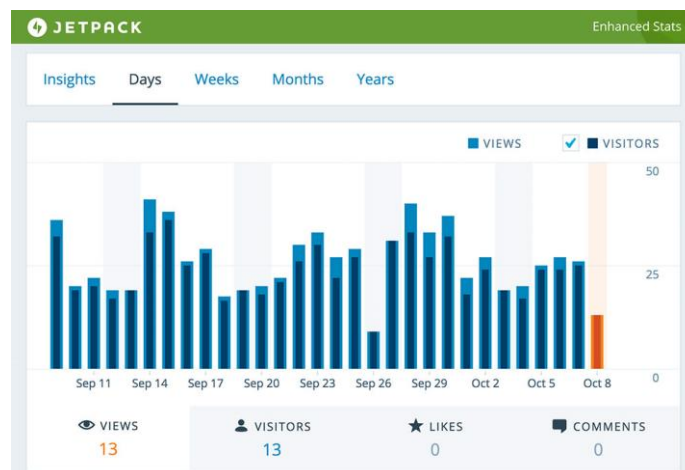
Image 1 Google analytics tool



Source: <https://www.hongkiat.com/blog/top-14-free-web-statistics-tools/>

Google Analytics also offers some suggestions to improve your conversation rate and improve your website for better ranking in the search engine. This includes tips on fast-moving up the website, managing content, insight on visitor’s behaviour and benchmarking tools. **AWStats.** This is an open-source analytics tool that can analyze multiple websites running on one server. To use it, the web host must log web data to a file that the tool could read from. Visits count, time spent on the website, bandwidth usage, entry/exit pages, OS and bandwidth used for each, “bot visit” tracking, and protection against worms attack, keyword tracking and bookmark tracking are some of its features that I found to be most interesting. Though not really a downside, but AWStats does not offer too many advanced features. **JetPack for WordPress** Apart from other features, JetPack offers basic web analytics and its simple interface makes it easily usable for beginners.

Image 2 Jetpack analytic tool



Source: <https://www.hongkiat.com/blog/top-14-free-web-statistics-tools/>

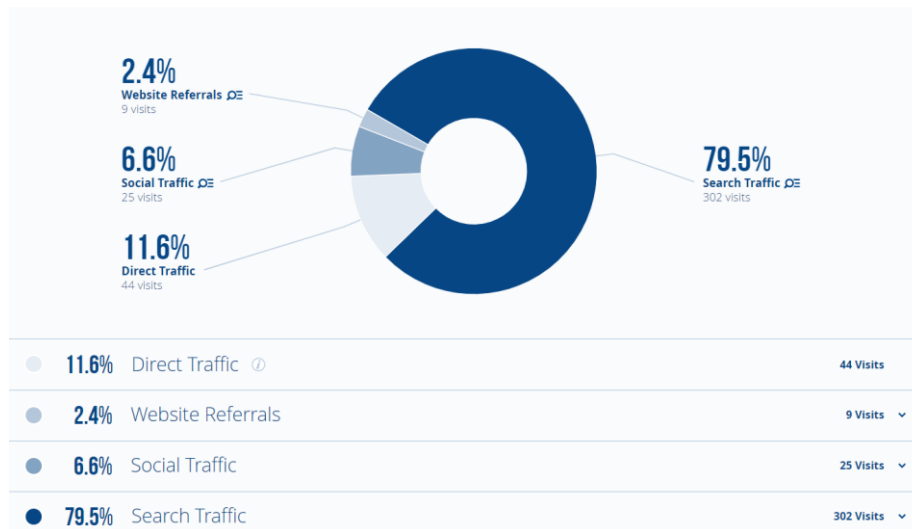
With the help of JetPack plugin you can see total visits of individual posts, popular pages, keyword tracking, subscriptions tracking, visitor location, on-site behaviour and more. Though for beginner users JetPack can be a advantage, for users who require detailed and advanced statistics about their website, this may not be a very good option. **Open Web Analytics.** One more open-source analytics tool. Its features include, traffic count, multiple website analytics support, monitor individual visitor behaviour, track clicks, view heat maps, track subscriptions, repeated visitor's activity over time, track entry/exits and more. **W3schools.** This analytics tool has more than 50 million visitors per month and that too to just look into browser statistics. That's how much browser usage statistics are important to the businesses. They have very simplified and neat home page that lists all the prominent browsers and show their user stats in an organized manner. **Clicky.** Clicky is a very simplified analytics tool that comes up with a neat interface reducing all the unnecessary details. They provide you with Powerful API. Twitter analytics, Google search rankings, Video analytics, Big screen mode, Sub-users, The best bounce rate in the biz, HTTPS tracking. According to [Booth, Jansen,2009] the first step in analyzing theWebsite and Website visitors is understanding and analyzing your business goals and then using that information to carefully choose your metrics. In order to take full advantage of the information gathered from web site's visitors, the company must consider alternative methods such as focus groups and online surveys, make site improvements gradually, hire a full-time analyst, and realize that your site's improvement is a process and not a one-time activity.

3. **Statcounter As A Tool For Analyzing The An Actual Web Page**

StatCounter. Stat Counter is a tool that provides deeper analytics about the website along with features to increase web traffic, generates sales leads, and detects click frauds. It could be also configured, to send custom summaries every week via email to get a quick glance at how things are going. Stat Counter's advanced features include an invisible counter, tracking the activity of visitors before and after visiting the website, heat maps, search engine comparison, tracking HTTPS websites, sharing access with team members, displaying the web stats publicly, checking JavaScript stats. However, Stat Counter's free option can only be used for tracking for up to 250,000 visitors per month. So it can only be a good free analytics tool if you have a medium-sized blog.

For the purpose of this paper we will use Statcounter, (among many others web analytics tools) as a web analytics tool to generate data from an actual web page www.vegansproducts.com (the page that promotes vegan lifestyle, vegans products, animal liberations activism, stop animal abuse, stop diary consuming)

Image 3 Web traffic

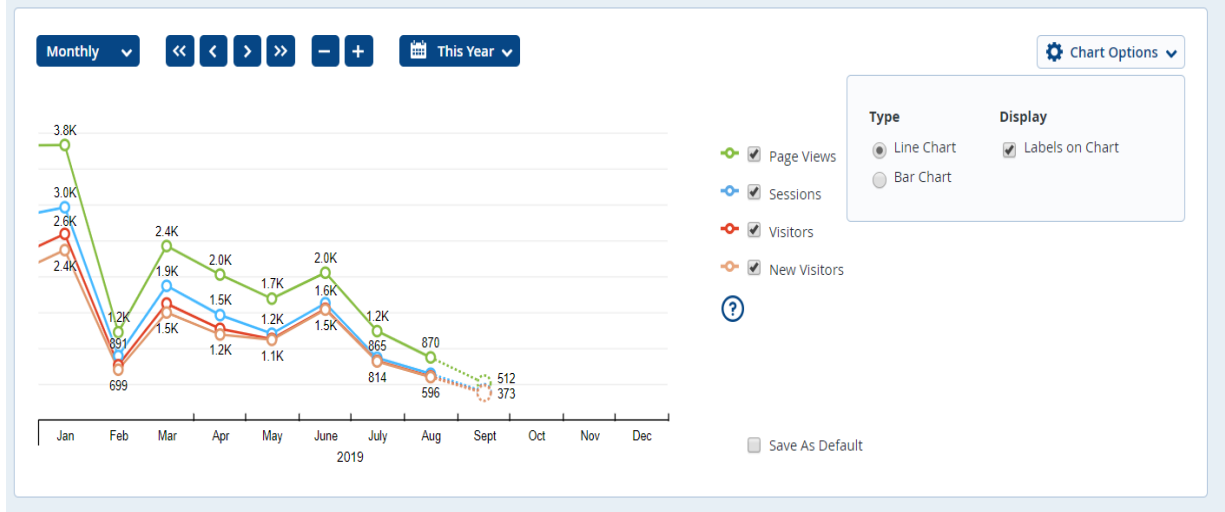


Source: www.vegansproduct.com

As we can see from the **image 1** 79.5% of the users(visitors of the page) are from **search traffic**, which means that people arrived to the site after clicking search engines listing results. They searched for something and then decided to make a visit; 11.6 % of the users are from **Direct traffic** (Visitors who visited the site by typing the URL directly into their browser.). If you are missing direct traffic, then you will have to work on customer retention through keeping relevant and current information on your website, such as having a blog that people can subscribe to. URLs with high return rates suggest webpages that have been favorites or included in email. Than 6,6 % of the users are from **Social traffic** (Visits from social networks/sites such as Facebook, Instagram, Pinterest, Twitter, you tube etc.) and 2.4 % of the users are from Website referrals. Referral traffic is used to describe visitors to your site that come from direct links on other websites rather than directly or from searches. If the referring sites are low, you may want to encourage companies that sponsor, donate, or volunteer to include a link from their organization's website to your website. Social media campaigns can also help in promoting the website.

Image 4 Page views

Summary Stats ?



Source: www.vegansproduct.com

The second image shows the Line chart for four parameters > **Page views, Sessions, Visitors, New Visitors** for the 2019, exactly until September. The line chart shows that in January the page had most page views (Each time a page is viewed on the website by any visitor, it is called a Page View.) over 3.8k. Then, in February decline process started with 699 visitors (A visitor represents a unique person visiting the website for that day, week or month. In short, a single visitor can have multiple sessions with multiple page views from each of those sessions.). But in March the page views increased to 2.4 k, and new visitors, which is somebody who had never visited your website on a different day, week, or month before, to 1.5 k. The sessions in January were 3.k , but in June are 1.6. This means that someone visits your website, browses one or more pages. The sessions can be increased by advertising, creating new content, also we can get more out of the existing content by optimizing for specific keywords and adding supporting meta descriptions, headlines, internal links, image alt text, and more to increase the search visibility of important pages on the website and build external links.

Image 5 Visit Length

Image 6 Browsers

Length	Page Views	Browser	Page Views
Less than 5 seconds	289	iPhone	143
5 seconds to 30 seconds	2	Chrome - for Android	89
30 seconds to 5 minutes	36	Chrome - 76.0	82
5 minutes to 20 minutes	11	Edge - 18.18	31
20 minutes to 1 hour	6	Safari - iPad	21
More than 1 hour	9	Edge - 18.17	16
		Samsung Internet - 9.4	15

Source: www.vegansproduct.com

Source: www.vegansproduct.com

In the image 5, data for the length of the page views are presented, and, as shown here 289 visitors stay on the page less than 5 seconds, 2 visitors stay from 5 seconds to 30 seconds, 36 visitors stay from 30 seconds to 5 minutes, 11 visitors stay from 5 minutes to 20 minutes, 6 visitors stay from 20 minutes to an hour and 9 visitors stay for more than an hour. Good average page view per visit is about 3-4 page views per visit with length 1.5 - 2 minutes. Usually, company can get high page views per visit on the wallpaper/videos/media blogs. In the next image we have data for the browsers that visitors use when they browse the page www.vegansproducts.com. The most used browser is iPhone used by 143 visitors, than Chrome- for Android, used by 89 visitors, Chrome - 76.0 used by 82 visitors, Edge- 18.18 used by 31 visitors, Safari – iPad 21, etc. the type of browsers that visitors use are directly connected with mobile devices that they use when they visit the page.

Image 7 Search Engine

Image 8 Operating System

Operating System	Page Views	Search Engine	Page Views
iOS iOS	153	G www.google.com	233
Android	108	B www.bing.com	22
Win10	102	G www.google.co.uk	13
Win7	35	G www.google.com.au	8
OS X	28	... www.ecosia.org	8
iOS iOS	21	G www.google.ca	6
Android	13	D duckduckgo.com	6

Source: www.vegansproduct.com

Source: www.vegansproduct.com

Also, Statcounter generated data about the operating system they use and the search engine that visitors use when they visit the page. The image shows us that the most used operating system is IOS (153 users), than Android (108), Win 10 (102), win 7 (35) OS X (23) which is corresponding with the mobile devices that visitors use. As we can see from the image7 about which search engine visitors use, the answer is that they are using Google with 233 visitors, then Bing 22 visitors, Google Uk 13 visitors, Google Au 8, than Ecosia, Duckduckgo, etc. If the traffic from search engines is low, having other company put links to the website on their websites also increases the likelihood that search engines will list your website higher in the results. Also, you can incorporate more meta tags in order to include more key words that when searched for in a search engine will bring up your website. „As you learn more about the value of SEO and how it integrates into the web, you should be able to increase your income or social reach significantly. Only by pairing SEO with other marketing methods or viewing the web through a larger lens will you be able to fully appreciate the value of SEO“.[Wall, 2005]

Image 9 Countries

Country	Page Views	Mobile Device	Page Views
USA	211	Apple iPhone	153
UK	48	Apple iPad	21
Australia	23	Samsung	18
Singapore	22	Samsung Galaxy Tab S2 9.7	10
Israel	18	Samsung Galaxy S9	9
India	17	Huawei Y5	6
Canada	16	Nokia	5

Image 10 Mobile devices

Source: www.vegansproduct.com

Source: www.vegansproduct.com

In the image 10 we can see where the most users come from. The page www.vegansproducts.com is visited by users from the USA - 211 users, then UK - 48 users, Australia - 23 users, Singapore - 22 users, Israel - 18, India - 17 users, Canada - 16 users. This data is very important for the business, because. Identifying a target audience of consumers is among the most crucial elements for a business operator to consider. Without knowing the target market, or whether an audience even exists, you can't realistically expect your business project to survive. "The idea is, the product we are selling to be seen by the customer that wants to buy the product. So, targeting audience is very important part of every online business, because if company does not target the audience, nobody will see the web page or the product ." [Gligorovski, Mancheski, Angeleski, 2018] Statcounter generated data about the most used brands of mobile devices when users approach the web page. As we can see in the image, the top brand that the customers regarding mobile devices is Apple iPhone (153 users), then Apple iPad (21 users), Samsung (18 users), Samsung Galaxy Tab S2 9.7 (10 users), Samsung Galaxy S9 (9 users), Huawei Y5 (6 users), Nokia (5 users), Samsung Galaxy S8 (4 users), Samsung Galaxy S7 (3 users), Motorola (3 users) etc. With this data we did a small research about usage of mobile devices, so this data can be interesting for mobile companies.

4. Conclusions

Why is it important to use analytics tool for the business decisions? When it comes to making business decisions, it's important to make sure that the decision made doesn't disappoint your current customers, but rather increases their user experience. To make a safe and informed decision, the company need, to know as visitors first. Using analytics allows the business to develop an effective digital strategy and also to add new elements to the whole marketing/business strategy in the future. Also, when company learn about the technology (device, operating system, and browsers), as show, in this paper, they're using to browse the site; test the site's compatibility with those technologies and make required developments. Search engine optimization (SEO) is one of the most crucial aspects in determining the business growth. The more organic traffic the business site receives, the more leads and conversions it gains.

When company has that information, it can decide to build stronger links with external partners, include call to action links on social media or measure online advertising campaigns for success in achieving your goals, helping you to measure a ROI on those campaigns. Analytical systems can tell which regions and cities the visitors are visiting from, which opens up new questions and possibilities for doing business. Online marketing analytics helps to discover potentials that a company may not have thought of without the information at its fingertips, which is always a great way to help the business grow and develop in the future.

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DIGITAL TRANSFORMATION OF CONSUMERS' MINDSET FOR DECISION MAKING PROCESS

Authors: PhD Snezana Obednikovska¹; PhD Karolina Ilieska²

Abstract:

Consumer Behavior is continuing process that does not finishes when the product is bought. It is a proces that explains consumer's mindset and decision making phases. Consumer behavior includes all aspects of the environment that affect the opinions, feelings and actions of consumers. By that meaning, it involves a lot of feelings, emotions and actions that should be researched.

Consumer behavior involves people's needs, thoughts and feelings, their experiences and actions in the decision-making process. Also, consumer behavior includes all aspects and influences that are coming from the environment that affect those opinions, feelings and actions of consumers. This influences are urging companies' need of concluding influence marketing concept, as a special part of marketing strategy, that will be of a main interest in this research. We can freely say that consumer behavior is complex and dynamic, which involves co-operation and exchange with companies, marketiers and other people that appear as influencers.

Key words: *consumer behavior, consumer satisfaction, influencers*

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Literature review and introduction of the concept

A definition of consumer behavior has been provided by the American Marketing Association (AMA-American Marketing Association), "*Consumer behavior is a dynamic interaction of consent, knowledge, behavior and the environment from which people are guided in the exchange process in different aspects of their lives*" (Peter & Olson, 2010). From this we understand that consumer behavior involves people's thoughts and feelings, their experiences and actions in the decision-making process. Also, consumer behavior includes all aspects of the environment that affect the opinions, feelings and actions of consumers. From this definition we can say that consumer behavior is dynamic, which involves co-operation and exchange.

The authors Kotler and Armstrong(Koltler&Armstrong, 2013) say "Buyer's behavior is the behavior of final consumer customers, individuals and families who buy goods and services for personal consumption." All of these final customers together form the consumer market.

According to (Solomon, Bamossy, Askegaard, & Hogg, 2006) "Consumer behavior has to do with studying the processes involved when individuals or groups choose, buy, use products, services, ideas or other experiences to satisfy their needs and desires".

According to Noel (Noel, 2009) the consumer behavior study the products and services consumers buy and use and how these purchases affect their daily lives. So it is important to note that the consumer behavior study is not limited to the behavior of a person who buys tangible products such as a water bottle or a new camera.

From the above definitions, we understand that consumer behavior is a process that begins before the purchase of a product or service, whenever the need for any product or service appears and continues after the purchase. According to consumer behavior, final buyers buy products and services for personal and family use, to satisfy their needs and requirements, not to make profit from them.

In the early stages of consumer behavior development, this area had involved interaction between customers and producers at the time of purchase. Today, marketers have come to the conclusion that consumer behavior is a continuous process, which is not just about exchanging a product or service when purchasing, but this process analyzes customer behavior even before and after purchase. This means that it is very important to understand whether the customer can find clear, precise and proper information about the products, where should that information be posted, who can promote and influence on the information, where is the best place for each product to be found etc. Of course, it is of significant importance to realize level of satisfaction with the product or service. If the product or service does not fulfill customer expectations then the customer is dissatisfied. If the product or service fulfill customer expectations, the customer is satisfied, and if the product or service exceeds customer expectations then the customer is impressed with the product or service. This is the situation that every company wishes to reach. The goal of the marketing is to find ways to convey and influence on positive consumer's reaction not just for the product, but also for the information that is send from the company.

Every day, people form impressions about brands from touch points such as advertisements, news reports, conversations with family and friends, and product experiences. Unless consumers are actively shopping, much of that exposure appears wasted. Those accumulated impressions then become crucial because they shape the initial-consideration set: the small number of brands consumers regard at the outset as potential purchasing options.

If marketing has one goal, it's to reach consumers at the moments that most influence their decisions. Marketing has always worked for those moments, or touch points, when consumers are open to influence. Touch points have been understood through the metaphor of a "funnel"—consumers start with a number of potential brands in mind, marketing is then directed at them as they methodically

reduce that number and move through the funnel, and at the end they emerge with the one brand they chose to purchase. But today, the funnel concept fails to capture all the touch points and key buying factors result from the different influences of some influencers and explosion of different products and digital channels. This mentioned factors coupled with the emergence of an increasingly discerning, well-informed consumer, who can also have great influence from colleagues, friends, family and virtual society urge the trend of composing new marketing strategy that will be composed of those factors. Because of the shift away from one-way communication—from marketers to consumers—toward a two-way conversation, marketers need a more systematic way to satisfy customer demands and manage word-of-mouth. So that is why it is important to understand the role of persons who have influence on consumer's choices.

There is no consensus on what an "influencer" is. One writer defines them as "a range of third parties who exercise influence over the organization and its potential customers". (Peck, Helen, Payne, Adrian, Christopher, Martin and Clark, Moira 1999) Another defines an influencer as a "third party who significantly shapes the customer's purchasing decision, but may never be accountable for it.(Brown, Hayes, 2008) Another says influencers are "activists, are well-connected, have impact, have active minds, and are trendsetters", (Keller, Ed and Berry 2003) though this set of attributes is aligned specifically to consumer markets. Companies are working harder on marketing strategies and paying more to pursue people who are trying to watch and listen less to its messages. Targeting influencers is seen as a method of increasing the reach of marketing messages, in order to counteract the growing tendency of prospective customers to ignore marketing. (Keller, Ed and Berry 2003)

This new trend has arisen by greater development of technology and digital channels. As more people use the internet, more are making purchases online. This forces some companies to invest more resources in their advertising on the internet, and on social networks in particular. Marketing through social networks allows for an instantaneous purchase process. Person can see the item and typically be connected to an online retailer immediately. This decrease between lag time - from seeing the promoted item and being redirected to the product - is more effective for spontaneous purchases. (Ward, 2019)

Online activity can be a core part of offline decision-making, as consumers research products and review sites. "(McKinsey, 2013)

Critics of this online-only approach argue that only researching online sources misses critical influential individuals and inputs. (Brown, Hayes,2008) They note that much influential exchange of information occurs in the offline world, and is not captured in online media. Indeed, the majority of consumer exchanges occur face-to-face, not in an online environment. (-Carl, W. J. (2006).

Some marketers use influencer marketing to establish credibility in the market, others to create social conversations around their brand, and others to drive online or in-store sales of their products. The influencer marketer can also take to marketing diversified products and services leveraging, leveraging upon the credibility earned over time. The value which influencer marketing creates can be measured in several ways. Some marketers measure earned media value, others track impressions (Schwemmer, Carsten,2018) and others track cost per action.

Influencer marketing derives its value from three sources:

- *Social reach*: influencers are able to reach millions of consumers through their social channels and blogs.
- *Original content*: influencers produce original, and often effective, marketing content for the brand.
- *Consumer trust*: influencers maintain strong relationships with their audience, who have a certain level of trust in the influencer's opinions.

Market research techniques can be used to identify influencers, using pre-defined criteria to determine the extent and type of influence.(Keller, Berry, 2003)

- *Activists*: influencers get involved with their communities, political movements, charities and so on.
- *Connected*: influencers have large social networks.
- *Authoritative*: influencers are looked up to and are trusted by others.
- *Active minds*: influencers have multiple and diverse interests.
- *Trendsetters*: influencers tend to be early adopters (or leavers) in markets

Malcolm Gladwell (2000). notes that “the success of any kind of social epidemic is heavily dependent on the involvement of people with a particular and rare set of social gifts”, and identified three types of influencer, who are responsible for the "generation, communication and adoption" of messages.:

- Connectors
- Mavens
- Salesmen

Connectors network across a variety of people, and thus have a wide reach. They are essential for word of mouth communication. (Brown, Hayes (2008)

Mavens look to consume information and share it with others, and are extremely insightful with regards to trends.

Salesmen are "charismatic persuaders". Their source of influence leans toward the tendency of others to attempt to imitate their behaviour.

Influencer marketing

“When you want to really scale and when you want to reach new audiences, you need content that makes people WANT you — and this comes from having great content.

One of the best ways to get this content is from influencers – they know how to tell a story that fits the social media channel’s objective.” — William Harris, Founder & CEO at [Elumynt](#).

Influencer marketing is a new and modern approach in marketing. Its importance is even bigger because trading parties should both understand and support it in order to be successful in reaching and fulfilling consumers’ needs. It directly addresses the most common sales barriers within prospective customers and focus attention on those individuals who advise decision-makers. We call these people influencers, and they are as crucial to the sales process as the prospects themselves. (Duncan Brown and Nick Hayes, 2008)

Influencers are individuals that are being used for marketing purposes. Their main activity is to evaluate brand value based on reactions and ratings of other consumer. On the other hand, social proof deals with consumer behavior on social networks, its effect on internet society and conformism called information social impact. When consumers are in a state of uncertainty about how to behave in specific situation on the market, the easiest way to seek the solution is to understand other consumers’ behavior. At least 60 times a day consumers are able to evaluate some information, so Social proof in the form of likes, comments, reviews, shares are ideal parameters in resolving a dilemma whether something is worth it or not.

Influencer marketing happens when company is partnering with influencers in order to increase brand awareness or conversions among a specific target audience.

Influencer is someone who has a certain number of fans and followers that they actively engage with on some internet social media. This could be a blogger, a sport personality, Instagram star, a You Tuber, or a full-fledged celebrity. An influencer establishes a relationship with their audience (followers and fans), thereby can affect on their purchase decisions. Relatable and accessible, influencers control the popularity on social media to establish themselves as trusted ambassadors for their favorite products and help brands get their message across.

A social media influencer is someone who has built loyal followers through their online content creation. A social influencer is a person who has built some reputation through social media channels for his/her expertise on a particular topic. These social media persons post regularly some specific online contents and generate large followers of engaged people in that specific area. Their contents are aimed to entertain, inform, and inspire, which in turn drives more engagement and sets new trends among audiences.

With consumers spending nearly half a day on social media, brands have come to leverage influencers to affect purchase decisions. This trend has proved to be more effective than traditional marketing as consumers are more receptive to messages delivered by a common persons they can relate to and trust, rather than a celebrity or a famous TV face.

Influencers will become even more valuable in 2019 and beyond, and influencer marketing will continue to thrive in all areas.

The idea of influencer marketing isn't new. In fact, its existence is long before social media came to reign. Brands began leveraging this concept by crafting campaigns with relatable characters from everyday life to evoke consumer sympathy a long time before influencer marketing as we know it existed. However, the concept took a new swing once the digital era introduced a bunch of new opportunities.

Types of Influencers:

- Nano-influencers – social media users with 1,000–10,000 followers
- Micro-Influencers – those with 10,000–50,000 followers
- Mid-tier Influencers – social media persons with 50,000–100,000 followers
- Macro-Influencers – established influencers who boast 500,000–1,000,000 social media followers
- Mega-influencers – social media powerhouses, close to the status of celebrities with 1,000,000-5,000,000 followers
- Celebrities – persons with over 5,000,000 followers

Key goals of influencer marketing are:

1. *Increasing brand awareness.* The most popular goal for influencer marketing campaigns is building awareness around a brand, product or service. Brand awareness is generally measured through impressions, reach and engagement metrics.
2. *Reaching new audiences.* Influencers should be able to share their personal data (age, gender, location, interests, etc.) to help ensure alignment with target audience.
3. *Generating sales.* More influencer campaigns today are aimed at driving tangible sales, which can be clearly tracked using custom links, landing pages and redemption codes. Influencers should have all these elements in place before launching their campaign to ensure accurate measurement.
4. *Improving brand advocacy.* Influencers can provide strong validation and spark word-of-mouth conversations about your product or brand amongst their fans.
5. *Drive lead generation.* Aside from sales, new leads are another popular direct response metric for influencer marketing campaigns. Names and emails can be collected through newsletter subscriptions, account setups, or giveaway entries.

Case Study: Research how Digital Transformation affects consumers' mindset when making a purchase decision in the Republic of North Macedonia

Internet users in Republic of North Macedonia were 1,592,376 (June 2019); and Facebook users were 1000000 (31-Dec-2018).³

So, the number of internet users, is steadily rising at 79.2 percent in 2018⁴

³ <https://www.internetworldstats.com/stats4.htm>

Individuals using the Internet (% of population)

Display: 10 lines

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
North Macedonia	6.0	51.8	51.9	56.7	57.5	65.2	68.1	70.4	72.2	74.5	79.2

Showing 1 to 1 of 1 entries

Source: World Bank (citing: International Telecommunication Union, World Telecommunication/ICT Development Report and database.)

Google searches for influencer marketing grew 1500% over past three years. Influencer marketing in 2019 is predicted to grow more than double comparing to 2017. Influencer marketing has continued to grow as an industry over the last few years. It was a \$1.7 billion industry in 2016, increasing to \$3 billion in 2017. 92% of survey respondents believe influencer marketing is an effective form of marketing, and 82% believe that the quality of customers from influencer marketing campaigns is better than from other forms of marketing.⁵

Influencer Marketing Statistics 2019:⁶

- 63% of brands plan to increase their budget for influencer marketing.
- Over the past three years, Google searches for “influencer marketing” grew by 1,500%.
- By 2020, influencer marketing is projected to become a \$10 billion industry.
- 93% of influencer marketing campaigns uses Instagram.
- Instagram influencer marketing is a \$1.7 billion industry.
- 55.4% of influencers use Instagram stories for sponsored campaigns.
- The top 25 YouTube stars get three times more video views than traditional celebrities.

Instagram is the fastest growing social network in 2019. Instagram is the most important tool of influencer marketing. Instagram considers experimenting with Instagram Stories, which are exploding in popularity.

Adored by the *Millennials*, Instagram became an indisputable powerhouse social media network. The platform has reached 1 billion users in June 2018. Nowadays, 95 million photos and videos are shared on Instagram every day. Moreover, users upload 400 million Stories and hit the heart-shaped button to like 4.2 billion posts every day.⁷

⁴ [https://world-statistics.org/index-res.php?code=IT.NET.USER.ZS?name=Individuals%20using%20the%20Internet%20\(%20of%20population\)#top-result](https://world-statistics.org/index-res.php?code=IT.NET.USER.ZS?name=Individuals%20using%20the%20Internet%20(%20of%20population)#top-result)

⁵ <https://influencermarketinghub.com/influencer-marketing-2019-benchmark-report/>

⁶ <https://99firms.com/blog/influencer-marketing-statistics/>

⁷ <https://influencermarketinghub.com/influencer-marketing-2019-benchmark-report/>

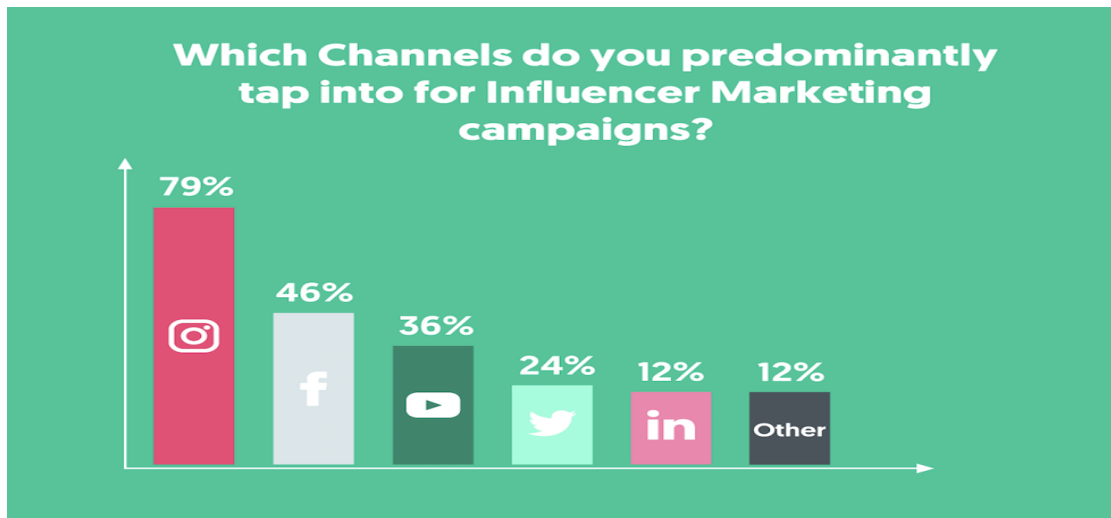


Figure 1. Channels used for Influencer Marketing

Marketers find influencer marketing effective, and are raising their budget in 2019. The influencer marketing industry global ad will spend \$5-\$10 billion by 2020⁸.

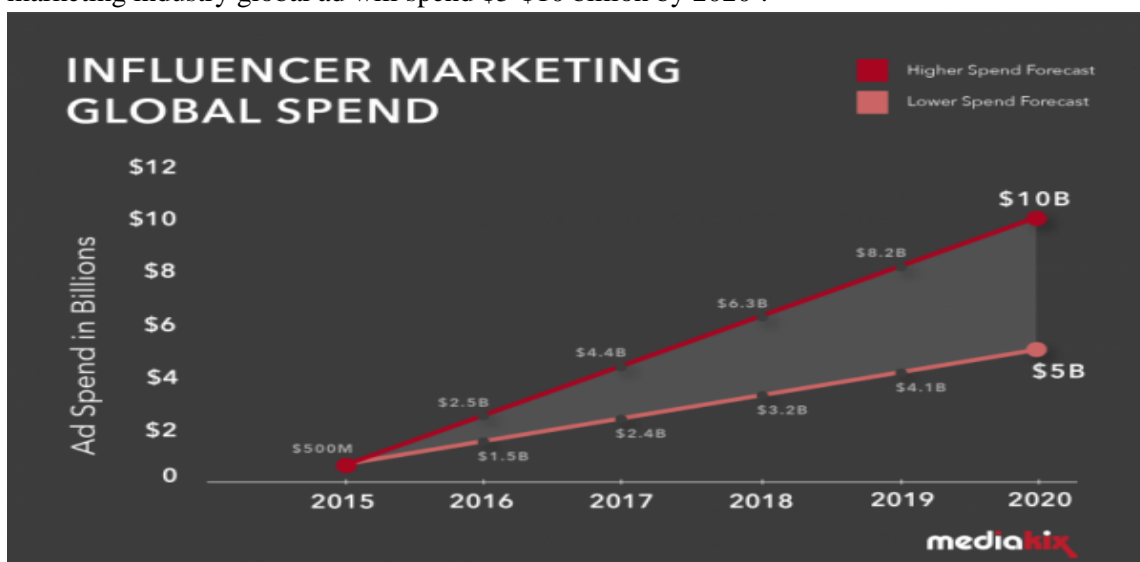


Figure 2. Influencer marketing global spending

Recently, there was promoted Instagram Top Lists⁹ for North Macedonia users in order to show Instagram users who have the most followers. This application is making its Top List by average number of likes.

⁸ <https://mediakix.com/blog/influencer-marketing-industry-ad-spend-chart/>

⁹ <http://www.influencer.mk/>

Elaboration of Case Study

In order to get clearer picture about the situation in North Macedonia, and to realize what impact have Internet and digitalization on Macedonians consumers' mindset when making a purchase decision we concluded research. According this research we have raised hypothesis and some research questions.

Hypothesis Ho: Digital transformation doesn't affect consumers' mindset when making a purchase decision.

Research Questions:

1. Do you follow consumer behavior on social networks to assess brand value based on reactions and ratings from other consumers? (Reactions focused on social proof coming in form of likes, comments, reviews, shares etc)

2. Do Influencers affect consumers' mindset when making a purchase decision?

Sample Size: 85 respondents (Confidence Level: 95%; Population Size: Republic of North Macedonia, Internet Users, 1,592,376; Margin of Error: 5, 83%)

	Variable 1	Variable 2
Mean	3.541176	3.223529
Variance	1.013165	1.318487
Observati	85	85
df	84	84
F	0.76843	
P(F<=f) on	0.114728	
F Critical c	0.696996	

0.76 > 0.69  Ho is rejected

So, there is dependence (impact) between variables: 1. Do you follow consumer behavior on social networks to assess brand value based on reactions and ratings from other consumers - Social proof in the form of likes, comments, reviews, shares and 2. Do Influencers affect consumers' mindset when making a purchase decision? According the results from the research we can say that hypothesis: Digital transformation affects consumers' mindset when making a purchase decision, is accepted.

Correlation between variables (1. Do you follow consumer behavior on social networks to assess brand value based on reactions and ratings from other consumers - Social proof in the form of likes, comments, reviews, shares and 2. Do Influencers affect consumers' mindset when making a purchase decision), is 0.82 – and we can conclude that there is high level of dependence.

Correlation

	Column 1	Column 2
Column 1	1	
Column 2	0.821102	1

From regression statistic we can conclude that if independent variable 1. Do you follow consumer behavior on social networks to assess brand value based on reactions and ratings from other consumers - Social proof in the form of likes, comments, reviews, shares, will change for 1, then dependent variable 2. Do Influencers affect consumers' mindset when making a purchase decision, will change for 0, 94.

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.821102
R Square	0.674208
Adjusted R Square	0.670283
Standard Error	0.659339
Observations	85

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	74.6705	74.6705	171.764	6.48E-22
Residual	83	36.0823	0.43472		
Total	84	110.752			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-0.09345	0.26300	-	0.72325	-0.61655	0.4296	-	0.4296
X Variable 1	0.936688	0.07147	13.1058	6.48E-22	0.794535	1.0788	0.79453	1.0788

Conclusion

Influencer marketing is very modern way in marketing. Its popularity has happened to be bigger in the companies since Internet is becoming a great part of each consumer everyday life. According positive effects that Internet and digitalization has on companies' work influencer marketing is becoming main marketing tool that should be of a great interest for the companies, especially for those whose target is Millennials.

Influencer marketing gives opportunity for the company to establish a relationship with their on-line target audience, thereby can affect on their purchase decisions. Relatable and accessible, influencers control the popularity on social media to establish themselves as trusted ambassadors for their favorite products and help brands get their message across.

The importance of Influencer marketing should be clearly and with no doubt understood by the companies. Its practice should become part of every marketing strategy in order to have successful one.

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IMPLEMENTATION OF ELECTRONIC DOCUMENT MANAGEMENT SYSTEM (EDMS) IN MACEDONIAN COMPANIES

Dejan Zdraveski PhD¹ Margarita Janeska PhD² Kosta Sotiroski PhD³

Abstract:

Modern working conditions and the great possibilities of electronic communications have a major impact on the need for digital management of the growing number of information. This business information can be in different format: text, tables, graphs, presentations, project documentation, e-mail, audio, video and multimedia contents, etc. Basically, in most cases that are unstructured data, which makes it difficult to use them.

The paperwork in companies that has been generated in last decade mostly is generated in an electronic form and is not functionally related to the existing printed documentation. This situation creates a high probability of loss or permanent destruction of a number of significant data. Also, companies have problem with irrational spending of human and material resources and inefficient operations. From this aspect, companies has a need for the application of an Electronic document management system. The application of information technology for document management allows organizations and institutions to increase productivity, efficiency and competitiveness in today's dynamic environment.

The main aim of this paper is to understand the significance and level of implementation of the Electronic document management system (EDMS) in various organizations and institutions in the Republic North Macedonia. For that purpose, a survey was conducted that included organizations and institutions from several regions in North Macedonia, from different industries. In the paper will be presented most important aspect of this research through qualitative and quantitative analysis.

Key words: *information technology, document management, standards, competitiveness*

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Introduction

Documents are an integral part of any organization, whether it is a business organization, a financial institution, a public service institution, a government organization etc. Documents is part of business processes and depending of the way of their distribution depends the efficiency of the business processes. Traditional document management is known as passive file management. Most users ignore organizational rules regarding document storage. Once users receive the documents relevant to their activity, they tend to gather that information. Traditional document management is paper based, with possible loss, fragmentation of information and inaccessibility of information. Because of that, the volume and distribution of documents increases. Documents are edited, archived, classified and stored in accordance with predefined rulebooks and regulations. They usually take up a lot of archive space. When all the paperwork is in paper form, especially in large enterprises where we have multiple departments and services, this is often a problem and creates difficulties. The risks of inappropriate DMS implementation are high costs of finding records and information, failure to comply with set standards, inaccurate data in the system, wrong decisions and reduced competitiveness.⁴

Document management systems enable document capture, editing, digital archiving, and document retrieval at the whole organization level. Also, Document Management System (DMS) is a system (based on computer programs in case of digital document management) used for tracking, managing and storing documents and at the same time reduces the amount of paper documentation. With the implementation of document management systems, it is possible to avoid a number of problems that reduce productivity and increase operating costs. Some of these problems can be:

- employees spend too much time searching for documents stored in an inadequate way,
- employees work with the wrong version of documents because at the same time several versions of the same document exist in circulation;
- decisions are made on the basis of outdated or incorrect information,
- unavailability of some documents and information that employees need,
- multiple storage of the same documents, etc.

Implementation of document management systems must be primarily a strategic decision because documents must be treated as strategic resources, and the critical processes involved in them must be optimized. This should integrate document management, business process automation, web content management, scanning and digitization of paper documents, as well as digital archives at the entire organization level. Apart from improving business processes, organizations must implement document management systems and due to legal regulations (Sarbanes-Oxley, Basel 2, etc.) Such rules have as starting points: information management, data security, transparency data flow and control of data and documents. Working in accordance with those rules is necessary a document management system implemented at the whole organization level.

Basic features and meaning of Electronic document management system

The standard features of a good Document management system should include many functionalities but most important are: object searching, markup functionality, printing, document workflows and lifecycles, document security, document links, document status reporting, issuance/distribution document management and remote access. The purpose of document management is to share

⁴G.Pećarina: Interaktivni PDF obrasci, Document Management, Zagreb, 2007

information, but also, ensuring the availability of documents. The solution to this situation is an Electronic document management system.

Every company needs some kind of Electronic Document Management System (EDMS) in order to control increasing volume of documents. Companies often oppose "this need" because of the cost and complexity of the EDMS implementation process. Namely, the effective use of EDMS requires great changes in working practices, although most technical aspects are resolved by adopting low-cost databases and easy integration with the Windows environment. Effective EDMS should not only control documents but also provide access to them throughout the company, and even to clients or other project participants through Internet or Extranet. EDMS should also centralize data in easily accessible environment, enabling users to easily store, access, and modify information.

EDMS helps users more easily to perform their work and ensure data security and confidentiality, as well as managing business processes. Many of these functions save time, simplify work, protect the investment made in creating these documents, enforce quality standards and provide control. EDMS has many advantages as:

- Generally efficient location and delivery of documentation
- Ability to manage documents and data regardless of originating system or format
- Ability to integrate computerized and paper based systems
- Control of access, distribution and modification of documents
- Provision of document editing and mark-up tools

Electronic Document Management System is now becoming one of the fastest growing back office technologies as many companies are beginning to understand that information in electronic format is not only more immediately accessible but it is also more secure and manageable. Some of the more obvious benefits of these systems are⁵:

- Reduce document access and retrieval times - process transactions are quicker, increase productivity and improve customer services
- Provide secure back-up and disaster recovery compliance – much of data is held on vulnerable media that would not survive a disaster, once it's all stored electronically it can be easily backed up
- Make better use of office space – no more need for multiple filing cabinets and document storage cupboards thus reducing office costs
- Help with legal compliance issues – for example the Sarbanes-Oxley Act requires an efficient document retention policy which EDM will help provide
- Improve document security – much of our paper-based information is very sensitive and yet it is not held securely
- Reduce work and document duplication – no more need to make numerous photocopies for distribution
- Reduce paper and printing costs as well as postage

It can be concluded that with the implementation of EDMS the costs of working with the company documentation are significantly reduced, processes are optimized, there is no need to archive printed documentation, it save time for finding documents, it eliminate the loss of documents, and the current

⁵https://www.documentsandrecords.com/facts_about_electronic_document_management.html

version is always available. Proper Electronic document management systems can bring many benefits to the company, but also, and personal benefits in terms of improving business processes and increasing business efficiency.

Implementation of Electronic document management system in companies and institution in R. North Macedonia

In the research for implementation of Electronic document management system in companies and institutions in the Republic North Macedonia was conducted a survey using an anonymous structured questionnaire. The research covered 138 companies and institutions in the Republic North Macedonia. The companies covered by this research were from different industries: financial institutions, public services institutions, manufacturing companies, government organizations and other organizations and institutions (wholesale, educational institutions, trading companies and services, postal service, telecommunications etc). Namely, the largest percentage of respondents are public services institution with 28%, manufacturing companies with 28% and other organizations(wholesale, educational institutions, trading companies and services, postal service, telecommunications etc), also, with 28%. Government organizations with 13% and financial institutions with 4% follow these. This research shows that, 32% of the respondents have 5-10 years of working experience with documents, 29% of the respondents have 5 years of experience, 25% of the respondents have over 20 years and 14% of the respondents have 11-20 years of working experience with documents.

Due to the limited size of this paper, will presented only those issues of crucial importance for the research.

The first question concerns the volume of paper documentation that are in companies and institutions in North Macedonia. This means whether that paper documentation is increasing or decreasing. The results show that significant part of companies or 54% have some reduction in the volume of paper records. This is primarily due to the technology development and implementation of new methods and techniques for gathering and storage of information no matter if they have implemented Electronic document management system. This is shown in Figure 1.

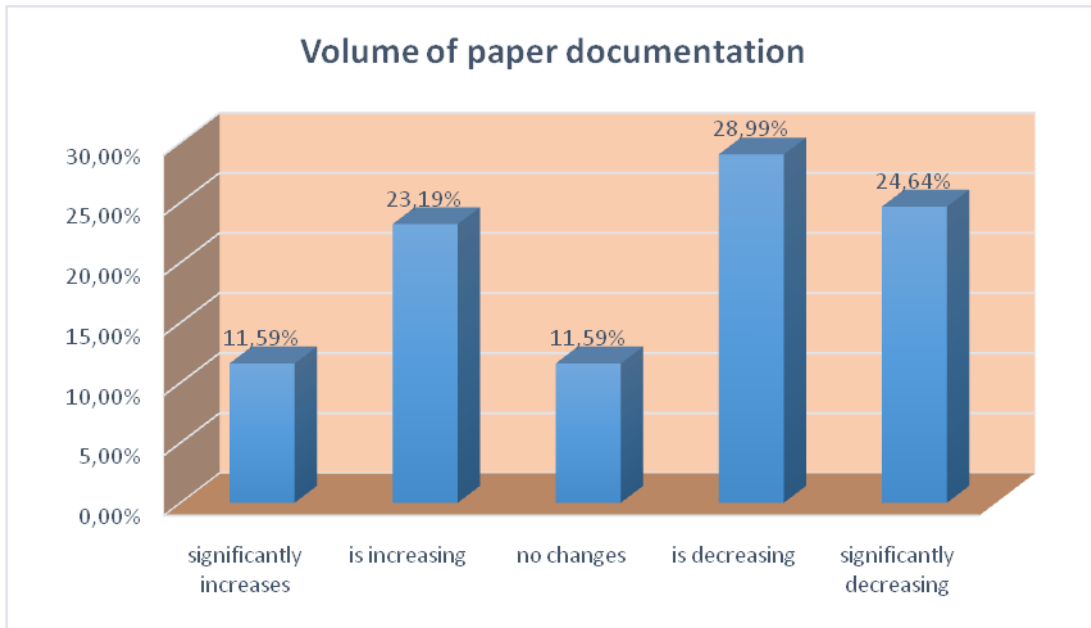


Figure 1. Volume of paper documentation in companies and institution in North Macedonia

The results of the previous question also confirm the answers to the following question, which refers to the volume of electronic documentation in companies and institutions in North Macedonia. Most of the companies and institutions, or 84%, stated that the volume of their electronic documentation is increasing which corresponds to the conclusion of the previous question that companies use advanced techniques for gathering and storage of information. Only a small part of the respondents answered that their electronic documentation is not increasing. These results are presented on the following figure:

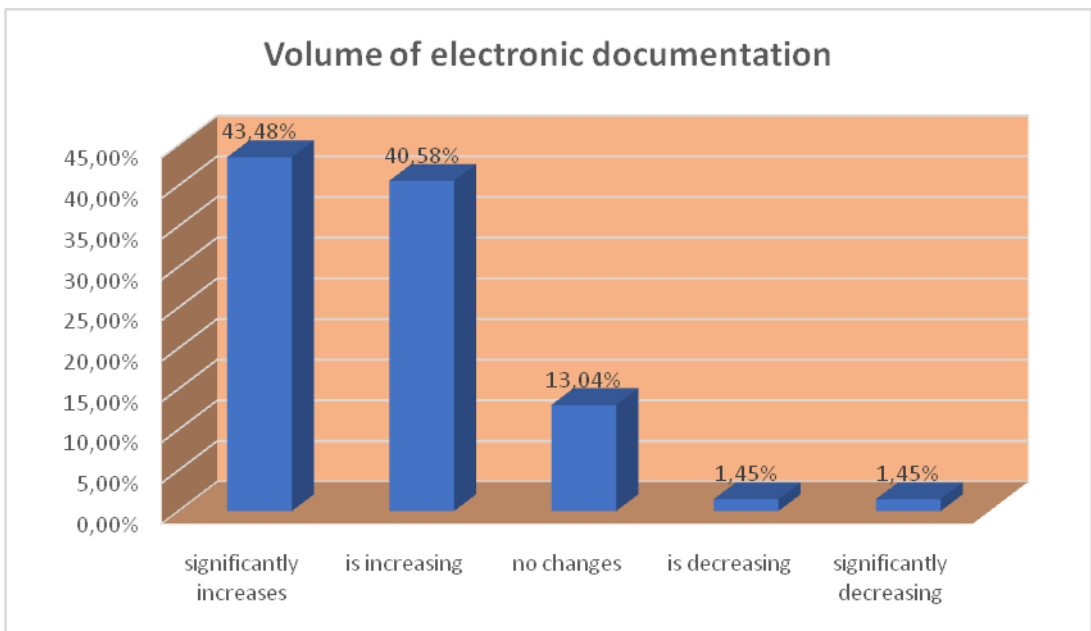


Figure 2. Volume of electronic documentation in companies and institution in North Macedonia

When comparing and analyzing the answers to the previous two questions it can be concluded that the reduction in paper documentation is followed by an increase in electronic documentation. This means

that a growing number of companies and institutions in North Macedonia use electronic tools for gathering and storing information. This is possible by the increasing development of technology and the modern way of communication between businesses. Most of the communication in today's world means using of ICT tools and most of the business reports resulting from business processes and business applications are in electronic form. It does not necessarily mean that each of these companies or institutions has implemented EDMS, but the modern way of working implies application of new methods and techniques for collecting, storing and managing information.

Very interesting is the question for the application of standards in the management of documents and records in companies and institutions in North Macedonia. Perhaps the most important and basic standards for documents and records management are ISO 15489 and ISO 9001. These standards should followed by every company and institution for more efficient management of their own documents and records. ISO 15489 Records management, the first global standard for records management, published in 2001. It was adopted in more than 50 countries and translated to over 15 languages. After a three-year period of review and consultation, a revised version of ISO 15489 Part 1 issued in 2016. It includes core concepts and following principles⁶:

- records, records systems and metadata for records;
- policies, assigned responsibilities, monitoring and training supporting the effective management of records;
- recurrent analysis of business context and the identification of records requirements;
- records controls; and
- processes for creating, capturing and managing records.

The ISO 9001:2015 standard has removed the distinction between documents and records. Both now called “documented information”. As per ISO’s definition, the term “documented information” refers to information that must be controlled and maintained. Therefore, it expects that you also maintain and control the medium as well as the information. Documented information is used as evidence of conformance. According to this standard organizations must establish a documented procedure to⁷:

- approving documents for adequacy prior to issue
- review, updating as necessary, and re-approve documents
- identifying the changes and current document revision status
- making relevant documents available at points of use
- ensuring the documents to remain legible and readily identifiable
- identifying external documents and control their distribution
- preventing obsolete documents from unintended use
- applying suitable identification if obsolete documents are retained

The results obtained on the question whether Macedonian companies and institutions follow the world standards for documents and records management is shown in Figure 3. According to these results, unfortunately only 45% of Macedonian companies and institutions follow and comply with these world standards. The rest of the respondents are not familiar with standards or not follow the standards related to documents and records management.

⁶<https://committee.iso.org/sites/tc46sc11/home/projects/published/iso-15489-records-management.html>

⁷<https://the9000store.com/articles/iso-9000-tips-document-control-requirements/>

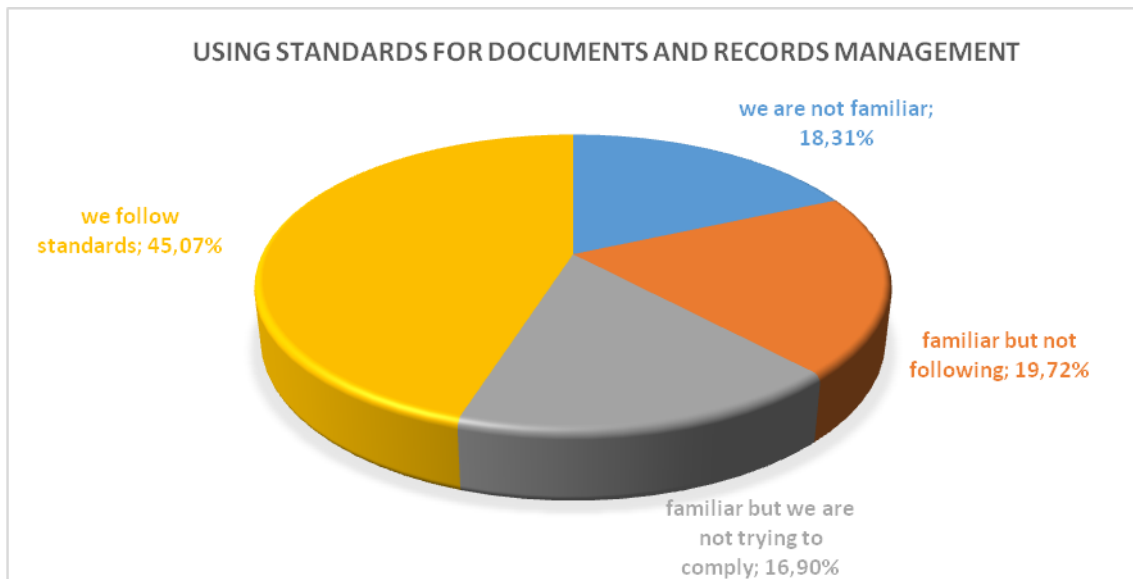


Figure 3. Using standards for documents and records management

Regarding the question “How you managed the documentation generated by business applications and business processes”, most of the organizations, i.e. 52% responded that the records generated by business applications and business processes are managed by the business application databases. On the other side 31% of respondents answered that documentation are managed as a paper, 10% responded that it was managed as part of EDMS, and only 7% responded that it was outsourced. Of concern is the fact that documentation is managed as part of the Electronic document management system in only in 10% of the researched organizations. The answers are shown in the following graph:

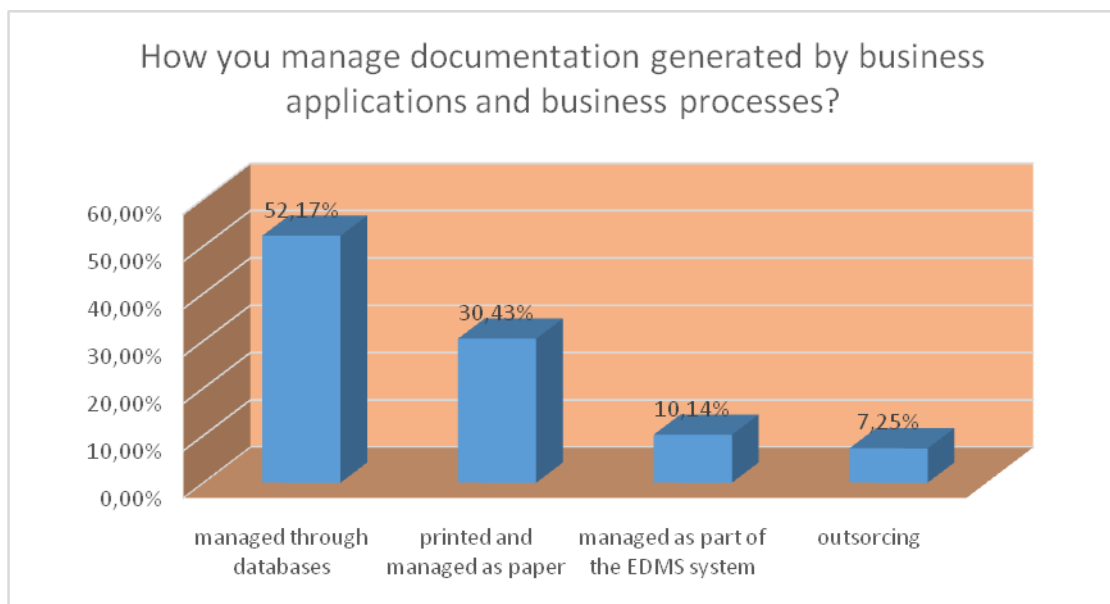


Figure 4. Managing of documentation

From the obtained results can be concluded that only, a small number of companies and institutions in North Macedonia have implemented EDMS. This means that only those 10% who responded that the documentation is managed as part of the EDMS system had implemented Electronic document management system in their operations. Therefore, very few companies have implemented EDMS,

although the benefits of using this system are numerous. Companies and institutions are aware of the benefits of using such a system but its implementation is lacking, which may be subject to further research. When referring to the benefits that would be gained by using EDMS, companies and institutions stated that those benefits are of great importance that can be seen from Figure 5. According to the answers, most of the organizations consider increased productivity and better customer services as the most important benefits, each with 23.08%. Other benefits for companies and institutions are: reducing costs with 18.46%, reducing paper storage space with 14.62%, better processing overview with 13.85% and integrated work procedures with 5.38%.

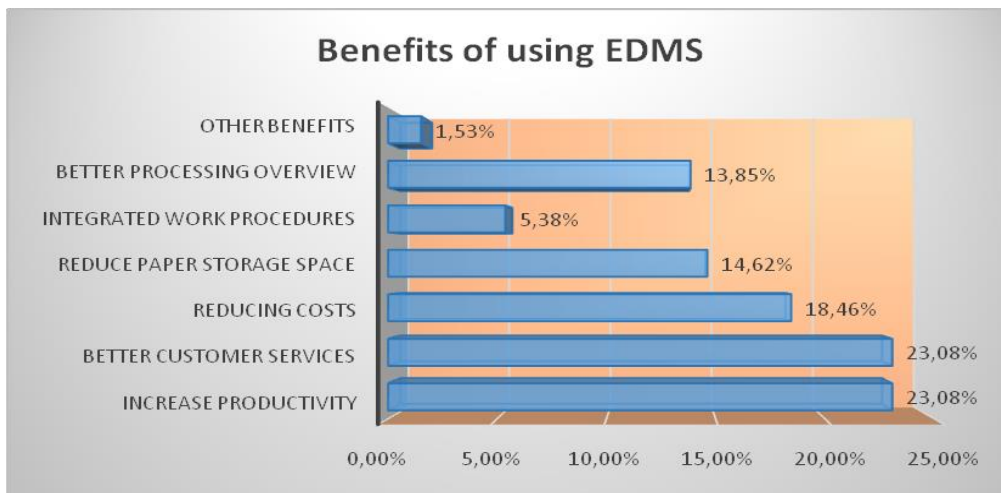


Figure 5. Benefits of using EDMS

However, the support of top management for the implementation of Electronic document management system in companies and institutions in North Macedonia is very encouraging. According to the research, there is a high level of support from the top management for implementation of EDMS, 68.12%. This would mean that most companies and institutions intend to run such a system that would help them in many ways, such as increasing the productivity of their employees, reducing costs, eliminating the storage space of paper documentation, integrating workflows etc.

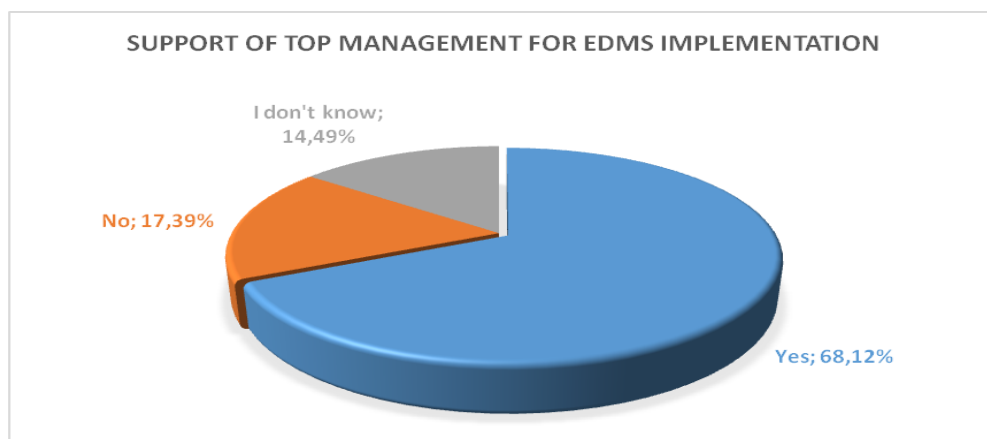


Figure 5. Support of top management for EDMS implementation

Conclusion

The increasing automation and modernization of business processes in organizations means generating large number of electronic documents and records that obtained in a variety of formats: textual documents created in digital form with the help of various word processing tools, scanned paper documents, web pages, tables and graphs, presentations, project documentation, e-mails, audio, video and multimedia content. Due to such a large amount of documentation, it becomes necessary properly manage with such documentation in order to increase employee productivity, optimize workflows, reduce costs etc.

Often in companies and institutions that have not, implemented EDMS there is a high chance of errors or delays in processing documents. This is due to the enormous amount of documentation in organizations that cannot processed without the use of modern software solutions. Therefore, the implementation of Electronic document management system becomes a necessity for any company if it wants to overcome the problems related to documents and records management.

General conclusion from the research for implementation Electronic document management system in companies and institutions in the Republic North Macedonia is that are made some initial steps in this domain, but it is at a very low level. Namely, organizations are aware of the necessity of applying such a system in terms of quality, efficiency and effectiveness of operation, but still do not apply it at all, or insufficiently. This confirmed by the results obtained with this research.

Although most of the companies and institutions in North Macedonia have increased electronic documentation, only 10% of them have some form of Electronic document management system. This means that only a handful of organizations manage documents and records through EDMS. Organizations are aware for the benefits of such an advanced document and records management system, but its implementation is lacking. However, the high support from the top management for the implementation of Electronic document management system points to the fact that companies and institutions in North Macedonia will soon decide to introduce this system into their operations.

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CONSTRUCTION E-PERMIT SOLUTION – DIGITAL TRANSFORMATION OF MOST CORRUPTED SEGMENT

Authors: *Sasha Gavrilovik¹, Prof. Dr. Vladimir Trajkovik², Prof. Dr. Vangel Fustic³*

Abstract:

The paper-less process is an excellent basis for a digital transformation of the management and review for issuing building permits by state institutions.

The vision of project for Construction e-Permit solution is effective system that can provide high level of efficiency, cost - efficiency, mobility, transparency and responsibility in the process of preparation, submission, processing documents within municipality, processing documents between institutions, issuing permit, informing citizens and giving them right for transparent way of objections.

One of the main goals is transparency in the work of municipalities in the process of issuing building permits. In addition, optimizing the process of issuing permits and other types of approvals is crucial to reducing the time it takes to serve citizens, as well as measuring and monitoring municipal performance by following deadlines, thereby contributing to increased agility of the state administration. With the introduction of electronic procedures and the circulation of electronic documents throughout the process, the costs of filing and processing cases are significantly reduced. This means that each institution, within the legal deadlines, inspect the submitted digital project files and accompanying digital case documentation and make its own decisions, opinions, which significantly shortens process and time and increases decision-making efficiency. During all the time the citizen has an insight into the process, in which stages the case is located and what are the decisions that are made for his/her request, thus making the citizen a central role in the whole process.

The results present additional positive benefits from implementation of this system starting from paper savings, reduction of CO₂ emission and direct money savings as a result of digital transformation.

Key words: *construction permits, digital transformation, paperless process, it solution.*

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Introduction

The paper has been completely discarded when it comes to project design and preparation since the first CAD software programs, so this fact is an excellent basis for a complete digital transformation of the entire management and auditing process for issuing building permits.

The vision of such a project for an electronic procedure for issuing building permits is an effective solution that can provide a high degree of efficiency, cost-effectiveness, mobility, transparency and accountability in the process of preparation, submission, processing of documents in municipalities, processing of documents between institutions, issuing permits, informing citizens and enabling their rights in a transparent way to complain. With the implementation of this information system, the state provides access to information to all parties involved in the process, anywhere and on any device, as well as faster decision-making and less bureaucracy.

One of the main goals of the project is transparency in the work of municipalities in the process of issuing building permits. In addition, optimizing the process of issuing permits and other types of approvals is crucial to reducing the time it takes to serve citizens, as well as measuring and monitoring municipal performance by following these deadlines, thereby contributing to increased agility of the state administration. With the introduction of electronic procedures and the circulation of electronic documents throughout the process, the costs of filing and processing cases is significantly reduced, as there is no need to make and submit multiple copies for inspection of appropriate services, as well as printing more project versions after each adjustment made in the appropriate phases. In addition to making the procedure cheaper, the time required for submitting the application is directly reduced, especially given that all project files are originally produced in digital form, so no additional conversion, printing, copying, packaging and the like are required. This means that the entire process is initiated with the digital files submitted in appropriate formats, which are then forwarded to the related departments in the municipality / ministry, as well as to all institutions concerned to inspect them and give their opinion on that documentation. This means that no additional meetings of the various committees are required to inspect the hard copy of the documentation, but each institution, within the legal deadlines, inspect the submitted digital project files and accompanying digital case documentation and make its own decisions, opinions, which significantly shortens process and time and increases decision-making efficiency. At all times the citizen has an insight into the process, the stages of his / her case and what are the decisions and decisions that are made for his / her request, thus making citizen a central role in the whole process. Such an organized system enables easy monitoring and measurement of the performance of civil servants involved in the process, as well as efficient management of the administration and resources required to issue building permits, with the aim of introducing a complete paperless process from start to end.

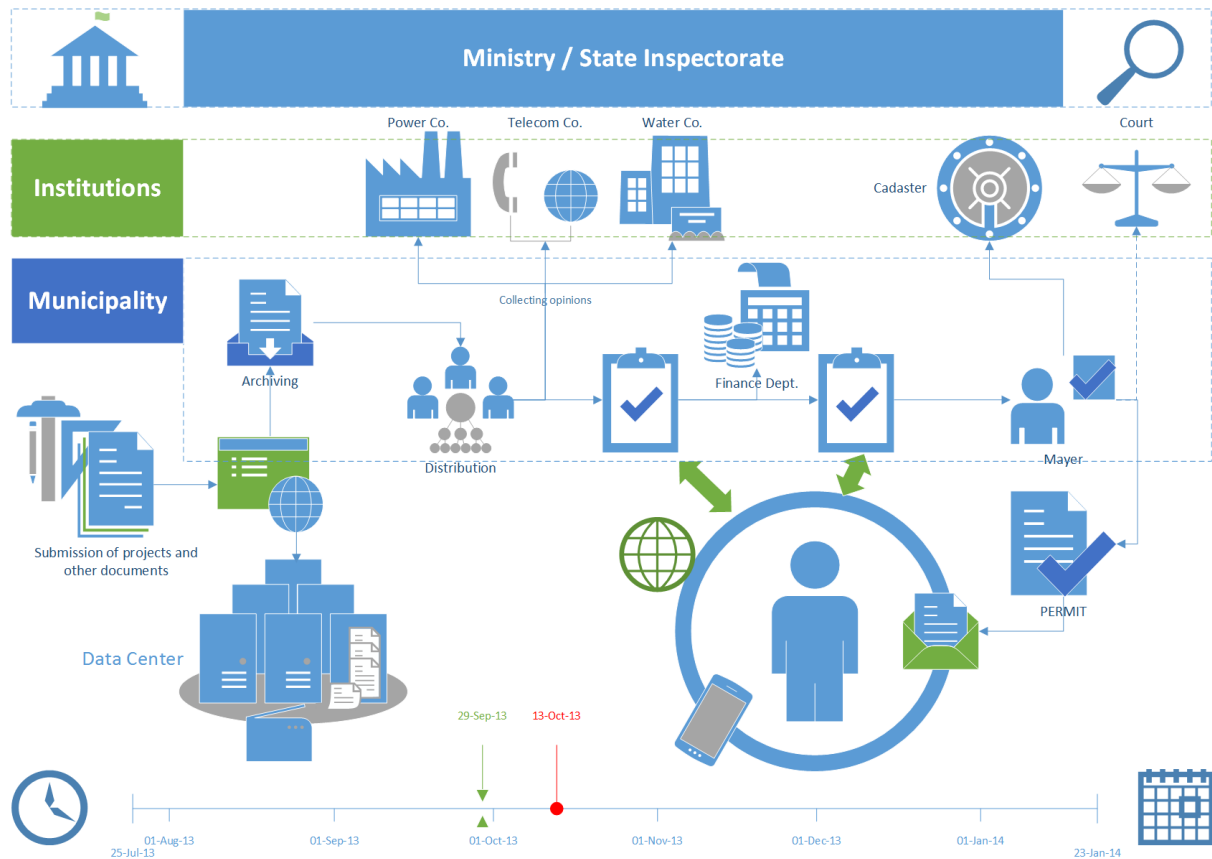
The rest of the paper is organized in 3 sections. The next section, Section Material and Method, gives an overview of what was planned to be analyzed. Second section, Results and Discussion, elaborates all the analysis and their results. Final Section Concludes the paper.

Material and method

To complete the circle of digital transformation and to conclude that there was successful implementation we had to analyze several segment for several aspects, like analyzing the processes for issuing construction permits, how citizens are involved in those processes and how other relevant external institutions are involved and give their opinions; analyzing the number of requests per one year, in this case the calendar year of 2018 is taken; how much time the requests are solved in average, how much the expenses would be for issuing construction permit if there is a use of paper procedure in compare with digital; everything on order to come to the some conclusions of the overall savings from complete process of digital transformation.

Results and discussion

According mostly on data from the system for issuing construction e-permits, here are the results in all segments taken into the consideration.



1. System overview and the position of citizen in the system

The main goal of the solution is tracking the process of issuing construction permits through management of required legal steps, documents and inter-institutional communication, everything monitored by legal time-frames and responsibilities. With this information system the information access is enabled to anyone involved in the process, anywhere and on any device and it is achieved faster decision-making, transparency and lower bureaucracy within the Municipality and other related institutions. The complete system brings:

- Reducing the time necessary for submission
- Defining roles of all involved municipality employees
- Distribution of subjects within the Municipality
- Independent view of subjects relevant for each Municipality/Employee/Institution/role/citizen
- Connection between each Municipality and external institutions relevant for the process of issuing permit (Electrical company, water authority, Cadastre, ...etc)
- Optimization of the processes for decisions and approvals
- Simple and flexible communication Citizen - Municipality and Municipality - Institution
- Process tracking
- Measuring the performances of the civil servants who are participating in the process
- Reducing of the paper usage in the Municipality and Institutions
- Reducing of the percentage of printed or scanned materials



2. Processes for issuing construction permits by segments

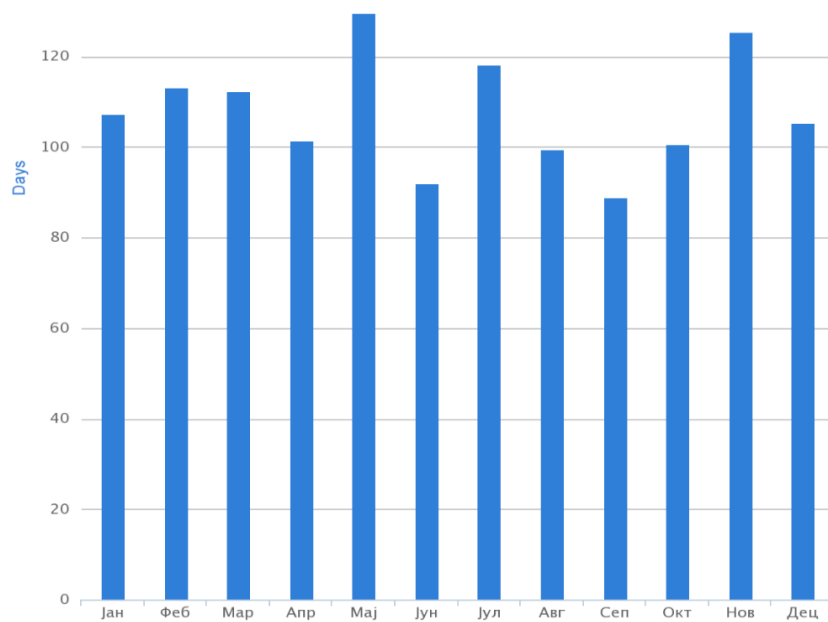
In the figure 2 above there is a graphical presentation of all process segments for issuing construction permits, as well as key points for sending notifications to the citizen that applied.

- Accepting requests through web-based system directly in digital form;
- Overview and archiving received requests;
- Distribution of requests to related municipalities and institutions, based on construction category
- Distribution of requests per employees within the municipality
- Central system for tracking legal time-frames for each process phase;
- Connection with relevant external institutions, distributing and forwarding requests for collecting their opinion and evidence of all opinions and institutional documents back in the central system according legal time-frames;
- Digital signing of all steps and actions by all involved users in the system;
- Generating template documents for most common needs with appropriate municipality logo and data, their archiving and possibility for their printing and forwarding through the system;
- Issuing construction permit and informing the applicants;
- Document versioning;
- Restricted access of each municipality to their documents only
- Defining roles and access rights;
- Dynamic process flow based on the hierarchy in the Municipality;
- User switch between several roles in the process;
- Possibility for each applicant to follow the status of his requests;
- SMS and e-mail notification for status change of requests;
- Integration with Ministry and State Inspectorate Authority and their notification and access to each application that exceeds legal time-frame for each process phases;
- Integration and forwarding requests to the Court for applications that are under court investigation;
- Reports and overviews by key parameters;
- Restricted portal segment for each applicant, so he can prepare for new requests and overview and follow existing;

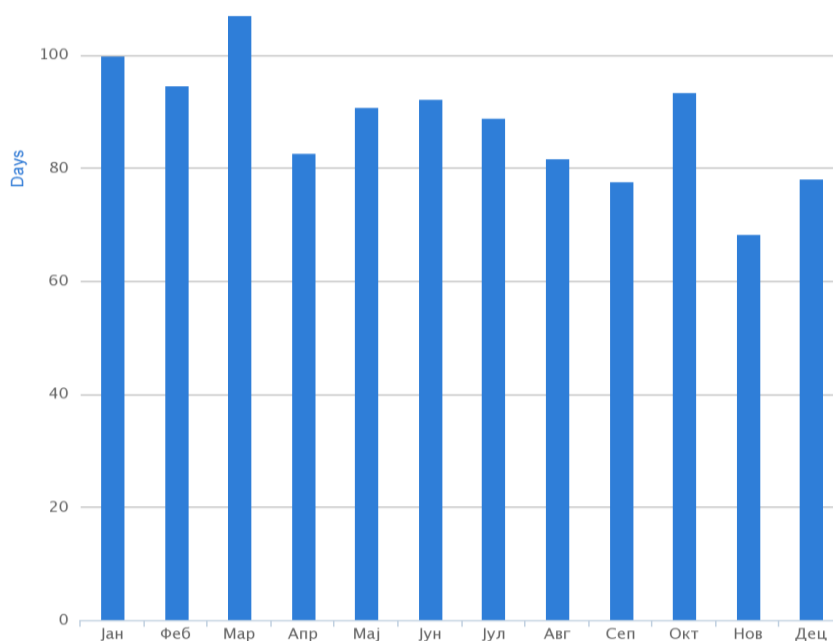
Here are some major parameters for the system usage:

- Number of requests per one year (2018)
- Total number of requests (2018): 9.675
- Total number of attached documents (2018): 204.301
- Total size of attached documents (2018): ~1TB
- Number of users in the system: 6.311
- Number of institutions in the system: 277

Analyzing how much time the requests are solved in average in the system:



3. Average monthly time for issuing permits, completed in related month (avg. 107,8 days for year 2018)

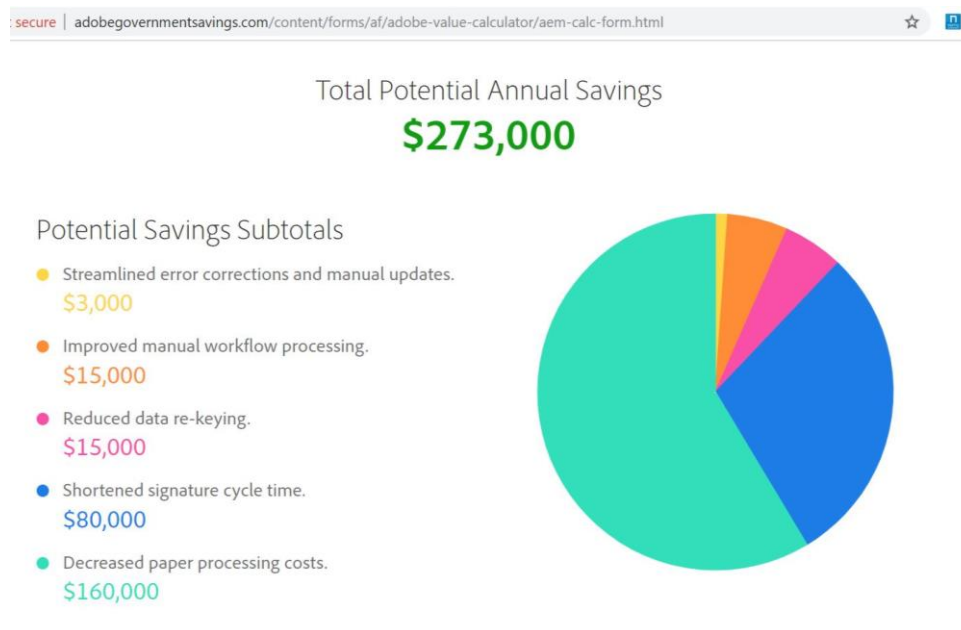


4. Average monthly time for issuing permits, requested in related month (avg. 87,9 days for year 2018)

Expenses for issuing construction permit would be if there is a use of paper procedure in compare with digital.

- According the number of paper documents used in 1 TB, having in approximate 75 million pages (cloudnine.com), we also can calculate the influence of paper savings directly on tree savings, which show savings of ~5.000 trees per year (www.sierraclub.org).

- According the Adobe savings calculator from digital transformation, having in mind the process (<http://adobegovernmentsavings.com>) the results are presented on the picture bellow:



5. Total annual savings (calculated by AdobeGovernmentSavings.com calculator)

Conclusion

Benefits for citizens:

- Fast and effective way of submitting application without long queues, misunderstandings and restrict working times and breaks.
- Transparency in the complete process of issuing the permit, through overview of process statuses.
- Detail information for the application status through SMS and e-mail notifications as well as evidence and citizen involvement if some additional documents are required in the process.
- Direct savings for application submission as digital files and scans are required only, no printing costs, copies, etc.

Benefits for Municipalities and institutions:

- Complete overview of applications, by process status;
- Overview of legal time frames per application;
- Digital interconnection with external institutions in order for accurate response and receiving their opinions for each application;
- Greater working efficiency;
- Process control;
- Increasing productivity and capacity for processing applications;
- Transparency in each segment of issuing process;
- Covering the complete process of issuing permit;

Having in mind the above benefits for all involved parties as well as presented numbers for savings in paper, time, money, along with the complete transparency and eliminating the corruption in this segment, it is obvious that this kind of successfully implemented systems are very welcome and accepted by citizens and deliver result in short-term period, as well as give space for additional investments in the solution and new technologies. The conclusion is that:

- One year savings (for year 2018) are more than double of the initial price paid for development of the solution.
- The citizens are transparently informed for the status of their request/case by SMS or email positioning the citizen in the center of the system.

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PROJECT QUALITY ASSURANCE AS A WAY TO SUCCESS FOR SMEs

Ana Dajovska, MSc¹

Abstract:

Following the findings of Harvard business review research, the future of business is having all of the work in every company as a separate project. This prediction of this HBR study in 2012 has become the reality nowadays. The paper “Project Quality Assurance as a way to success for SMEs” elaborates the importance of implementation of project management and project quality assurance tools into every company. The paper researches the practical side of the project management process and how success in small and medium companies in North Macedonia can be delivered through implementation of project quality assurance tools. We are presenting all of the research phases that has guided to creation of unique project quality assurance tool, joined with employees’ feedback. To conclude the paper, we add statistical overview and practical samples of how a PQA form and implementation of project management in small and medium companies can bring success in the working process. In the research process, we divided the two concepts and worked on the theoretical and the research part separately. Concerning the methodological approach, this paper includes the following segments:

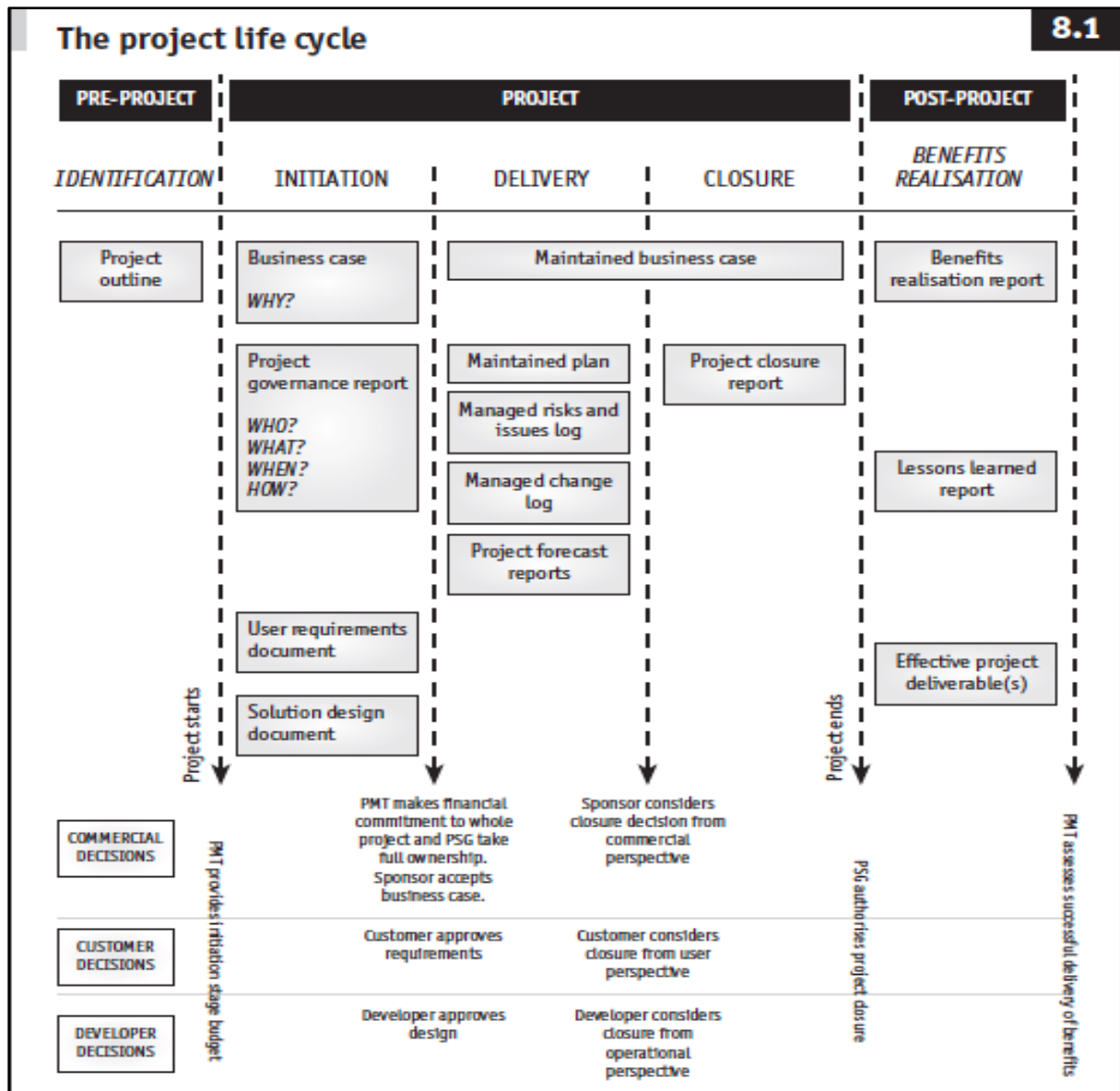
- *Analysis of the concept of project quality assurance and tools for project management in companies*
- *Comparison of the contemporary methods of project management with the newly designed tool named Karpa’s PQA*
- *Presentation of the information gathered from the employees of the company Karpa of Europe based on the usage of the Karpa PQA tool in a period of ten months*
- *Presentation of the advantages and the needs for improvement of the PQA tool based on testing period of ten months inside the company Karpa of Europe.*

Key words: *project management, quality, assurance, SMEs.*

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Project management as a tool for creating added value in the companies

The basis of functioning of the modern companies is seen through the project management process. Having separate projects and working on their development and implementation, the companies are able to create strategic access to innovations and they are able to foresee the project outputs and impact at its very beginning. In order to maintain healthy project and assure its quality, the author Paul Roberts presents the main elements of the project life cycle in his book “Guide to project management”:



1. Roberts, P. (2007) “Guide to project management”, The Economist, Profile Books Ltd.

Following the phases of the project and the possibility to assure its quality, we have been able to work on an internal company research in Karpa of Europe that

contributes towards the implementation of good quality of projects and creates functional teams through a tool that is very simple to use.

Karpa's PQA toll compared to the Agile project management

Just for illustration, we have taken into consideration some of the most contemporary project management practices and compared them to the Karpa's PQA tool. On one side, the Karpa PQA tool promotes the project work of the teams as their independent and joint effort. The project manager is consulted upon need, only in cases when certain elements of the process need to be explained. The focus of the PQA tool are the people and how they will determine their work according to previously created SMART goal (Specific, Measurable, Achievable, Relevant and Time-bound goal). This tool gives space to the team to determine their scope of work, their confidence in doing the work and the time they need to complete different project milestones. This tool gives the opportunity to the team to examine the project idea and give positive or negative feedback related to the given milestones assigned to them. In case the confidence score of any team member is marked with 1, the entire project needs to be re-examined and discussed since there is a need for the team confidence score to go to a level of 5 or above. The Karpa PQA tool has been tested by the employees of Karpa of Europe for a period of ten months and results have been visible. The company has been able to maintain the good quality of work based on individuals' dedication to their tasks, and to ensure the quality of the project without having the team feel pressured in case some steps need to take longer time. This is a tool which is team centered and does not take in consideration the costs as part of the project implementation process.

The Karpa PQA tool is created to support the knowledge work process of Karpa as a company. It requires long term dedication to people and complete effort from the entire company in order to be developed, maintained and achieved. Karpa trains people to be the leaders of their work and their life. The independent working based on complete dedication to Karpa's goals as a company and knowledge of how the company works and lives, are the main elements of how the PQA tool needs to contribute to the knowledge work process of the employees. This concept might look as a complete turnaround from the traditional models, but the long term results that Karpa as a company and its employees as professionals have achieved is empowering. The most important element is that the company, by having the PQA tool, has created the freedom with a framework² for its employees, which according to some of the most significant leadership professionals of today, Jim Collins, leads to greatness and maintaining a successful company. The success of Karpa as a company and the PQA as a tool is to have consistency, discipline and relationship incorporated in the model of trust developed between the employees and the company. With that, we would like to point out that PQA is a tool for assurance of project quality, and does not relate to the control of quality of the project since this is task of the project teams, the trustworthy Karpa employees.

² Collins, J. (2001) Good to Great: Why Some Companies Make the Leap...And Others Don't, HarperCollinsPublisher

Compared to the contemporary practices as the agile project management, the PQA tool might be defined as the ‘new air’ of human centered project management as well.

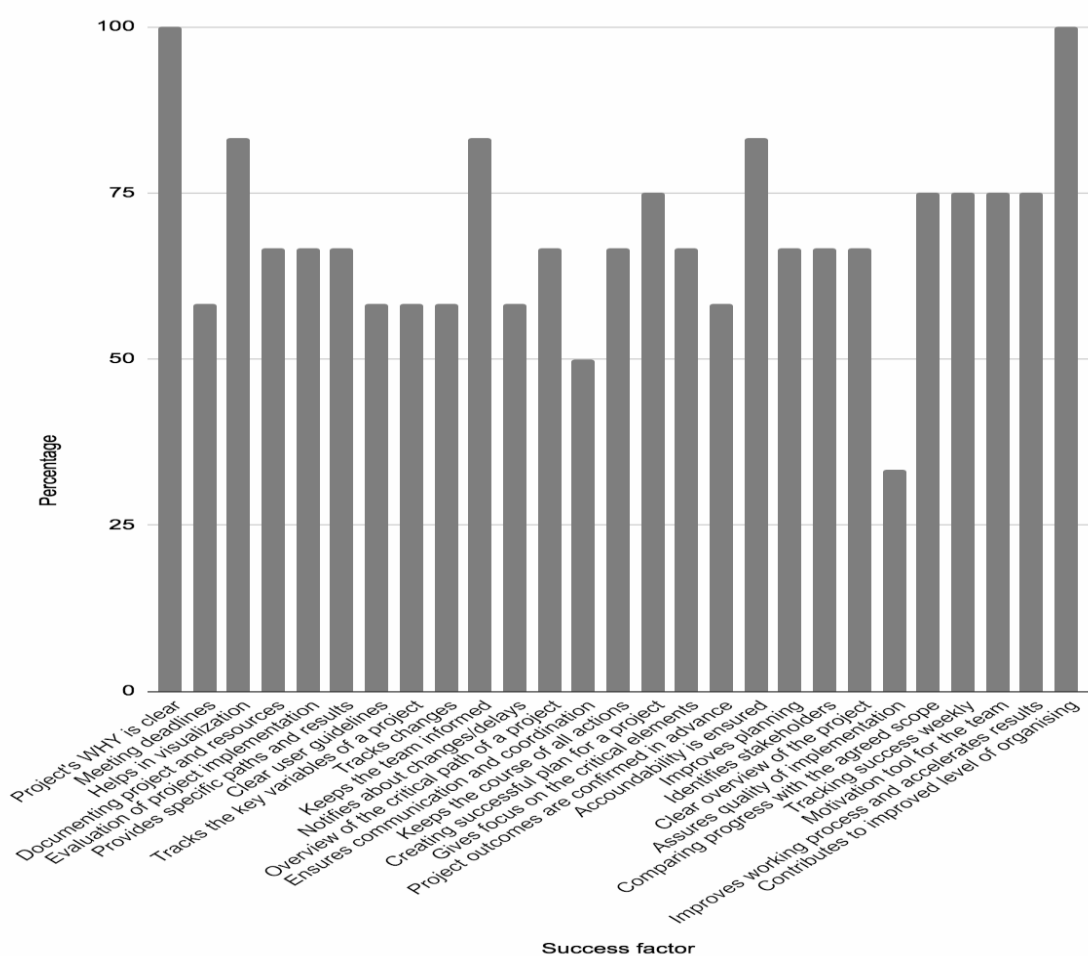
Only for comparison, the agile model follows the need to reach the speed of market but also maintaining certain flexibility and accommodating change. All of the elements of the agile project management methods point out to ensuring the risk management and cost control in order to implement the process and ensure the delivery of the final product. Through agile, project management quality is delivered through control maintained through frequent meetings, software applications used, separation of the project in sprints which is expected delivery of tasks in a period from two to four weeks. All of these elements would raise the debate about the possibility of freedom and creativity of each individual and how work is done in accordance with the development of the knowledge work role of each employee. The pioneers of the agile project management, Hirotaka Takeuchi and Ikujiro Nonaka, when speaking about the quality control, would note: “Although project teams are largely on their own, they are not uncontrolled. Management establishes enough checkpoints to prevent instability, ambiguity, and tension from turning into chaos. At the same time, management avoids the kind of rigid control that impairs creativity and spontaneity. Instead, the emphasis is on "self-control," "control through peer pressure," and "control by love," which collectively we call "subtle control."³

Inside company research results

In the initial phase, the PQA document has been evaluated inside the company in order to receive feedback from direct users in Karpa of Europe. The answers given by the employees point out that the Karpa’s project quality assurance tool is helpful for each of the interviewed employees in two main fields: having a clear perspective of the job that needs to be done and helping them in the process of organizing their work. This tool has also been very useful for the employees in the following fields: visualising of the project, keeping the team informed, providing a frame where there is one person - the project implementation owner, who has a task to take care of the project flow.

The list of priorities and the internal feedback received in various elements listed as a PQA success factors is given in the chart below:

³ Nonaka, I. & Takeuchi H. (1986). Harvard Business Review article: The New New Product Development Game, <https://hbr.org/1986/01/the-new-new-product-development-game> (accessed 09.10.2019), pp. 143



2. Graphic created with the data gathered through the research “PQA as a tool for Karpa knowledge work”

The average number of PQAs that a Karpa employee works on is 5. The results received in the internal research are done on a representative sample of 12 employees out of the total of 38 Karpa of Europe employees worldwide.

Knowledge worker in Karpa is a person that works independently and organized. By having this company culture, Karpa is giving the people the opportunity to develop as professionals in the areas that they find their key competencies are the strongest. By being free of administrative elements and over trapped with bureaucracy, the employees are able to contribute to Karpa of Europe in the most creative way they can. One sample is exactly this research. In the internal questionnaire with the Karpa staff around the world, there are several conclusions on how the PQA tool helps these employees:

- Clear understanding of the task
- Easier construction of the project
- Helps in dividing the project in small manageable steps
- Dividing tasks amongst the team
- Following the work and organizing time accordingly
- Get a complete picture of the project

- Enhances the knowledge of the workload
- Introduces the entire team with all of the tasks and helps them understand the tasks and contributions of other team members as well

Asked about the improvements needed in the PQA tool, Karpa’s employees have the following suggestions:

- Need for more clear definition about scoring
- Receiving notification about changes in milestones
- To be done on a Trello board instead of Google docs
- Last milestone to be Next-Step for that PQA, a new PQA for continuation of the project
- Need for more specific guidelines when creating the SMART goals. For example how they should be structured and written.
- A training process could be helpful about what role each member has.
- Creating a procedure to follow when changing / updating the due dates, the milestones
- Adding notification about changes made in the PQA
- Develop a better way to keep track of milestones. As in, there needs to be more flow between milestones and the Trello tasks.

It is important to point out that the Karpa team uses PQA as an additional tool to their already established Trello systems, documentation and processes. The close relation of these two elements helps employees to organize their work and manage their responsibilities at Karpa.

A comparison between Agile, Kanban and PQA tool project management practices

When speaking about project management in the companies in Pelagonia region of North Macedonia, it is often mentioned that most of them use agile project management. The comparison of how many companies related to this method would be a topic for another research. This time, only to illustrate the possible similarities and existing differences between the agile project management practices and Karpa’s PQA tool, we have designed a comparison chart between Agile, Kanban and the PQA tool for project management. The main resource for the comparison chart of these approaches has been the online learning platform www.guru99.com. To the existing chart, the features of the Karpa PQA tool have been added in order to illustrate the change in project management practise inside the company delivered.

Parameter	Agile	Kanban	Karpa PQA tool
Application	Agile is a beneficial method for projects where the final goal is not set. As the project progresses, the development can adapt as per the	Reducing waste and removing activities that never add value to the team.	Enhancing independent teamwork and improvement of organization process to get the project done. Confidence of

	requirements of the product owner.		the team to do the job is a crucial element.
Advantage	Breaking the entire project into smaller segments helps the team to focus on high-quality development, testing, and collaboration. Conducting testing after every iteration helps the team to find and resolve bug quickly.	Shorter cycle times can deliver features faster.	Teams are able to define all project tasks as milestones, analyse them and create expectations for the project to be completed based on their level of confidence to get the job done.
Focus	Agile process focuses on constant communication.	Shorter sprint lengths force to breaks up items to fit within sprint boundaries.	Well informed team and foreseeing the timing for a project to be completed.
Involvement of QA	QA had nothing to do at the beginning of a sprint but is overworked at the end.	QA has been involved in every phase and regularly test system under development.	QA is involved through the entire process of implementation as a consultative help. The role of the QA is to lead the team in case of need. No control is applied, the system is based on confidence in the team's capabilities.
Iterative Development	Agile process allows Iterative Development.	Kanban process does not allow Iterative Development.	Iterative development is done by having new phase of each project being developed every 3 months.

Dependency	Process depends on Story Boards.	Process depends on Kanban Boards.	Process depends on the project team.
Visual checking	Not providing support for visually checking the work in progress.	Visually check the work in progress.	PQA gives a visual frame for the project implementation process.
Goal	The goal of Agile approach is continuous Integration, development and testing.	The goal of the Kanban approach is to improve the team's process	The goal of PQA is to help the team's functionality and by that, to enhance the project implementation process.
Planning	Sprint planning can consume the scrum teams time for an entire day.	Need very less organization set-up changes to get started	Need project sponsor and project implementation owner to agree on the project SMART statement. Team needs also to fully understand the SMART statement. Based on this, milestones of the project are crafted. Team can start to work.
Advantage	With shorter planning cycles, it's easy to accommodate changes at any time during the project management.	Rapid feedback loops may result in more motivated, empowered and actively performing team members.	Team suggests changes and in communication with the project sponsor and project implementation owner the suggestions are applied. This is a tool of collabotation.

3. Graphic sample resource: <https://www.guru99.com/agile-vs-kanban.html>

Conclusion

Karpa's PQA tool is bringing out a completely different approach to project management. The model has been created recently and it is still in its initial phase of implementation and usage. The constant testing and improvements done are leading this tool to the process of automation in the upcoming period. This tool supports a new leadership framework and a complete mindset change of business, and as so, it needs to be examined and tested furthermore. The results that the PQA tool brings to the Karpa team have been truly visible. What we need to take in consideration is the long term implementation of the tool, and the creation of a more user friendly and automated tool in the second phase of development of the tool.

In the annexed documents of this paper, the full Karpa's PQA template has been added together with the guidelines for usage of this document.

Reference list

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8.

Scoring Section 1 of 2 - SPEC SHEET

QUESTION	ANSWER	PCS SCORING GUIDE
<p>Project Sponsor (Defines "the why" for the project and confirms it's completion).</p> <p>The SMART goal (1) [Specific, Measurable, Achievable, Relevant (this is the WHY for the project), Time bound]</p> <p>(2) Is a declarative and measurable statement, made up of the SMART elements in (1), which will be true at the project end date.</p> <p>Important: The project sponsor must approve the SMART statement (2), and any changes to it during the project execution.</p>	<p>1. Please define separately: (S) (M) (A) (R) (T)</p> <p>2. Please add the full statement confirmed by the project sponsor:</p>	<p><i>1 point subtracted from the PCS if no sponsor is assigned</i></p> <p><i>For each missing SMART criteria in (1) subtract 1 from the the PCS.</i></p> <p><i>A missing full statement (2) reduces the PCS by 5, as it indicates that the project sponsor wasn't presented with a clear SMART goal.</i></p>
<p>Project Implementation owner (Ensures the project is on track and all milestones delivered on their due date)</p>		<p><i>1 point subtracted from the PCS if no owner is assigned</i></p>
<p>Project confidence score (PCS) (Confidence score between 1(low), 5(medium) and 10(high), that the project SMART statement will be true on the project End Date.)</p>	<p>1</p> <p>Scoring Notes: -1 for no sponsor, -10 for no SMART goal or statement, -1 for no owner, -1 for no review date, -1 no start date, -1 no end date, PCS set to 1 because no milestones are defined, PCS set to 1 because no last review date exists</p>	<p><i>Starts as a 10 or the lowest score of all incomplete milestones, with points subtracted based on the scoring guide for each section.</i></p>
<p>Last review date (The last date when the project implementation owner reviewed the milestones)</p>		<p><i>If PCS is 1 to 4, each day past the last review date subtracts 1 point from the PCS.</i></p>
<p>When PCS is 1-4: Daily reviews When PCS is 5-7: Weekly reviews When PCS is 8-10: Reviews as needed</p>		<p><i>If PCS between 5-7, postponing of one additional week since the last review date, subtracts 1 point from the PCS</i></p>
<p>Start date (When does the 1st milestone start)</p>		<p><i>If no last review date then PCS is set to 1</i></p>
<p>End date (Within 3 months after the Start Date)</p>		<p><i>The PCS is reduced by 1 point if the start or end dates are missing.</i></p> <p><i>The PCS is set to 1 if the project is incomplete past its End date</i></p>

CONTINUE TO THE NEXT SECTION FOR THE MILESTONES (Section 2)

Communication plan (The tools which will be used for updating the sponsor and milestone owners when updates are needed based on the PCS.)	Communication tool/channel	Frequency of communication	<i>n/a</i>
PCS of 1-4: daily updates PCS of 5-7: weekly updates PCS of 9-10: updates as needed		Daily Weekly As needed	
Risk management plan (If risks appear during the project, please make a list of possible actions you plan to undertake (ex. calls, meetings, team brainstorming etc.)			<i>n/a</i>
Link to project resources (Trello board, Google docs, Calendars, etc)			

Guide for Scoring Section 1 of 2 - SPEC SHEET

- Project sponsor** is the person who receives the fulfilled PQA template and approves the SMART sentence
- Firstly, you need to define all of the steps of the **SMART analysis**. Questions to ask:
 - (S) What is the main thing which we want to achieve?
 - (M) How will I know that what I want to achieve is properly measured? What stats/numbers/metrics show me that I have achieved the specific goal?
 - (A) How do I make sure that this goal can be achieved? On what is based my knowledge that this goal can be achieved?
 - (R) Why do I do this? What am I accomplishing?
 - (T) Put exact date or a specific month of completion of the project. In some cases, you may also refer to the start and end date of a project.
- Project owner** is the person who prepared the entire PQA documentation and defines SMART goals, dates and milestones, as well as the non-scoring section of the PQA.
- Project Confidence Score (PCS)** is defined in order to measure the initial assessment to the entire quality of the project. Please follow the scoring guidelines given in the PQA sheet in order to determine the general project PCS score. Important note: In case some of the grades of the milestones is lower than the general project PCS, the score decreases to the same value as that given milestone.
- Last review date** refers to the date when the project milestones and concept were reviewed by the project owner. Please follow the scoring guidelines given in the 'Last review section' in order to determine the frequency of reviewing your PQA. Last

review date highly depends on the project's general PCS. **Important information when you submit a project to the project sponsor:** The last review date at the start of the project can be a day before, or on the day when the project is sent to the project sponsor.

- Project start date** is the timing when the first project milestone starts.
- Project end date** is the time of completion of all project milestones, and it cannot exceed 3 months after the project start date.

Guide for Scoring Section 2 of 2 - MILESTONES

- Milestones** are specific actions/tasks that specific members of the project team need to complete. Please determine date of completion of each milestone, their owner, and most important- an understandable definition of the milestone and what exactly should be accomplished. Each team member needs to add their confidence score for the milestone that they own.

How we know that we have a good PQA?

- Team members are aware about what the project will accomplish
- Clear expected result about who is impacted by the project, and awareness of the impact.
- Stakeholders' requirements and roles are well known and clearly addressed.
- Timelines of the project clearly outlined.
- There is a possibility to foresee the critical points based on the PQA template.

THE USAGE OF DECISION SUPPORT SYSTEMS FOR IMPROVING MANAGERIAL DECISION MAKING PROCESS

Viktorija Stojkovski¹

Abstract:

The ten main managerial roles are classified into three categories and one of them is decision making. Managers need timely information to perform their roles in this category. However, managerial decision-making is synonymous with the whole managerial process. The environment in which managers operate today is much more complex, and the trends themselves lead to increasing complexity. Due to a number of factors, such as new technologies, global markets, competition and political stability, managers are increasingly faced with the choice of multiple alternatives, with higher costs due to mistakes made and greater uncertainty about the future. As a result of these changes in the environment, managers need to learn how to use the new tools and techniques developed to support their decision making.

Individual, group, and organizational success is particularly important, so information systems research is moving toward finding ways to improve support for the decision-making process. Therefore, different information systems are designed, developed and implemented to provide the needed support. This paper focuses on a specific research done on the territory of the Republic of North Macedonia to determine the impact that systems have in their company. The survey involved 52 managers from different levels of decision making, from medium to large companies in the Republic of North Macedonia, and the purpose of this research is from obtained results to identify the impact of the decision support systems (DSS) on the degree of managerial satisfaction and the impact of these systems on company productivity.

Key words: *decision support systems (DSS), managerial decision making, productivity, managerial satisfaction.*

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Introduction

Managerial functions play a major role in the level of productivity of the company, so executing the various managerial functions involves a continuous decision-making process, and all managerial activities are reduced to decision making. To make decisions, managers need information that is mainly obtained through the company network and company information systems. Companies understand that in order to be able to "survive" and thrive in a global and competitive world, they must effectively manage and use their information resources. Today, information is the bloodstream of the companies and successful companies need to collect quality data that will further lead to quality information and effective managerial decision making (Wang, Hassan, 2015: 27). Decision support systems incorporate technology that enables them to acquire the necessary knowledge and thereby help managers to be more productive and innovative.

In order to improve the process of managerial decision making, the companies need to integrate decision support systems and, through their application, enhance the decision maker's ability to process knowledge, stimulate managers to new approaches of problem thinking, and reduce the time and costs of decision making, as well as to increase manager satisfaction in the decision making process.

Benefits from DSS Usage in the companies

According to Hung (2005), the success of DSS usage is generally measured by the efficiency and effectiveness of the system. Effectiveness is measured by the outcome of the decision, the quality and precision of the decision, and user satisfaction, while effectiveness is more oriented to the decision-making process and is measured by the amount of time needed to make a decision or by number of alternatives that could be considered.

In addition to the benefits of DSS usage, several researchers have also examined the user satisfaction with DSS usage (Adams, Nelson, Todd, 1992; Newman, Robey, 1992; McKeen Guimares, 1994). Their research boils down to the fact that users satisfaction with DSS usage exists when the level of user participation is high, furthermore, when users receive top management support for DSS usage, when appropriate training is provided prior to system implementation, also when end-users are involved in the system development and when users face unstructured problems that require greater effort.

The main benefit of using decision support systems is that it increases efficiency and reduces the possibility of human error in the decision making process. Once decisions are implemented, they have the effect of reducing costs, using funds more efficiently, improving customer service, and reducing risks and so on. In fact, the purpose of using DSS is to enable a better decision-making process. An improved decision-making process can be viewed from different angles and may be the result of the same decision, but that decision was made more quickly or with less cost or with better documentation.

Hypothetical research framework

The general hypothesis in this study is: *The usage of decision support systems has a positive impact on the managerial decision making process and the productivity of the company.* The research is based on the assumption that decision support systems influence the managerial decision making process, as well as the satisfaction of the managers, from the point of view that the system contributes to the reduction of time and cost of the decision making. Testing the general hypothesis in this study

included variables that were confirmed that have an impact on the managers' satisfaction and productivity of the company.

The first particular hypothesis is: *The usage of the decision support systems has an impact on the degree of managers satisfaction.* In order to determine the impact of decision support systems on managers satisfaction level, a correlation analysis of factors that influence managers satisfaction is made. The correlation coefficient is used to determine the dependence between the variables. The correlation describes the strength of the relationship of at least two variables, and for the purpose of the research the correlation analysis is presented by Pearson coefficient. First, a correlation analysis of the usage of the decision support systems to companies with managers involvement in the system development phase has been made, as more researchers have examined users satisfaction with the use of DSS and their research findings indicate that users satisfaction with the application of the system is greater when they are involved in the system development (Adams, Nelson, 1992; Newman and Robey, 1992; McKeen Guimares, 1994).

Correlations

		The company uses decision support systems	Managers were involved in the development phase of the decision support system
The company uses decision support systems	Pearson Correlation	1	,824**
	Sig. (2-tailed)		,000
	N	52	52
Managers were involved in the development phase of the decision support system	Pearson Correlation	,824**	1
	Sig. (2-tailed)	,000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

Table 1. Correlation analysis of DSS usage with managers involvement in the system development

The results obtained in the correlation analysis shown in Table 1. show that the analysis covers the responses of all 52 managers, and then excludes all responses with missed data that is of particular importance for both variables, so in this case are excludes those responses that indicate that managers do not use decision support systems. According to Cohen (1988: 79-81), the strength directions of correlation are as follows: small where $r = 0.10 - 0.29$, medium where $r = 0.30 - 0.49$, large where $r = 0.50 - 1.0$. According to the analysis, i.e. according to the Pearson coefficient, which is equal to 0.824, there is a great positive correlation between the usage of DSS and the involvement of managers in the system development phase, as a factor that increases the manager's satisfaction with the application of the system. Furthermore, the coefficient of determination indicates how much of the variability of the dependent variable is explained by the independent variable. In this correlation, the coefficient of determination is 0.678, i.e. 67.8% of the variability of managers satisfaction as a variable in this research is explained by usage of DSS as another variable in this research. This data shows that the use of decision support systems explains 67.8% of managers satisfaction, assuming that managers involvement in system development contributes to increasing managers satisfaction. The statistical

significance of the relationship between variables is determined by Sig, which in this case is .000, which is less than 0.01, i.e. $p < 0.01$, making the relationship between variables statistically significant. Since there is a link between the application of decision support systems and managers involvement in the system development as a factor to increase managers satisfaction, this variable is included in the testing of the general hypothesis.

The way DSS is used, or how easy is the system to use, has been taken into account as a second factor affecting managers satisfaction. In the following is a summary of the results of the correlation analysis between managers usage of the decision support system and their answers on whether the system is easy to use.

		The company uses decision support systems	The decision support system is easy to use
The company uses decision support systems	Pearson Correlation	1	,890**
	Sig. (2-tailed)		,000
	N	52	52
The decision support system is easy to use	Pearson Correlation	,890**	1
	Sig. (2-tailed)	,000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

Table 2. Correlation analysis between DSS usage and whether the system is easy to use

According to the analysis presented in Table 2, i.e. according to the Pearson coefficient, which is equal to 0.890, there is a great positive correlation between the usage of DSS and whether the system is easy to use, as a factor that increases the manager's satisfaction with the usage of the system. Furthermore, the coefficient of determination indicates how much of the variance of the dependent variable is explained by the independent variable. In this correlation, the coefficient of determination is 0.792, ie 79.2% of the variability of one variable is explained by the other variable. This data shows that the usage of decision support systems explains 79.2% of managers satisfaction, assuming that if it is easy to use, the system also contributes to increasing managers satisfaction. The statistical significance of the relationship between variables is determined by Sig, which in this case is .000, which is less than 0.01, i.e. $p < 0.01$, making the relationship between variables statistically significant. Since there is a relationship between the usage of DSS and whether the system is easy to use, as a factor in increasing managers satisfaction, this variable is included in the testing of the general hypothesis.

The focus of DSS is on effective decision making when a company faces semi-structured or unstructured business problems, and in this respect it is necessary for the system to be designed and developed according to the needs of the managers in order to help the companies achieve their goals. From this point of view, the adjustment of DSS to the needs of the company is taken as a factor contributing to the increase in managers satisfaction. In the following is a correlation analysis between

the usage of DSS as a dependent variable and the adjustment of DSS to the needs of the company as an independent variable.

Correlations

		The company uses decision support systems	The decision support system is adjusted to the needs of the company
The company uses decision support systems	Pearson Correlation	1	,962**
	Sig. (2-tailed)		,000
	N	52	52
The decision support system is adjusted to the needs of the company	Pearson Correlation	,962**	1
	Sig. (2-tailed)	,000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

Table 3. Correlation analysis between DSS usage and system adaptation to the company needs

According to the analysis presented in Table 3, i.e. according to the Pearson coefficient, which equals 0.962, there is a great positive correlation between the usage of DSS and the adaptation of the system to the needs of the company, as a factor that increases the manager's satisfaction with the application of the system. In this correlation, the coefficient of determination is 0.925, ie 92.5% of the variability of one variable is explained by the other variable. This data shows that the usage of decision support systems explains 92.5% of managers satisfaction, assuming that if adopted to the company's needs the system also contributes to enhancing managers satisfaction. The statistical significance of the relationship between variables is determined by Sig, which in this case is .000, and is less than 0.01, i.e. $p < 0.01$, making the relationship between variables statistically significant. Since there is a link between the usage of DSS and the adaptation of the system to the needs of the company, as a factor in increasing the satisfaction of managers, this variable is included in the testing of the general hypothesis.

The fourth factor that is thought to contribute to increasing managers satisfaction is that the application of the system improves the communication and leadership direction of the managers. In order to determine the relationship between DSS usage and the improved communication and leadership guidance of managers, a correlation analysis is also performed, and DSS usage is presented as a dependent variable.

Correlations

		The company uses decision support systems	Communication and leadership guidance are enhanced by the implementation of the decision support system
The company uses decision support systems	Pearson Correlation	1	1,000**
	Sig. (2-tailed)		,000
	N	52	52
Communication and leadership guidance are enhanced by the implementation of the decision support system	Pearson Correlation	1,000**	1
	Sig. (2-tailed)	,000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4. Correlation analysis between DSS usage and communication improvement and managers leadership

According to the results shown in Table 4, the analysis covers the responses of all 52 managers, then excludes all responses in which missed data that is of particular importance for both variables, and in this case those answers which are excluded shows that managers do not apply decision support systems. The Pearson coefficient, which is 1 in this case, indicates that there is a complete and positive correlation between DSS usage and improved communication and leadership guidance for managers. In this correlation, the coefficient of determination is 1, i.e. 100% of the variability of one variable is explained by the other variable. This data shows that the application of decision support systems explains 100% of managers satisfaction, assuming that if the system is implemented in the company, it will also contribute to enhancing managers' satisfaction in terms of improving communication and leadership. The statistical significance of the relationship between variables is determined by Sig, which in this case is .000, which is less than 0.01, i.e. $p < 0.01$, making the relationship between variables statistically significant. As there is a link between DSS usage and improved communication and leadership guidance as a factor in enhancing managers' satisfaction, this variable is included in testing the general hypothesis.

The last factor taken into account in determining the impact of DSS on managerial satisfaction is whether DSS provides certainty in the decision-making process and the outcome of the process itself. One of the benefits of using DSS is that it helps users make better decisions. Successful implementation of the decision support system fundamentally improves the quality of the decision making process, which further results in better decision making.

Correlations

		The Company use DSS systems	DSS provides certainty in the decision- making process and the outcome of the process itself
The Company use DSS systems	Pearson Correlation	1	,571**
	Sig. (2-tailed)		,000
	N	52	52
DSS provides certainty in the decision-making process and the outcome of the process itself	Pearson Correlation	,571**	1
	Sig. (2-tailed)	,000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

Table 5. Correlation analysis between DSS usage and certainty in the decision-making process and the process outcome itself

According to the analysis presented in Table 5, i.e. according to the Pearson coefficient, which is equal to 0.571, there is a great positive correlation between the usage of DSS and that the system provides confidence in the decision-making process and the outcome of the process itself, which further contribute to increasing manager satisfaction with the application of the system. In this correlation, the coefficient of determination is 0.326, i.e. 32.6% of the variability of one variable is explained by the other variable. This data shows that the use of decision support systems explains 32.6% of managers satisfaction, assuming that if the system provides certainty in the decision making process and the outcome of the process itself, it will also contribute to enhancing managers satisfaction. The statistical significance of the relationship between variables is determined by Sig, which in this case is .000, which is less than 0.01, i.e. $p < 0.01$, making the relationship between variables statistically significant. Given that there is a link between DSS usage and that the system provides certainty in the decision-making process and the outcome of the process itself, as a factor in enhancing managers satisfaction, this variable is included in the testing of the general hypothesis.

From the five correlation analyzes of the factors that influence the degree of satisfaction of managers, it can be concluded that decision support systems influence the degree of satisfaction of the manager, and therefore, the first particular hypothesis is accepted, i.e. *the application of the decision support systems have an impact on the degree of satisfaction of the managers.*

The second particular hypothesis is: *The application of decision support systems increases the productivity of the company.* Productivity involves two common dimensions as effectiveness and efficiency. Effective performance refers to measuring the performance of tasks or the achievement of goals through outputs, whereby productivity refers to meeting consumer demands, and efficient performance refers to measuring the cost of resources associated with achieving the objectives company. Any inefficient operation entails costs that reduce productivity. The following questions

from the survey questionnaire were considered as independent variables for further analysis: - Does the decision support system contribute to the efficient allocation of resources in your company? - Does the decision support system contribute to meeting the demands of your customers? - Does the decision support system reduce the time for decision making? - Does the decision support system reduce costs? Using the simple linear regression statistical method it is necessary to determine the interrelationship between the application of decision support systems and the efficient allocation of resources in the company, ie to determine how the application of decision support systems in the company can predict the effective company resource allocation. The concept in the linear regression model is that if the random variable X has a certain value, a response to the random variable Y. is also expected. This means that the value it has X affects the value of Y. , or dependent or endogenous variables Y have values that depend on independent or exogenous variables X whose values are determined or influenced by external factors. The model evaluation is presented in Table 6. The correlation coefficient R is 0.925 and shows a high degree of correlation between the variables. In this linear regression model, the coefficient of determination shows how efficient the allocation of resources in the company is explained by the application of DSS in the company. According to the summary, the model explains 85.6% of the DSS contribution to the efficient allocation of resources in the company, while the Adjusted R Square coefficient of determination is 0.853 which explains the 85.3% of the DSS contribution to the efficient allocation of the company resources.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,925 ^a	,856	,853	,193

Table 6. Summary for Model 1

The ANOVA test, tests the statistical significance of the relationship between the variables, so according to the ANOVA test shown in Table 7, the statistical significance is $p = 0.000$ or $p < 0.0005$ from which it can be concluded that the regression model statistically predicts the dependent variable, i.e. the decision support system contributes to the efficient allocation of resources.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,056	1	11,056	296,154	,000 ^b
	Residual	1,867	50	,037		
	Total	12,923	51			

Table 7. ANOVA test for Model 1

Since the application of the system contributes to the efficient allocation of resources, this variable is tested in the general hypothesis.

Meeting the consumer demands and the usage of DSS in the company as a dependent and independent

variable represent the second linear regression model in this study. The model evaluation is presented in Table 8. The correlation coefficient R is 0.793 and shows a high degree of correlation between the usage of DSS in the company and the fulfilment of the consumer requirements. The coefficient of determination (R²) shows how much of the dispersion of the dependent variable is explained by this model, and in this linear regression model, the coefficient of determination shows how much the fulfilment of consumer demands is explained by using DSS. According to the summary, the model explains 62.9% of the fulfilment of the consumer demands. The corrected coefficient of determination, according to Tabachnick and Fidell (2007), is considered to give a better estimation of the actual coefficient of determination, due to the overly optimistic estimation of the coefficient of determination. In this case, the value of the Adjusted R Square correction coefficient is 0.621, i.e. 62.1% of the fulfilment of the consumer demands is explained by the model.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,793 ^a	,629	,621	,310

Table 8. Summary for Model 2

In Table 9 is shown ANOVA Test for Model 2, which shows the coefficient values for the independent variable, it is necessary to look at the value in column Sig. The value of Sig for Model 2 is 0,000 or $p = 0,000$, and since $p < 0,05$ it can be concluded that the regression model statistically significantly predicts the DSS contribution in the company to meet consumer demands, i.e. the DSS in the company contributes to the fulfilment to the consumers demands.

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	8,123	1	8,123	84,615	,000 ^b
	Residual	4,800	50	,096		
	Total	12,923	51			

Table 9. ANOVA test for Model 2

Since the application of the system contributes to meeting consumer demands, this variable is tested in the general hypothesis.

Reducing the time for decision making and the usage of DSS in the company as a dependent and independent variable represent the third linear regression model in this study. The model evaluation is presented in Table 10. The correlation coefficient R is 0.890 and shows a high degree of correlation between the variables, while the coefficient of determination (R²) indicates how much of the dispersion of the dependent variable is explained by this model. In this linear model of linear regression, the coefficient of determination shows how the reduction of decision time is explained by the application of DSS. According to the summary, the model explains 79.2% of the reduction in

decision time. In this case, the value of the Adjusted R Square correction coefficient is 0.788, ie the model explains 78.8% of the reduction in decision time.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,890 ^a	,792	,788	,232

Table 10. Summary for Model 3

In Table 11 is shown ANOVA test for Model 3 which shows statistical significance of this data in Model 3, and according to the ANOVA test, the statistical significance is $p = 0.000$ or $p < 0.0005$, from which it can be concluded that the regression model predicts statistically significant dependence variable.

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	10,281	1	10,281	190,385	,000 ^b
1 Residual	2,700	50	,054		
Total	12,981	51			

Table 11. ANOVA test for Model 3

Since the application of the system contributes to the reduction of decision-making time in the managerial decision-making process, this variable is taken into account when the general hypothesis is tested.

Cost reduction and DSS usage in the company as a dependent and independent variable represent the fourth linear-regression model in this study. The model evaluation is presented in Table 12. The correlation coefficient R, which in this model is 0.793, shows the correlation between the variables and shows a high degree of correlation, while the coefficient of determination (R²) shows how much of the dispersion of the dependent variable is explained by this model. In this linear model of linear regression, the coefficient of determination shows how much the cost reduction is explained by applying DSS. According to the summary, the model explains 62.9% of the company's cost savings.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,793 ^a	,629	,621	,310

Table 12. Summary for Model 4

The ANOVA test, tests the statistical significance of this data in Model 4, and according to the ANOVA test shown in Table 13, the statistical significance is $p = 0.000$ or $p < 0.0005$, from which it can be concluded that the regression model predicts statistically significant dependence variable or DSS in the company contributes to reducing the costs in the company.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8,123	1	8,123	84,615	,000 ^b
	Residual	4,800	50	,096		
	Total	12,923	51			

Table 13 ANOVA test for Model 4

From the four linear regression models made for the factors that affecting company productivity and the usage of decision support systems, it can be concluded that decision support systems have impact on company productivity, so the second particularly hypothesis is accepted, that is, *the application of decision support systems has an impact on the productivity of the company.*

For testing the general hypothesis only the sample of companies that using DSS is tested, and the technique used is the nonparametric χ^2 test, in which the categorical variables are compared with hypothetical values. The hypothetical values for each variable are as follows: - 60% of the respondents in the sample are affected by the system application - 40% of the respondents in the sample have no influence on the system use, and the impact is considered for each variable separately depending on which variable the test is applied.

	Managers were involved in the development phase of the decision support system	The decision support system is adjusted to the needs of the company	The decision support system is easy to use	The decision support system contributes to the efficient allocation of resources	The decision support system contributes to meeting consumer demands	The decision support system provides security in the decision-making process	DSS reduces costs	The DSS reduces decision time
Chi-Square	6,806 ^a	16,806 ^a	11,250 ^a	13,889 ^a	5,000 ^a	,556 ^a	5,000 ^a	11,250 ^a
df	1	1	1	1	1	1	1	1
Asymp. Sig.	,009	,000	,001	,000	,025	,456	,025	,001

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 12,0.

Table 14. χ^2 test for testing the general hypothesis

The test results are presented in Table 14, which shows the statistical significance of the values compared with the expected ones. The statistical significance of the first variable, whether management was involved in the system development phase and refers to the increase in manager satisfaction is equal to 0.009 or $p = 0.009$, and for the result to be significant p must be equal to or less from 0.05. Therefore we can conclude that the test is significant, i.e. there is a difference between the managers who were involved in the system development phase and those who were not involved in the system development phase. The second variable test of whether the system is adopted to the needs of the company also shows statistical significance or $p = 0.000$ and according to the result the difference between the companies in which the system is adopted to their needs and those that are not adopted is statistically significant and quite significant differs from expected value. The test for the third variable which is related to the increase in managers' satisfaction regarding whether the system is easy to use shows a value equal to 0.001 and in this case $p < 0.05$ and shows a difference between the respondents who consider the system to be easy to use and those who find the system not easy to use and it is statistically significant. The test of company productivity represented by the variable of whether the system contributes to efficient resource allocation also shows statistical significance at $p = 0.000$ which is the difference between the respondents who believe that the system contributes to efficient allocation of resources in the company.

According to the results of the test, the general hypothesis in this study is accepted, given that the expectations for the number of respondents who believe that the decision support system has an impact on the factors contributing to the improvement of the decision making process, i.e. increase managers' satisfaction with the usage of the system, such as the involvement of the management in the system development phase, adjusting the system to the needs of the company and making the system easy to use, but is rejected variable that the system provides security in the decision making process, given that the test did not show statistical significance for this variable. Expectations are also met for the number of respondents who believe that the decision support system has an impact on factors affecting company productivity, including efficient allocation of company resources, meeting customer demands, reducing company costs and reducing the time it takes for managerial decisions to be made. According to these indicators, the general hypothesis is accepted, that is, the usage of decision support systems has a positive impact on the managerial decision making process and the productivity of the company.

Conclusion

From the five correlation analyzes of the factors that influence the degree of satisfaction of managers, it can be concluded that decision support systems influence the degree of satisfaction of the manager, and therefore, the first particular hypothesis is accepted, ie the usage of the decision support systems have an impact on the degree of managers satisfaction. From the four linear regression models made for the factors that affecting company productivity and the usage of decision support systems, it can be concluded that decision support systems have impact on company productivity, so the second particularly hypothesis is accepted, that is, the application of decision support systems has an impact on the productivity of the company. According to the results of this research, it can be concluded that decision support systems have a positive impact on the degree of satisfaction of the managers as well as on the productivity of the company.

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ADAPTIVE ORGANIZATIONS IN THE DIGITAL AGE: COMPLEXITY, CREATIVITY AND INNOVATION

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Abstract:

Adaptive organizations are the contemporary kind of socio-technical systems derived from the need to respond effectively to changes in the dynamic and unpredictable landscape of the digital economy. These organizations are both internetworked and knowledge-driven, and thus responsive to challenges and opportunities of the digital age. The networking capability (e.g. ICT-enabled virtuality, organizational teaming, and knowledge hyperlinking) provides for the adaptive organizations to cope with one of the biggest challenges they face today – complexity. For a small number of businesses, embracing complexity yields a competitive edge in terms of creativity, innovation, information management, and human resources. If we consider our countries, unions, departments, projects as complex adaptive systems, then we need to take into account their specificities to address and guide them properly. This paper looks through the lens of system design, complex adaptive systems, and the tactical management adaptability and effectiveness to provide an analysis of the European (1) strengths in strategy and operations (2) problems in ‘silos’, matrix-organizations, insufficient information and communication flows, current project management and slow risk management (3) example of the freedom of movement for workers (4) ‘business model’, and (5) growth paradigm that need to be fundamentally redefined through the value co-creation and co-evolution. The solutions we provide here are both conceptual (e.g. greater effectiveness delivered through the existing governance structures by drawing attention to the missing link between tactics and empowered project management), and tangible (e.g. methods providing adaptability in dynamic and unpredictable environment that is preserved by continuous Sense-Interpret-Decide-Act (SIDA) Loop and Role-and-Accountability system design, with proper information sensors, emitters and risk management for strategy and tactics).

Key words: adaptive organizations, digital age, complexity, Denica method, sense-and-respond framework

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1. Introduction

Planet, state, union, department – they all represent complex adaptive systems. The latter (planet excluded) stand for the lower level sub-systems which, as autonomous agents, are networked together and interact towards achieving their own and collective purposes (Gell-Mann, 1992; Garcia, 1999; Holland, 2010; Lichtenstein et al., 2006; Chan, 2001; Gintis, 2006; Eidelson, 1997; McGrath, Arrow and Berdahl, 2000; Higgs, 1999). By definition, a complex adaptive system (CAS) is a dynamic network of agents acting in parallel and always reacting to the actions of other agents, which in turn affects both the behavior and the network as a whole (Holland, 1975). Until we acknowledge that our societies, planet and many of its sub-systems are complex adaptive systems needed to be addressed properly, we will never punctuate the equilibrium (Gersick, 2009) that requires change to move to the next level. Complex adaptive systems are open, dynamic, self-organizing and non-deterministic systems having highly interactive elements and non-linear interactions, with small changes producing large effects. What's more, every single element of the system is affected by and also affects the other systems (Holland, 2010) which cause an emergent effect (Edson, 2010). The question that naturally arises is whether we take into account these scientific and practical findings when doing something that might affect them? How do we manage a particular complex adaptive system to accomplish a certain goal? What is clear is that we have to: 1) address it with both simple rules and human rules on how to detect and interpret information, as well as how to respond appropriately 2) create moderately dense connections (Waldrop, 2013).

It appears that we (as global citizens, as national governments, as Europe, as EU, and as a World) are rather good in making strategies and, to a certain extent, we are doing a good job in realizing those strategies. If they were all to be implemented in perfect conditions and non-dynamic, non-interrelated world, we would have been almost perfect. There are numerous examples of proper strategy setting, e.g. Millennium Development Goals (United Nations, 2000), post-2015 ambitious Sustainable Development Goals (United Nations, 2015a), Paris climate agreement (United Nations, 2015b), EU global strategy (European Union – Institute for Security Studies, 2015), Strategy for smart, sustainable and inclusive growth (European Commission, 2010), etc. Their strategic altitude (Strategy Management Group, 2016) follow-up occurs in the form of reports, findings or recommendations (United Nations, 2015c; European Commission, 2015a; European Commission, 2015b). There are also numerous EU institutions and bodies (European Commission, 2016a), as well as many acts, regulations, directives, and processes (European Commission, 2016b) in place. A number of guidelines and governing principles exist in the form of founding principles (European Union, 2019) or freedoms (European Policy Centre, 2019) prescribed in various strategic documents and actions. All of the above-mentioned entails the need to differentiate between strategy and operations. Adding onto the side of operations, there is extensive portion of accomplishments resulting in high quality and incredible intellectual real-life practical efforts and creations. However, these strategic guidelines, principles, goals and KPIs need to be implemented, monitored and sustained towards effectiveness, whilst at the same time the operations are doing their part of the work – quality and efficiency. The goal of this paper is actually to examine how we could steer a complex adaptive system towards a purpose, or a goal?! We will therefore throw light on tactical management (especially to adaptability, continuous context-scanning, responsiveness and dynamics) and, by looking at the freedom of movement for workers, provide a genuine, real-world example on the need for a system design, roles and accountabilities, 'silos' collaboration and process-flow design.

The rest of the paper is organized as follows. The second section refers to tactics and projects in terms of: helicopter authority and adaptability; information sensors; and risk management. The third section speaks of the system design and addressing. The fourth section provides an analysis of the freedom of movement for workers. The last section concludes and makes recommendations.

2. Tactics and Projects: helicopter authority, adaptability, information sensors and risk management

Tactical management (in the form of continuous institutional and organizational tactics) and the redefined project management (as one of tactic's most representative handlers) are of special importance. The tactical management we are referring to here is not what we call a 'mid-term planning' or regular follow-up that is exclusively too late for any corrective or timely action. On the contrary, the tactical management we are shedding light to refers to adaptability, continuous context-scanning, responsiveness and dynamics. Tactical management is a managerial function concerned with 'how to achieve what is expected by utilizing what is given and following certain governing principles in the current context of the organization and environment' (PetrevskaNechkoska, Poels and Manceski, 2015) (Petrevska Nechkoska, 2019). These are the residual choices open to a firm by virtue of the business model that it employs (Casadesus-Masanell and Ricart, 2010). Adaptability and context-capture are two essential components of this definition. Utilizing the givens and aiming for achieving expectations are another set. Employment of appropriate business model is an issue. And last but not least – 'how to achieve' the goals is the most important one. Regular planning and periodical evaluations are too late, simply concluding the discrepancies between planned (and actual) developments and KPIs. What every significant goal needs is a dynamic adaptability framework for a socio-technical system that is responsive to leader's guidance and actions. Tactics of this type introduces the concepts of customer-back system design, level of 'roles' and 'accountabilities', Sense-Interpret-Decide-Act (SIDA) Loop as adaptability engine connected with Plan-Do-Check-Act (PDCA) Loop as improvement engine (Haeckel, 1999; Crim, 2014; Nalchigar and Yu, 2013; Kapoor et al., 2005; Haeckel, 2004; Forno, 2012), each completed with information sensing, emitting and revisions, and continuous risk management (Petrevska Nechkoska, Poels, and Manceski, 2016). It's obvious that we need to change the paradigm of thinking and acting so we could solve the problems we've created with the same thinking. Moreover, we need to motivate ourselves to make sure that our efforts and deeds will not fail. Tactics 'are inexhaustible as Heaven and Earth, unending as the flow of rivers and streams; like the sun and the moon, they end but to begin a new; like the four seasons, they pass away to return once more' (Sun Tzu, Chinese philosopher, general and strategist). The intertwining of strategy, tactics, operations is still inseparable and necessary – yet, these 'islands' are drifting away from each other along with the expansion of universe. Project management (that steers while maneuvering these three managerial functions) is a managerial activity that should promise effectiveness. Instead, project management, especially in terms of non-purely business domains, where the profit is not the primary motivation, is 'stuck' in the matrix-organizational structures and silos, complex procedures, duplicated and redundant administrative steps, with both inappropriate authority level and information, as well as risk awareness and responsiveness. Likewise, even when chasing profits, most of the projects are over budget, over time, with compromised functionalities, over and over again (Flyvbjerg, 2011).

3. Systems Design and Addressing

After the important realms – complex adaptive systems, tactical and project management (reflected on strategy and operations) have been introduced, the next few paragraphs will provide a guideline on how we can assist and overcome them. It takes time to digest and reason, and then implement adaptable tactical management mindset from the highest level down and across. Primarily, we ought to address a CAS with simple rules. If a person makes just one step from the strategic guidelines, he/she will face mastered complicatedness and ambiguity of written recommendations, rules, guidelines, expectations, documentation, process flows and sequences. However, the things get even

worse if we try to address a complex adaptive system with complicated rules and unoptimised processes. In order to achieve big-picture overview and synergic effect, the governing bodies need to think in terms of system design, referring to socio-technical system that complies with the specificities of a complex adaptive system. A system is a collection of elements interacting to produce an effect that cannot be produced by any subset of those elements (Banathy, 1996, 2009). A properly designed system generates an effect, but also has a reason-for-being, no duplicated or redundant roles, sub-optimisation, and control mechanism. Most systems have waste management, information sensors, networks of channels, and elements for proper reactions. A car does not have ten engines; a body does not have two eyes for aesthetics, but to achieve three-dimensional vision; the planet does not have another planet to put the garbage on, but needs to establish/re-establish itself for properly containing it; an organism has immediate controls for temperature regulation, etc. We are spiralling into sub-optimisation and developing sub-systems looking from the middle-down or even lower level down. It is recommended that the tactical management systems should be designed from a higher level as possible. Indeed, our strategic thinkers provide appropriate guidelines, goals, recommendations, and follow-ups, but looking below the surface, we find that everything is blurry, segmented, duplicated, and ambiguous, with slow inter-communication and action channels in the network. Europe has the prevalence of ‘silos’ and matrix-organisational structures – the ‘nemesis’ of effectiveness, adaptability and empowered project management. However, for many situations, we have no proper controls in place. This goes along with the risk management that, in our opinion, should not be a separate function, but rather integrated in every single manager’s sense-making. It appears that governing bodies of developed countries are having the impression that any physical/legal person is decent and honest. Sometimes because of ignorance and un-familiarity, but many times as a result of ill-intentions, the world is populated with criminal entities and harmful actions, irrespective of whether the motivation is coming from the mind, body or soul. So, a good systems design has controls in place, and when it comes to socio-technical or natural systems, it also provides a ‘knows earlier’ (Haeckel, 2004) in order to take corrective or proactive action. Another important element to position the risk management reasoning from the very beginning is the necessity of continuous scanning throughout the lifecycle and beyond (Petrevska Nechkoska, Poels and Manceschi, 2016). Information sensors, emitters, risks, roles, and accountabilities do not represent components to set-and-forget. On the contrary, they are dynamic and alive. The findings of a tactical management adaptability and information systems research with managers have shown that 87% of all information sensors and emitters contain qualitative information; 61% of incoming information is on-demand unstructured information, and only 39% of the information is provided through event-driven reports and regular ‘too late’ follow-ups; 48% change the frequency, while 13% change the manner of obtaining (Petrevska Nechkoska, Poels and Manceschi, 2016). The important information is rather dynamic (not rigid and prescribed) and is coming in various forms, frequencies and modes of acquisition.

1. Freedom of movement for workers: a critical appraisal

If freedom of movement for workers is considered a developmental and altruistic principle that reflects to pro-growth immigration, labor-market flexibility, effective education, and that also contributes to innovation, competitiveness, digitalization and public sector productivity, the question that arises is what are the obstacles still in place preventing this principle from being alive to its full? An example using more extreme cases will be provided here to make a point of the necessity for a system design, roles and accountabilities, ‘silos’ collaboration and process-flow design, as well as (tactical) problems in its realization (even though well designed in strategy and nicely fulfilled

through operations). To find a job in Europe and increase chances of success, a person needs to register a profile in recruiting platforms, e.g. EURES, ESRA, CORDIS, EURAXESS, ORCID, LinkedIn, Research Gate (if in research), Xing, Google Scholar, Biblio, e-Prints of all kinds, Elsevier etc. Each of these platforms require manual one-by-one record input of each experience, language, profile, education, skill, motivation, publication and continuous update. EURES draws categories of skills, competences, qualifications and occupations from ESCO (European Commission, 2013) – excellent idea, especially for the focus on skills that are the future of HR management (Petrevska Nechkoska and Manceski, 2012). Overarching and encompassing, with remarkable thoughtfulness and directions – New Skills Agenda for Europe (European Commission, 2016d) is in place and action points are designated. And then it all goes into silos and matrix sub-optimisation, with almost no overlap and very little visible collaboration among the verticals – blurry and not very effective. The results are visible in projects and platforms with immense quality of realisation, reports, science, conclusions, significant intellectual input and output. The problem is that many of them have been doing things ‘in isolation’, as if everything/everyone else does not exist or is static. The collaboration and mutual awareness of synergy and problems appear to be missing. Top EU management should set up a tactical system of roles and accountabilities that will be populated by various resources (e.g. departments, bodies, experts, countries, etc.) and will incorporate collaboration; making a mandatory requirement for ‘silos’ to work together towards its purpose. That tactical system should be designed from a high level, not as it is now. The same goes through funding for academy-business projects, multi-disciplinary projects, or business-ecology projects. Let us get back to the workforce mobility recruitment stage. ESCO is a nicely designed platform, but its intuitive use and part of the database content and connections are discussable. The attempt to find relatively straightforward occupations (e.g. researcher, manager, lecturer, teaching assistant, or consultant) at first seems impossible. At second attempt, there are either huge details making a person not in a position to situate himself/herself, or a several-step quest for a strange category producing confusion to classify a person not to be mistaken for deception in his/her CV. The main purpose – the skills passport – to recognise skills – is not functional up to this moment. There should have been information sensors in place, to catch very early signal for such an important function. The existence of several others similar-but-slightly-different platforms confirm lack of system design and collaboration among members. This European Commission tactics seems like a model of disconnected and not-talking-to-each-other sub-systems aiming to their own goals.

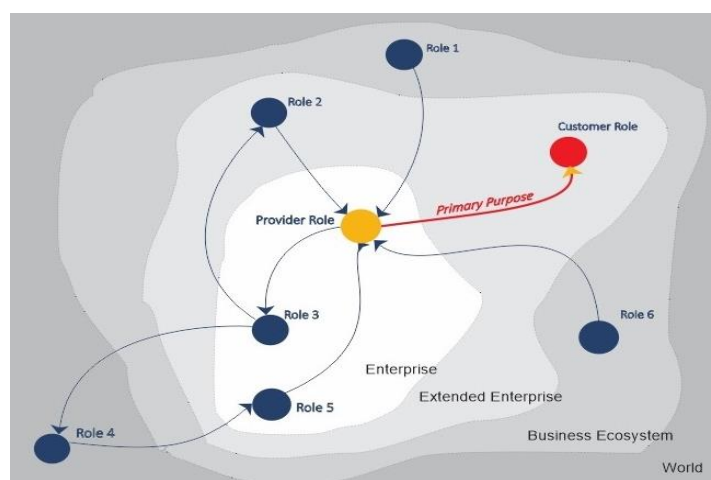


Figure 1. Role-and-Accountability system for tactical management achieving a purpose (strategic goal), with roles positioned throughout the widest business ecosystem (Petrevska Nechkoska, Poels and G. Manceski, 2016)

A person needs days to maintain his/her profiles in different platforms just to be visible on the job market. The discrepancies per countries' National Qualification Frameworks in the similarity of the European Qualifications Framework – EQF (European Commission, 2005, 2008) are still significant. Knowledge of local language, salary contributions recognition, local labor regulations and sometimes migration, housing or taxation rules and regulations are challenge on their own – and are mostly country-specific. The case of non-EU European countries is worth mentioning, with highly qualified workers moving to EU for positions of fast-food workers or drivers, up to level 4 in the EQF. In conclusion, the freedom of movement for workers is not facilitated yet. There are numerous efforts in this direction, e.g. EU Blue Card (European Commission, 2016c; 2016d); the aforementioned networks for connecting employers and job-seekers and other components. Some are duplicated and redundant, not designed from systems perspective, and thus not producing the expected effect. The knowledge triangle (European Institute of Innovation and Technology, 2012) should result into obligatory applicability of research and science in real-life (DG Education and Culture, 2010). If and when a job seeker finds a job, the family goes where? When? If not at home, everywhere else you are a stranger, it's a universe's spacetime fabric (Overduin, 2007) issue. The tenure jobs are rare as diamonds nowadays, increasing stress with 1+ year employment contracts migrating from one place to another living nomadic life with family in rented places and second-hand furniture. These proactive hardworking self-motivated workers are among the ones to engage and/or boost bolder action (Wessels, Maurer and Mittag, 1999) to the highly paid and more relaxed EU peers. The mobilization of the workforce is an underlying component for synergic effect. But it has to be directed from developed towards less developed European and EU countries for learning adaptability, challenges, real-life situations and boosting energy and competitiveness of the highly paid and highly skilled workers too (McKinsey Global Institute, 2015).

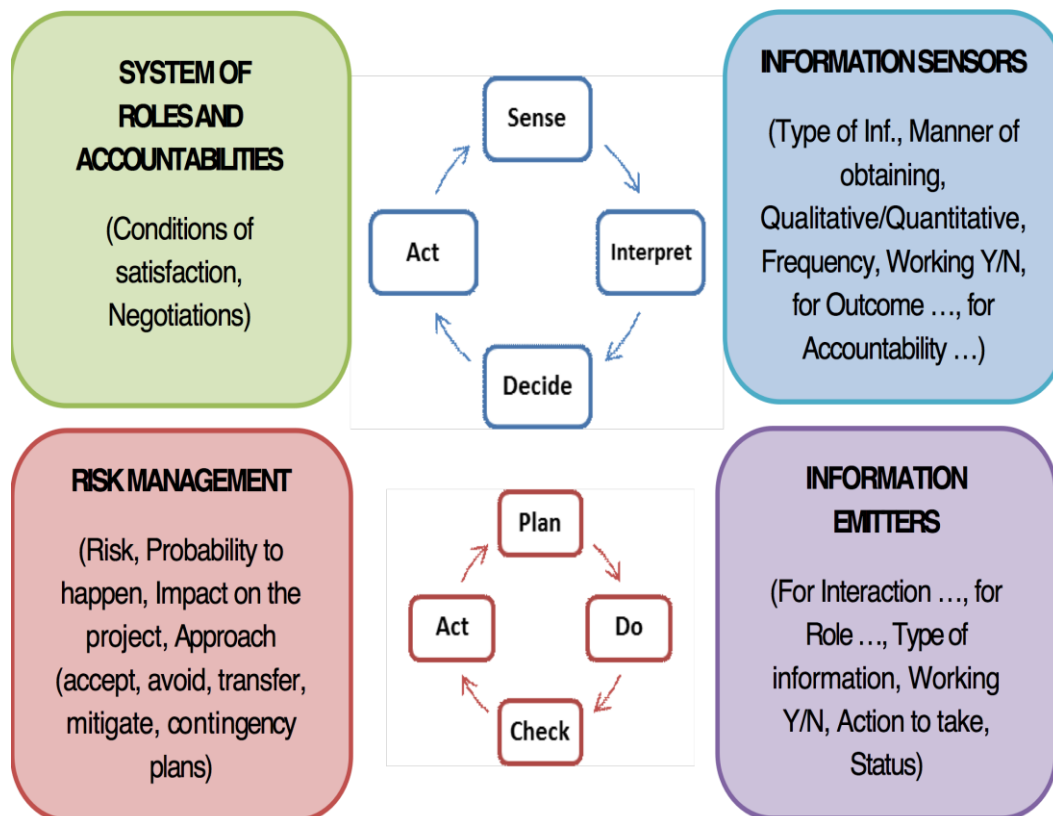


Figure 2. The main components of Tactical Management adaptability and information systems method for managers (Petrevska Nechkoska, 2019)

Co-evolving together for Europe means both the co-creating and growing together. We are far from European synergy and emergent effect. We have numerous valuable segments, departments, organs that have done decent job for their lower-level goals, but we are not facilitating a system of systems. We are designing projects and processes in silos, following job-descriptions (not skills or roles), rigid non-adaptive processes, following-up on plans too late, being very little aware of actual implementation contexts, run-time adjustments (Giannoulis, Petit and Zdravkovic, 2011; Bērziša et al., 2015; Zdravkovic et al., 2013) and risks (Baskerville, Pries-Heje and Venable, 2008; Miller et al., 2005). A project to accomplish the strategic goal of free movement for workers needs a tactical design, with: 1) facilitator (an empowered Project Manager) having proper authority level not just vertically, but also cross-sectoral and across-silos; 2) competent ‘team members’; 3) populating roles to achieve what they are accountable for, and 4) Sense-Interpret-Decide-Act (SIDA) Loop.

Figure 1 visualizes a generic Role-and-Accountability system diagram based on Sense-and-Respond framework for adaptability (Haeckel, 1999) for tactical management designed around a purpose (strategic goal), with roles positioned throughout the widest business ecosystem (Petrevska Nechkoska, Poels and G. Manceschi, 2016) and the use of Social Network Analysis directed graph.

Figure 2 presents the main components of a method for the tactical manager (the person) that provides adaptability in unpredictable environment. It is consisted of System of Roles-and-Accountabilities, Risk Management, Information Sensors and Information Emitters. The adaptability engine is the SIDA Loop and the improvement engine is PDCA Loop.

2. Conclusions

Europe has what it takes to move to the next level - and take everyone along. Co-evolution is the goal, diversity is one input. Leaders, strategy and high quality operations are already in place being amazing. Effective and adaptable tactics is missing but there are directions where to search, all along with empowered project management, system view, system design, proper information settings, open communication channels and incorporated risk management. And, above all, awareness of the complexity, interrelatedness and fragility of the adaptive systems we are all part of. The intertwining of strategy, tactics, operations is still inseparable and necessary – yet, these ‘islands’ are drifting away from each other along with the expansion of universe. Project management (that steers while maneuvering these three managerial functions) is a managerial activity meant to promise effectiveness. Nevertheless, it is ‘stuck’ in the matrix-organizational structures and silos, complex procedures, duplicated and redundant administrative steps, with both inappropriate authority level (to ‘cut’ across them) and unsuitable information (or risk awareness and responsiveness). We are spiraling into sub-optimization and developing sub-systems looking from the middle-down or even lower level down. It is therefore recommended that the tactical management systems to be designed from a higher level as possible. It is also noteworthy to mention that a good systems design has controls in place, and when it comes to socio-technical or natural systems, ‘knows earlier’ in order to take corrective or proactive action. This goes in line with risk management that should not be a separate function, but integrated in the sense-making of every single manager. Finally, information sensors, emitters, risks, roles, and accountabilities are not components to set-and-forget. The important information is not rigid and prescribed; it rather comes in different forms, frequencies, and modes of acquisition.

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THE USAGE OF DECISION SUPPORT SYSTEMS IN NORTH MACEDONIAN COMPANIES

Viktorija Stojkovski¹, Blagoj Nenovski²

Abstract:

The increased complexity as well as the fast pace changes and the escalation of risks that are faced by the companies and their managers imply the need of a computerized support in their decision making process. The increased need for information also imposes the need for these systems whose purpose is to create and make a better use of the information. Managers can better perform when they use the right information at the right time. In order to be competitive, North Macedonian companies need to accept and adapt to the new trends that include information systems and technologies in executing their business activities.

The use of this type of systems offers multiple opportunities for the companies and has certain influence in the workload of the companies. Integrating decision support systems (DSS) companies can make better management decisions by strengthening the decision maker in processing the knowledge, by stimulating the managers in new approaches when thinking about problems, by reducing the time and cost of decision making and by increasing the pleasure level in the process of decision making.

The aim of this research is to review the state of North Macedonian companies regarding the implementation of decision support systems, their usage, the different developed system types and the management level that they are used on.

Key words: decision support systems, management decisions, information systems, knowledge processing.

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Introduction

Decision support systems are interactive, computer based systems that help their users when choosing alternative solutions (Druzdzel, Flynn, 2002: 6). According to Turban, DSS represent interactive, flexible and adaptable computer based information systems, developed to enable decision support of unstructured managerial problems that make the decision making process better (Turban, 1995). These systems allow for data storage and locating and improve the traditional approach to information and their location by using developed models.

Decision support systems are usually implemented for strategic and tactical decisions on a higher management level, for low frequency decisions and high outcome potential, as well as decisions in where the time factor for thinking and modeling the problem is a key factor (Druzdzel, Flynn, 2002: 6).

The need for decision support systems in companies

According to the traditional approach to decision making process, the decision is correlated to making a choice in: choosing an action (Simon, 1960), choosing a strategy (Fishburn, 1964), choice that leads to the desired goal (Churchman, 1968). In the decision process, certain amount of alternatives are identified and one of them is chosen, but the number of identified alternatives to be considered can be very large and each alternative can be of a high complexity. When the decider is faced with this situation, couple of questions occur: Where are the alternatives coming from? How many alternatives are enough? How to manage the large amount of alternatives in a way that none of them is forgotten or mixed? In this case, computer based systems can be very useful when reviewing the alternatives as well as determining and following the alternatives implications' in a systematic way.

Here we have to note that understanding the alternatives implications does not help in choosing an alternative, but it does help in reviewing and comparing the alternatives in their implications'. According to Keen and Scott Morton (1978) decision support systems are of high importance when making half-structured and unstructured decisions. When making unstructured decisions, decision support systems can be designed to ease the knowledge inspection and synthesize the solution methods. They allow different perspectives to the problems stimulate creative abilities for the decider. Systems support of half-structured decisions have the same characteristics with the ability of additional pre-specified procedures that aid the decision making. With structured decisions, decision support systems can be used for automatic extraction of completely specified procedures. The main benefit of using these systems is the increased efficiency and the reduced probability of a human error in the decision process.

Decision support system types (DSS)

- Communication managed decision support system (DSS)

Communication managed DSS uses network and communication technologies to ease the decision making process via collaboration and communication. This type of DSS enables for more than one person to work on a shared task. The hybrid network and electronic communication technologies connect the deciders by creating a environment that provides resources and the ability to share information. The dominant component of these systems are the communication technologies and the

used software designed to help the groups work together and more efficient via video conferences and computer based boards (Power, 2008: 129).

- Data managed decision support systems

Data managed DSS enable access and manipulation of structured data and can display company data in real time or in time intervals (Power, 2001:431-436). Systems that include data storage allow data manipulation with computer tools developed for a specific task and enable increased functionality. Data managed DSS with online analytical processing allow for the greatest level of functionality. The decision support is connected with analysis of large databases of historical data. Executive information systems and intelligent business systems are examples for data managed DSS that enable the highest level of operation and decision support (Dhar, Stein, 1997).

- Document managed decision support systems

Document managed DSS is a relatively new field in decision support systems. Though the years, document management became more and more important to the companies and therefore the need for a system that would store and manage the multiple documents. Today the development of document managed DSS is enabled by large databases containing documents as well as web technologies. According to Holsapple and Whinston (1996) these systems are also called text oriented DSS. This type of DSS is oriented on searching and managing unstructured documents (Power, 2002). Document managed DSS is similar to the communication managed DSS but servers more as an infrastructure. Document managed DSS supports decision making by searching and collection the right documents, using computer data storage and processing technologies with the goal of collecting and analyzing the needed documents and therefore the primary tool that helps the decision making in this type of DSS is the searcher (Power, 2008: 130).

- Knowledge managed decision support systems

Knowledge managed DSS originate from intelligent decision support systems or in greater sense artificial intelligence (Negnevitsky, 2005). These are computer based systems where artificial intelligence, expert systems, data mining and communication mechanisms are integrated into one system. Knowledge managed DSS aim to identify the specific meaning by using multiple techniques and data mining tools. Companies are focused on automating as many of the processes so therefore managing the data is of a key importance for decision support.

- Model managed DSS

Model managed DSS are complex systems that help analyze the decisions and choose among the different alternatives (Ghaffarzadeh, 2015: 102). These systems emphasize the approach and manipulation of financial, optimization or simulation model. By definition, one or more quantitative models are the dominant components that enable the primary functionality of model managed DSS (Power, 2004). These systems offer the highest level of functionality by using simple quantitative models. Systems use limited data and parameters provided by the deciders, helping them analyze a certain situation and that is why these systems are not dependent on large data bases. Models that use algebra, especially the ones developed in electronic worksheets are the most used ones in model managed DSS.

Application of decision support systems

DSS focus on efficient decision making when the company is facing half structured or unstructured business problems. That is why DSS need to be designed and developed to help companies reach their goals. Multiple authors have researched the DSS application in various fields. According to Eom, Lee, Kim and Somarajan, DSS are most applicable in the following fields: production and operative management, marketing, finance, strategic management, human resources, accounting. DSS are least applicable in multinational business. Application of DSS in production and operation management is seen as an effective tool for factory automation and to simplify the technological process with using “just-in-time” production (Eom, Lee, Kim, Somorajan, 1998: 111). DSS in marketing can be used to measure the direct sales profitability, forming competitive prices, designing distribution systems, planning logistics and vehicle schedule and in advertising DSS is used for media planning and choosing the right medium and timeframe. Financial DSS are applied with corporative financing by managing assets and liabilities such as cash, capital budget, financial analysis and evaluation of financial risk. DSS in financial institutions is used for financing strategic product development, planning and connecting companies and acquisitions and the choice to inspect and develop project. In the field of strategic management DSS are applied to: analyze the outside surroundings and trends in the industry, placing specific product (on a specific market), managing company crises, as well as support in integrated processes for strategic planning. Regarding human resources DSS can help the user in planning the workforce but also settle complains in managing the workforce. In multinational business DSS are used to allocate investment funds in multinational corporations, to analyze the opportunities in international investment, to help plan the global logistics and also plan the global marketing, production and distribution. Lee-Post and Chung in their research show the application of DSS in operative management regarding the time dimension, including the long term decisions including: operative strategy, capacity planning, location planning, product design or the process and integration of the design in production; then mid term and short term decisions that affect the planning and production control, material planning, resource and production planning, distribution planning, company resource planning and the operation schedule. According to their research, many different DSS are developed and used to ease the decision process in operative management for decisions related to structural planning of production and control activities as well as unstructured strategic decisions in operative management. Lee-Post and Chung emphasize the need for DSS in operative management as a result of the rapid growth of information and communication technologies that change the way operations are managed and supported. Research is done to determine the managerial level on which DSS are most used on. The results show that as time goes the use in decision support on strategic level is increasing and the use on operative level is decreasing but still most of the DSS are developed for operation and tactical management level (Eom, Kim, 2005: 8). Here we have to note that the nature of strategic decisions is widely different, starting with the primary company strategies and all of the decisions in extended and virtual companies.

Usage in Republic of North Macedonia, analysis and results interpretation

To measure the DSS usage in Republic of North Macedonia we created a survey that included 52 companies. From the gathered results in Table 1 we can see that 57,7% or 30 managers use DSS and 42,3% or 22 managers don't use DSS.

Table 1. DSS company usage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	22	42,3	42,3	42,3
	YES	30	57,7	57,7	100,0
Total		52	100,0	100,0	

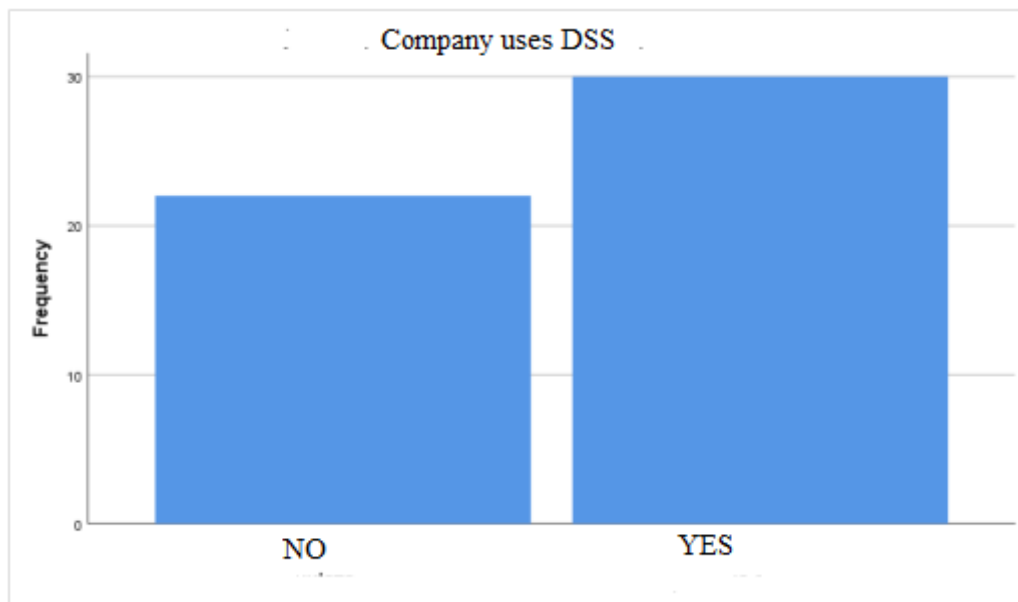


Image 1. DSS company usage

Regarding the types of DSS used in the process of managerial decision making, 51,1% use managerial information systems, 26,7% use decision support systems and 22,2% use executive information systems. The answers from this question are displayed in Table 2. Having offered multiple answers on this question we noted that some managers use a combination of DSS systems. Having 51,1% using managerial information systems we can conclude that managers in Republic of North Macedonia use these systems to help them control, organize and plan everyday operations in the company. Managers with these type of systems gather information, mostly in reports that support the effective decision making and allow for return feedback on daily operations.

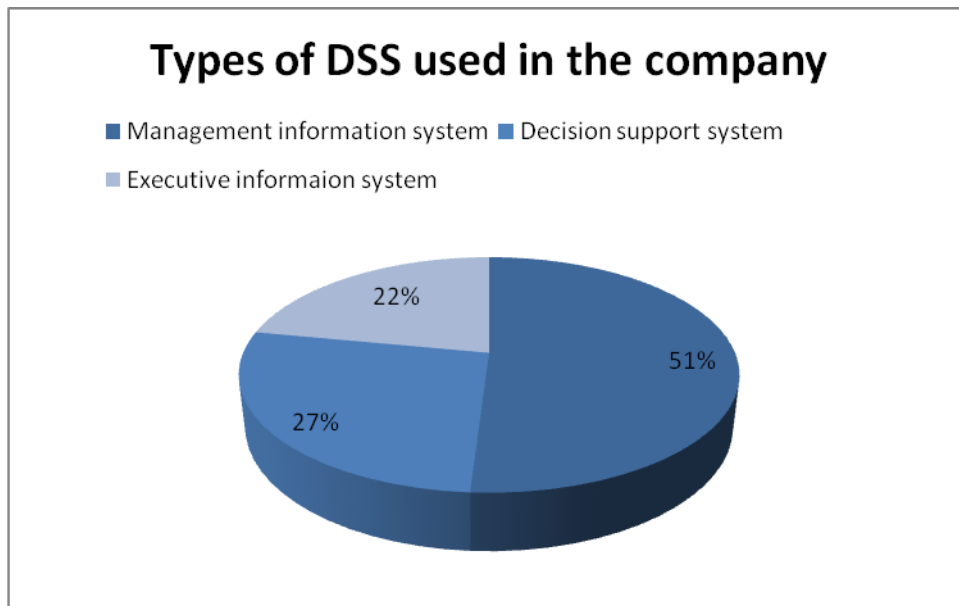


Image 2. Types of DSS used in the company

We also asked on which managerial level are the systems used. From this question we can see that at 50% most of the DSS are used on operational level, 24,4% are used on tactical level and 28,6% are used to make strategic decision. From these results, displayed in Table 3, we can confirm that company managers in Republic of North Macedonia mostly focus on operational level and developed systems are used on this level. We can also confirm the fact that the systems are more used on strategic level compared to tactical level.

Table 2. Types of DSS used in the company

Types of DSS used in the company

DSS use ^a	Managerial information systems Decision support systems Executive information systems	Responses		Percent of Cases
		N	Percent	
	Managerial information systems	23	51,1%	76,7%
	Decision support systems	12	26,7%	40,0%
	Executive information systems	10	22,2%	33,3%
Total		45	100,0%	150,0%

Table 3. DSS usage on managerial level

		Responses		Percent of Cases
		N	Percent	
DSS usage on managerial level ^a	DSS used on operational level	28	50,0%	93,3%
	DSS used on tactical level	12	21,4%	40,0%
	DSS used on strategic level	16	28,6%	53,3%
Total		56	100,0%	186,7%

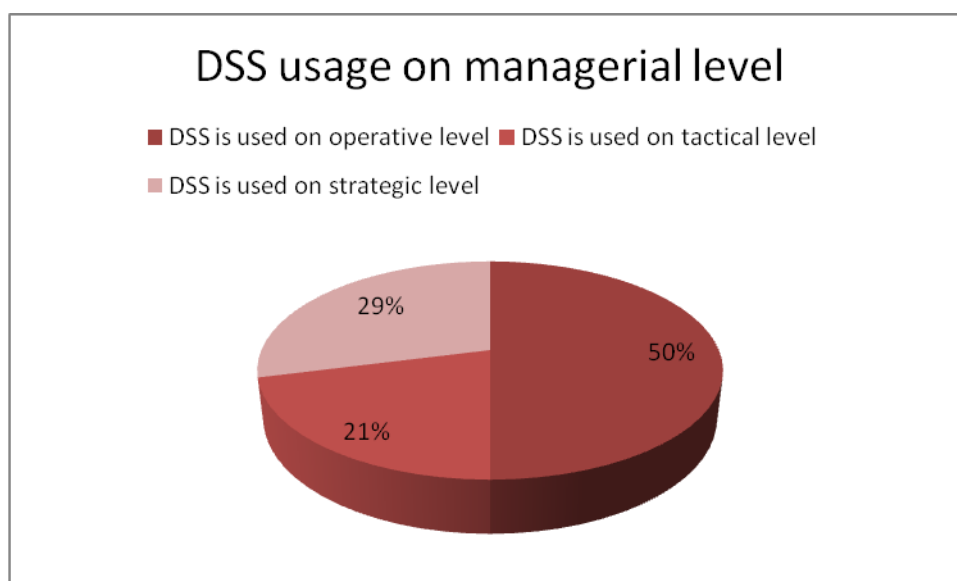


Image 3. DSS usage on managerial level

We also asked about the purpose usage of DSS in companies. From the responses showed in Table 4 we can see that document searching from data bases is the most used scenario (23) with 29,5%, then we have 19 respondents or 24,4% that use DSS to simulate, optimize and analyze data and 11 managers or 14,1% use it for knowledge discovery. Only 8 managers or 10,3% use DSS for online analytical processing. From these results we can conclude that managers in North Macedonian companies mostly use document managed DSS that functions on methods and technologies for storage and processing. Then we have model managed DSS that uses optimization and analytic methods and is used for multiple choice decisions. Managers that use DSS for document online sharing actually use the communication managed DSS based on network technologies that have the widest usage when deciding in groups. We noted that 14,1% use knowledge managed DSS that includes intelligent support and data mining methods with combination of artificial intelligence. Small number of managers use data managed DSS based on data storage with online analytical processing as a method such as the executive information system.

Table 4. DSS purpose usage

Purpose usage of DSS ^a		Responses		Percent of Cases
		N	Percent	
document searching in data bases	23	29,5%	76,7%	
document online sharing	17	21,8%	56,7%	
процесирање online analytic processing	8	10,3%	26,7%	
simulation, optimization and data analysis	19	24,4%	63,3%	
knowledge discovery	11	14,1%	36,7%	
Total	78	100,0%	260,0%	

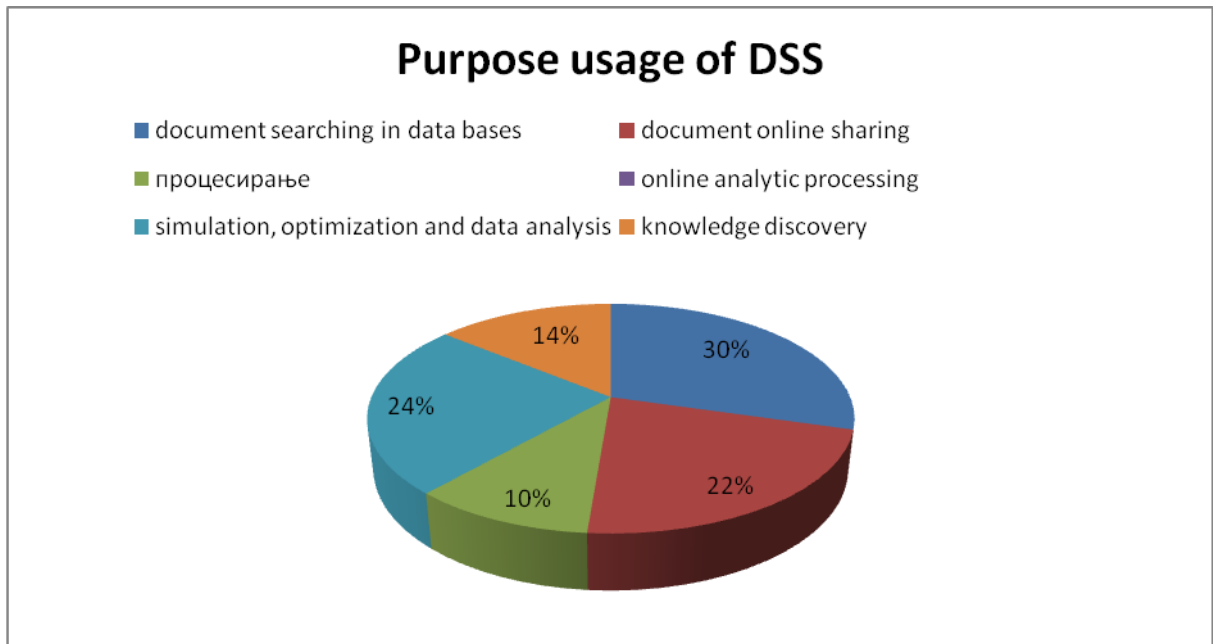


Image 4. Purpose usage of DSS

With this research we concluded that companies in Republic of North Macedonia use DSS in the process of managerial decision making.

To test out hypothesis we applied the non parameter X^2 technique. Our assumptions based on non parameter techniques are that the samples need to be random and the observations independent in a sense that each observation can be counted once and that the data of one subject can not affect the data of other subjects. The executable assumptions in the non parameter test in this research are completed with the sample being randomly chosen and that the data from one subject do not affect the data from other subjects. To test the hypothesis we applied the X^2 method to test the fitting quality and examine the cases in a category of one variable and matching them with hypothetical values. For this test we needed a database that included only one category variable. On Image 5 we can see a graphical representation of the companies in Republic of North Macedonia that use DSS where 57,7% use DSS in their managerial decision making and 42,2% don't use DSS.

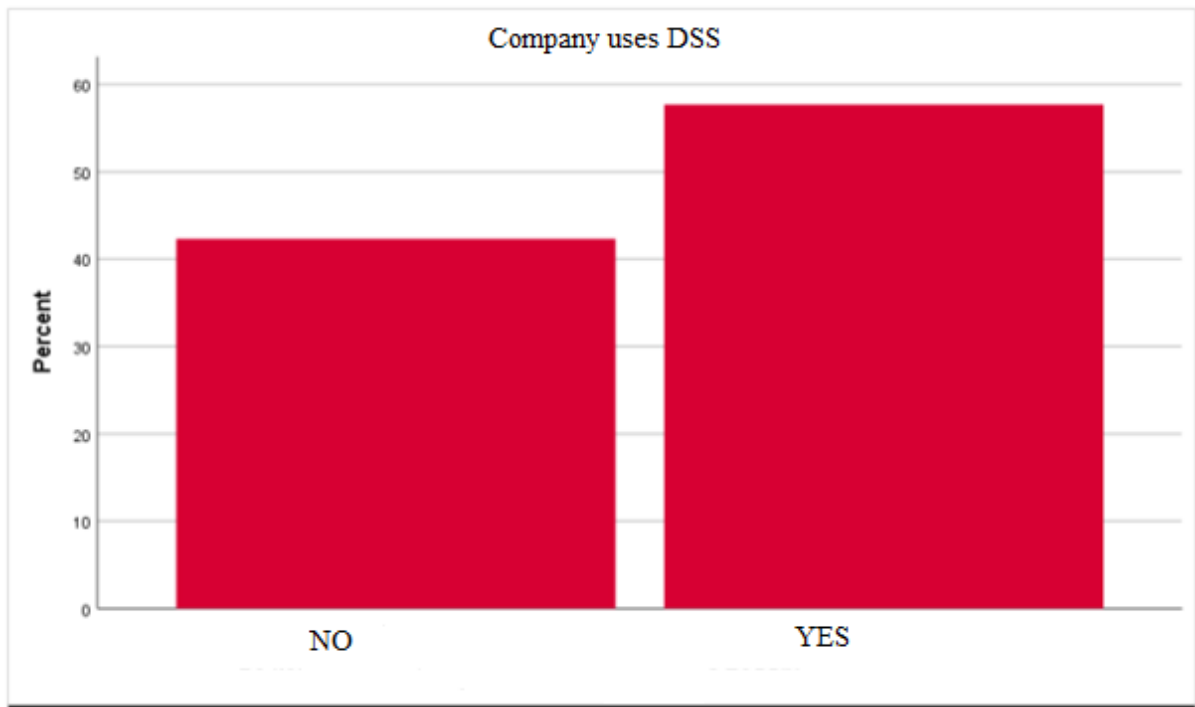


Image 5. Company uses DSS

In Table 5 we can see the classification of companies that use DSS in a column of observed subjects compared to a column of expected DSS usage. We set the expected values at 50% each or 26 companies that will confirm and 26 companies that will decline the use of DSS. In Table 6 we can see the test statistics needed to provide us with the information of the statistical relevance of the data.

Table 5. Classification of companies that use DSS

The company uses DSS			
	Observed N	Expected N	Residual
NO	22	26,0	-4,0)
YES	30	26,0	4,0
Total	52		

The results from the χ^2 test in Table 6 show us the statistical relevance of the observed data compared to the expected values. Statistical relevance or $p= 0,267$ not being lower than 0,05 does not provide statistical relevance and therefore the test is rejected. This means there is not enough difference between the companies that use and the companies that don't use DSS in the decision making process.

Table 6. χ^2 for the usage of DSS in North Macedonian companies

Test Statistics

The company uses DSS	
Chi-Square	1,231 ^a
df	1
Asymp. Sig.	,267

- a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 26,0.

With the X^2 test results with 26 (50%) expected and 30 (57,7%) companies using DSS and the low gap of expected and observed companies we can confirm that the hypothesis is accepted

Conclusion

We made a research that included managerial decision making in companies in Republic of North Macedonia to determine the usage of DSS. Most of the used DSS are based on managing information and on operational managerial level. DSS are mostly used to search documents in databases.

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THE INFLUENCE OF MARKETING STRATEGY AND MARKETING CAPABILITIES ON ORGANIZATIONAL PERFORMANCE OF COMPANIES – THE CASE OF MACEDONIA

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Abstract:

Marketing has a significant role in determining the strategic orientation and performance outcomes of companies especially in today's modern world based on digital technologies and platforms in which information and messages are distributed in the speed of a second. Marketing strategy, understood as a continuous process, is a process that guides the organization towards the long-term goals and marketing capabilities defined as an integrated process designed to make use of corporate knowledge, skills and resources enable the businesses to satisfy the customer needs through services that add value to their products.

This paper aims to explore the relationship between marketing strategy, marketing capabilities and overall organizational performance of companies with special focus of the case of Macedonian companies. The initial hypothesis is that there is a positive relationship between marketing strategy, marketing capabilities and overall firm performance. An applicative research with a survey questionnaire was conducted on a sample of companies to test this relationship and the obtained results will bring an insight of how marketing strategy and marketing capabilities influence organizational performance.

Additionally this paper will give an overview of the current marketing strategies applied in Macedonian companies, their current set of marketing capabilities and the use of technologically based marketing capabilities and the perceived level of organizational performance achieved as a result of the applied combination.

Key words: *marketing strategy, marketing capabilities, organizational performance*

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Introduction

In today's modern economy, marketing plays a significant role in determining the strategic orientation of the firm and the level of achieved performance. The role of the marketing function for market orientation and firm performance is to facilitate the link between the customer and several key firm processes, such as financial performance and customer relationship performance and to gain competitive advantage through the interrelation of various firm-level resources and marketing-specific actions in complex ways.

The role of marketing in the firm depends on the applied marketing strategy and the marketing capabilities which are in possession of the firm. Marketing capability can be defined as the integrative process in which the firm uses the tangible and intangible resources to understand the customer needs, to achieve differentiation relative to the competition and achieve superior brand equity. (Nath, Nachiappan, Ramanathan, 2010, pp. 317-329) The concept of developing capability and its impact on performance has been an essential centre of attention within the marketing field in recent years. Marketing resources and capabilities, exercised through marketing processes, can have important influence on achieving competitive advantage. (G. J. Hooley, G. E. Greenley, J. W. Cadogan, J. Fahy, 2005, pp. 18-27)

According to the RBV- resource based view of the firm, which was developed by Wernerfelt in the early 1980's (Wernerfelt, 1984, pp. 171-180), the desired outcome of the managerial effort within the firm is the creation and the development of sustainable competitive advantage which will result in achievement of superior performance. This competitive advantage can be achieved through possession of certain key resources which could be assets: tangible such as plant and machinery, or intangible such as brand name and reputation (Aaker, 1989, pp. 91-106) or capabilities which include the skills to create, develop and deploy assets (Mahoney, 1995, pp. 91-101).

The interest of differentiating the marketing resources can be traced back to King, but the concept of marketing capabilities can be explored through the work of Hooley, Moller and Broderick (Hooley, Moller and Broderick, 1998, pp. 97-115) and Hooley, Saunders and Piercy (1998).

In addition, big contribution to the research of marketing capabilities was given from Day (Day, 1994, pp. 37-52) who worked on the development of a framework for categorizing capabilities, based on their focus within the firm or outside of the firm and he divided them into: outside-in and inside-out processes. The first group is comprised of capabilities such as market sensing, customer linking, channel bonding and technology monitoring, whereas the second group of outside-out processes focuses on the internal resources and capabilities of the firm such as financial management, cost control, technology development and integrated logistics.

Theoretical and research background on the relationship between marketing capabilities and firm performance

The marketing capabilities effect on firm performance has been pointed out by many scholars (D. W. Vorhies, N. A. Morgan, 2005, pp. 80-94; R. J. Slotegraaf, C. Moorman, J. J. Inman, 2003, pp. 295-309; C. Moorman, pp. 180-197). Morgan's study (Morgan, 2009, pp. 909-920) examined how market sensing, brand management, and customer relationship management (CRM) capabilities define firms' revenue growth and margin growth - the two components of profit growth. The obtained results indicated that marketing capabilities have a direct and complementary effect on revenue and margin growth rates.

Marketing capabilities such as market sensing, partner linking, customer capabilities, functional capabilities, networking capabilities have proven to have a positive impact on organizational outcomes. (M. Mitrega, C. Ramos, S. Forkmann, S. C. Henneberg, 2011). They can be used as a base

for a marketing strategy that would lead to superior performance or may be of tactical or operational use, thus contributing to the value chain.

A study conducted by Finkelstein, Mitchell, Peteraf, Singh, Teece (2009) proved that marketing capability can drive business performance. Superior marketing capabilities is one of the strong attributes for those organizations that outperform their competitors. As a result, most organizations invest huge amounts in the development of the marketing capabilities, which benefits the organization with both business growth and sustainable competitive advantage. In this area the development of a holistic capability has bigger value to the firm than the individual marketing capability, but both initiatives have their own advantages and disadvantages. This is because those capabilities have the goal to improve customer satisfaction, profitability, market effectiveness and return on assets.

The findings by Danneels (E. Danneels, 2011, pp. 1-31) confirm that marketing capability is proven to drive business performance, not just to be associated with it but most importantly, marketing capability drives both top and bottom line growth.

In a study conducted by Nath, Nachiappan, Ramanathan (P. Nath, S. Nachiappan, and R. Ramanathan, 2010, pp.317-329) the ultimate focus was to find out the influence of a firm's functional capabilities (marketing and operations) and diversification approaches (product/ service and international diversification) on overall financial performance. According that study the fundamental determinant for superior financial performance is marketing capability and market-driven firms are likely to have much better business performance than a firm focusing entirely on operational capabilities.

Marketing capability can assist firm's sense and react to market changes such as competitors' moves, technological evolution and revolution. They can help the firm to develop both radical new products or employ existing products with new features and attributes to satisfy both the needs of current customers and new customers to guarantee the stability, survivability, and avoidance of shocks from new waves of competition based on new technologies and new value propositions.

Yu (Yu, 2015, pp. 943-988) studied marketing capability from a resource-based perspective and showed that it has an important impact on operations capability, and that operations capability is positively linked to firm's efficiency. According him operations capability fully mediates the connection between marketing capability and financial performance.

Marketing capabilities can also affect the international expansion by impacting firm's decision to choose entry modes including higher resource engagement in foreign markets. Past research studies in international marketing identified that there is a relationship between marketing capabilities and export performance. Marketing capabilities additionally enable exporting firms to implement new export marketing strategies to reflect changing global market conditions through transforming and combining available resources in new and different ways. (Tooksoon, Mohamad, 2010, p.39).

Marketing capabilities have a key role in an efficient marketing strategy. Like it was stated in the research studies mentioned above, there is a positive relationship between marketing capabilities and organizational performance. Marketing capabilities are essential for businesses operating on international and domestic markets, in which deeper understanding of markets and its marketing capabilities allows them to prioritize and maximize efforts and budgets effectively.

Methodology and hypothesis

As it was stated in the abstract this paper will give an overview of the current marketing strategies applied in Macedonian companies, their current set of marketing capabilities and the use of technologically based marketing capabilities and the perceived level of organizational performance achieved as a result of the applied combination.

In order to achieve this goal, appropriate methodology was used that consists of analysis and synthesis of the current available research efforts in the area of interest and also an exploratory and descriptive research on a sample of companies working in North Macedonia was conducted. The applicative research was a combination of qualitative and quantitative research and the sample was comprised of 170 companies from different sectors, size, and geographic location in the country. One part of that research was dedicated to the position of marketing in the company, the application of marketing strategies, marketing capabilities and the level of obtained performance.

The **main hypothesis** defined in this paper was:

H1: There is a positive relationship between marketing strategy, marketing capabilities and overall firm performance.

Also starting from the goals of the paper defined in the abstract additional hypothesis were defined:

H2: Companies in North Macedonia focus on keeping the current market share and not on expansion

H3: The main marketing capability of companies in North Macedonia is the offer of goods and services with good quality

H4: Companies in North Macedonia use technologically based marketing capabilities

H5: Companies in North Macedonia have medium level of organizational performance

They were tested and the received results are summarized in the following segment.

Research findings, hypothesis testing and discussion

In the previous segment the corresponding hypothesis were defined and here they are tested and either accepted or rejected.

H1: There is a positive relationship between marketing strategy, marketing capabilities and overall firm performance.

The relationship was tested with the use of the correlation method that shows the strength and the direction of the relationship between the tested variables. The correlation between the marketing strategy and the level of organizational performance is a positive one of 0.304, which shows weak positive relationship between the mentioned variables.

Table 1: Correlation between marketing strategy and organizational performance

Correlations		
	Level of organizational performance	Marketing strategy
Pearson Correlation	1	,304)* *
Sig. (2-tailed)		,000
N	170	170
**. Correlation is significant at the 0.01 level (2-tailed).		

Also the relationship between the level of organizational performance and marketing capabilities is positive of 0.220 which means weak positive relationship.

Table 2: Correlation between marketing capabilities and organizational performance

Correlations			
		Level of organizational performance	Marketing capabilities
	Pearson Correlation	1	,220)**
	Sig. (2-tailed)		,004
	N	170	170
**. Correlation is significant at the 0.01 level (2-tailed).			

Although weak the relationship between the variables is positive and shows that marketing strategy and marketing capabilities have positive effect on organizational performance in companies in North Macedonia. Due to this, this hypothesis can be accepted.

H2: Companies in North Macedonia focus on keeping the current market share and not on expansion

Starting from the descriptive definition of this hypothesis that the companies in North Macedonia focus on keeping the current market share and not on expansion, the testing process based on which this hypothesis will be accepted or rejected is based on the frequency of application of the appropriate marketing strategy in the responses of the companies that comprise the sample.

The results are as follows: 25 companies or 14.7% strive to maintain current market share, 31 companies or 18.2% strive to increase sales volume through higher sales to existing customers, 28 companies or 16.5 % try to increase sales volume by selling new products to existing customers, 49 companies or 28.8% try to increase sales volume by selling to new customers, 32 companies or 18.8% try to increase the sales volume by selling new products and brands to new customers and 5 companies or 2.9% tend to focus only on profitable customers.

From these answers it can be seen that most of the surveyed companies apply strategies that should help them increase sales volume and thus market performance, and some of the companies that are successful and take leadership positions try to maintain market share or focus on those consumers that are most profitable to them.

Based on this it can be concluded that this hypothesis should be rejected.

Table 3: Marketing strategy applied in companies in North Macedonia

Marketing strategy	Frequency	Percent
The company is trying to maintain the current market share	25	14,7
The company is trying to increase sales volume through higher sales to existing customers	31	18,2
The company is trying to increase sales volume by selling new products to existing customers	28	16,5
The company is trying to increase sales volume by selling to new customers	49	28,8
The company is trying to increase sales volume by selling new products and brands to new customers	32	18,8
The company is trying to focus on profitable customers	5	2,9
Total	170	100,0

H3: The main marketing capability of companies in North Macedonia is the offer of goods and services with good quality

In addition to the applied marketing strategy the goal of this paper was to identify the core marketing capabilities in the surveyed companies and based on the received data to develop a set of core marketing capabilities of the companies in North Macedonia which are used in their competitive battle on the local, regional and global market. The obtained results are summarized in the table below:

Table 4: Marketing capabilities of companies in North Macedonia

Marketing capabilities	Frequenc y	Percen t
Well-known brand	57	33,5
Credibility with consumers	81	47,6
High levels of customer service and support	104	61,2
Relationships with key customers	52	30,6
Superior marketing information system	9	5,3
Superior system for cost control	17	10,0
Ability to develop new products and services	39	22,9
Good price strategy	87	51,2
Good relationships with the suppliers	78	45,9
Good quality products and services	119	70,0
Developed distribution channels	37	21,8
Copyrights and patents	12	7,1
Access to other markets, technologies and knowledge through alliances and partnerships	13	7,6
Strong financial, human resource management and operational management	23	13,5

The results show that: 119 companies or 70% cited quality products and services as their key marketing capability, 104 companies or 61.2% point out high levels of customer service and support as key marketing capability, for 87 companies or 51.2% crucial is the good pricing strategy, for 81 companies or 47.6% key is consumer credibility, for 78 companies or 45.9% it's the good relationship with suppliers, for 57 companies or 33.5% it's the well-known brand, for 52 companies or 30.6% significant is the relationship with the key customers, to 39 companies or 22.9% significant is the capability to develop new products and services to 37 companies or 21.8% crucial are the developed distribution channels.

On the basis of the above, if the key marketing capabilities of the surveyed business entities are combined, our companies offer quality products and services with high levels of service and customer support at good prices and on the basis of good credibility of the company itself in the eyes of consumers and own well-known brands that are built through good relationships with suppliers and key consumers.

This is an important finding and this can be used as a basis for developing an effective marketing strategy that should bring the business to a higher level of performance.

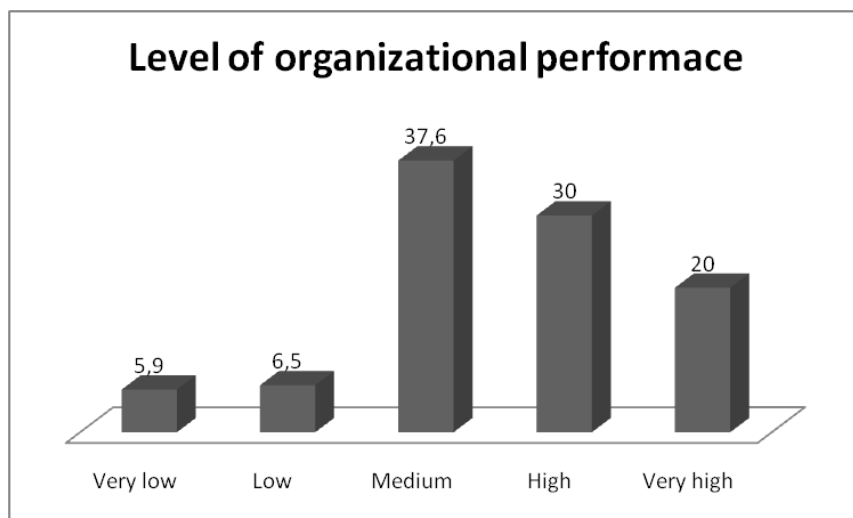
Based on this, this hypothesis can be accepted.

H4: Companies in North Macedonia use technologically based marketing capabilities

Technology is an essential part of today's modern society and most of the above mentioned marketing capabilities that were identified by the companies rely on application of modern systems for keeping and managing with marketing information, cost control, customer service and support, delivery of products and services, basically all the marketing capabilities have the technological part and since they are used in the work of companies in North Macedonia, this hypothesis can be accepted

H5: Companies in North Macedonia have medium level of organizational performance

The companies that comprise the sample also gave an insight on the current levels of organizational performance and their summarized responses are presented in the graph below and this data is used in the testing of the above mentioned hypothesis:



Graph 1: Level of organizational performance

The graphic shows that most of the companies grade their organizational performance on medium level or as high and some of them view it as a very high level of achieved performance. Only a tiny fraction of the surveyed companies think that their organizational performance is very low or low and this is a positive finding since most of the companies in the sample, whose findings based on its representation ability can be generalized on the level of the economy in North Macedonia, think that they are in the upper scales of the performance ladder and they are working on improving their overall achievement on the market.

The knowledge gained from this research is very important and it shows that most of the companies in our country have a medium level of performance and there is a lot of room for improvement towards higher level of performance. The achievement of those levels of performance requires knowledge, investments and strategies applied in the appropriate time and market place. Based on this, H5 can be accepted.

Conclusion

The main contribution of this paper is that it confirms the findings of many authors that have studied the influence of marketing strategy and marketing capabilities on organizational performance viewed as the performance achieved by companies. All of them pointed out that marketing strategy and marketing capabilities have positive effect on organizational performance and this was also confirmed with the findings of the research conducted on a sample of companies in North Macedonia.

Until this moment this kind of research for this region was not conducted, but the results confirm the results from the worldwide studies of the effect of marketing on performance. These findings and research can be useful as a basis for future research and even for model development in which the obtained data can be used for modeling and predicting the levels of organizational performance through the marketing perspective.

Additionally this research identifies the main marketing capabilities and types of marketing strategies applied, data that has not been available so far and can be used for future marketing strategy and capabilities development either inside the companies or with the help of the academic community which has a starting point of the current position of marketing in the companies in the economy in North Macedonia.

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MODEL OF SOFTWARE SYSTEM FOR BUSINESS WORKFLOW MANAGEMENT, BASED ON PETRI NET

S. Cheresharov¹ and K. Stefanova²

Abstract:

This paper describes a model of a software system that helps the digital transformation of business models. It can be used as a module in a modular system for rapid application development. It offers consistency, simplicity, functionality reuse, high quality, balance and stability in the architecture and approach for building enterprise applications. The existing business systems don't always offer models based on strong mathematical theory. The proposed model addresses this problem in a new consistent way. The model uses flexible, reusable workflow engine module, based on the Petri Nets theory. It can be built with different technologies, and can use standard dependency managers. The communication can be done using web services. The model is not restricted to use a single SQL or NoSQL database. The problem we tackle is offering a model for building wide variety of information systems as possible in a standard way, by using interchangeable module. It allows a graphical and formal mathematical solution for a wide variety of business problems.

Key words: *Business Models, Information Systems, Workflow Management, Petri Nets*

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1. Introduction

The problem we try to solve is how to create digital models of the existing business processes on the most efficient way. Very often we create software in attempt to simplify and manage business processes. Each time we have to write a different software since the business processes differ from one another. For each different workflow we have to write a different software. The elements of the software are similar, but not exactly the same and we end up rewriting and reinventing the same principles over and over again. With our model of a software modular system we try to solve this issue, by creating a reusable module which can model and manage different business processes, models and workflows. The model of the module is using the Petri Nets theory. Since this theory can be used to create models and manage many processes the module will be able to do the same. This way we will write the code once and reuse the module in different software systems for managing business processes. In fact, the module can be used for managing any kind of process. Such approach perfectly fits the new trends in software development like server-less service oriented architecture. Sometimes the existing solutions are too complex and overkill for the small tasks we try to solve. Our goal is to create relatively simple to implement module which solves as many problems as possible as simple as possible. The complexity stays in balance with simplicity. The model should be easy to implement and use. Our contribution is a simple implementation of Petri Net theory build as an exchangeable module for modeling and managing business processes (workflow engine). The business process can be represented (modelled) with a clear and simple set of objects and rules. The model of the business process can be created and tested with a lot of available tools for creating Petri Nets. After that it can be exported as XML file or another format and used by the module to orchestrate the business process. The proposed model is for building workflow modules for managing business processes which can be stand alone as a microservice and follow the modern tendencies of server-less, service oriented distributed architecture base in the cloud. The module can exist in the cloud and offer its functionality through Remote Procedure Call (RPC), RESTful or GraphQL Application Programming Interfaces (API). With such module is possible to manage business processes which can be used as a cloud service. We can introduce a new term Workflow as a Service (WaaS). The mathematical model can be created with a third party tool and deployed to the module to be used. It can be used as a stand-alone service or as a part of a bigger system which has authorization, authentication systems etc. The proposed model is only for activity base business processes, answering the question “Who does what, when and how?”. Since there is no standard model for Petri Net implementation we propose a simplified model.

1.1. Related work

Related work has been done with the use of Petri Nets in different domains for managing and creating business processes and models.

Yu in (Yu et al. 2018) is describing methods which can help the designers of software systems to analyze structural security issues of an e-commerce business process. The Petri Nets theory in this case is used to help analyze distributed and complex system, using Application Programming Interfaces (APIs) such as Cashier-as-a-Service or CaaS.

An investigation of consistency feature in resource perspective by using a Petri Nets has been done (Lacheheb, Hameurlain, and Maamri 2019). The authors apply Petri Nets theory for optimizing business process construction.

Another effort for creating a formal model that supports the specification and analysis of company requirements has been made (Lacheheb and Maamri 2016). The authors reveal the fact that

deployment and execution of business processes can be a very costly and offer a formal model to detect problems that can be caused by the lack of resources.

All mentioned previously work is done in a different domain using Petri Nets theory.

Van der Aalst in (van der Aalst and van Hee 1996) proposes a framework for redesigning business processes based on Petri Nets theory. The framework verifies the correctness of the redesigned business process, but it does not offer management.

In (Kim, Gangolly, and Elsas 2017) Kim provides a detailed guidelines of how design analytics can be done for accounting information systems (AIS) using Petri Nets theory. This research is another attempt to use unified modeling strategy of business processes.

Business process simulation (BPS) with Petri Nets is a powerful tool for resource allocation (Si et al. 2018). The research of Si endeavors to combine the power of a genetic algorithm (GA) and the benefits of the process simulation.

Wang in (Wang et al. 2019) develops a model of flexible production process based on the Petri Net. A serial optimization approach and search algorithm are used to solve the problem. A case study is carried out to verify the validity and performance of the methodology

Clempner in (Clempner 2014) presents a trajectory-tracking approach for verifying soundness of workflow/Petri nets. The advantage of this approach is to represent the dynamic character of the business process.

“A correct business process model is the key to achieving a business goal through business process management.” (Kang, Yang, and Zhang 2019). Modeling a business process with a strong mathematical theory such as Petri Nets guaranties the correctness of the model. Kang addresses the verification of behavioral soundness for an artifact-centric process model with synchronizations using Petri Nets.

In (Mejía et al. 2016) Mejía presents a real life Petri Net-based framework. It is for collaborative project management in the Animation and Videogame industry. The potential of the framework is illustrated with two short case studies. The results and deliverables have been tested by managers of some companies.

The research of the scientific literature reviles that the modeling and managing business processes and their different aspects with Petri Nets theory is a common practice.

Ribas in (Ribas et al. 2015) describes a framework for place/transition or Petri net-based multi-criteria decision-making (MCDM) framework to assess a cloud service in comparison with a similar on-premises service. The framework helps the managers to make decision and choose between cloud and on-premises service.

In the interesting research of Saini (Saini and Thiry 2017) the combination between functional programming (FP) and Petri Nets is used for Business Process Modeling (BPM). The authors propose a general methodology to model business processes using mathematical functions and higher-order functions. They describe the basic part of Business Process Modeling, behavioral semantics via Petri Nets (PN) and Functional implementation of the models.

Gonsalves in (Gonsalves and Itoh 2011) deals with the performance modelling and the optimization of concurrent service systems. Petri Nets have some limitations such as lacking in time duration concept, in data collecting mechanism and in conjunctive logic on the preconditions of an event. The authors are introducing the Client Server Petri net, which overcomes all these limitations. They demonstrate the effectiveness of the novel Client Server Petri net model editor–simulator–optimizer with the practical example of an automobile purchase concurrent service system.

In (Akshay, Helouet, and Phawade 2016) Akshay is working with Time Petri nets (TPNs). TPN is classical extension of Petri nets. It has time constraints attached to transitions. In the paper the authors show that the questions of friability and termination are decidable for this class.

Petri Net Markup Language (PNML) allows creating of formal models of the business models and processes. They can be exchanged and shared between the businesses. In (Hsieh and Lin 2014) the authors demonstrate the capabilities of PNML in the development of applications instead of an industrial interchange format only. A PNML is used to develop context-aware workflow systems. The authors propose a methodology to automatically generate context-aware action lists and control resource allocation. A health care example is suggested to demonstrate the design methodology.

2. Methods and Model

The methods of the module-oriented, object-oriented and aspect-oriented programming have been used to build a workflow engine module. It plays the key role in modeling and managing of business processes. It is a simple implementation of Petri Nets theory. The architectural principles of the server-less, service-oriented architecture are applied.

2.1. Conceptual Model

The conceptual model of a modular software system for business workflow management is represented on Figure 1. The key role in the modular system plays the workflow module. It manages the processes into the entire system. The rest of the modules can be standard elements of a software systems such as modules for authentication, authorization, ORM etc. Very important requirement is for the system to have a module or system for events management, since the communication between the workflow module and the rest of the system is done with events. This allows the system to be loosely coupled. The modern approaches such as server-less and microservices architecture can be used.

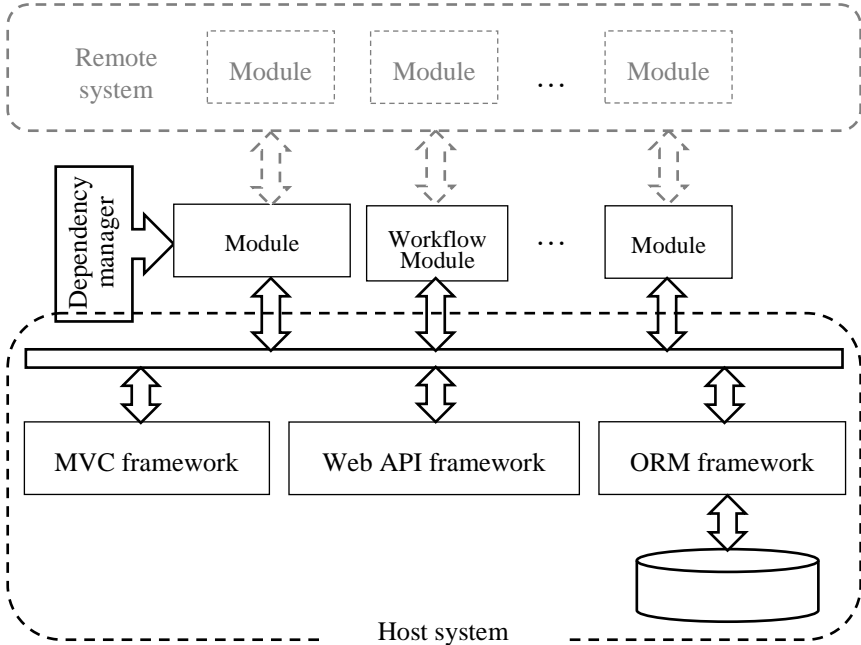


Figure 1. Modular system: Conceptual Model

The modules can communicate between each other and other systems using web services or sockets. This will allow each individual module to be built with a different technology. The workflow module offers an extra layer of abstraction and simplification for modeling and managing business processes.

2.2. Implementation of the Workflow Management System based on Petri Nets theory

The module is an implementation of Petri Nets theory. Petri Nets is a formal and graphical language for modeling discrete parallel processes. It is a generalization of the automata theory and follows formal mathematical rules described in the theory. The logic of the module is using the Petri Nets theory objects and rules to create an environment for executing workflows. Each participant has its own role in the workflow. In a workflow management system each user has a so called “in-box”. This in-box contains task instances (workitems) which can trigger a transition. The model is using terms, definitions and rules borrowed from Petri Nets theory. The business process (workflow) should be represented (modelled) by objects and rules described below.

Objects in Petri Nets

The objects in Petri Nets are:

- **Places** – they are passive and can play the role of an inbox in a business management system. They are represented with circles in the Petri Net diagram. Every Petri net has one input and one output place but unlimited number of intermediate places.
- **Transitions** – they are active and represent the tasks that needs to be done. They are represented with rectangles in the diagram.
- **Arcs** – every arc connects one place with one transition. They are represented with arrows in the diagram. “Inward arc” is going out of a place and going into a transition. “Outward arc” is going out of a transition and going into a place.
- **Tokens** – they represent the current state of the business process (workflow). They are represented as black dots in the places of the diagram. A place can hold 0 or more tokens in every moment of time.

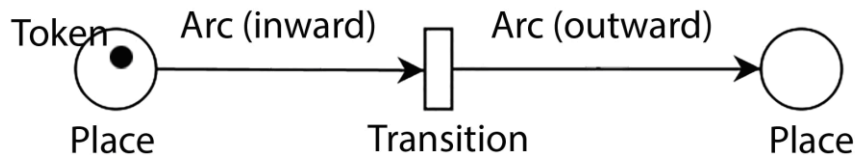


Figure 2. Objects in Petri Nets

Rules for the objects in Petri Nets

The places do not do anything, but hold the tokens, which represent the state of the process. A given place can contain 0 or more tokens in every given moment of time. An arch connects one place with one transition. Place P is called:

- *input place* for transition T if there is a direct inward arc connecting P with T;
- *output place* for transition T if there is a direct outward arc connecting T with P.

When an enabled transition is triggered, it moves tokens from all its input places to all its output places. A transition T is enabled when all input places for T have at least one free token. How an enabled transition is triggered depends on the type of the trigger. When a transition T is triggered it consumes one token from all its input places P for T and produces one token for every out place P for T.

Every workflow has exactly one starting place. It needs to have at least one inward arc entering a transition. It is possible to have one outward arc coming from a transition for restarting the workflow process.

Every workflow can have only one finishing place. It needs to have at least one outward arc coming from a transition. It is possible to have more than one outward arc coming from transitions. But the finishing place cannot have inward arcs going to a transition.

Triggers in Petri Nets

The moment when a transition becomes enabled and the moment when the transition is triggered are usually different. The event that triggers an enabled transition is called *trigger*. There are four different types of triggers:

- **Automatic** – the transition is triggered immediately after it becomes enabled.
- **User** – the enabled transition is triggered by the user. In a workflow system every user has an inbox and there can find its tasks – work items. The user triggers a transition by clicking a button or another interaction within the task.
- **Time** – an enabled transition can be triggered after certain amount of time elapses.
- **Message** – external event can trigger an enabled transition. Such external event includes receiving an email, phone call etc.

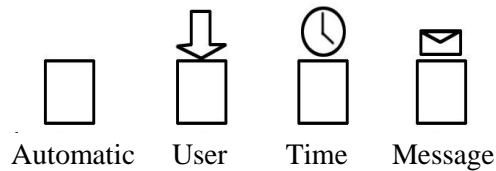


Figure 3. Triggers in Petri Nets

Routing in Petri Nets

Based on the previously described rules there are different types of routing in Petri Nets represented on Fig. 4–7.

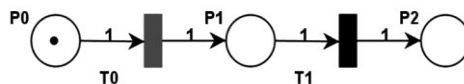


Figure 4. Sequential Routing

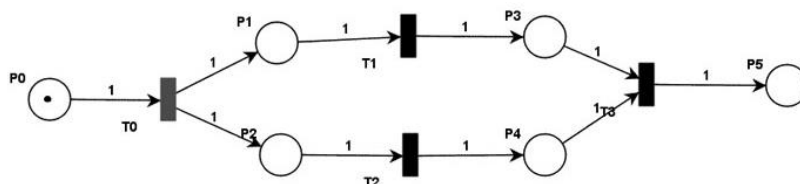


Figure 5. Parallel Routing

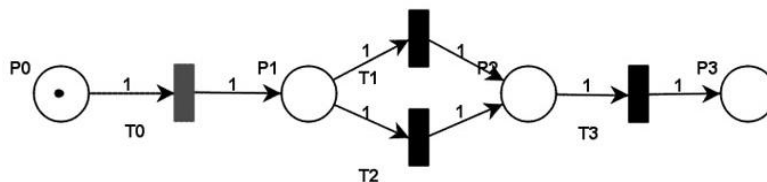


Figure 6. Conditional Routing

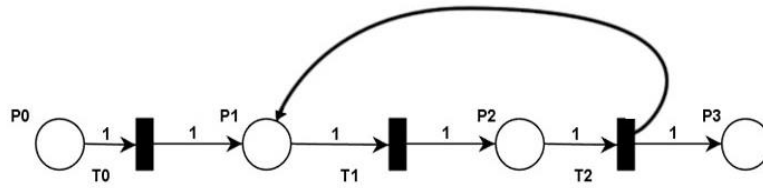


Figure 7. Iterative Routing

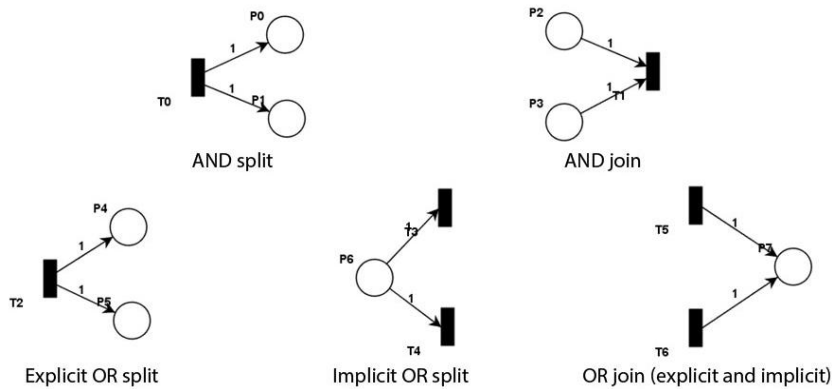


Figure 8. Split and join in Petri Nets

Business processes represented with the previously described rules can be managed by the module. With another words the business process has to be represented with the set of formal rules. The main objects used in the implementations include Workflow, Place, Transition, Arc, Token, Workitem, Workflow Case and User.

The logic of the module unites all objects and offers an environment for execution of the workflow. Every participant in the workflow has a specific and different role for each workflow and it is determined individually according to the needs. The role of the participant in the workflow does not match the role of the user in the software system. For instance, a given user can have the role of an administrator for the software system, but his role in a given workflow can be different.

The module creates an inbox with tasks (work items) for every participant in the workflow process. Analogy with the very well-known email inbox can be made. Similarly, every task generated by the module for a participant appears in its tasks inbox and looks like an e-mail. After finishing the task, the participant must confirm the completion by interacting with the task in the inbox and after that the task is removed from the inbox and the module advances the workflow. Another task can be generated for the participant or other participants according to the rules determined by the objects and rules of the workflow.

3. Results

As a result of the research and described model, a prototype of a modular system was built and it proved a concept. The model was used to build a module implementing the described principles. The workflow module and the entire software system proved to be sound and reliable. It was involved in a standard MVC software system shorting the time for modeling and managing business. It reduced the necessity of writing code for every different business process which needed to be modelled and managed.

The model, its objects and rules were implemented using PHP as a primary programming language. PHP has matured enough as an OOP language offering a lot of frameworks, which simplify the process of building web applications. The PHP technology was chosen because the language is simple

and easy to learn. In the development process can be involved developers without experience or students.

To set the rules and speed up the development process frameworks have been used such as Zend (for a primary framework), Doctrine (for ORM) and Apigility (for API). The modules are using MVC paradigm. The implementation is based on MySQL database. The tables in the database perfectly match the entities from the code-first built domain model. The database schema is built and kept in sync with the help of the ORM framework Doctrine.

The domain model of the prototype matches the objects from Petri Nets theory. Each object is represented with a class. For the abstraction to work extra classes were created such Workflow, Case, Work Item, etc. The actions in the MVC system are responsible for executing the transitions in the workflow system.

The implementation of the workflow module offers two different approaches for building the User Interface (UI). One of them is by using front-end technics HTML/CSS/JavaScript. The second approach is by preparing the HTML on the server-side with the help of the controllers and actions of the framework.

The goal was to be able to create a model and manage a business process without writing programming code, just by using the abstraction offered by Petri Nets theory. For creating the Petri Net third party tools were used such as Platform Independent PetriNet Editor (PIPE) (Figure 9.). The workflow module needs as input a XML file which can be produced manually or better by the help of a graphical tool. This approach is giving the freedom to use a tool of choice for creating Petri Nets. The Petri net is a mathematical representation of the business process.

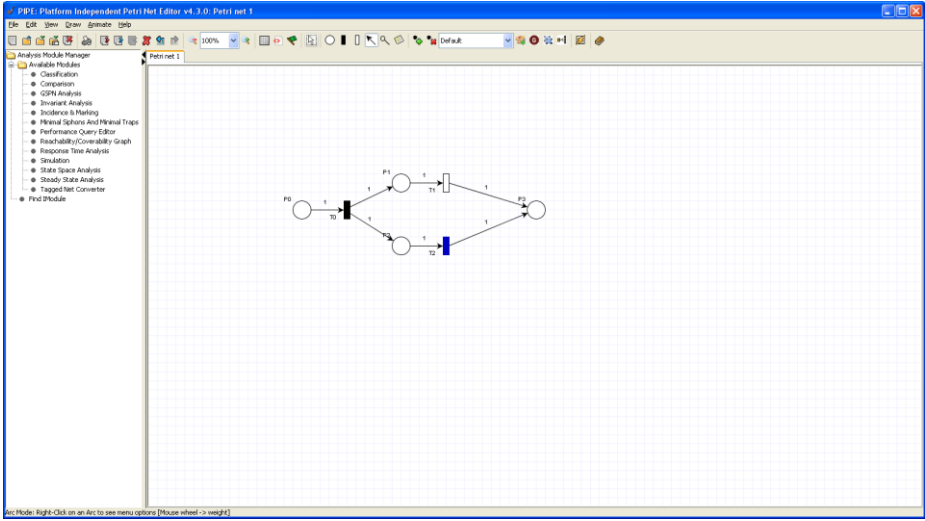


Figure 9. Third party graphical tool for modeling a process – Platform Independent PetriNet Editor (PIPE)

4. Discussion

Mathematical formalism such as Petri Nets theory offers a unique opportunity to create another level of abstraction and simplification which speeds up and makes it easy to create a model and manage business workflow processes. The workflow module built by the model allows standard strict mathematical approach for solving wide variety of problems for creating and managing business processes.

5. Conclusion

Using the model, a real live software systems were built, using the module in the monolithic and distributed architecture. The model is limited to activity base workflow systems. In the future other mathematical formalisms can be used in the model. For instance, Time Petri Nets (TPNs) theory can be used. Another possible way of extensions is creating a workflow module using Generalized Nets

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RESPONSIBILITY ACCOUNTING – A SOURCE OF INFORMATION FOR MEASURING THE PERFORMANCE OF INDIVIDUAL CENTERS

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Abstract:

Management accounting is primarily intended to be an information base for enterprise management. Of course this applies to all levels of management. In any situation, whether decisions are made or not, plans or other activities are created, management extracts information from this source. Due to constant changes, rapid technological and digital advances, competition, environment, etc. managers inevitably need continuous information in all segments of the business. In these situations, responsibility accounting has a special role. It has an obligation to present accurate data on the needs of the enterprise related to planning and control.

Here, we will emphasize that performance outcomes are measured at the level of responsibility within an enterprise. That is, how much each organizational unit (department) is satisfied with the funds, that the costs are tracked and the result achieved is measured in a given period. The company is also a group of people who all have their own tasks and responsibilities. If each individual invests in achieving the set goals, the percentage of tasks completed will always be higher. But of course the responsibility of the individual for the costs will affect their reduction.

In fact, the overall results of the enterprise are the consequence (sum) of activities of all the organizational parts of them. Hence, tracking costs against results will be seen on the basis of actions taken at different levels in the enterprise. Therefore, responsibility accounting is - a mechanism - that monitors the performance of departments in the enterprise and their managers and thus creates insight and effective control at every level.

Key words: *measurement, tasks, responsibility, management, results.*

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Introduction

Implementation of the control of managers' competences and responsibilities confirms the practical realization of responsible accounting. It is an important system for increasing the profitability of business entities. The need for important and useful information to satisfy the control and performance of all the individual departments in the enterprise increases the importance of responsible accounting.

Of course, there are reasons for this, including:

- ★ the emergence of large and complex enterprises,
- ★ increased competition,
- ★ the need for efficient management, control and planning,
- ★ monitoring dispersed production processes,
- ★ decentralized management,
- ★ capital allocation and monitoring.

All these processes must be systematic and comprehensive.

But they also need to be measured and presented in the financial statements.

Therefore, in responsible accounting, it can be said that it is a subsystem of management accounting and it contains several stages:

First phase - identify responsible centers,

Second phase - determine the competences of the managers of the responsible centers,

Third phase - preparing the plans of the responsibility centers and preparing reports on their success, and

Fourth phase - assesses the responsibility of managers and their activities.

All of this is necessary because many companies have decentralized management.

That is, for each department, the individually responsible manager makes decisions at a particular level.

In fact, the reports that are prepared for their success and results are used by top level managers.

1. Centers and elements of responsibility

In a decentralized management system, responsible accounting has a special place. Its' elements and centers of responsibility are numerous.

Namely, they should be classified in different ways depending on the powers and capabilities in controlling the operation. This is necessary because responsible accounting implies the institutionalization of planning and control.

This process should be systematically set up and comprehensive. In any case, not the slightest detail should be left out which would cause some incomplete reports. Because, when preparing financial statements, it is very important to determine costs by sector, by unit, by function and by the way costs are calculated. That is, responsibility centers are places that control costs, revenue generation, and investments.

These places or parts, according to the organization and systematization of the enterprise, can be: production lines, departments, administrative departments, specific jobs, divisional enterprises and so on.

Namely, the responsibility centers need to be separated, and their main task is to create and submit information according to the reports prepared, before and after the work operations.

Their comparison and re-planning is carried out in order to build a system that will function in a quality and efficient manner. Because, responsible accounting follows all the characteristics of the

narrower organizational parts of the whole enterprise. The financial effects of each individual liability center are also seen. But it also monitors the way each manager behaves toward the top management of the company. This system of organized accounting needs to be designed to meet the needs of the enterprise and the needs of managers at every level of management.

Their compatibility is very important because they need to know and recognize the areas of responsibility that form the basis for reporting and measuring performance. Because, the responsible accounting system generates the information for efficient use and management of all levels and all parts of the enterprise effectively.

Here, we can emphasize that companies have differentiated multiple liability centers such as cost center, revenue center, profit center and investment responsibility center.

In the management accounting system, the need to perceive and achieve cost control is always emphasized.

Therefore, the division of these centers is necessary. The need of every manager is to have insight and control in the responsible center. In cost centers, managers have no influence on the different types of products, prices, quantities, sales, and therefore have no responsibility for the revenue generated.

Namely, their direction of responsibility refers to the economical consumption of the factors of production, the effectiveness of the work activities, as well as the achievement of the quality of the output. The role of quality is crucial, because if there is no quality, the success of the centers, but also the overall operation of the enterprise will be inefficient and ineffective.

1.1. Cost center of responsibility

Namely, the cost center of responsibility has a special role in controlling the operation. It is a fact that at all levels and in all parts of the entity certain costs are generated. This responsibility center requires tracking costs and measuring between planned and executed tasks. But also in terms of measuring the cost center results different types of costs arise. Of course, some of those costs cannot be the responsibility of the manager.

Namely, from the planning-control point of view and responsibility, we have two types of costs.

First, the costs that the cost center manager can directly influence over a given accounting period. These are costs that take on the nature of controlled costs.

Second, other costs incurred at the cost center level, but the manager has no direct impact.

These are costs that have the character of uncontrolled costs.

Here, we can emphasize that cost centers can be divided into:

- standard cost centers, and
- centers of budgeted expenditures.

1.1.1. Budgeted expenditure centers and expenditure discretion centers

If in the responsible centers, the managers are responsible for the expenses, but not for the profit, then such centers are centers of budgeted expenditures.

Here, we are talking about parts of the organization where nonprofit functions are performed (research and development, finance and accounting, administrative administration, etc.).

Whereas, if the amount of expenditure is determined by the decision of the responsible manager or by the decision of the top management of the enterprise, these are centers of responsibility which are discretionary centers of expenditure.

In fact, in the centers of responsibility for budgeted expenditures, in addition to costs of a discretionary nature, there are costs that have the character of standard costs (individual costs of

procurement, sales, etc.). Of course, we will emphasize that the way of planning and controlling the standard costs in the centers of responsibility is easy and simple.

However, when it comes to discretionary costs, it is much more difficult to measure their efficiency. Namely, providing a framework and quality services in the context of the budget is really complex. But also defining the scope of certain activities is difficult to determine by how long it takes and how many people (eg. researchers) are needed for the purpose.

Therefore, the emphasis on responsibility as well as control is of a qualitative nature, and to a very small extent on the quantitative side.

Also, at discretionary spending centers, responsible managers have the responsibility to maximize the output within the budget. And that is the basis for their control.

1.2.Revenue control center

Revenue control centers carry out revenue controls. The responsible manager has certain competences and is responsible for generating revenue for the enterprise and has no direct control over the costs of the products. It is also solely responsible for the revenue it may affect.

Income centers of responsibility condition control based on the effects obtained.

In fact, the perception is made through deviations from the planned revenues. Managers aim to achieve the realization and for this reason they engage with many activities (promotion and propaganda, market research, etc.). Such centers should usually be set up in the sales and marketing function.

1.3.Profit center of responsibility

Whereas, profit centers of responsibility control costs and revenues. This means, that responsible managers are committed to producing certain products (and their planned costs), as well as selling them. the realization of the planned revenues.

Namely, the profit centers of responsibility in the manufacturing enterprise have control over the production function, sales, purchasing function, preparation, etc.

These control centers (units in the enterprise), more precisely the cost centers are most present in the production function.

While the sales function has the most revenue centers. In addition to control and responsibility for costs and revenues, profit center managers have responsibility and authority for quality, delivery time, procurement period, production mix and more.

These centers of responsibility can be perceived in large enterprises, factories, but also in smaller entities within another business, in the form of divisions and so on.

In fact, managers in profit centers of responsibility are responsible for input, transformation and output realization.

Therefore, when there is a clear relationship with the profit centers, the opportunity arises for profit to be uncertain of the decisions and efficiency of each profit center individually. This means precisely defining the responsibilities of each manager individually.

In this way, the results achieved for each manager come to the top of the management of the company. This means, that top management has a clear picture of each manager individually, but also has a view of the success of each profit center. The way results are presented is by compiling an - internal report – which contains information and data on the overall operation of the responsibility centers.

Namely, - the internal report - should be presented as an internal balance of responsibility and success covering: direct revenues and direct costs per profit center, as well as allocated common costs.

1.4. Investment Center

The investment responsibility center, analyzed from a management perspective, is conditioned by the high degree of decentralization of the management organization.

It is a center of responsibility that provides control over costs, revenues and investments.

In some cases, there is a balance between the profit and the investment center of responsibility, but in each case there is a difference.

Namely, the degree of responsibility assigned by the top management of the organization creates specificities in the way and freedom of decision making, as well as the method of measuring the results by the manager.

In fact, investment centers have the highest level of responsibility and independence.

This is due to the amount of profit that is closely related to the amount of capital invested.

Top management transfers responsibility for making the key decisions that determine profit.

At the same time, it provides competences when deciding on the level and type of investments that should enable profit in the future.

Therefore, we will emphasize here that the investment center of responsibility is a functional relative stand-alone entity within an enterprise.

In practice, an organizational part of an enterprise, in order to gain the character of an investment center, should:

- ★ be large enough to allow its control to be effected through the rate of return or residual gain,
- ★ be autonomous so that the funds and expenditure of finance can be easily and safely returned,
- ★ the manager of an organizational unit has authority and responsibility, not only for determining their profits, but also for the type and quality of the investments,
- ★ the management of the enterprise can measure and control the results of managers and centers through the rate of return,
- ★ to fulfill the conditions provided for the existence of an investment control center.

An additional feature of these centers is the ability to produce information that enables analysis of the financial structure, asset structure and financial position of the investment center.

This means that these centers need to prepare internal reports for determining the return of investments (ROI) and residual profit.

2. Measuring the results of the work of the responsibility centers

First of all we will emphasize that in measuring the results of performance, the key measure of success is profit. Of course, the measurement depends on what kind of profit center it is.

Namely, the cost center is a unit that does not deal with production. The success of this unit is made by comparing actual costs with previously established costs.

In fact, there are some difficulties with the cost center as there are some common costs related to multiple cost centers. So, their demarcation in a certain way is a problem.

Therefore, the cost limitation is done by agreement between the managers of the individual centers. The contract with each responsibility center specifies the rate of common costs that will be accepted by each individual center.

However, in the profit centers, profit is a quantified expression of the contribution made to the profitability of the enterprise.

At the same time, we will emphasize that the absolute magnitude of profit does not necessarily mean an adequate measure of business success.

That is, if a profit center has more capital it will generate more profits that have relative importance. At the investment center of responsibility, the rate of measure of investment is the rate of return on investment. Typically, the performance measurement criteria for enterprise operations and responsibility centers are different. For this reason, different factors operate at different times and there are different possibilities, but the environment is also characterized by special features. Therefore, the valuation method covers all the conditions and opportunities on the day of calculating and determining the performance of the operation and operating profit.

2.Success of total results of profit centers

In addition to the rate of return as a measure of success, we need to emphasize the rate of return on performance. In many cases, the sales ratio against the hired assets is also used. As we have underlined earlier, in the accounting of management, hence in the responsible accounting ratios are used. This means that these centers have an ultimate goal.

But they also affect variable costs and the rest of the conversion. In fact, the rest of the realization is the basic indicator for measuring the results of operations. In this way, we can determine the cost-effectiveness of operating in the long run.

Of course, we will underline that in the production of certain types of products regardless of the volume of production, the fixed costs remain the same, but in calculating the success and profit determination they must not be left out. Above all, in order to achieve the highest possible degree of effectiveness and efficiency in operation, it is necessary to observe all the delimitations of the costs that cannot be affected and the costs that can be affected.

In this way, the principle of comparability between profit centers will be achieved and we will have insight into the overall operation of the profit center. Hence, the calculation of the success will be able to determine the success of the highest level of management of the enterprise, since the management also has the character of a profit center. Namely, the total results of the profit centers are presented in the internal income statement. Through it, we can perceive responsibility for meeting the set goals or evaluate the performance of management. We additionally perceive the economic performance and the quality of the tasks performed.

Conclusion

It should be noted that responsible accounting represents the results of operations that are measured at the level of responsibility within an enterprise.

Also, implementation and control of the responsibilities of managers at the level at which they are assigned should also be carried out. All this depends on the complexity and location of the enterprise. Due to the specifics of the business entities, the tasks being performed create the style of responsible accounting. The reports have great importance.

Through them accountability is given on the results related to cost-effectiveness, effectiveness and efficiency, as well as the established hierarchy of management. Responsible accounting is required to cover all organizational units of the enterprise. It also monitors the state of management from the lowest to the highest level of the enterprise. Given the emphasis on modern business entities that have

a decentralized management style, responsible accounting becomes the foundation for the successful monitoring and implementation of assigned tasks. Because it allows you to see the deviations of the plan from the actual reality, to make comparisons by time, by territories, etc. Also, responsible accounting needs to be designed according to the type of enterprise. It then generates accurate and precise information that enables the right decisions to be made. In fact, responsible accounting needs to reconcile the individual goals and objectives with the goals and objectives of the overall business.

Also, this accounting should motivate employees who will work more successfully and perform their assigned tasks with high quality. The occurrence of problems and risks will be minimized. We will therefore emphasize that responsible accounting should be able to provide quality information to quantify objectives. Of course, this also implies the need for a sophisticated approach to management control, developing a competitive relationship between business units, rewarding employees, and so on.

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APPLICATION OF ELASTICITY IN COST CONTROL

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Abstract:

An analysis of a company's costs was carried out in the paper using mathematical methods, having in mind that in addition to increased revenue intensity and increased production, the reduction, or control of costs is an important indicator of business performance. The emphasis is placed on one mathematical measure, i.e. elasticity, as an indicator that changing the scope of production affects cost change. On a specific empirical example of approximated cost function, we have shown what functions of total costs look like, as well as of marginal costs as the most important for the management of a company, and of average costs, and we have shown how the elasticity of these functions indicates the volume of output that is profitable. In this way we have shown that costs can be monitored in a safe and exact way and that along with their reduction, they affect profit increase, which is the ultimate goal of management. All the above listed procedures, will be accompanied by appropriate mathematical software.

Key words: *total costs, marginal and average costs, approximated cost function, elasticity of function*

1. Introduction

Modern business conditions raise increasingly demanding questions for the management of a company. Increased competition in the market, which has to be accompanied with adequate product prices on the one hand, indicates that, in addition to the ambition to increase and preserve profits, it is necessary to pay attention to control first and to cost reduction as much as it is possible. Therefore, the central problem we are dealing with is precisely the costs of a company. The interest in costs itself dates back to the early 20th century in terms of post-World War I research. Namely, a great number of scientific papers have emerged since the 1930s, which can be considered as the beginning of the development of the Theory of Costs. Over time, it has become more interesting because it is precisely the success of a company that is measured by its revenue at minimal cost. Economic theory recognizes various classifications of costs, which we will not discuss on this occasion, but will look at them from a mathematical perspective as certain functional dependencies. In the continuation of this paper, we outline basic mathematical concepts of costs, which are exact and exist in mathematical theory and the listed references will be used on this occasion.

Hereinafter, we will denote **the total cost of production** by T_u , as a functional dependence on the volume of production x , i.e.

$$T_u = T_u(x). \quad (1)$$

Since a business can manufacture more products, this function may be shown depending on more variables, as:

$$T_u = T_u(x_1, x_2, \dots, x_n) \quad (2)$$

In each case, the analytic expression of the function is obtained on the basis of empirical data and approximation performed. In the case of one variable, i.e. of a single product, the total cost function is most often expressed as a linear, quadratic, exponential or degree function.

For further analysis, function (1) will be used, and quite similarly, everything can be generalized to function (2). The area of definition of cost function is the interval $[a, b] \subseteq R^+$, i.e. a set of non-negative real numbers. At this interval, function T_u is differentiable and since increase in production volume x , leads to an increase in costs, for the function T_u , is valid:

$$(\forall x \in [a, b])(T_u(x) > 0 \wedge T_u'(x) > 0) \quad (3)$$

The marked function $T_u'(x)$ is a functional derivative and it is clear that it is a positive number as the function $T_u(x)$ grows. This function is of particular importance for economic analysis as it will be a marginal cost function. Namely, the function of total costs itself is sometimes not a sufficient indicator because it does not show the change in costs that is caused by the change in production volume, and therefore it is not sufficient in assessing whether the increase in production volume is cost-effective. In cost theory, **marginal cost function** is defined as follows (Barnett & all, 2003):

Definition: Marginal cost of function $T_u(x)$ at point $x_0 \in (a, b)$, marked as $T_g(x_0)$, is the marginal value

$$T_g(x_0) = \lim_{\Delta x_0 \rightarrow 0} \frac{\Delta T_u(x_0)}{\Delta x_0} = \lim_{\Delta x_0 \rightarrow 0} \frac{T_u(x_0 + \Delta x_0) - T_u(x_0)}{\Delta x_0}, \quad (4)$$

if it exists and if it is finite.

The difference $T_u(x_0 + \Delta x_0) - T_u(x_0)$ denotes a change in costs, if the volume of production changes from level x_0 by Δx_0 . Marginal costs themselves show the rate of cost change at point x_0 .

For $\Delta x_0 \neq 0$, the approximate value of marginal cost is:

$$T_g(x_0) \approx \frac{T_u(x_0 + \Delta x_0) - T_u(x_0)}{\Delta x_0} \quad (5)$$

$$\text{for } \Delta x_0 = 1, \quad T_g(x_0) \approx T_u(x_0 + 1) - T_u(x_0) \quad (6)$$

Since $T_u(x_0 + 1) - T_u(x_0)$, is the exact cost for $(x_0 + 1)^{\text{th}}$ product, marginal cost function can be used to approximate the exact cost and thus look ahead, i.e. estimate cost for subsequent product and thus estimate how cost-effective an increase in production volume is.

In monitoring the costs of a company, in addition to the total and marginal costs, very often **average costs** are monitored, i.e. costs per unit of product. We denote average cost function by $\bar{T}(x)$ and it is calculated as a quotient of total cost of production and physical volume of production, i.e. it is given as:

$$\bar{T}(x) = \frac{T_u(x)}{x} \quad (7)$$

for each $x \in [a, b]$ and $x \neq 0$.

As an important link between marginal cost function and average cost function, we provide the following theorem without proof.

Theorem 1.1: Marginal cost equals average cost at the level of production x_0 at which minimum average cost is met. (Božinović and Stojanović, 2005).

2. Elasticity of cost function

For a more accurate analysis of cost function, as well as an assessment of the extent to which an increase in production volume influences an increase in costs, a measure called cost **elasticity** can be used. To begin with, we define the term elasticity, for an arbitrary function $y = f(x)$, which depends on an independently variable quantity x .

If the independently variable quantity x_0 changes by Δx_0 , then we gave a change in the function $\Delta y_0 = f(x_0 + \Delta x_0) - f(x_0)$.

Definition: Elasticity of function $y = f(x)$ at point $x_0 \in (a, b)$, at mark E_{y,x_0} , is marginal value:

$$E_{y,x_0} = \lim_{\Delta x_0 \rightarrow 0} \frac{\frac{\Delta y_0}{y_0}}{\frac{\Delta x_0}{x_0}} = \frac{x_0}{y_0} \lim_{\Delta x_0 \rightarrow 0} \frac{\Delta y_0}{\Delta x_0} = \frac{x_0}{y_0} y'(x_0) \quad (8)$$

if it exists.

If this marginal value exists at every interval point (a, b) for the function $y = f(x)$, then we can talk about the **coefficient of elasticity** in the mark:

$$E_{y,x} = \frac{x}{y} y'(x). \quad (9)$$

In case when:

1. $|E_{y,x}| < 1$, function $y = f(x)$ is inelastic;
2. $|E_{y,x}| > 1$, function $y = f(x)$ is elastic;
3. $|E_{y,x}| = 1$, function $y = f(x)$ has a unit elasticity.

The function is more elastic if its reaction to changes of another quantity is larger. In the case of unit elasticity, changing the argument x , does not affect the change in function.

Specially, if we consider the function of total costs $T_u(x)$, depending on the physical volume of production, we can analyze **elasticity coefficient of the total costs function** in the mark:

$$E_{T_u,x} = \frac{x}{T_u(x)} \cdot T'_u(x) = \frac{T_g(x)}{\bar{T}(x)}, \quad (10)$$

since $\bar{T}(x) = \frac{T_u(x)}{x}$, a $T_g(x) = T'_u(x)$.

So, cost elasticity is the ratio of marginal and average costs. Since: $x > 0, T > 0, T' > 0$, it follows that $E_{T_u,x} > 0$. Therefore, for the elasticity coefficient of total costs is valid:

1. If $E_{T_u,x} \in (0,1)$, total costs are inelastic, i.e. $\frac{T_g(x)}{\bar{T}(x)} < 1$, then $T_g(x) < \bar{T}(x)$, which means that making a decision on increasing the existing production volume makes sense.
2. If $E_{T_u,x} > 1$, total costs are elastic, then $T_g(x) > \bar{T}(x)$, so that making a decision on increasing the existing production volume is not justified.
3. If $E_{T_u,x} = 1$, then $T_g(x) = \bar{T}(x)$, i.e. minimum average costs are achieved according to Theorem 1.1.

Elasticity coefficient is of great importance for economic cost analysis and can serve to control costs. Its economic interpretation is that if $E_{T_u,x} = k$, this means that an increase in production volume by 1% leads to an increase in costs by $k\%$, if $k > 0$, or a decrease in costs by $k\%$, if $k < 0$ (Barnett & all, 2003).

3. Practical application of elasticity coefficient of the total cost function

In the continuation of the paper, the above mathematical theory of costs, as well as the theory of the elasticity of total costs, will be practically confirmed on the example of one function of costs approximated on the basis of real empirical data.

Namely, a survey was carried out at the Measuring Transformers Factory in Zajecar, which has been operating since 1969 and is engaged in the production of electrical equipment. From a wide range of products, we have monitored costs of producing medium voltage transformers which are delivered in large batches (on a monthly basis) and depend on the number of produced transformers x . According to the information available from the accounting department of the factory, which employs no more than 100 workers, fixed costs are approximately EUR 50000, and total costs are increased by the number of products manufactured. This growth is certainly not linear as the components are mostly produced in serial production. According to empirical data showing costs depending on the physical volume of production of a single product, the cost function is approximated in the form of a quadratic function $y = ax^2 + bx + c$.

So, based on the data collected from the Measuring Transformers Factory, we have come up with a contingency table, Table 1. It shows values of the independent variable X (number of transformers produced on a monthly basis) and the dependent variable $Y=T_u(X)$ (value of production costs (in euros) for a given number of transformers).

Table 1. Input data and contingency table

m	X number transf.	Y=T _u (X) (000 euro)	X	Y	X ²	X ³	X ⁴	XY	X ² Y	Y ²	\bar{Y}	
1	50	78	50	78	2500	125000	6250000	3900	195000	6084	77.94740854	
2	70	88	70	88	4900	343000	24010000	6160	431200	7744	88.09878717	
3	100	102	100	102	10000	1000000	100000000	10200	1020000	10404	102.2152606	
4	130	115	130	115	16900	2197000	285610000	14950	1943500	13225	114.9990206	
5	150	123	150	123	22500	3375000	506250000	18450	2767500	15129	122.781131	
6	170	130	170	130	28900	4913000	835210000	22100	3757000	16900	129.9709242	
7	200	140	200	140	40000	8000000	1600000000	28000	5600000	19600	139.6450196	
8	225	147	225	147	50625	11390625	2562890625	33075	7441875	21609	146.6887208	
9	240	150	240	150	57600	13824000	3317760000	36000	8640000	22500	150.4707037	
10	275	158	275	158	75625	20796875	5719140625	43450	11948750	24964	157.9996369	
11	300	167	300	167	90000	27000000	8100000000	48600	14580000	26244	162.2668519	
12	320	165	320	165	102400	32768000	10485760000	52800	16896000	27225	165.0142671	
13	340	167	340	167	115600	39304000	13363360000	56780	19305200	27889	167.1693653	
14	365	169	365	169	133225	48627125	17748900625	61685	22515025	28561	169.0302921	
15	380	170	380	170	144400	54872000	20851360000	64600	24548000	28900	169.7026104	
			Σ	3315	2064	895175	268535625	85506501875	500750	141589050	296978	

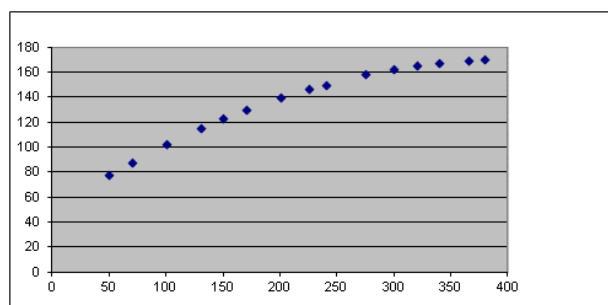


Figure 1. Graphic representation of input data

By applying the least squares method to find quadratic regression function that best approximates given points, i.e. by solving the system of equations (the least squares method)(Milton and Arnold, 2002):

$$\begin{aligned} \sum y &= na + b \sum x + c \sum x^2 \\ \sum xy &= a \sum x + b \sum x^2 + c \sum x^3 \\ \sum x^2 y &= a \sum x^2 + b \sum x^3 + c \sum x^4 \end{aligned} \quad (11)$$

that is,

$$\begin{aligned} 2064 &= 15b + 3315b + 895175c \\ 500750 &= 3315a + 895175b + 268535625c \\ 141589050 &= 895175a + 268535625b + 85506501875c \end{aligned}$$

we obtain the values of the coefficients $a= 49.9775748$, $b= 0.596416492$ and $c= -0.0007404$, which by rounding and multiplying by 1000, since the data is given in 000 units of product manufactured, is: **$a= 50000$, $b= 600$ and $c= -0,75$** .

The whole data processing in this part of the paper were carried out in statistical software SPSS and Excell.

Based on the procedure previously performed, we conclude that the approximate total cost function by the quadratic regression function based on the initial empirical data takes the following form:

$$T_u(x) = -0,75x^2 + 600x + 50000, \quad (12)$$

and describes the costs in euros.

It is understood that $x > 0$ as the volume of production, that is, the number of pieces of a product. In any other problem, of course, it can be the amount of a product expressed in any measure depending on the situation. Also, $T_u(x) > 0$, from where we get $x \in (0,1076)$.

On the other hand, by differentiating equation (12), we obtain *marginal cost function*:

$$T_g(x) = -0,75x \cdot 2x + 600 = -1,5x + 600 \quad (13)$$

The total cost function increases with increasing production volume x , which means $T'(x) = T_g(x) > 0$, i.e. $-1,5x + 600 > 0$, where $x < 400$. As the intersection of both intervals of the definition of these functions we obtain $x \in (0,400)$.

In the further analysis, we also use *the average cost function* which is obtained by (7) and equals:

$$\bar{T}(x) = -0,75x + 600 + \frac{50000}{x}. \quad (14)$$

In Figure 2. that follows, we see the previous three functions. *The data were processed and graphically illustrated using mathematical software MathLab.*

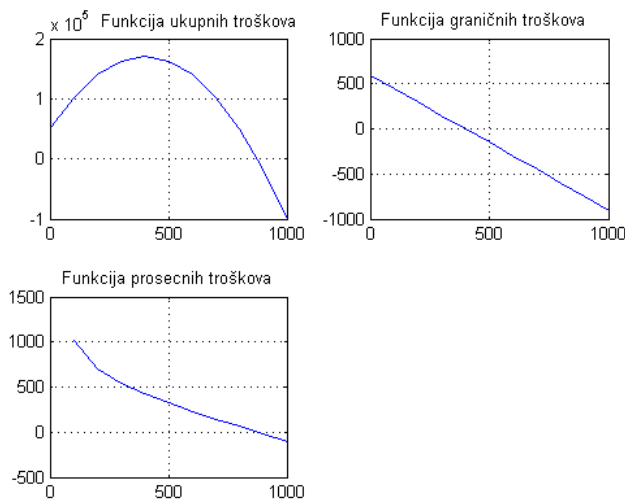


Figure 2. Total cost function, marginal cost function and average cost function (illustrated in Matlab)

When all these functions are known, we can obtain information on the value of total, marginal or average costs for any value of production volume within the permitted area $x \in (0, 400)$. We understand that increasing volume increases costs, but at some point in time, the following realistic questions are posed to the management of a company:

1. How much would total costs be increased if the volume of production were increased to a certain extent and would making a decision to increase production make sense?
2. What is the exact cost of producing each subsequent product?

The answers to these questions are given by the example below, which can be implemented for any other specific situation and thus make the right decision whether to increase production with cost control that ensures sustainable development of both small businesses and large companies.

In our example, we ask the question: How much will the costs increase if the volume of production increases from the level $x = 200$ products.

We get total costs for 200 products, when in equation (12), we substitute for $x = 200$, i.e.

$$T_u(200) = -0,75 \cdot 200^2 + 600 \cdot 200 + 50000 = 140000 \text{ €}$$

If the production increases to $x = 201$, the total costs would be:

$$T_u(201) = -0,75 \cdot 201^2 + 600 \cdot 201 + 50000 = 140299,25 \text{ €}.$$

It is clear that the difference $T_u(201) - T_u(200) = 140299,25 - 140000 = 299,25 \text{ €}$, represents the exact cost for producing 201st product.

By using equation (6), an approximate result can be obtained using marginal cost function, which we have seen can approximate the exact cost of producing the next product. Thus, an approximate result can also be obtained using equation (13) as follows:

$$T_g(200) = -1,5 \cdot 200 + 600 = 300 \approx 299,25$$

With this we have confirmed that marginal cost function can be used as a faster, easier way of obtaining approximate exact costs for the next product.

If we are interested in what these costs are for the 201st product relative to the average cost per unit of product when a total of 200 products are manufactured, then we use the average cost function (14) and obtain:

$$\bar{T}(200) = -0,75 \cdot 200 + 600 + \frac{50000}{200} = 700\text{€}.$$

Obviously, the cost for the 201st product would be greatly decreased compared to the average cost for the previous 200 products.

In deciding whether to increase production volume, in terms of increasing costs, elasticity coefficient also gives significant results, which in our case, according to (10) is:

$$E_{T_u, x} = \frac{x}{T_u(x)} \cdot T'(x) = \frac{T_g(x)}{T(x)} = \frac{T_g(200)}{T(200)} = \frac{299,25}{700} = 0,43\%$$

Therefore, $E_{T_u, 200} = 0,43\% < 1$, so in line with the previous theory of total cost elasticity, we obtain that the total cost is elastic, i.e. a decision can be made to increase production. More precisely, if the volume of production increases by 1%, i.e. from 200 to 202 products, the total costs increase to

$$T_u = 140000 + 140000 \cdot \frac{0,43}{100} = 140602\text{€}.$$

With the results obtained in this way, which in a certain way predict costs in the future, when they increase the volume of production and having in mind available finance for investment, the management of any company can make right decisions, while having safe and accurate control over costs.

4. Conclusion

Higher profits and increasing production volume are the most important objective of the management of a company. Sustainable development, which requires control over costs that are inevitable and naturally increase with production volume, transport, sales, use of human and other natural resources, cannot be forgotten. It is impossible to give an absolute exhaustive classification of costs, but regardless of their nature, one thing is indisputable: without daily cost control, there is no successful business. To this end, increased competition in the market requires immediate improvement from the management. In this paper, based on the example of the production of medium voltage transformers in the Measuring Transformers Factory – Zajecar, we started from the empirical data related to the number of units of products (transformers) produced and costs incurred for a period of 15 months and obtained an approximate function of total costs. We further provided a complete mathematical analysis of the total costs and indicated how it is possible to predict, with the help of the measure of elasticity, the extent to which an increase in production volume can influence an increase in costs. Making the right decision by the management is in any case a complex decision, but such an analysis of costs and its elasticity is useful and can help companies to operate more successfully, generate and save more profit at less cost.

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STRATEGIC APPROACH IN IMPLEMENTATION OF E-BUSINESS ACTIVITIES IN MICRO AND SMALL ENTERPRISES

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Janevski³

Abstract:

The dominant use of information technology have a huge impact on today's transformation of many enterprises and imposes the need for changes in the business model. The changeable and unstable environment urges the business entities not only to constantly adjust but also to accept a strategic approach especially to their e-market performance. Businesses that use digital technologies and the Internet in their business activities are becoming more competitive and efficient, and time and space constraints are disappearing for them.

The paper emphasizes the need for a strategic approach to the new business environment, which will lead to greater implementation of e-business activities and models in the operation of small businesses. By using statistical analysis examines how knowledge of certain elements of strategic analysis will lead to more e-business activities, ie implementation of e-business models and applications.

The analysis in the paper emphasizes the correlation between the perception of the business entities regarding the conditions and the opportunities in e-environment and their internal factors, on one hand, and the implementation of the e-business applications and models in their business operations, on the other hand.

Key words: *strategic planning, business environment, e-market, e-business*

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Introduction

New developments in the enterprise environment create new problems and challenges, but also opportunities for finding solutions for them. In order for them to be efficient in their work, enterprises must respond immediately to changes in the environment, that is, to the changed demands and needs of their consumers, as well as to the activities of their competition. The proportion and pace of technology offer a great challenge for businesses. The external environment that includes, consumers, competitors, suppliers, technology, work force, education, legal, demographic, political, sociological and other factors (Shuklev and Drakulevski, 2001, p.81) can be stable, dynamic or turbulent (Friend and Zehle, 2004, p.31). Today it is especially important for the enterprise to be resilient, to be able to survive in a dynamic and turbulent environment, and to adjust to the changes taking place there.

With the development of the Internet, consumers are becoming ever more present and selective on the e-market, while the competition ever more strong. In such conditions, it is not just important to make a decision for entering that market, but it is especially important for that decision to be based on strategic concepts. It is clear that working conditions of enterprises are becoming increasingly more uncertain and dynamic with everyday technological innovations, and as they enter the e-market, they have to follow the steps of strategic planning (strategic analysis of the e-environment, strategic goals – vision, mission, goals, formulating of a strategy and implementation and control).

The new business environment provides great opportunities, both for large and small entities, regardless of the fact that small enterprises have limited materials and human resources. The results from the research on the strategic approach of small businesses will be presented within the framework of this paper, as well as recommendations for their action in the new environment. Namely, small businesses makesubstantial contributionstonational economies (Jutla et al., 2002, pp.139-164), main drivers of job creation (OECD, 2019, p.5), they are majorplayers in achieving sustainable growth and development of the national economies(Taylor and Murphy, 2004, pp.280-289). In today's business environment, small businesses face with very powerful forces that shape the competitive position and change the rules of the game.Digitalization is opening up new opportunities for young and small enterprises to innovate and flourish, asthey acquire capacity to use and combine emerging digital technologies to transform their business models and work practices. Potential implications for overall productivity and inclusive growth are large across all business sectors, including those traditionally dominated by small firms (OECD, 2019, p.7).

Like large enterprises, small enterprises also need to be flexible and react according to the conditions in the new environment. Nowadays, the Internet is making the strategy more necessary than ever before. The role of the strategy is in its contribution to achieving competitive advantage of the enterprise (Anthony, 2011, p.4).

Business entities for success at e-market need to develop a strategy with a clear focus. Considering the fact that today business entities operate in dynamic and unpredictable environment it is necessary monitoring and evaluation of e-business strategy in order to adjust to the same and at the same time to achieve the goals of the business entity. The essence of a strategy lies in choosing activities in a different way, or in performing activities in a different way from those of the rivals (Porter, 2009, p.43) or series of decisions and actions that are taken to achieve stated aims and objectives (Combe, 2006, p.213) and strategy is an integrated and coordinated set of obligations and actions in the direction of utilizing the basic competencies of business enterprises and gaining competitive advantages (Michae et al. 2008, p.4).

As a result of the Internet and the Web are created a number of powerful new software applications that enable certain traditional activities to be performed electronically, such as e-mail, search engines, intelligent tools, online forums, streaming media, cookies, web 2.0 features and other services

(Laudon and Traver, 2010, pp.172-181). All of these software applications are relieving people's life and simplify and speed up business. With the development of Internet the enterprises have more strategic alternatives for the market, but choosing them should rely on good alignment of the strategic capabilities of the business entity and its environment. New challenges in the environment of the enterprises impose the need for building a strategy with a clear focus, i.e. they should have the following characteristics (Porter, 2009, p.130):

- a strong Internet technology and its knowledge,
- building distinctive strategies with a clear focus,
- accent and focus on creating value for customers,
- distinctive ways of performing physical activities and making the property that is not on the Internet and
- deep knowledge of the business and establishing their own skills, communications and information.

The traditional view and planning system within enterprises nowadays is becoming inefficient and outdated in terms of improving business performance. Today, leading businesses are concentrating on the following three key areas (Elkin, 2007, p.2):

- consumers – how to ensure that consumer needs are met;
- competitors – how to achieve and maintain competitive advantage and
- company – how to continue and build company forces.

According Jantavongso and K. Y. R. Li (2002, p.443) their literature surveys indicate that businesses that succeed in this new economy undertake careful planning in the following seven key factors: management commitment - having a clear focus what to achieve; IT infrastructure availability; web pages is a key factor in determining the success of e-business; Web Content; e-business systems; effective marketing and customer service.

However, in order to achieve success in these areas, it is necessary to get to know and apply the entire strategic planning process when entering the new e-environment.

Materials and Methods

With the purpose of gaining knowledge on the conditions and opportunities for conducting e-business in the Republic of North Macedonia, and the strategic considerations of micro and small enterprises for implementation of e-business solutions, desk and field research was carried out. The desk research identified certain conditions and opportunities of enterprises in the environment of the Republic of North Macedonia, through analyses of data on relevant websites, expert publications, reports, laws and so on. The field research provided information on the implementation of e- business applications and models in enterprises in the country, as well as their strategic approach, more specifically, knowledge on e-environment. The field research on the enterprises was conducted through a questionnaire structured in the following four groups of questions: general data on the business entity, knowledge of the business entity about consumer behaviour on the Internet, conditions for conducting e-business (e-commerce) in Republic of Macedonia, and e-business strategic thinking (strategic approach) of the enterprises, and included 140 enterprises. The data obtained from the survey was processed with a statistical tool from the SPSS software package with the intention of reviewing and determining the need of the business entities to gain insight in the strategic approach and application of the strategic analysis for more efficient implementation of e-business activities in the initial steps of entering the e-market. Following the processed data from the research, a model was proposed for the

strategic approach in the new environment, with the purpose of greater implementation of e-business activities in small and medium enterprises, which was also examined through statistical analysis.

Results and discussion

The results of the research confirm that many obstacles to conducting e-business that previously existed in the Macedonian online space, have gradually began to be eliminated. The liberalization of the telecommunication sector and the reduction of prices for Internet use, the development of broadband internet, the development of e-services of banks, or internet banking and their e-commerce service, the adoption of a legal regulation related to e-business and internet security, ratified international agreements for countering cybercrime, the development of services of digital marketing agencies, the widespread acceptance of the Internet by the citizens, the development of express mail, separate programs and government projects and similar, gradually assist in the development of e-commerce, namely, e-business in Republic of North Macedonia. However, it is necessary to take additional measures and activities for improving the e-business climate, that is, for completely removing the obstacles for conducting e-business. Data from the State Statistical Office of the Republic of North Macedonia (2018, p.4) indicates that almost all of the companies (92.4%) in the country have Internet access. Regarding the e-commerce only 5.7% of the enterprises received e-sales orders via computer networks and 4.4% of the enterprises received orders of products and services via web -sales. The growth of electronic commerce is still not significant enough, given the fact that almost all of the companies in the country use the Internet.

The research outlines (Angeloska-Dichovska & Petkovska-Mirchevska, 2016, p.36) the following five challenges to conducting e-business (e-commerce) in Republic of North Macedonia: concern in regards to privacy and security (46%), insufficient information on starting or implementing e-business (43,4%), consumers not using the technology (35%), finding staff with appropriate experience in e-commerce (29%) and the need of organizational changes (28%).

Research on the Republic of North Macedonia confirms that most bank institutions offer the service electronic commerce to legal entities, thus offering their clients intermediation in the payment in electronic sale of products and services. On the other hand, 60% of micro and small business entities have no knowledge of the e-commerce services of the bank institutions, even though they are a significant partner in their everyday work.

In the country, there are more than ten laws that are applied, which directly or indirectly regulate certain areas of information society, more specifically, of electronic business and electronic commerce. All these laws are an important element in the safe and secure e-business environment of business entities. Furthermore, the country's ratified international agreements on information security increase the security in conducting e-business. However, despite the wide legal regulation that regulates the area related to e-business, in fact, micro (64%) and small (75%) companies are not familiar with it. Digital internet agencies play an important role in the professional presentation of enterprises across the online space. They offer various services related to online working of enterprises as follows: developing and maintaining websites, strategy for performance of social medias, managing social media, creating contents from a marketing perspective, creating contents on blogs, consultation services for internet marketing, optimization of search engines and etc. Although lately there has been a trend of accepting services of digital agencies also by small business entities, still, over 60% of small business entities have stated that they are not familiar with the services of digital marketing agencies. In the previous period, Republic of Macedonia was lacking projects and initiatives directly aimed at development of electronic commerce, especially at electronic business. Some of the government's initiatives that were focused on development of information society indirectly contributed to development of e-business in the country. However, despite the extensive

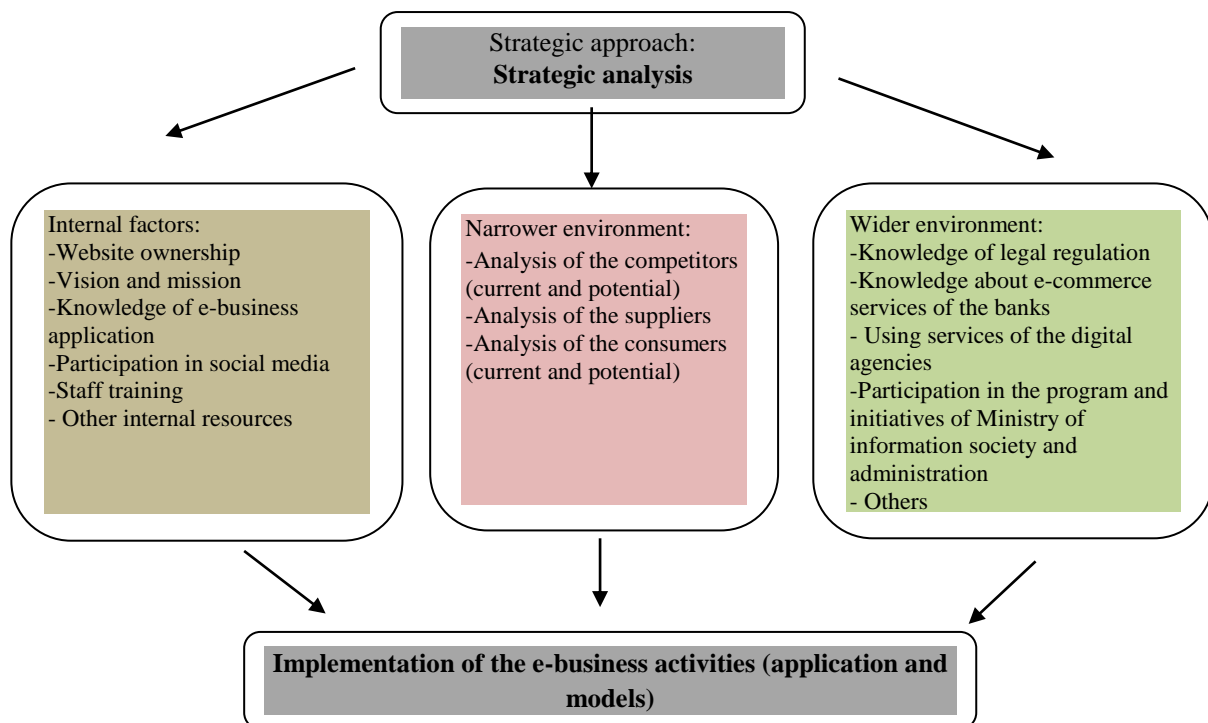
promotion of numerous initiatives (example “100 electronic shops and 100 Macedonian entrepreneurs” and others), over 50% of small businesses are not familiar with the initiative of the Ministry of Information Society and Administration for development of e-commerce (e-business) in the country.

From the analysed data on the strategic approach of the business entities, it can be concluded that Macedonian business entities do have certain elements of a strategic approach in their business operations in regards to the e-environment in the country, but that a complete approach is lacking towards the narrower and broader external and internal e-environment.

Half of the surveyed enterprises (about 51%) do not have elements of e-business (e-commerce) incorporated in their mission and vision. Also, the analyses confirm that small enterprises are facing the problem of insufficient information on the business environment and about the behaviour of their consumers on the internet, as well as the opportunities and conditions for entering the e-market, i.e., for introducing electronic business. The analysis confirms that more than half of the surveyed micro and small enterprises do not have a website.

Based on the received and analysed data from the conducted surveys, as well as the theoretical framework for implementing a strategic analysis, a model emerged for a strategic approach in small and medium enterprises in the Republic of North Macedonia for the necessary steps that need to be made for greater and more efficient implementation of e-business applications and models in the initial steps of entering the e-market. The schematic display of the model of strategic approach is given in Picture 1.

Picture 1 Model of strategic approach



Source: Made according of the analysis from ouw research

By using the statistical tool from the SPSS software package, and the results received from the field research, the need was confirmed for business entities to learn about the strategic approach through a strategic analysis (application of the above-mentioned model in the first phases of applying e-business

applications), because in this way, there is greater implementation of e-business applications and models in their working.

By using the multistage standard regression statistical technique, the interrelationship between the implementation of e-business applications and models and separate predictors of the above-mentioned strategic approach model was determined. The following two predictors or variables from each group of environment were analyzed: knowledge about the legal regulation related to e-business (e-commerce), knowledge about e-commerce services of banks, incorporated elements of e-business in the vision and mission of the company, website ownership, knowledge about e-business activities of competitors and knowledge about the online presence of suppliers. Furthermore, the same technique was used to examine which of the previously stated variables is the best predictor.

The use of the multistage standard regression statistical technique is based on several assumptions. At the beginning, all assumption on which this technique is based on are tested, that is, the relationship between the variables is checked.

According to Tabachnik and Fidell (Pallant2009, p.151), the required sample size that takes into consideration the number of independent variables, whose influence is tested on the dependent variable, is calculated according to the following formula: $N > 50 + 8 * m$, where N is the sample size, while m is the number of independent samples.

Six independent variables have been included in the following analysis, and according to Tabachnik and Fidell, N , or the sample size, should be greater than 98, more specifically, more than 98 business entities need to be included in the sample. Our research included 140 business entities, hence the condition for the sample size has been fulfilled. Next, the multicollinearity, singularity, atypical points, normal distribution, linearity and homogeneity of the dispersion of variables were checked. Table 1 shows the correlation between the variables of the strategic approach model.

Table 1 Correlation between variables of the strategic approach Model

		1	2	3	4	5	6	7
Pearson Correlation	1	1.000	.245	.217	.383	.269	.356	.226
	2	.245	1.000	.400	.319	.079	.203	.042
	3	.217	.400	1.000	.188	.027	.119	.110
	4	.383	.319	.188	1.000	.160	.188	.191
	5	.269	.079	.027	.160	1.000	.138	.233
	6	.356	.203	.119	.188	.138	1.000	.183
	7	.226	.042	.110	.191	.233	.183	1.000
Sig. (1-tailed)	1	.	.002	.005	.000	.001	.000	.004
	2	.002	.	.000	.000	.176	.008	.313
	3	.005	.000	.	.013	.374	.080	.098
	4	.000	.000	.013	.	.030	.013	.012
	5	.001	.176	.374	.030	.	.051	.003
	6	.000	.008	.080	.013	.051	.	.015
	7	.004	.313	.098	.012	.003	.015	.

From the given table it can be seen that between the dependent and independent variables there is a correlation (Pearson Correlation). A medium correlation is evident between the implementation of e-

business applications and models and the incorporation of e-business elements in the vision and mission of the business entity (0,38), and between the implementation of e-business applications and models and knowledge about e-business activities of competitors (0,36). Also, there is correlation of a smaller scale between the implementation of e-business applications and models and the other variables. A separate analysis determined that there is no multicollinearity.

In the text below, the graphic display of the distribution (Normal Probability Plot (P-P)) of the strategic approach model is given in Figure 1. In the given graph, the points are distributed in an approximately straight diagonal line from the bottom left to the upper right corner, which indicates that there are no great deviations from the normality.

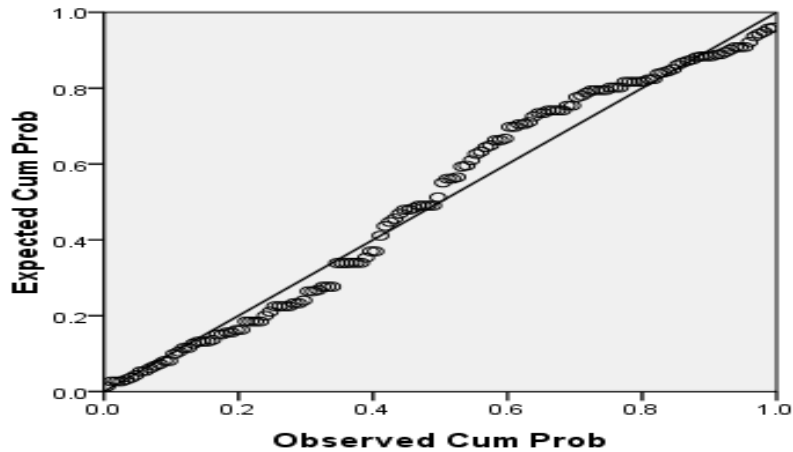


Figure 1 Distributed of the strategic approach model

Figure 2 gives a display of the scatter plot of the strategic approach model. In the given figure, the points are diagonally distributed and most of the points are positioned around the zero, from which it can be concluded that there are no atypical points. According to Tabachnik and Fidell, there are atypical points when the points on the figure are located on a position greater than 3.3 or -3.3.

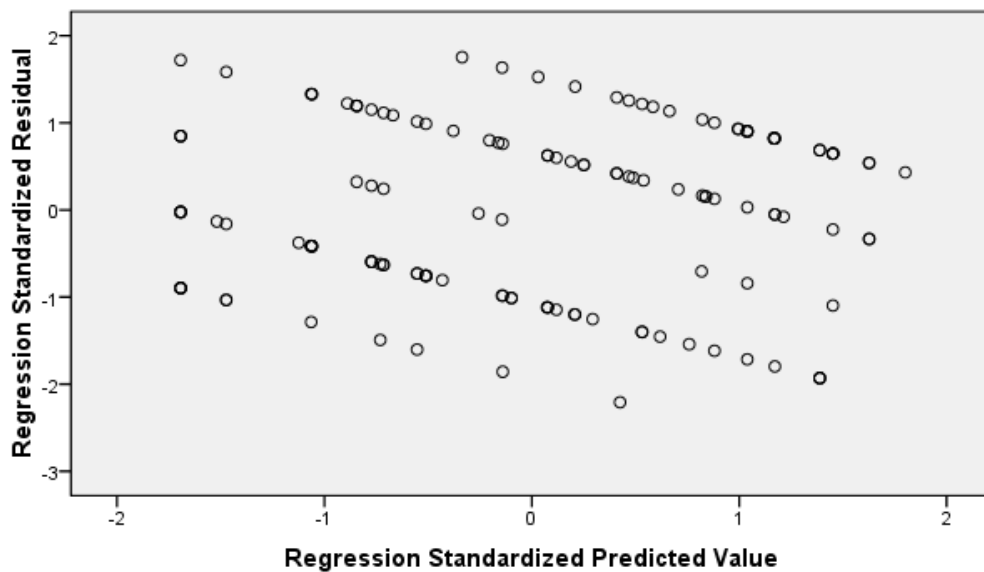


Figure 2 Scatter plot of the strategic approach model

Dependent variable: Implementation of e-business applications and models

Once the assumptions for a multistage standard regression are determined, next is the evaluation of the model. Table 2 gives a summary display of the strategic approach model, where the coefficient of determination r^2 (RSquare) can be observed. This coefficient r^2 shows how much of the dispersion of the dependent variable (implementation of e-business applications and models) is explained by the model that includes the following variables: knowledge about the legal regulation related to e-business (e-commerce), knowledge about e-commerce services of banks, incorporated elements of e-business in the vision and mission of the business entity, website ownership, knowledge about e-business activities of competitors and knowledge about the online presence of suppliers.

Table 2 Summary display of the strategic approach model

Model	R	RSquare	Adjusted R Square	Std.Error of the Estimate
1	,534	,286	,253	1.14644

The summary review shows that the coefficient of determination is $r^2 = ,286$. This data shows that the strategic approach model explains 28,6% of the implementation of e-business applications and models. Right next to RSquare in the table, is the column titled Adjusted RSquare, which is corrected r^2 . Actually, r^2 is an optimistic estimation, hence the indicator Adjusted RSquare corrects that value and gives a better estimation. In this analysis, the Adjusted RSquare is 0,253, which shows that the strategic approach model (analysed variables from the model) supports 25,3% of the implementation of e-business applications and models. With the purpose of checking the statistical significance of this indicator, the ANOVA test is used for determining the statistical significance. The statistical significance is Sig. = ,000, namely, it indicates that $p < 0,0005$, which confirms that this data is statistically significant (Table 3).

Table 3 ANOVA test of the strategic approach Model

ANOVA ^b						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.882	6	11.647	8.862	.000 ^a
	Residual	174.804	133	1.314		
	Total	244.686	139			

a. Predictors: knowledge about the legal regulation related to e-business (e-commerce), knowledge about e-commerce services of banks, incorporated elements of e-business in the vision and mission of the company, website ownership, knowledge about e-business activities of competitors and knowledge about the online presence of suppliers

b. Depend Variable: implementation of e-business activities (applications and models)

Table 4 shows the values of the individual impact of the variables of the strategic approach model. From the Beta column in the section Standardised Coefficients it can be seen how much each independent variable in the model contributes to the prediction of the dependent variable.

Table 4 Values of the coefficients for the independent variables in the strategic approach model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.326	.531		-.613	.541	-1.377	.725
	Knowledge about the legal regulation related to e-business (e-commerce)	.156	.239	.055	.651	.516	-.318	.630
	Knowledge about e-commerce services of banks	.293	.228	.103	1.283	.202	-.158	.744
	Incorporated elements of e-business in the vision and mission of the company	.683	.211	.258	3.241	.002	.266	1.099
	Website ownership	.446	.202	.168	2.207	.029	.046	.846
	Knowledge about e-business activities of competitors	.652	.203	.246	3.208	.002	.250	1.055
	Knowledge about the online presence of suppliers	.124	.121	.079	1.023	.308	-.116	.363

Of a total of six independent variables included in the model, the variable incorporating elements of e-business in the vision and mission of the business entity gives the greatest individual contribution (0,258) to explaining the initial implementation of e-business applications and models. Knowledge about e-business activities of competitors (0,246) and website ownership (0,168) also make statistical significant individual contribution.

From the analysis that has been conducted by using the multistage standard regression statistical technique, it can be concluded that the given strategic approach model for micro and small enterprises in the initial steps of entering the e-market, which includes knowledge about the legal regulation related to e-business (e-commerce), knowledge about e-commerce services of banks, incorporated elements of e-business in the vision and mission of the business entity, website ownership, knowledge about e-business activities of competitors and knowledge about the online presence of suppliers, supports 25,3% of the dispersion of the implementation of e-business applications and models.

Conclusions

Working conditions of enterprises are becoming increasingly more uncertain and dynamic with everyday technological innovations, and even more complex for smaller businesses that have limited material and human resources. Enterprises that use digital technologies and the Internet in their business activities, become more competitive and more efficient, while time and space limitations disappear for them. With the Internet, our everyday way of life changes, the needs and behaviours of the modern consumer change, and all this imposes changes to the traditional business processes as well. The Internet is becoming a very important business tool for sharing information, buying, selling, communication and cooperation.

The conclusion that has emerged from the results of the research is that Macedonian micro and small enterprises are not sufficiently familiar with the conditions and opportunities of conducting e-business

(e-commerce) in the country, that is, more than 60% of micro and small business entities do not have knowledge about e-commerce services of banking institutions, there is little information on legal regulations related to e-business, there is little knowledge among them about services that digital marketing agencies offer (60%), as well as the possibilities for developing e-business activities offered by national programs and projects in the country. For the purpose of accelerating the process of introducing e-business in the country, it is necessary to take direct measures to eliminate the existing barriers for conducting e-business (e-commerce).

The statistical analysis determined the interrelationship between the implementation of e-business applications and models and separate variables of the strategic approach model, namely, the variable incorporating e-business elements into the vision and mission of the business subject, gives the most individual contribution to the explanation of the initial implementation of e-business applications and models in micro and small enterprises. Also, knowledge about e-business activities of competitors and website ownership have statistically significant and individual contribution. These elements need to be taken into consideration in the first steps when entering the e-market.

In order to increase the implementation of e-business applications and models in enterprises, especially in micro and small enterprises, it is necessary to follow the steps of strategic planning when entering the e-market, on which base is the strategic analysis of e-environment.

The statistical analysis points to the conclusion that greater knowledge of the factors from the narrower and wider e-environment and having appropriate internal elements and resources lead to a strategic decision on e-business, that is, it will lead to greater implementation of e-business applications and models in Macedonian enterprises. Hence, the need for a strategic approach of micro and small business entities towards the e-environment and continuous monitoring of changes in the competitive environment, with the purpose of greater implementation of e-business solutions.

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**MUTUAL IMPACT OF DIGITAL MARKETING IN THE
RELATIONSHIP
ENTERPRISE – CUSTOMER**

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Abstract:

In the contemporary world, the enterprise operates in an increasingly fierce competition situation. Today, the consumer is surrounded by a variety of products and services that meet their needs and desires. Therefore, a genuine marketing interaction strategy is needed to harmonize these interactions and maintain the viability and profitability of the enterprise. It is precisely in this respect that the role of mutual marketing is needed to establish long-term relationships with consumers. This discipline encompasses customer satisfaction with the product and services offered to provide a customer life cycle that is more conducive to enterprise and sustainability of its development.

This study, through a model, explains the interaction of consumer and enterprise marketing with digital marketing, taking into account several explanatory variables such as: consumer satisfaction, reciprocal consumer relationships, consumer loyalty, and longevity. The research is based on a survey involving 300 customers of three of the largest local trading companies in Kosovo, such as Viva Fresh Store, ETC and Interex.

Key words: *Digital Marketing; Enterprise; Customer.*

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1. Introduction

Relationship between product and consumer in the context of marketing is a discipline that supposed have been created in 1980 and that aims to establish a long term relationship of enterprise with clients, especially in terms of personal relationships. This discipline involves a proper understanding of the client's needs through understanding and in line with the customer life cycle. Economist Schneider B. considered to be the father of this discipline, who observed in 1980: "The bitter surprise is for market researchers and businessmen focused on traditional promotion mechanisms, when they learn that for a very banal reason, their product is not suitable for the majority of customers".

The first research on this topic was conducted by Christian Grwnroos in 1982 at the Swedish school of Economics, describing what was included in the word "interactive marketing." The term "marketing of interpersonal relationships" has since been defined by Len Berry. The subject was also touched upon a year later by the first generation of marketing theorists including Professor Theodore Levitt at Harvard University, who was attempted to study marketing methods through individual transactions. Levitt is also famous for its theory of globalization. He is the man who created it this term, as an example of how the American way of life would affect the whole world, enabling identical goods to be sold in different countries. Actually, direct relations existed at the time under the concept of contacts between businesses, but in the 90's they were first used in retail. Today at worldwide, there are special companies that provide interactive marketing services only. As the market has become more competitive and the threats to absorb new entrants have increased, different companies need to consider ways to develop relationships with their existing customers in order to protect their market share. To do so, they must understand how interactive marketing has evolved. Interactive marketing has been facilitated since the 90's, with the development of technology and especially the internet. In the days of some technology thanks to the internet marketing operations have taken a huge hit. I'm saying all marketing activities are internet based and that's why it's called internet marketing or better to say Digital Marketing. So, the theory that creating new clients is very costly has also changed the concept entirely developing country markets (Anderson, 2000).

2. Theoretical approach

The interactive marketing or consumer behavior literature describes the potential benefits to customers and the company of managing its business and strategic performance. The literature calls for relationship building so companies can build trust and loyalty, developed by long-term strategies and to be pro-active for customer needs (Anderson, Fornell and Lehman, 1994; Anderson, 2000). Previous research has shown that there is a strong and positive relationship between the variables of service quality and customer satisfaction (Rust and Oliver, 1994; Fornel 1996). But there have been no genuine studies to identify the "power" created by relationship marketing interactions when applied through online marketing. Finding critical service variables can lead service firms to seek comprehensive strategies for achieving sustainable competitive advantage and identifying the power of relationship marketing, online marketing (Matzler, 2004) and the synergy effect created by theirs interaction. Moreover, relationship marketing plays an important role in their attitude, between the variables of service quality and customer behavior.

Interactive marketing or consumer behavior literature describes the potential benefits to customers and the company of managing its business and strategic performance. The literature calls for relationship building so companies can build trust and loyalty, developed by long-term strategies and to be pro-active for customer needs (Fornell and Lehman, 1994; Anderson, 1999). Some of the

existing empirical studies appear to lack the necessary theoretical and analytical consistency and this has been seen as a pressing requirement for the future, for an analysis of consumer behavior (Matzler and Sauerwein, 2002).

Development of technologies and management styles in society, and consequently in the business world, are numerous and need to be understood and analyzed in relation to one another to fully understand their reach and the opportunities they offer. Interactive marketing and online marketing has brought rapid growth for some companies, but is causing great concern for others (Rayport and Jaworski, 2001). Academics and researchers alike have speculated on whether existing marketing tools are suitable for online marketing or not (Rayport and Jaworski, 2001).

Internet marketing, otherwise called e-marketing is the marketing of products or Internet services. When it comes to e-marketing we should not narrow it or downsizing the concept in e-commerce only. E-commerce includes any transaction that is executed electronically between the parties, such as: between companies (business-to-business), between companies and customers (business-to-consumer), between business and the public sector (business-to-government) and between the public sector and customers (government-to-consumer). People they often remember that e-commerce is primarily the visit that customers different make web sites to buy, but this is only a small part of the trade.

The most important and rapidly growing part of e-commerce large are transactions that make purchases easier for companies. This growth is stimulated also by increasing internet access, user reliability, better systems payments as well as improved internet security. E-commerce offers opportunities even for small business, giving them the opportunity to market and sell with lower cost worldwide and giving the opportunity to extend directly to the globalmarket. For distributors and retailers the internet provides the easiest opportunity to be complete supplier. Unlike "offline" type suppliers, which are often tried from the inventory at their disposal or the services they rendered somewhere in a warehouse, e-commerce sites can give the illusion of having endless inventory, responding to offers. This can be achieved by placing a web page information on products and services, but once agreements have been reached with external suppliers for the provision of services and transport. With an agreement such, consumers may be given the feeling that they are trading with suppliers they offer full service, while in reality a significant percentage of products and services are provided from other sources.

Internet technologies are replacing the more costly methods for the transport of goods and services, and the management of information on customer needs. Cost reduction can be clearly seen in products and services that can be digitally distributed (e.g., music, publications, graphic design, etc.), where production and shipping costs have been substantially eliminated from the cost equation. The Internet brings numerous and unique benefits to marketing, including low cost in the dissemination of information and thus plays the role of a media audience global. The interactive nature of e-marketing giving a quick response to the customer, the potential for the product or service offered is special quality for this type medium. This kind of marketing brings together the creative and technical aspects of the internet, including design, development, publicity and sales.

3. The relationship between variables and online marketing

The growth in internet marketing and the emergence of internet commerce, as a result of the great development of the internet, makes it necessary for those involved in marketing to capitalize on the advantages enabled by information technology in order to be competitive. The key component of

internet marketing is its ability to improve an organization's marketing program by identifying customers who are more attracted to a specific offer. In fact, competent internet marketing practice needs to be integrated with other marketing practices and strategies. The interactive web environment and introduction of internet marketing, pose a proven and clear opportunity for firms to leverage maximum benefits in online marketing. Although the basic principles of internet marketing are the same, integrating the web into the internet marketing process allows communication and personalized interaction.



Fig. 1: The relationship between variables and online marketing

In order to have a good comparison basis, even in this relationship it has been evaluated that its main attributes are: consumer satisfaction, quality communication, longevity of customers, their loyalty, customer retention and profitability, recommendation and database. One of the main variables of service quality, in relation to internet marketing, is communication, which in this relationship serves as locomotive for other variables.

4. Research questions

Perhaps the current marketing principles, the basic and elaborate ones, do not refer to or represent the exact problems of interactive marketing and the Internet? Many researchers have identified the power of interactive marketing or online marketing in different sectors. But at a time when the development of these two forms of marketing is moving in parallel and at high growth, is there any additional power from their interaction? There are four research questions that this study attempts to answer:

1. What is the power (competitive advantage) that is achieved by the marketing application of relationships through variables of this form of marketing?
2. What is the power of relationship marketing variables under the influence of internet marketing?
3. What is the relationship between the importance of relationship marketing variables and internet marketing?

This study is an attempt to delve deeper into the constituent variables of interactive marketing and how these variables are affected by the impact of technological development. We have seen as important the seven variables taken from marketing theories, which appear to be a way of measuring interactive marketing. The treated variables of Relationship marketing are:

- Customer Satisfaction
- Communication
- Database
- Customer loyalty
- Consumer life expectancy
- Consumer recommendation
- Customer retention

5. Purpose of the search

The purpose of this research is to create a framework that evaluates the relationships between enterprise and consumer and the impact of internet marketing in this relation, identify the power of interactive marketing. Moreover, the consumer satisfaction as a base of consumers faithfulness keeping longevity through database communication. Also, showing the impact of Internet Marketing effecting of synergy of marketing mix activities of enterprise.

This paper focuses in the Kosovo trade sector (customer satisfaction variable, communication, database, customer loyalty, longevity, recommendation and retention consumer) and identify the power of the internet in the marketing implementation of relations.

6. Data analyses

The main objective of this study was to investigate the customers of the three largest commercial centers in Kosovo and the behavior of their employees. To determine these investigations, study points are defined according to the components of this service. Based on the above explanation, 28 questions represent the theoretical basis of the questionnaire. Study questions were reviewed and tested before the distribution process began. The process of screening the questionnaire went through three stages to properly control the factors taken into account. From the customer relations point of view, the first phase of selecting questionnaire questions, drawn from consumer loyalty cards such as: quantity of purchase number of purchases over a period of time etc. Research is defined as “a systematic process in collecting and analyzing information, in order to increase our understanding of the phenomenon we are about concerned or interested” (Leedy and Ormrod, 2010). Key points in this Definition is the systematic steps and logical ways of collecting and analyzing it study data, which represent the main research steps that are defined by the methodology.

The sample size for this study should be around 300 survey. The most important customer service questions are defined within the relevant set of questions. Usually, these questions are used by these secret businesses to manipulate customer behavior. In the second phase Interviews were analyzed with the managers of these businesses in order to add or remove study factors, where possible, as recommended by participants representing the business side. The first draft of the questionnaire was prepared according to these questions. The methodology is described as: "the steps to be taken in order to give reliable and valid answers to those questions and determines suitability in a definite research tool" (Ellis and Levy, 2008, p.21). In this way, these theses investigate the problem of consumer

retention using one organized, systematic and justified investigation of data, based on a framework theoretical, to help find a suitable solution.

Data analysis was done based on predicted evaluation indicators and the main findings of the study. The data provided by the survey were recorded in one special database for relevant computer analysis, interpretation and argumentation of the main findings of the study. Data will be processed by SPSS 20.0, where are used the methods of alternating. Based on the data distribution, we will focus mainly on the analysis of linear regression. Linear regression analysis is used to estimate the statistical dependence between variables. One of the advantages of regression analysis is that the method provides a model for all attributes and forms an overall estimate. As a result, multiple regression analysis assesses the degree of influence attributes have on determining of consumer satisfaction. The main problem with this approach is the multicollinearity between the independent variables.

$$\text{Overall consumer satisfaction} = \alpha_0 + \alpha_1 X_1 + \dots + \alpha_n X_n + \varepsilon$$

In the correlation analysis, the goal is to determine the strength of the linear relation between variables, while regression coefficients indicate the difference of mean Y, when the corresponding variable varies for one unit and other factors are kept constant. The significant difference between these two analyzes is that in the regression analysis, the dependent variable is stochastic, and independent variables are assumed to be fixed. On the other hand, in correlation analysis does not make the difference, the dependent variable - the independent variable, but both variables are taken as random.

H1: The impact of variables together (customer satisfaction variable, communication, database, customer loyalty, longevity, recommendation and consumer retention) has a significant impact on the interactive marketing of enterprise.

Using multiple regression analysis, for constructs created by modeling the structural equation with categorical variables, are seen the value of Pvalue and e compare it with the coefficient α (0.05). In hypothesis H1 we treated all variables together, to identify their importance and the impact that each of them has, when they interact with each other in relationship marketing. In our case, Pvalue H1 = (0.00) < (a) 0.05. This indicates that H1 is statistically supported by the results of testing. So the variables taken into consideration together are important in the marketing of relations. Statistically significant deduction (indirect method) was used to derive the significance of the variables was calculated from customer satisfaction or product performance surveys. Then, the data are analyzed by one of the statistical methods (multiple regression analysis or structural equation modeling), normalizing the estimation and using the least squares model partial toddlers (Danaher and Mattsson, 1994; Wittink and Bayer, 1994; Taylor, 1997; Varva, 1997; Anderson and Mittal, 2000; Chu, 2002).

Table 1. Coefficients (Model Summary) - Relationship marketing through traditional marketing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.297 ^a	.680	.640	.44096	.680	3.740	5	194	.000

Meanwhile, from the statistical indicator of R^2 we understand that all seven variables together explain 68% of relationship marketing when is applying traditional marketing and we emphasize that multicollinearity exists in this relationship, (table 1). Whereas from the analyses of data processing,

we see that $R^2 = 85\%$, which means that based on the latter survey, all variables together explain 85% of relationship marketing applying online marketing (Table 2). These conclusions are in line with the theories of marketing researchers, whose studies emphasize that relationship marketing is considered to involve the activities of enticing, maintaining, and enhancing customer relationships in an organization. Thus, relationship marketing considers both offensive and differential marketing strategies while at the same time incorporating elements of customer service.

Table 2. Coefficients (Model Summary) - Relationship marketing via Internet

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.388 ^a	.855	.840	.34022	.855	3.740	5	194	.000

From the Anova (table 3) we see that the model as a whole is good because Pvalue = 0.00, which means that the constructed relationship marketing model and its constituent variables, is significant within the 95% confidence interval. We reach the same conclusion even if we interpret F from the Anova table.

Table 3. Anova

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	171.721	6	24.732	93.263	.000 ^a
Residual	83.285	322	.263		
Total	266.113	332			

Referring to the respective coefficients table (coefficients of the TOT - MM model), we find that the variables of satisfaction, longevity, communication, database, recommendation and consumer retention, when the variables are treated together, are important for relationship marketing, since for these variables, Pvalue = 0.00 < 0.05. Whereas, the consumer life expectancy variable does not statistically supported, so businesses should work on it, as this is the consumer perception given through the survey.

Table 4. Coefficient table

Model		Unst. Coeff.		St. Coeff	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.212	.533		-.588	.592
	Customer satisfaction	.244	.122	.224	2.122	.039
	Communication	.266	.133	.166	1.777	.023
	Database	.106	.067	.114	1.116	.030
	Customer loyalty	.455	.121	.289	3.676	.045
	Longevity	.233	.141	.153	1.554	.021
	Recommendation	.005	.125	.251	2.433	.077
	Retention consumer	.240	.101	.388	4.933	.550

7. Discussions and results

One of the most rewarding results of this search is finding the additional, effect synergy, where the variable is applied via the Internet, for the purpose of implementation of relationship marketing. Simply saying synergy can be described as power of $2 + 2 = 5$. Ansoff (1965) identifies the concept of synergy as a collaboration of two or more activities of an enterprise for mutual benefit. Liedtka (1998) explains that the purpose of the synergy is to explain the economics of scale and reduce redundancy. For our goals, companies that operate virtually, in the concrete case of banks second level, are composed of a sequence of very close relationships and marketing professionals who are also intertwined with each of the variables, internet marketing and technology. The concept of synergy is central to successful operation of the virtual organization. The concept of synergy itself advocates harmony and value as a central aspect of its successful implementation. To measure and identifying the effect of synergy, we based our change on the R^2 indicator. Comparison of R^2 for identifying additive effect from interaction (customer questionnaire).

Referring to the summary data of the R^2 comparison for identifying the additive effect of the interaction, there are positive changes from the first model (variables together - imaging marketing) to the other model (variables together via internet - imaging marketing). In the first case, all variables together explained 68% of relationship marketing, while in the other model, variables together explained 85.5% of relationship marketing via the Internet. So an increase in weight of 18.5%. From this we conclude that the variables treated, taken together under the influence of the Internet, occupy a greater weight in relationship marketing than when used in the traditional way. By increasing their importance, they lead to their own growth the weight of relationship marketing in total marketing strategies and policies.

8. Limitations

Since we used qualitative data in our study, we were limited to using statistical methods with categorical variables. The data were not continuous and as a result we cannot make quantitative predictions about the impact or changes of variables on the quantitative measures in the models raised.

Another limitation of this study is that the sample belongs to only the three largest trading companies, although their selection best represents the harmonization of traditional forms of marketing with virtual ones in the commerce sector.

Another limitation is that the study refers to the consumer market (B2C) and omits the research, industrial businesses (B2B) market are not included.

9. Conclusions

The results of this research have practical implications for all companies and especially for those operating in the commerce sector. This is due to the fact that the findings of this research suggest that the variables taken into consideration and especially consumer retention, communication, database, consumer lifespan and recommendation, are very important for building customer relationships. Herewith, is argued that understanding the relationship between relationship marketing variables and the internet is vital on businesses development. Firms are already using the internet for their marketing processes and are improving customer relationship management. Essentially, it is shown that the

implementation of internet marketing brings solutions to many difficulties in managing customer relationships, enabling an interactivity in personalized marketing. For example, the Internet offers benefits such as: high accuracy and speed in collecting customer data, cost savings in data collection, greater influence, more personalized relationships, cost effective in their interaction and better customer relationship.

Technological companies need to pay much more attention to these variables if they want to become competitive in this dynamic and, at the same time, so "modern" and virtual marketplace. In recent years, at a time when technological development is moving at a galloping pace, there must be a growing interest among companies in cultivating consumer relationships. The reason for this lies in the fact that Kosovo's companies, and not only, need to understand that building long-term customer relationships offers a way to increase their satisfaction, reduce their departure rates, reduce costs and increase revenue. Moreover, this research goes further with its practical contributions, recommending to these companies that the strength of each variable would be higher by increasing the attribute and relationship marketing self-efficacy if internet marketing was applied for the above purposes. Relationship marketing business-consumer should be implemented by all businesses in Kosovo and not only. Additionally, with market development and clear customer segmentation, will be increased brand loyalty and increased competition. Now is the imperative to recognize and apply this modern marketing form as crucial for success in doing business.

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**CHOICE OF LAW IN ELECTRONIC CONSUMER CONTRACTS
WITHIN EUROPEAN UNION AND REPUBLIC OF NORTH
MACEDONIA**

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Abstract:

Subject: *The subject of this paper is the presentation the system of choice of law rules for electronic consumer contracts in the law of the Republic of North Macedonia and the European Union Law, through a normative analysis of the Regulation (EC) No. 593/2008 of the European Parliament and Council of 17 June 2008 on the law applicable to contractual obligations (The Rome I Regulation) and the Macedonian Law on Private International Law.*

Method: *The study of this paper's subject will be primarily realized by applying the method of normative analysis, the methods of comparison and the case law method.*

Aim: *The aim of this paper is to give a comparative overview of the collision law protection to consumers who conclude consumer contracts on line in European Union and Republic of North Macedonia, as well as to give an answer to the question to what extent is the Macedonian system harmonized with the EU's system in this very important judiciary segment.*

Conclusion: *In the paper's conclusion certain recommendations and guidelines for amending the Macedonian legislation will be provided in the direction of harmonization with the European Union Law and more effective protection for Macedonian on line consumers.*

Keywords: *choice of law, electronic consumer contracts, Rome I.*

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Introduction

With the development of e-commerce, markets are expanding and consumers are becoming increasingly involved in the cross-border trading process. The international nature of e-commerce, on the one hand, offers numerous opportunities for both consumers and traders, but on the other hand it also contains numerous challenges for the protection of consumers who shop online. Namely, consumers have the benefit of a wide selection and lower prices of the products and services offered to them, while traders, in turn, have the opportunity to conquer new consumer markets and to profit heavily from e-commerce, as a result of increased supply and reduced transaction costs. However, the consumer who contracts online with an overseas trader can no longer rely solely on the provisions of national law enabling him protection. The predictability of the law can easily be "lost" in an on-line transaction. Therefore, a situation could arise where the consumer would be left unprotected by the application of the law of a particular foreign state, which he does not know at all. The consumer is traditionally considered to be the weaker party to the contract, as electronic consumer contracts are usually adhesion contracts, i.e. the contract terms are designed by the trader and the consumer cannot negotiate or change them. These kinds of contracts are concluded on the "take or leave" principle. Thus, if all contractual terms in electronic consumer contracts are designed by the traders, exclusively and solely for his benefit, this means that the consumer is weaker in both, contractual and economic terms. Consumers must therefore be encouraged to participate in and gain confidence in e-commerce. On the other hand, enabling consumer protection by applying the law of the state in which his or her habitual residence or domicile is located, in all cases where the consumer concludes a contract with a foreign trader, can place an enormous burden on on-line transactions. The risk that a trader could be sued in any jurisdiction by applying any applicable consumer law may deter him from practicing on-line business. If a trader is potentially exposed to all existing legal systems, it would imply that there is no legal certainty for him. Therefore, uniform transaction rules are needed to balance the interests of traders and the interests of consumers. In this regard, Simone van der Hof emphasizes that it is necessary, on the one hand, to provide protection for consumers who sign contracts online, and on the other, to provide foresight for online traders.²

The determination of the electronic consumer contracts

Defining electronic consumer contracts is an intriguing task. In the simplest sense, electronic consumer contracts are contracts that are concluded electronically, i.e. over the Internet. Accordingly, the Internet is a mean or medium of communication for the parties who use it to reach a contract with one another.³ According to Sikirić, the contract can be encouraged via the Internet, the contract can be concluded via the Internet and the contract can be executed via the Internet, i.e. three situations may arise: first, the contract can be encouraged via the Internet, until the actual signing and execution of the contract is done online. For example, the electronic site is only an advertisement and offers the consumer the only opportunity to obtain certain information, but not the opportunity to enter into a contract; secondly, the Internet can be used to encourage contracting and contracting through the internet, but contract execution in no way depends on the internet and thirdly, the Internet can

²Van der Hof S., 2003, *European conflict rules concerning international online consumer contracts*, Information and Communication Technology Law, Vo.12, No.2, London, p.163.

³ Gillies L., 2013, *Electronic Commerce and International Private Law*, Hampshire, p. 23-24.

encourage contracting, concluding and executing. For example, a software license contract or a contract to use certain information services from a particular institution.⁴

The Directive 97/7/EC, in Article 2 (1) the distance contract defines as: *“any contract concerning goods or services concluded between a supplier and a consumer under an organized distance sales or service-provision scheme run by the supplier, who, for the purpose of the contract, makes exclusive use of one or more means of distance communication up to and including the moment at which the contract is concluded.”*⁵

Whereas, in Directive 2011/83/EU, in Article 2, paragraph 7, the distance contract is defined as: *“any contract concluded between the trader and the consumer under an organized distance sales or service-provision scheme without the simultaneous physical presence of the trader and the consumer, with the exclusive use of one or more means of distance communication up to and including the time at which the contract is concluded”*⁶

In the Law on Consumer Protection of the Republic of North Macedonia⁷, the distance contract is defined in the provision of Article 84: *“a distance contract is a contract concluded between the trader and the consumer within the organized sale of products or the organized delivery of services by the trader who, at the time of concluding the contract, only uses one or more means of distance telecommunications.”*

Hereby, the means of distance communication are: *“... those assets which are suitable for concluding contracts between the trader and the consumer without the simultaneous physical presence of the trader and the consumer. The assets referred to in paragraph 1 of this Article, inter alia, are: addressed and unaddressed printed materials, standard letters, printed advertisement with order form, catalog, telephone with or without human intervention, radio, videophone, video text, fax, television, electronic mail and similar.”*

According to the Law on Electronic Commerce⁸, in the Republic of North Macedonia, electronic contracts are those: *“contracts which legal or natural persons, in whole or in part, conclude, send, receive, terminate, cancel, access and display electronically, using electronic, optical or similar means, including but not limited to online transmission (Internet).”*

In this regard, we can conclude that the contracts in electronic form, in accordance with the positive regulations in our state, are part of the contracts concluded at a distance.

Based on this definition, as well as the definition of the term consumer contract in the Law on International Private Law⁹, the term electronic consumer contract with a foreign element in our legal system may be defined as: *“the contract for the delivery of movable property or rights of the consumer and the contract for the performance of consumer services, which, in whole or in part, the parties conclude, send, receive, terminate, cancel, access and display electronically, using electronic, optical or similar means, including but not limited to online transmission (Internet).”*

⁴Sikirić H., 2006, *Mjerodavno pravo za ugovore u elektroničkoj trgovini u Hrvatskom I Europskom međunarodnom privatnom pravu*, Zbornik PFZ, 56, Posebni broj, Zagreb, p. 741.

⁵ Directive 97/5/EC of the European Parliament and of the Council of 27 January 1997 on cross-border credit transfers, Official Journal L 043 , 14/02/1997

⁶ Directive 2011/83/EU of the European Parliament and of the Council of 25 October 2011 on consumer rights, amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council Text with EEA relevance , Official Journal L 304 , 22/11/2011

⁷ Law on consumer protection, Official Gazette of Republic of Macedonia, no. 38/2004 from 17.06.2014, 77/2007, 103/2008, 24/2011, 164/2013

⁸ Law on Electronic Commerce, Official Gazette of Republic of Macedonia, no. 133/2007, 17/2011

⁹ Law on Private International Law, Official Gazette of Republic of Macedonia, no. 87/2007, 156/2010

By becoming a means of fast and inexpensive communication available to every individual, the Internet enables international contracts to be concluded with strangers. In this context, there is a need for the adoption of specific legislative norms for electronic consumer contracts in both the EU and the US law. This discussion includes the necessary distinction between active and passive electronic sites, the activity of electronic sites as an economic activity in the forum state, the location of the server as a test of international competence, and the relevance of the site of the recipient of the products and services.¹⁰ In legal theory and practice, contracts that are concluded by clicking on a particular button or so called *click wrap contracts* are particularly well known, as well as the contracts that are concluded by browsing or *browsing contracts*. These kinds of contracts in electronic business and the electronic commerce law originate from the so-called *shrink wrap* contracts, that is, contracts that are concluded in short manner.

Legal literature, as a new type of electronic consumer contracts, also refers to the so-called "*M-contracts*", i.e. contracts concluded with the use of a mobile phone.¹¹ Further, another type of consumer electronics contracts is "*virtual contracts*." These types of contracts are concluded in the "virtual world" (VW), mainly for on-line games. The question that will be addressed in this regard and which will be analyzed is whether e-commerce and the Internet in general have an impact on the nature and content of the provisions of international private law? Certain theorists have suggested that electronic consumer contracts cannot be governed by traditional rules of international private law, while other theorists point out that the Internet only increases the number of such contracts, but does not change their essential purpose.¹²

The law applicable to electronic consumer contracts in the light of European Union legislation

The legal protection of consumers who conclude electronic consumer contracts, within the European Union, is practically identical to the protection of consumers who conclude traditional consumer contracts. Although, there have been proposals, in this respect, to determine specific choice of law rules for electronic consumer contracts, given their specific form, neither in Rome I nor in the Roman Convention have these proposals been accepted. Accordingly, Article 6 of the Rome I Regulation and Article 5 of the Rome Convention apply to electronic consumer contracts as well. In this section, the normative analysis of the provision of Article 6 of the Rome I Regulation will be made.¹³

¹⁰ Charles E. F. R., Thomas G. W. T., 2003, *International Perspectives on Consumers' Access to Justice*, Cambridge, p. 18.

¹¹ Pavan D., 2013, *Law of Contracts & Use of Mobile Devices*, New Delhi, p. 15.

¹² Draf O., 1999, *Selected Issues of Private International Law and of Contracts on the Internet*, Montreal, p.7-9.

¹³ Article 6: "1. Without prejudice to Articles 5 and 7, a contract concluded by a natural person for a purpose which can be regarded as being outside his trade or profession (the consumer) with another person acting in the exercise of his trade or profession (the professional) shall be governed by the law of the state where the consumer has his habitual residence, provided that the professional: (a) pursues his commercial or professional activities in the state where the consumer has his habitual residence, or (b) by any means, directs such activities to that state or to several states including that state, and the contract falls within the scope of such activities. 2. Notwithstanding paragraph 1, the parties may choose the law applicable to a contract which fulfils the requirements of paragraph 1, in accordance with Article 3. Such a choice may not, however, have the result of depriving the consumer of the protection afforded to him by provisions that cannot be derogated from by contract by virtue of the law which, in the absence of choice, would have been applicable on the basis of paragraph 1. 3. If the requirements in points (a) or (b) of paragraph 1 are not fulfilled, the law applicable to a contract between a consumer and a professional shall be determined pursuant to Articles 3 and 4. 4. Paragraphs 1 and 2 shall not apply to: (a) a contract for the supply of services where the services are to be supplied to the consumer exclusively in a state other than that in which he has his habitual residence; (b) a contract of carriage

The definition of the term consumer contract, according to the Rome Convention, as a precursor to Rome I Regulation, created obstacles to the legal protection of consumers concluding electronic consumer contracts whose subject matter was, for example, downloading software which was considered neither as "product" nor as a "service", according to certain legal systems.¹⁴ Contrary to the expectations of some authors, rather than explicitly incorporating "intangible products" into the subject of consumer contracts, in the definition contained in Rome I Regulation the subject of consumer contracts is completely omitted. Article 6 is therefore technologically and technically neutral and applies to consumer contracts irrespective of their subject matter. The need for modernization should be seen in the context of the development of electronic communications and the independent development of electronic bargaining. Thus, the Green Paper emphasizes the need to change the framework of international private law for contractual relations in order to comply with the development of "distance selling techniques."¹⁵

Pursuant to Article 6, paragraph 1, if the parties have not made a choice of law, the consumer contract shall be governed by the law of the State in which the consumer has his habitual residence, provided that the trader:

a) has undertaken commercial or professional activities in the state in which the consumer has his habitual residence;

(b) in any way, has directed such activities to that State or to several States, including that State.

Pursuant to Article 6, paragraph 2, if the parties have made a choice of law, the chosen law shall apply in accordance with Article 3. Furthermore, the consumer shall, however, be protected by the ius cogens norms of the law of the State in which his habitual residence is, insofar as the conditions referred to in Article 6 (1) are fulfilled. Consequently, Article 6 protection is afforded to the consumer only if one of the alternative conditions laid down in Article 6 (1) (a) and (b) is fulfilled. Pursuant to the first condition of Article 6, paragraph 1, the contract must be concluded by a consumer and a trader who undertakes commercial or professional activities in the state in which the habitual residence of the consumer is located and the contract must be covered by such activities. However, the meaning of the word "take over" is not explained in this Article. According to Øren, the meaning of the term "take over" should be understood as: first that the commercial and professional activities are carried out continuously and systematically and second a more comprehensive notion of business arrangements, resources, and transactions, compared to the second condition "he directed them to."¹⁶ In this respect, it could be concluded that the meaning of this requirement presupposes the presence of a business in the state in which the habitual residence of the consumer is situated, for example through a business unit, agent or the like.

other than a contract relating to package travel within the meaning of Council Directive 90/314/EEC of 13 June 1990 on package travel, package holidays and package tours (1); (c) a contract relating to a right in rem in immovable property or a tenancy of immovable property other than a contract relating to the right to use immovable properties on a timeshare basis within the meaning of Directive 94/47/EC; (d) rights and obligations which constitute a financial instrument and rights and obligations constituting the terms and conditions governing the issuance or offer to the public and public take-over bids of transferable securities, and the subscription and redemption of units in collective investment undertakings in so far as these activities do not constitute provision of a financial service; (e) a contract concluded within the type of system falling within the scope of Article 4(1)(h)."

¹⁴ France, for example.

¹⁵ Green Paper on the conversion of the Rome Convention of 1980 on the law applicable to contractual obligations into a Community instrument and its modernization [327KB] COM(2002) 654, January 2003, p.28, sec.3.2.7.2.

¹⁶ Øren St.J., 2004, *International Jurisdiction and Consumer Contracts: Section 4 of the Brussels Jurisdiction Regulation*, Oslo, p.71-72.

In our opinion, the concept of "undertaking activities in" emphasizes the relationship between the trader and the state in which the habitual residence of the consumer is located, but does not imply the physical presence of the trader in that state. Namely, in the foreground, the commercial and professional activities of the trader should be primarily concerned, not his physical location, as well as the fact that the contract concluded falls within those activities.

According to the second condition of Article 6, paragraph 1, the contract is concluded between a consumer and a trader who, by any means or by any means, has directed his commercial or professional activities to the state in which the habitual residence of the consumer is situated or to several States, including this State and the contract falls within the scope of such activities.

The syntagma "by any means" is practically a reflection of the European Commission's intention to adopt a new instrument for the development of distance telemarketing referred to in the Green Paper. From a technical-technological point of view, this expression is neutral and encompasses all activities undertaken by means of electronic communication, as well as other methods of cross-border consumer transactions. In this respect is the thinking of Øren, according to which: "*in the context of electronic communications, not only the electronic sites of the Internet will be relevant, but also electronic agents, e-mails (...), as well as commercial activities downloaded via digital TV, digital radio and mobile phones.*"¹⁷ The purpose of this provision is therefore to cover all current distance selling techniques as well as those that may emerge in the future. An accompanying component of this requirement is that the trader "directed his trade or business activities" to the state in which the habitual residence of the consumer is located or to several states, including that state. The introduction of this requirement was intended to emphasize technological development and make Article 6 applicable irrespective of the localization of some parts of the contractual relationship. Practically, under the Rome Convention, precisely the conditions of localization of consumer behavior were cited as a significant reason for its inapplicability to electronic consumer contracts. Accordingly, the Commission has changed the concept of "passive consumer",¹⁸ which is targeted by the trader in Rome I Regulation, in the same way as in Brussels I Regulation or Brussels I Regulation (revised text). According to the evolved concept, the trader's behavior is set in the foreground as to whether the trader intended to target the consumer in the state of his habitual residence. The purpose of the "directs activities" is to bring legal certainty about *lex causae* into contractual relations. In this regard, Gillies suggests that determining the applicable law to electronic consumer contracts is simpler, since it should be the law of the state in which business and professional activities are directed.¹⁹ Accordingly, the trader may foresee the applicable law to an electronic consumer transaction, that is, the state in which he has conducted his activity and has the opportunity to comply with that right.

The Rome I Proposal for the new linking factor "directs activities" states: "... it is also fair in the economic sense: the consumer will place a cross-border order only occasionally, while the majority of traders working across borders will should increase the cost of learning one or more legal systems during transactions."²⁰ Accordingly, the Commission's motives for the condition "directed activities" were, first, to introduce legal predictability in the contractual relationship for the trader, as he should

¹⁷ Øren St.J., 2004, *International Jurisdiction and Consumer Contracts: Section 4 of the Brussels Jurisdiction Regulation*, Oslo, p. 74.

¹⁸ Francisco J. G. A., 2009, *The Rome I Regulation: expectations to the rule on consumer contracts and financial instruments*, Journal of Private International Law, Vol.5, No.1, Oxford, p. 87.

¹⁹ Gillies Lorna, 2013, *Electronic Commerce and International Private Law*, Hampshire, p. 130.

²⁰ Proposal for a Regulation of the European Parliament and the Council on the Law Applicable to Contractual Obligations (Rome I), COM (2005) 650, 2005/0261/COD, p. 6.

know which consumer markets he targeted and at the same time familiarize himself with the laws of the target states and, secondly, to provide protection to targeted consumers.

In the final version of Rome I Regulation, the meaning of the term "directed activities" is not defined. Point 24 of the Rome I Preamble contains only one direction for the application of this requirement: "the concept of targeted business should be a condition for the consumer protection provisions application." However, according to Øren (Oren), this concept re-introduces ambiguity and offers the following example: if trader offers digital product A to consumers habitually residing in other Member States through its online store, while material product B is only sold to consumers who have the same habitual residence as the trader in a Member State, through a physical store, the cross-border contract for product B shall not affect the application of the consumer protection provisions contained in Article 6 of Rome I Regulation. Making an allowance for this concept, we think that the term 'targeted' in electronic consumer contracts standings, implies that the electronic site is of an interactive nature and is also available in the state where the consumer's habitual residence is. Interactivity of the electronic site is considered to be a sufficiently active step taken by the trader, in order to target a particular market, i.e. in the sense of the European Commission "creating a link with a particular market, via e-mail offers, on-line advertising or other means."²¹ We also consider that the application of the provision of Article 6 of the Regulation with regard to electronic consumer contracts for the purpose of better clarifying this concept should take into account the elements cited by the ECJ in the case of *Hotel Alpenhof GesmbH v. Oliver Heller*.²²

The second part of Article 6 (1) of Rome I Regulation provides that the contract covers the scope of activities aimed at the market of a particular consumer. This view virtually confirms our view that only the availability of an electronic site in the state in which the habitual residence of the consumer is located is not sufficient for the application of Article 6 of Rome I.

The law applicable to electronic consumer contracts in the light of Macedonian legislation

The Law on Private International Law of the Republic of North Macedonia contains special provisions for the determination of the applicable law to consumer contracts, following the example of the modern European legislation. Accordingly, the Macedonian law adopts the second model for determining the applicable law for consumer contracts, as well as.

Namely, firstly, in the case of choice of applicable law, the consumer cannot be deprived of the protection provided by the imperative rules for consumer protection contained in the law of the state in which his domicile is located and secondly, in the absence of the parties autonomy of will, the law of the State in which the consumer's domicile is located constitutes the sole applicable law, provided that three additional assumptions are fulfilled.

The detailed provision contained in Article 25 of the Law on Private International Law is almost fully aligned with the provision of Article 5 of the Rome Convention, but not with the provision of Article 6 of the Rome I Regulation, since at the time this Law was drafted, the Regulation was still not adopted. Accordingly, in the future it will be necessary to amend this Law in order to comply with the provisions of this Regulation.

The subject of the analysis in this section will be, above all, the provision of Article 25, which regulates the special regime for consumer contracts from the electronic commerce point of view. The consumer legal protection which concludes electronic consumer contracts, in Macedonian law is

²¹ Proposal for a Council Regulation (EC) on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters (COM/99/0348 final), OJ C 376 E, 28/12/1999, p. 16.

²² Case C-585/08, *Peter Pammer v Reederei Karl Schlüter GmbH & Co KG* and Case C-144/09, *Hotel Alpenhof GesmbH v Oliver Heller*, ECR, 2010

identical with the protection of consumer who concludes consumer contracts that are not in electronic form, i.e. there are no specific binding points for electronic consumer contracts, having in mind their specific form.

Electronic consumer contracts and Law on Private International Law

In the first part, we set out a descriptive definition of the consumer contract in electronic form, concluding that this type of consumer contract differs from the traditional consumer contract only by their form. From the e-commerce point of view, in this section only the condition set out in Article 25 paragraph 4 point 1: *“the conclusion of the contract is a consequence of an offer or an advertisement in that state (the state in which the consumer resides) and if the consumer in that state has taken the action necessary to conclude the contract”* will be subject of normative analysis.

The conditions set out in point 2 and point 3 of this article have minimum point contact with electronic consumer contracts, since they territorially localize the entities, i.e. the events, so they will not be subject of analysis.

In general, the concept of offer and advertising should be analyzed in terms of European legislation. These terms meaning is regulated by the Macedonian material law, which is in line with the European law. First of all, it should be emphasized that the consumer who has entered into an electronic consumer contract should be prompted by an offer or advertisement by the trader. The purpose of this provision is primarily to protect "passive" consumers from "aggressive" traders who offer and advertise their products through various media in the state in which the consumer domicile is located. Thus, a Macedonian consumer who has entered into an electronic contract with a foreign trader may be protected by the provision of Article 25 of the Law on Private International Law if he proves that he was prompted by an advertisement or offer sent by that foreign trader by electronic means, or the conclusion of the contract is a consequence of offer or advertisement. This provision assumes, however, that the trader should take the first active steps to conclude the contract, for example, by sending an offer to the consumer's e-mail or by displaying an advertisement on an electronic page that is accessible and interactive in the Republic of North Macedonia as well. This provision does not cover "active" consumers, that is, consumers who voluntarily come into contact with a foreign trader and take first steps to conclude an electronic consumer contract.

As to, whether and in which cases, the electronic site is an invitation or advertisement, there are three different approaches according to legal doctrine.

Under the first approach, the commercial electronic site is, in any case, an invitation or advertisement, which is, covered by this requirement, although it is available worldwide.²³ In this view, the consumer always plays a passive role in the electronic consumer contracts conclusion. This approach practically strives for maximum consumer protection, especially in e-commerce.

The second approach is diametrically opposite to the first. Namely, under this approach, the commercial electronic site does not contain, in any case, an invitation or advertisement, i.e. it is not covered by the requirement of Article 25 paragraph 4 point 1 in any case. Namely, in this opinion, consumers who conclude electronic contracts always have active role, that is, they take the first steps to conclude the contract, and therefore cannot be protected by the special provisions.²⁴

²³ Lubitz Markus, Jurisdiction and Choice of Law for Electronic Contracts: an English Perspective, Computer und Recht International, Issue 2, 2001, p. 41.

²⁴ Powell D. Mark and Turner-Kerr M. Peter, Putting the E - in Brussels and Rome, Computer Law and Security Report, Volume 16, Number 1, 2000, p. 23-27.

The third approach represents a certain balance between the first and second approaches. In this opinion, it is necessary to consider each case separately and it cannot generally be said that the electronic site represents or does not represent an invitation or advertisement.²⁵

Two principles are set out in this regard: first, the electronic site needs to be interactive, that is, a certain relationship can be established through the electronic site between the consumer and the trader, and second, the electronic site should be available in the state in which the consumer has a domicile, that is, the trader intended to trade with the consumers of that state. The intent of the trader, as we have previously stated, is determined by various categories of clues, or elements as constituents of the content of the electronic page.

In our view, the third approach should also be accepted in Macedonian case law and theory, as it is based on objective principles that are easily established and applied. Practically, this approach is in line with ECJ practice as well as.

The second cumulatively requirement set out in Article 25 paragraph 4 point 1 provides that "*the consumer in that State has taken the action necessary to conclude the contract.*" This condition implies that the consumer, when concluding an electronic consumer contract, has taken all the related steps in the state where his domicile is located. Actions needed to conclude an electronic contract may include: entering a credit or debit card number, pressing enter key or OK on the keyboard or mouse, and so on. However, this requirement is incompatible with the development of information technology and e-commerce in general, since it territorially localizes the consumer in a particular state. Namely, on the one hand, it is a particular problem to prove the fact that the consumer has really taken the necessary steps in the state where his domicile is located, but on the other hand, this condition minimizes the opportunities and conditions offered by electronic bargaining, in terms of physical presence in a precisely determined place. Therefore, we consider that this requirement should be amended in order to facilitate its application in the case law in our state.

Conclusion

From the above it can be concluded that the European Union law corresponds to the information technologies developments in terms of electronic consumer protection. On the other hand, the Macedonian Law is not in line with EU law in this context and it should be amended.

According to our point of view, the provision of Article 25 of the Law on Private International Law should be amended as follows:

First, the consumer's domicile should be replaced by the consumer's habitual residence;

Second, the conditions referred to in paragraph 4 of this Article under the influence of the Rome Convention should be brought into line with the new conditions laid down in Rome I Regulation, as they have a larger scope of application in terms of consumer protection and are more eligible in terms of e-commerce consumer protection; and

Third, the time sharing contract and the contracts for travel and accommodation service to be designated as consumer contracts, as set out in Rome I Regulation.

Accordingly, the provision of Article 25 of the Law on Private International Law governing consumer contracts should be as follows:

"(1) For the purposes of this Law, the consumer contract shall be the contract concluded by a natural person for a purpose which can be regarded as being outside his trade or profession (the consumer) with another person acting in the exercise of his trade or profession (the trader).

²⁵Niemann J. M. 2000, *Webvertisements covered by Art 5(2) Rome Convention*, Tolleys Communications Law, Vol.5 n.3, 2000, p.100.

(2) The following shall not be considered as consumer contracts under this Law:

1) a contract of carriage other than a contract relating to package travel;

2) a contract for the supply of services where the services are to be supplied to the consumer exclusively in a country other than that in which he has his habitual residence;

3) a contract relating to a right in rem in immovable property or a tenancy of immovable property other than a contract relating to the right to use immovable properties on a timeshare basis.

(3) Notwithstanding the other provisions of this Law, the consumer contracts shall be governed by the law of the country where the consumer has his habitual residence, provided that the trader:

(a) pursues his commercial or professional activities in the country where the consumer has his habitual residence, or

(b) by any means, directs such activities to that country or to several countries including that country, and the contract falls within the scope of such activities.

(4) In the cases referred to in paragraph (3) of this Article, the parties may choose the law applicable to a contract and such a choice may not, however, have the result of depriving the consumer of the protection afforded to him by provisions that cannot be derogated from by agreement contained in the law of the country in which the consumer habitual residence is situated.

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TECHNOLOGIES AND METHODS FOR DEVELOPMENT OF A CORPORATE DIGITAL MARKETING STRATEGY

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Abstract:

The main purpose of marketing is to present a business in a fast, accessible and quality way to potential customers. In the development of the information society, it is necessary to consider what are the possibilities of promoting a business not only through the means of direct communication, but also through digital technologies. In order to be successful, the business should not only measure its profit but also to focus on its presence in the virtual space. The paper aims to suggest a successive corporate strategy for digital marketing. It combines various software tools and marketing techniques which can be implemented in different business environments. The application of special software platforms for creating of brand campaign can elevate the marketing performance of a business to a customer-friendly layer. Additionally, to the building of pattern based email campaign, it is paid attention to Google products for advertising. Also, the suggested strategy concerns with the development of precise profiles in the most popular social media.

Keywords: *corporate strategy, digital marketing, software tools*

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1. Introduction

Marketing as an ideology was first introduced in the early 20th century, presenting some of the techniques and features of established American universities. In 1960, McCarthy offered a marketing model based on four main pillars – commodity, price, placement and promotion. More than 50 years later, his ideas have played a major role in the growth of marketing to his appearances in the digital world. It is because of the modernization of daily activities, the promotion of every aspect of a person’s work contributes to his or her success. A common spread and nowadays it remains “mouth to mouth”. Simultaneously with the known techniques, computerization methods have already been successfully applied. In order to raise the status of a business or a service, it is crucial to find the right target audience.

It is no coincidence that the target audience is mentioned in the first place. There is a defined business model structure that illustrates the exact specifics of a business. This structure is divided into nine distinct sectors, which, although individually important in their own right, determine the overall characteristics of the particular business.

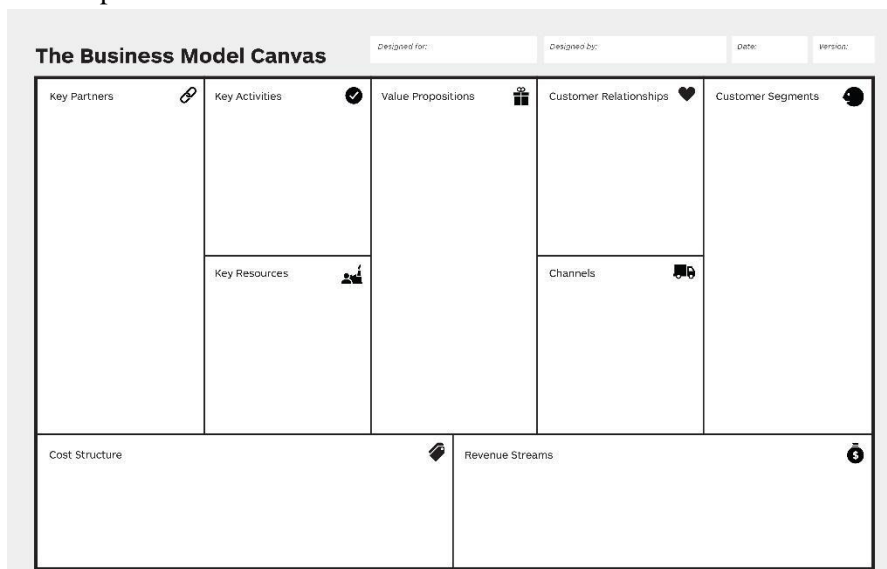


Figure 1. Business model canvas

The business model starts with the introduction of segment users. By definition, this represents the group of users to whom we will offer value. The target unit combines the mass market and the market niche. It is necessary to list all the characteristics of the potential users of the service offered by the respective business. The consumer section will be discussed in detail in other distributed models that may find a place in the main business canvas. After customer segments, the value proposition should be defined.

A value proposition can be presented as the idea of the real “value” that people belonging to the target audience are about to receive [1]. Value as a term in marketing is the difference between a prospective customer’s assessment of the benefits and costs of one product compared to others. In the ideology of strategic performance, value is a reflection of consumer needs. Human needs can be divided into cultural (national, religious and financial) levels as well as individual needs that determine everyday demands, family relationships and self-expression. The value proposition includes four types of characteristics – functional value, monetary value, psychological and social value. For each type, there is a specific definition that represents the customer vision for each service offered:

- Functional value – build value on the principle of an offer that meets the needs of the client;

- Monetary value – a relationship between price and quality for a product or service related to the client’s wishes;
- Social value – a certain type of service is provided as it reaches its customers with the ability to compare them with competing businesses that offer it;
- Psychological value – represents the extent to which a product or service allows consumers to express themselves and feel better.

The value proposition can be measured in both quantitative and qualitative measures. From the point of view of quality, and taking into account the points listed above, the profit itself should be assessed as an emotional and psychological unit. On the quantitative side, clear information is given with exact numbers, percentages and amounts.

After defining the value proposition, it is time to consider customer relations. It is of the utmost importance that we have a clear idea of what quality relationships we have with our customers. They can be divided into short-term with benefits, short-term with no benefits, beneficial long-term and long-term without benefits. In every business, besides meeting the needs of the clients, it is necessary to build relationships with potential returns. Such would be with clients directly related to the activity of our business, as well as those who have rich communication and would bring us more client resources. In a growing service-related business, the customer is transformed to a liaison partner into market share statistics. There are two obvious reasons for this. First, the difficulty of managing relationship-oriented customer relationships increases as the number of clients. Second, the growing influence of non-relational marketing approaches based on popular consumer goods. It is important to define the cost of each relationship with a particular client. Do we have a responsibility to communicate with him periodically and does it cost us more.

Consideration should be given to where the business will be promoted. In the canvas of the business model, these needs are being described in the section – Channels. The entire strategic layout of the advertising route should be organized in this sector. The question that should be asked is – how and where it will reach the target audience. Like the waterfall model, known in software development, the channel section must be separated into several stages that are independent of each other and follow a certain arrangement. By definition, this model is used when there will be no critical changes in each part of the process. From a marketing point of view, it should be argued that the construction of advertising follows the consumer interest, but in terms of strategy accuracy it is appropriate to justify the given steps and to give their exact specifics:

- Awareness – at this stage, the service, company representatives and contacts of the company are presented through a selected channel. No other costs than advertising funds are foreseen at this stage.
- Evaluation – after analyzing consumer interest data, it should be prepared a report with relative data on customer engagement, their positive feedback, as well as their negative comments;
- Purchasing – at this stage are taken significant costs for the business, i.e. material and human resources are purchased in order to achieve the set goal;
- Delivery – the required service or product should be provided after the investment, which can be reached directly to the consumer or through an intermediary firm/software;
- After-sales period – this is the period of expectation of a lasting return. The valuation of this period is characterized not only by an increase in revenue, but also by a constantly active group of consumers who require to use the services of a given business.

After defining the channels through which we will advertise, we need to present the sources of revenue. Depending on the individuality of each business, revenue would be of a different nature, but in any case would be measurable. In this aspect of the canvas, the types of users from the target audience should be distinguished and their reaction monetized.

Key activities and resources must be reflected after channels. The activity of each business classifies all aspects of its client's needs. By defining a number of services, a business can derive the value of each of its resources responsible for providing those services. In this way, the integrity of the "value proposition" is organized and the marketing strategy is facilitated. In terms of resources, they are divided into material, intellectual (patent, copyright, brand data), human and financial. Human resources need to be addressed taking into account the fact that in order to properly calculate income and expenses, the human resources section also includes those employees who are not directly involved in the activity of the company, but support it in a specific way.

Once the key elements have been considered, it is necessary to reflect the partners involved. These are employees, services and products that contribute to the proper and successful operation of the business. These partners need to come up with three basic solutions to be in this section. These are optimization and cost savings, reducing risk and uncertainty and acquiring new resources. Finally, we need to define the cost structure. This is not a coincidence given the fact that every aspect considered so far has to do with the financial dimension of the business.

The canvas of the business model is a strategic tool for managing entrepreneurship. This model aims to facilitate the description, design and management of a particular business by focusing on its strengths, weaknesses, activities and assets. Thus, optimizing his marketing strategy or creating a new one is based on clear and defined bases.

2. Planning the strategy

The business we will be looking at is related to the printing and production of plastic cards, print publications, indoor and outdoor advertising in small and medium-sized prints for Bulgarian and foreign companies, retail chains and sites, hotels, clubs and establishments, medical centers and other public and private organizations. Essential to 2019 is to pay attention to email marketing. In view of the adopted GDPR data protection regulations [2], access to the corresponding email is becoming an increasingly desirable recognition option. Under the regulation, receiving an email is subject to the voluntary consent of its holder, and making an active email list is a long process. Taking into account the theory of digital marketing, an active email list is characterized by a list of active users who review and implement the CALL TO ACTION of the respective campaign at each iteration. Email marketing features are distinguished, which give a sample report for a particular email campaign, such as:

- Delivery rate – how many emails have reached our users. Our database can be hot or cold. The cold database is characterized by a lack of active emails, nonexistent or poorly accessible ones.
- Open rate – depends on the Subject Line. The larger our base, the lower it will be. Extensions or platforms need to be used to track how many times an email has been opened.
- Click rate – depends on Content. The larger our base, the lower it will be. It is important to build an optimized email.
- Click through rate (%) – it determines the success – the ratio of open and clicked Email.
- Conversion rate (%) – how many people "bought" what we offered.

In order to reach the ad agency's clients, it is necessary to build a suitable email campaign with exact criteria. It is of paramount importance to determine the vision of the content as well as the length of the Subject Line. According to campaign trends, it is a good idea to rely on a personalized product that engages every email on the active list. We may use software for sending out bulk advertising emails such as Mailchimp. This is a multifunctional platform for building brand representation by describing potential customers and accessing their features and subsequently sending personalized emails to suit a specific vision and style. In addition to being an email marketing tool, Mailchimp offers building of a Social media content, Landing pages, Digital ads, Postcards and Automations.

When mentioning social networks, one of the main steps to reach a specific target audience is the social network Facebook. This platform is well known as a means of direct communication – chat, commentary, etc., but has specific features regarding advertising activity. In order to define the actions to be taken, it is imperative to clarify the principle of action of Facebook. Facebook’s algorithm is divided into three main steps. They define visible and suggested content in order to shape the marketing strategy. A direct reference is made to our personal algorithm and to the one that acts as a universal vehicle for promotion. Both algorithms are characterized by:

- Inventory – these are the posts of our friends or the pages we have followed;
- Alerts – actions that Facebook concludes about the content of a post (like, comments, share);
- Assumptions – the Facebook algorithm predicts how much a post will be liked and shared.

On this basis, it determines its relevance score. Relevance score is the unit of measure by which posts that are to be seen on the wall are ranked. The higher it is, the higher the News feed will go up and the user will access it before the rest of the posts. Ranking is calculated based on our attitude to the individual sites. If we return to a page or are interested in its posts, we will see content from the page again while using Facebook. So the relevance score never stays the same. With each interaction we give a signal to the Facebook algorithm and it recalculates the score.

To get the most out of Facebook’s advertising concept, we should use the extension they offer – Facebook manager [3]. The created ad page, which is related to the business we describe, will automatically appear in the manager and we will be able to organize its promotion. Facebook offers to activate the algorithm with the personal content of the page or the publication, which will be promoted after a certain payment. The amount we anticipate is for a specific period of time and it is divided into days and number of iterations by users. We need to create an appropriate advertising post and track the impact on users and their user path so that we can build an overall Facebook marketing strategy.

In addition to the already mandatory website and presence on social networks, an analysis of the digital status should be attached in order to track the user path and the consumers’ engagement with our business. This can be possible through Google Analytics. In order to bind a website or page with Google Analytics services, it is necessary to place a javascript code that indexes the reference to the site.

A relatively large percentage is the use of another Google service – Google Ads [4]. This service provides the creation of advertising, recognition and identity on Google, so that by writing a specific keyword in the search engine, the specificity of the business to stand out from the other results displayed. Again, there is a definite fee with three separate directions for advertising:

- Stimulate website visits – increase online sales or sign-up listings for online ads that direct people to the business website;
- Receive more phone calls – increase the number of calls from customers with ads containing the phone number and click-to-call button;
- Increase business office visits – attract more customers with business ads that help people find their business on the map.

3. The application of the strategy

In order to activate Facebook presence, it is necessary to use the facebook – Facebook manager extension. To do this, we need to add the business page to the platform. After designing the page and access to the specific campaign, it is planned to install a special Pixel plugin. It loads with the site and records the user login and path. In addition, it creates special “audiences” to our site. We can then advertise to these audiences. Pixel comes with a special predefined code, and a typical plugin type is used to match the personality of the business and the site’s type. If we have Pixel Events, we can find out exactly where our sales came from. Pixel Events only exist for sites. If our site is informative only

– we can use a single Pixel on it. However, if we have a product site and sell it – we need to put in there to track where the sales flow comes from. The events hook up to our only Pixel as he does both actions – gathering special audiences and making complex events.

The screenshot shows the Facebook Ads campaign creation interface for 'Engagement' (Ангажиране). At the top, there is a blue icon with three people. Below it, the title 'Ангажиране' is displayed. A short description follows: 'Накарайте повече хора да видят и да се ангажират с публикацията или страницата ви. Ангажиментите може да включват коментари, споделяния, харесвания, отговори на събитие или приемания на оферта.' Below this, there are three tabs: 'Ангажиране с публикация' (selected), 'Харесвания на страница', and 'Отговори на събитие'. The main form area includes: 'Име на кампанията' (Campaign name) with a 'Create name template' link and a text input field containing 'Ангажиране'; 'Create Split Test' section with a toggle switch set to 'Изключено' (Off) and a link to 'Научете повече'; 'Оптимизиране на бюджета на кампанията' (Optimize budget) section with a toggle switch set to 'Включено' (On) and a link to 'Научете повече'; 'Бюджет на кампанията' (Campaign budget) section with a dropdown menu set to 'Дневен бюджет' (Daily budget) and a value of '55.00 \$', with a note that 'Actual amount spent daily may vary.'; and a 'Show More Options' link. At the bottom, there is a blue 'Продължаване' (Continue) button.

Figure 2. Facebook ads

The service through which we create relevant mass advertising is Google Ads. While creating our ad, we have the right to choose a few titles and a few descriptions. We have to be careful with them. The reason is that they will appear in different combinations on different sources. It is good practice to use as few titles and descriptions as possible. Usually, images for an ad can be downloaded from the URL that we set as a link to the product/service from the ad. We also have the option to upload our own pictures. The idea is that the images must match regardless of the ad's size. This ad can be either reworked for google search or displayed on social networks or YouTube.

One of the most powerful tools for analyzing user activity and business status is Google Analytics. You need to add a site reference with the account to the service, which it will provide to get the best results. The system enables the use of Google Analytics, which contains various data for visitors to sites where the code to be used for cookies is placed. Google Display Network, such as European Directives of cookies, also includes data from views on Google ads that have also been commercially presented. Google Analytics also monitors the effectiveness of several sponsored posts on social networks and reads the perception of funds from the investments made. Google equipped products are handy for tracking the performance of paid ads on Facebook.

4. Results

By creating a personalized email campaign, the marketing strategy intends to get as many users as possible. To this aim, 100 specific email recipients are provided to analyze the consumer response. The campaign is a landing page and contains all information about the type of business, key activities and individual offers. Through the functionality of the platform, each recipient has access to the campaign, can open it and subsequently communicate with the site by selecting the call to action button. After submitting the campaign, there is made a daily, biweekly and monthly results report. The figure shows that there are 70% open emails. A certain percentage of them have selected the button for more information. It is good to note that there are no bounced emails. They are divided into hard and

soft bounced according to the type of error – no email or no message received. The given 45% click rate proves the enviable success of the email campaign, which is a combination of well-selected and accessible sent information and a properly selected list of recipients.

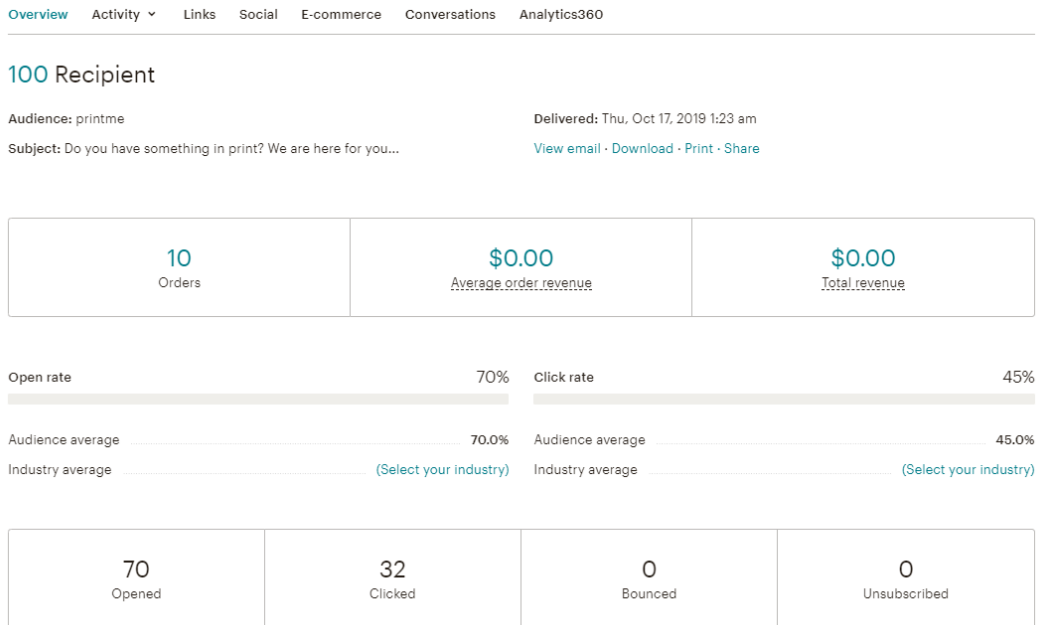


Figure 3. Mailchimp

There is displayed screen of the demographic distribution of user activity on Facebook manager. It is important to mention that the buyer persona is a man of working age whose job is a fashion designer for example. He has the financial means, he is communicative and he has technical skills. The client wants to be involved in the process of creating printed material, which is the main business activity of the publication. Based on the demographic data, it can be clearly seen that the fundamental of the persona set and the goal are achieved by being possible in the platform to make a detailed filtration. It is of particular importance to reflect the consumer's place of residence, because, for example, in small settlements, even if the demographic user meets the criteria, he or she would hardly need to have the necessary computer skills to participate in the process or to have enough financial resources.

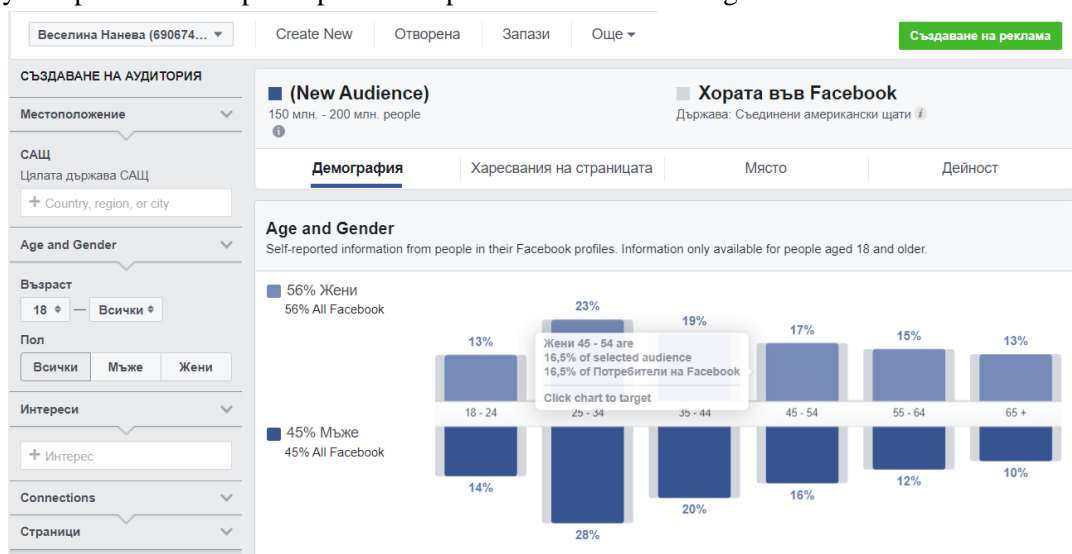


Figure 4. Facebook Manager

The established marketing strategy in every aspect should evaluate the consumer presence. The Monthly User Activity Timeline screen is displayed. It can be seen that, following the application of

marketing growth techniques, a deviation in the curve is observed. The platform itself has the ability to offer both an activity curve and a distribution of users across countries. Exact values are displayed for a particular ad, page, or link, as well as the exact duration of a particular user session.

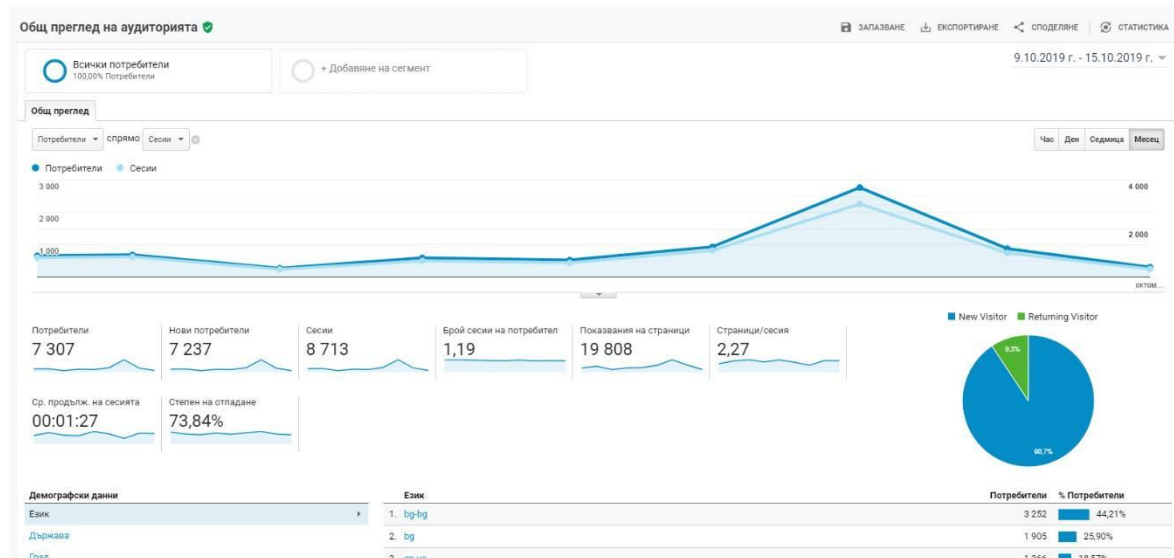


Figure 5. Google Analytics

5. Conclusion

Once all the theoretical rationale for the need for a marketing strategy has been established, the opportunities should be offered for its implementation. There is a large number of software tools and platforms that can be classified as tools to help the brand's elevation. Therefore, screening the most appropriate and current techniques is of the utmost importance. In this paper, we chose a sector of human activity as an example and the campaign was applied to its buyer persona. As a result, the levels of business recognition and its accessibility for users and website activity increased. This inevitably leads to an improvement in profits from organic customers.

Acknowledgments

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CHALLENGES AND BENEFITS OF E - INVOICE EXCHANGE SYSTEM IMPLEMENTATION

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Petkoska⁴

Abstract:

The global information and communication infrastructure is the basis for the current integration of economies, cultures and societies around the world. Electronic technology involves the combined use of information technology and telecommunications. This technology enables companies sending large amounts of information over a long distance in a short time period. E-invoice exchange system enables businesses to reduce costs and errors, increase the security and money flow in the company and to become more environmentally friendly. The implementation process of this type of invoice exchange system can be a long-term process because not all businesses can move to e-invoicing at the same time. The process of exchanging electronic invoices is fully automated and is economical as opposed to the traditional way of exchanging invoices.

The main goal of this paper is to research what are the key benefits of implementation of the electronic invoice exchange system for the businesses. It has already been established that the e-invoicing is an ideal timesaving solution and it improves the productivity and service quality compared to the traditional paper invoicing. This paper will compare the disadvantages of the traditional and the benefits of the e-invoice exchange system. In addition, will include a comparative analysis of these two types of invoice exchange systems.

Key words: *electronic invoicing, business processes, invoice exchange.*

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Introduction

The advances in technology imposed in all segments of human life undoubtedly require the optimization and reengineering of many business processes. From this point of view, if we look at the document exchange process we can conclude that it has not been digitized sufficiently. In this paper the focus is on identifying the weaknesses and the advantages of the existing electronic invoicing system. The benefits of implementing an e-invoice exchange system are multiple for all participants as it follows: reduced invoice administration time, increased efficiency in the exchange process, opportunity to exchange invoices at any time, saving time and money, control of state taxes and the inability to evade taxes on the exchange of invoiced goods and services.

Therefore, the main idea of this paper is to analyze the existing invoice exchange system and to emphasize the key benefits of an e-invoice exchange system implementation. The research methodology consists of: an analysis of existing literature that focused on the e-invoice exchange processes; SWOT analysis - analyzing the strength, weaknesses, opportunities and threats of implementing an electronic invoice exchange service; Cost Benefit analysis - costs and possible benefits analysis of the e- invoice exchange system implementation. With our research we contribute to the existing literature by identifying the key reasons why should companies switch from paper invoicing to e-invoice exchange system.

The rest of the paper is organized as follows: A literature review on the importance of e-invoicing market development and the benefits of e-invoice implementation are presented in the first section. The second section focuses on the features and disadvantages of the traditional invoice exchange system. By performing COST Benefit and SWOT analysis, comparative study of the existing and e-invoice exchange system is elaborated in the next section of the research. And the concluding remarks of our research are presented in the last section of this paper.

1. Literature review

There has been abundant theoretical and empirical analysis in the literature focused on the importance of the e-invoice exchange system implementation for achieving a single European digital market. According to Zion Market Research Report (2019) the global e-invoicing market was valued at approximately USD 4,649 million in 2018 and is expected to generate around USD 20,529 million by 2026. Based on this report, Europe was the second largest e-invoicing market in 2018 globally. E-invoicing is part of the European Commission's flagship initiative *A Digital Agenda for Europe* which calls for removal of the regulatory and technical obstacles that prevent mass implementation of e-invoicing. The European Commission action for adoption of e-invoicing contribute to the expansion of the European e-invoicing market and boost the competitiveness of the European companies. (COM, 2010).

Many researches have analyzed the benefits and challenges of e-invoice implementation. According to Fernandens and Longbottom (2011) the business have numerous benefits from e-invoicing including: significant cost reduction and time savings, efficiency gains and business process automation. They also emphasize the fact that there are many disadvantages of the traditional invoicing such as: reduced staff productivity, mislaid and lost invoices, unnecessary duplicates, poor approval control etc.

In addition, Ali (2016) indicates that automation of invoice processing and invoice validation, lower printing and postal costs, faster cash management, lower carbon footprint are among the benefits that business will have from e-invoice implementation. The author also tries to explore the internal and external challenges that companies will face while adapting e-invoicing process. Internal challenges include: choice of an operator, errors during e-invoicing processing, employees approach towards e-invoicing, geographical challenge and different tax regulations, vendor and customer problems. In his

analysis he emphasis that when the number of e-invoices increases in very large companies, the firms start facing internal problem of lost e-invoices from their system.

Driven by the theoretical and empirical findings our research focuses on comparative analysis of the disadvantages of the traditional and the benefits of adapting the e-invoice exchange system, where we are particularly interested in the following research question: What benefits will business have of implementing an e-invoice exchange system? To answer this research question, we have conducted a systematic literature review of studies related to the research topic.

2. Characteristics of the existing invoice exchange system

In the digital age of the 21st century, one of the most used business documents - the invoice, is still being prepared and sent in paper form. In 2014, only 10% of 30 billion invoices sent in Europe, were electronic invoices. The need for implementation for an electronic invoice exchange system is imposed in order to reduce costs that are needed for invoice exchange in traditional way. The cost for preparing and sending invoices in traditional way, like cost for their delivery, the time that takes to prepare, print, send and archive the invoice are very high compared to the cost for preparing and sending invoice through electronic exchange system. Preparing paper invoices slows down the organizational process, as manual data entry includes errors, lost invoices, processing delays, increased checking time and error correction. Paper invoices are not only expensive but also they are time-consuming because they need to be sent by mail and to be archived and stored. Alignment of the disputes regarding the invoice can cause a burden for the company, as it can disrupt relationships with suppliers, customers and consumers, making it difficult to provide regular invoices for timely payment of invoices or discounts for a certain period of time. Companies may have difficulty making final statements as well as problems with meeting the VAT refund requirements. On the other hand, the use of paper invoices causes environmental pollution, not only with waste paper but also in energy costs, transportation costs, printing costs.

As technology evolves, businesses need to optimize their financial supply chains and minimize manual operations, thereby the interest for implementing electronic invoicing is increasing. It gives customers and suppliers operational and strategic benefits.

In this context we would mention that the process of preparation and traditional exchange of paper invoices takes longer than the electronic invoice exchange. Also, some bank fees such as provisions must be paid when the money for paper invoice are transferred. Because of the time it takes to create, process, and send paper invoices, many companies replace the traditional way of exchanging invoices (mail, couriers, etc.) with electronic systems in order to reduce costs and speed up the payment process. Below we highlight some of the features of traditional ways of preparing, processing and exchanging invoices:

- time needed to prepare documents,
- document errors,
- preparation of mail (or e-mail),
- postage costs,
- phone calls for any errors,
- manual data entry,
- checks and reporting,
- high costs,
- reduced document exchange rate,
- reduced staff productivity,
- lost invoices,
- reduced approval control,
- unused duplicates,

- missed discounts on suppliers,
- missed payment dates,
- storage of invoices,
- lost time searching for invoices,
- bill payment invoices.

The traditional way of exchanging invoices consumes more time and resources, reduces employee productivity because paper invoices need to be received, opened, compared, approved and sent for further accounting processing. The costs are smaller or higher depending on the size of the company, as well as the number of invoices received or sent annually.

2.1. Disadvantages of the existing invoice exchange system

According to Kumaran, S. (2015) many organizations continue to practice manual invoice processing. The majority of invoices are processed in PDF's format that requires a huge amount of time and resources on data entry, verification and processing of physical invoices.⁵

There are numerous disadvantages to the existing invoice exchange system for the organizations. For instance, many companies don't have direct continuous insight into their invoices, and these leads to incensement of the phone calls between buyer and seller.

Due to untimely arrival of invoices, the delivery of products may be delayed or some of the invoices may not be paid so the company may be liable for unplanned costs resulting from untimely collection, such as interest, penalties, etc. Delivering invoices in one of the traditional ways of exchanges increases the possibility of inefficient and poor quality interaction between buyers and sellers, thereby reducing business cooperation between business partners. In the traditional invoice exchange system, users face problems arising from invoice viewing and retrieval, which increases processing time, and there is a greater likelihood of errors in manual data entry. It is also likely that some of the invoice forms are inaccurately drafted or completed, which may misinterpret or invalidate the invoice and may delay its payment or delay the delivery of products. Late payment of invoices can also reduce the liquidity of the company.

Despite the above mentioned problems, manual invoicing can lead to various types of costs increasing, such as:

- **postal service cost** - For the issuer of the invoice, postal costs can be significant, especially if the invoice is sent to the buyer by registered mail with a return. Given that the minimum cost for sending such mail is 70 denars and that a larger company produces around 200 invoices per month, the company only needs to set aside 14,000 denars per month for postal costs. If the invoice is sent by regular mail (no return) for the same number of invoices, the costs are about 7,000 denars. Given these costs, it is clear that using electronic invoices can save enough money on some other priority activities that can improve the performance of the company itself.

- **materials costs and shipping costs including:** archiving documents, envelopes, paper, stamps, printing costs, and others. As electronic invoicing does not incur these costs, it is very detailed for any company to calculate how much it can save on a monthly or yearly basis.

- **costs for archiving** - Depending on the number of invoices and the obligation to keep and file documents for tax and other laws, archives takes up a lot of space. The cost of certain terabytes / gigabytes of server memory is much more favorable for companies than the costs associated with archiving documents.

⁵ Kumaran, S. (2015): "3 Major Challenges of Using Paper-Based Invoices", Invensis Technologies. Available at: <https://www.invensis.net/blog/finance-and-accounting/3-major-challenges-using-paper-based-invoices/> .

Reduction or exclusion of these costs can help organizations to make better decisions around re-investing their resources in order to achieve higher profits or boost their competitiveness.

Replacing the existing system with an electronic invoice exchange system speeds up not only the process of delivering the invoice, the confirmation that the customer has received it, but also its payment, thus speeding up and facilitating the operation of the companies. Thus reduce costs and the efficiency will increase, as well as the control over the actual handling of invoices.

3. Benefits of implementing an electronic invoice exchange system

Electronic Data Interchange is an electronic business information exchange that uses a standardized format for the exchange of data and documents; a process that allows one company to send information to another company electronically instead of sending paper documents by mail.⁶ Many of the business documents can be exchanged using EDI, but the most common are orders and invoices. EDI replaces traditional electronic communication, which reduces the steps for preparing traditional mail, or it can be said that most of them are completely eliminated. However, the real power of EDI is that it standardizes the information provided in business documents, that is, what is enabled by "paper" exchange is possible with EDI as well.

Most of the companies create invoices using certain computer software, print them, make a copy of the invoice and send it by mail to the client. Upon receipt, the client archives the invoice and inserts it into his computer. The whole process is nothing more than a transfer of information from the vendor's computer to the user's computer. EDI enables the manual steps involved in this transmission to be minimized or even eliminated.

EDI enables the company to be more competitive in today's business environment. A study by EDI Group, Ltd reported that companies that are using EDI in 1994 reduced the time to send and receive documents by about 40.3%, with the error rates falling from an average of 10.1% to 4.4 % at the same time. Cost savings averaged is \$ 2.20 per document after EDI was implemented.⁷

A key feature of electronic compared to paper invoices is that e-invoices can be processed automatically if the invoice is sent in a structured format. In that case, electronic invoices can be generated and transferred automatically and directly from the issuer to the recipient. In addition to reducing printing costs, electronic invoices reduce administrative costs over the entire chain, which in addition to the sender and recipient, include the state, the public revenue office, customs and the like. Benefits of electronic invoices can also have and the end users, primarily because receiving and storing electronic invoices is considerably simpler than paper invoices.

One of the main benefits of electronic invoicing is faster communication between seller and buyer, which helps governments and businesses to move continuously towards a "real-time economy". This kind of economy allows the buyer to check the accuracy of the seller's data, buyers can quickly check the invoices and notify the seller of any errors. This can all happen within a few hours or a day and the seller may submit a new invoice with adjustments so that payment can be made in a shorter period of time. If invoices are traditionally exchanged, there may be a significant delay in the payment process. In the following we will list the key benefits of electronic invoicing for issuers, customers, suppliers and company managers.

The benefits of an electronic invoice exchange system for **invoice issuers** are the following:

- Reduce the costs of distributing invoices, the costs associated with manually entering invoices into the company's information system, as well as the costs of correcting incorrectly entered data.

⁶ Data Interchange Plc. (2006): Electronic Data Interchange, Available at:

<http://www.datainterchange.com/Downloads/Brochures/WhitePaper-What-is-EDI.pdf>

⁷ https://www.up.com/suppliers/order_inv/edi/why_edi/index.htm

- Improving the recovery rate. Assuming that one retail chain produces about 2.5 million invoices each year, each has an average of four sheets. The price per sheet of paper (in 2018 in Macedonia) cost 0.5 denar, 1 toner printing price (according to the toner prices in Macedonia in 2018), thus for the printed 10 million pages, the annual cost of printed invoices can be calculated on the following way:

- **C1** - price per sheet of paper,
- **C2** - toner price for printing on one sheet of paper,
- **N** - number of 2.5 million documents,
- **NI** - number of sheets per document,
- **T** - total costs.

$$T = N * NI * C1 * C2 = 10,000,000 * 4 * 0.5 * 1 = 325,000.00 \text{ Euros}$$

It can be seen from the calculation that the costs are worth up to 325,000.00 Euros with no costs for workers, shipping, filing, electricity and other services.

- saving time for company owners or employees who typically spend time writing messages, calling or even visiting their clients to check the status of their unpaid invoices,
- Increase of cash flows in the company due to faster collection of invoices.
- Improved security and very little chance of fraud. This is based on the fact that invoice data remains unchanged. In addition, many electronic invoicing systems provide SSL and secure encryption, meaning not everyone can read invoice data,
- Improving customer relationships, due to the fact that the process of finding and fixing errors is speeding up. Namely, as a result of faster communication and timely corrected errors on the sent and received invoices increases customer satisfaction.

Most people believe that customers have more benefits using electronic invoicing systems than suppliers. Key benefits for **customers** include:

- Cost Reduction: Sorting, archiving and manual data entry on paper invoices can be eliminated, with electronic processing leading to savings of 60-80%, with a payback period of 6-18 months.
- Increased accuracy: this system enables bills to be paid directly without relying on errors, data re-entry, account re-issuance and more.
- Increased productivity: as a result of the increased accuracy of the invoice, it can be processed faster, which will pay faster.
- Faster processing and payment: Electronic invoicing can fully automate the process of recording the invoice, its routing and approval. This allows invoices to be processed faster, paid faster, avoiding overpayments, negotiating timely payment discounts and more.
- the buyer can focus on higher value activities: staff are freed from tasks such as manual invoicing, so they can focus on more strategic activities such as auditing and checking invoices or exploring discount opportunities for early payment.
- More discount options: electronic invoicing enables faster processing and approval of invoices. As a result, a discount can be used for timely payment. Certainly this process can be further enhanced by proper processing of invoice recipient software solutions.
- Improved management and avoidance of disputes over some invoices: resolving some invoices can cost up to 50 euros or more, resulting in inefficiency in the payment system. The faster and more accurate the invoice payments are, the greater the number of calls by suppliers for invoice payment is greatly reduced.
- improved relationships with suppliers: an effective payment process can become the cornerstone of good strategic relationships with suppliers. This in turn helps to ensure greater collaboration and improved relationships that ultimately result in better customer service, a stable supply chain and greater product availability.

Apart from the fact that electronic invoice exchange systems provide significant benefits to customers, the benefits to suppliers should not be underestimated here. Improving customer

satisfaction, reducing credit costs, better equity management and cash flow control are some of the benefits associated with suppliers. Some of the key benefits to suppliers include:

- Faster payment: e-invoicing eliminates delays resulting from mailing, sending, sorting and reissuing paper documents. The processing and approval of invoices is fast as they are available to clients electronically and are visible in their systems. As a result, the invoice can be paid on time, the waiting time can be reduced and the cash flow can be improved.
- Cost Reduction: Companies that use electronic invoice exchange systems make huge savings on shipping costs and can save up to 80% on postage, materials, processing and archiving savings. The extra savings is a result of reduced printing requirements, customer calls, and of course electronic payment. Also companies that use electronic invoices have their own electronic archive which saves on paper storage costs.
- Less invoices discarded: e-invoicing enables direct processing, thus eliminating the need for the customer to enter the data manually, thereby reducing the incorrect data entry. As a result, invoices are less likely to be rejected and customers may begin processing them immediately.
- Increased productivity: With the electronic delivery of invoices, customers know exactly when the invoice was delivered, when it is received, thereby reducing customer calls, accuracy is greatly improved.
- Improved payment of bills: Suppliers often face problems such as incomplete invoices, less than the original invoice, etc. Customers know how to pay a large number of invoices with a single bank transfer, but rarely check whether suppliers have received the funds paid into their accounts. With e-invoicing users can send electronic notifications that invoices have been paid, can send corrections, borrowings, etc. This also helps in situations where customers refuse to pay an invoice due to problems with the delivery of products, or the possibility that some products may be damaged and missing in the shipment.
- Improving Customer Satisfaction: One of the most potential benefits for suppliers is having satisfied customers. Faster processing and payment of invoices means that customers receive a higher level of service.

In addition to the benefits that customers and suppliers have, this system can also benefit managers. Increased process efficiency means that managers have more control over planning and forecasting as well as the ability to deliver higher level services.

Some of the **key benefits** for managers include:

- Improved visibility: invoicing paper means that there is a delay in invoice visibility in the accounting system. The ability to see the invoice as soon as it is issued provides a much greater degree of security and control.
- optimized cash flow: for many companies the ability to optimize their working capital is essential. It improves business agility and can reduce the need for external financing. These systems allow businesses to make payments on a timely basis and take advantage of some of the discounts available.
- improved compliance: when working with third parties, organizations can take advantage of systems that exist in different countries. This means that companies do not have to have tax expertise for every region in the world, removing is one of the important barriers to entering a new market or new territory.
- improved relationships with suppliers and customers: making the invoicing process effective, as well as reducing the amount of disputed invoices and ensuring that the organization can deliver a high level of service. By integrating with supplier and customer systems, both parties make significant investments over the long term.
- Improved IT system and optimization: in most cases, e-invoicing does not require major technological investments. Most IT departments can safely transfer the necessary data by optimizing

existing IT infrastructure or by using third-party infrastructure. IT managers can reduce the resources needed to support the functionality of an electronic invoice exchange system.

- nature conservation meetings / meetings ("green initiative"): these systems eliminate paper use, reduce the cost of transporting paper from supplier to buyer. One invoice may not save the planet, but with the digitization of some 30 billion invoices in Europe, each year will have a significant impact. Reducing paper printing, reducing postal costs is simply good business practice for most companies.

The advantages of an electronic invoice exchange system for invoice issuers are the following:

Reduce the costs of distributing invoices, the costs associated with manually entering invoices into the company's information system, as well as the costs of correcting incorrectly entered data.

Improving the recovery rate. Assuming that one retail chain produces about 2.5 million invoices each year, each has an average of four sheets. The price per sheet of paper (in 2018 in Macedonia) cost 0.5 denars, 1 toner for printing (according to the toner prices in Macedonia in 2018), thus, for a printed 10 million pages, the annual cost of printed invoices can be calculated at the following way:

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- saving time for business owners or employees who typically spend time writing messages, calling or even visiting their clients to check the status of their unpaid invoices,
- increase of cash flows in the company due to faster collection of invoices.
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- increased productivity: as a result of the increased accuracy of the invoice, it can be processed faster, making it faster to pay, reducing the volume of calls to toll centers, etc.
- Faster processing and payment: Electronic invoicing can fully automate the process of recording the invoice, its routing and approval. This allows invoices to be processed faster, paid faster, avoiding overpayments, negotiating timely payment discounts and more.
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Apart from the fact that electronic invoice exchange systems provide significant benefits to customers, the benefits to suppliers should not be underestimated here. Improving customer satisfaction, reducing credit costs, better equity management and cash flow control are some of the benefits associated with suppliers. Some of the key benefits to suppliers include:

- faster payment: e-invoicing eliminates delays resulting from mail, sending, sorting and reissuing paper documents. The processing and approval of invoices is fast as they are available to clients electronically and are visible in their systems. As a result, the invoice can be paid on time, the waiting time can be reduced and the cash flow can be improved.
- Cost Reduction: Companies that use electronic invoice exchange systems make huge savings on shipping costs and can save up to 80% on postage, materials, processing and archiving savings. The extra savings is a result of reduced printing requirements, customer calls, and of course electronic payment. Also companies that use electronic invoices have their own electronic archive which saves on paper storage costs.
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systems allow businesses to make payments on a timely basis and take advantage of some of the discounts available.

- improved compliance: when working with third parties, organizations can take advantage of systems that exist in different countries. This means that companies do not have to have tax expertise for every region in the world, removing is one of the important barriers to entering a new market or new territory.
- improved relationships with suppliers and customers: making the billing process effective, as well as reducing the amount of disputed invoices and ensuring that the organization can deliver a high level of service. By integrating with supplier and customer systems, both parties make significant investments over the long term.
- Improved IT system and optimization: In most cases, e-invoicing does not require major technological investments. Most IT departments can safely transfer the necessary data by optimizing their existing IT infrastructure or by using third-party infrastructure. IT managers can reduce the resources needed to support the functionality of an electronic invoice exchange system.
- meetings / meetings

4. Comparative analysis of the classical and electronic invoice exchange system

Comparative analysis can be done from very different aspects. The most relevant analysis in this case is through COST-BENEFIT and SWOT analysis. Cost reduction is an important part of implementing electronic invoice exchange system. Also, this concept also has many non-economic indicators that are also very important.

The classic way of exchanging invoices involves a very manual manipulation which, besides the high costs, is subject of to many errors. On the other hand we have electronic exchange system that is more flexible, fast and up-to-date and much cheaper one. This software would be the business secret of the data that certain PRO operators would have access to. But they still have access if they want to control businesses. Certainly this can be regulated by an appropriate law that will regulate the process of access to data and the possibility of its being misused by persons having access to it. To slow down this process it should be regulated by a proper command and log file that will be stored in the software about who accessed, when accessed, what device accessed, what requested, what received, what order accessed. Business entities would also be informed of this approach if it was not for inspection supervision previously announced in the business entity. That way everyone could react if someone accessed their data and against those who accessed it if proceedings were found to be illegal.

Otherwise, this does not have to be considered as a lack of it, since the inspectors, of course, have access to official company documents and can also disclose business secrets. What this means in this respect is not necessarily disadvantageous to the previous way of submitting invoices.

All these features offered by the software solution provide many benefits from its implementation.

COST-BENEFIT analysis

The COST-BENEFIT analysis is a standard method for determining the optimal cost-benefit ratio. Not all parameters can be quantitatively measurable. If we use the expression that can calculate cost reductions:

DeltaCostPerYear - cost difference in the classic way of exchanging invoices,

ClasicInvoiceCost - classic invoice exchange costs,

CostEstablishedSystem - costs of establishing the system in companies,

Ny - years of exploitation of the system so established,

NInvoicesPerYear - number of invoices per year,

YearlySystemCostSupport - the annual cost of maintaining a company electronic invoice exchange system,

CostEInvoice - costs for electronic invoice exchange.

The expression that will calculate the profit in terms of reducing direct costs to customers is as follows:

DeltaCostPerYear = (ClasicInvoiceCost - (CostEstablishedSystem / Ny / NInvoicesPerYear + YearlySystemCostSupport / NInvoicesperYear - CostEInvoice)) * NInvoicesPerYear

Deducting the cost of electronic invoicing to calculate profits as a result of cost savings is a multiple. According to the analysis the price of electronic invoice exchange should not be higher than 2 denars. Of course, in this section we cannot rely on the commercial objectives that are the result of competition for electronic invoice exchanges. Since there is no competition, the price offered by such an operator cannot be determined (since it may be unrealistically high). If we take into account that the real price with all costs is 2 denars and sending an invoice by mail costs 70 denars the profit is obvious, ie the costs are reduced by 35 times. If other costs incurred as a result of indirect costs are included here, this proportion would be even greater.

Given that CostEInvoicing is very small the benefits of implementing such a system would be ≥ 35 times cheaper than the classic and established system the financial benefits would be very high. Of course, this savings is a benefit to the whole process.

The previous model mathematically shows that the financial savings for companies would be enormous, though at first glance it is not impressive when talking about saving on one document.

If we consider that the concept of GO DIGITAL which is current today in all spheres of human activity we can conclude that digital technology is particularly suitable for this segment of business entities. Benefits besides financials that are direct and indirect part cannot be transferred to financial values. The productivity and efficiency of administrative procedures related to the electronic exchange of invoices would be raised to a very high level which would be a huge benefit for businesses.

The integration of this service with workflow to confirm invoice acceptance to customers can further enhance the efficiency of some business processes in businesses. It can be integrated with all devices that can be connected to the Internet (PCs, tablets, mobile phones, PDAs, etc.). This can further improve the internal and external communication of the invoice exchange process.

Such a principle of affirmation also allows for improved communication between businesses in terms of timely receipt of invoices, timely "notification" that they have been received and accepted or rejected due to objections. All this will enable almost instant communication between the business entities regarding this process which will certainly raise their level of business.

SWOT analysis

SWOT analysis is an effective tool for decision making in different situations and under different circumstances in which the company operates. The SWOT abbreviation is an acronym derived from the first letters of the words: S-strengths, W-weaknesses, O-opportunities and T-threats. This analysis starts with how a company is developing if it makes the most of its advantages and opportunities, while at the same time finding a module to minimize weaknesses and dangers. Analyzing the strengths and weaknesses, as well as the positive and negative external influences, are essential in identifying whether the project is worth implementing.

The strengths of the SWOT analysis are the attributes or characteristics that are important when implementing an electronic exchange system.

The weaknesses in the SWOT analysis relate to internal factors that may hinder the achievement of successful results from the implementation of the electronic exchange system.

The third classification of factors in the SWOT analysis is opportunities. They relate to external influences that will prove useful in achieving the objectives of implementing an electronic invoice exchange system.

The last but equally important components of the SWOT analysis are the threats. They are external influences that threaten the success of the implementation of the electronic exchange system.

In our case, a SWOT analysis was conducted to identify the strengths and weaknesses, as well as the opportunities and threats that may arise when implementing an electronic exchange system.

The SWOT analysis of the electronic invoice exchange system is shown in the following table:

Table1: SWOT analysis for implementing electronic invoice exchange

Internal	
Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Improved IT system optimization; 2. Saving expensive labor costs; 3. Reduce the high costs of postal services and materials; 4. Reduce shipping and archiving costs; 5. Increase cash flow; 6. Increased productivity; 7. Faster processing and payment; 8. Faster payment; 9. Optimized working capital; 10. Employees focus on higher value activities; 11. Reduce frauds, duplicates and interest on late payment; 12. Alternative financing options; 13. Optimized community management; 14. Real-time economy 	<ol style="list-style-type: none"> 1. The automation of the process will reduce the number of jobs, which means some employees may be out of work and thus increase unemployment; 2. The older generations are computer literate; 3. Some companies cannot afford additional software costs 4. Increasing the cost of purchasing software, using the Internet; 5. There is a possibility of technical problems, which may cause the entire network to break down; 6. Lack of internet access in certain locations;

External	
Opportunities	Threats
<ol style="list-style-type: none"> 1. Improved efficiency of the management process; 2. Cost reduction; 3. Faster response time; 4. Improved security and very little chance of fraud; 5. Integration with management systems; 6. Environmental protection; 7. Increased productivity; 8. Faster processing and payment; 9. Faster payment; 10. Optimized working capital; 11. Employees focus on higher value activities; 12. Reduced fraud, duplicates and interest on late payment; 13. Alternative financing options; 14. Optimized community management; 	<ol style="list-style-type: none"> 1. There is not legislation for this way of exchanging invoices; 2. Not all companies and suppliers have installed this software, which prevents the electronic exchange of invoices; 3. Invoice storage problems: in some countries invoices must be stored in original form; 4. There is a danger of cyber terrorism and cybercrime; 5. Lack of internet access in certain locations; 6. Implementation of this integration system into existing software solutions;

Source: Authors own research

Prior SWOT analysis for the implementation of the electronic invoice exchange system shows a large number of potential strengths of weaknesses, as well as a greater number of threat opportunities. This

is another indication that the implementation of such a system in companies can contribute to more efficient and effective invoice exchange, thus speeding up the process of exchanging them compared to the traditional way of invoice exchange. Despite the existence of some weaknesses and threats in the implementation of this system, however, the analysis of the opportunities and strengths shows that the implementation of this system is crucial for many companies, especially for companies that have many invoices annually. operating, which would greatly reduce costs, speed up delivery and payment, improve customer relationships, increase productivity, and optimize company performance.

Adding to this analysis the COST-BENEFIT analysis shows that such a model for electronic invoice exchange would be of great benefit in many aspects. The proposed model can be relatively simple to implement and fully operational.

In this context, we would mention the existence of a possible problem with the availability of internet in all locations where invoices are made, as this would also mean inability to operate this system. However, given that mobile operators cover almost the entire territory of the Republic of North Macedonia, and on the other hand that the PRO has introduced SIM cards for all cash registers, we can conclude that the problem of internet accessibility has been overcome.

This would also indicate the danger that due to the sinking of older software solutions (for which development or support is already abandoned) software companies would not want to implement the proposed system. This would be a serious problem for the full implementation of this electronic invoice exchange system. But of course the prestige of software companies and marketers would do their part. If such a system had to be implemented for implementation it would be obligatory to implement it, in which case it would be implemented in all invoicing software solutions.

Conclusion

Having in mind the analyzes and the results obtained from the research, the implementation of the electronic invoice exchange system will have multiple benefits for all participants in the invoice exchange process. Namely, this concept is extremely effective because invoices will be exchanged instantly, and some problems with invoicing will be eliminated. The costs of business invoice submission are minimal, and invoice confirmation is more efficient and much faster than previous confirmation models.

On the other hand, the implementation of such a solution also contributes to reducing the need for paper which contributes to the preservation of nature from its paper destruction as well as the reduction of waste paper.

Cost Benefit analysis has shown great financial savings as well as many non-financial measurable benefits. If taken into consideration and to avoid the cascading VAT evasion that once again confirms that the implementation of such a model would contribute to improving the whole business environment as well as reducing and possibly eliminating the possibility of fraud.

SWOT analysis has also shown that the proposed concept has many strengths and opportunities against weaknesses and threats, so its implementation will optimize the overall performance of companies.

Bearing in mind that today in all spheres of human activity the concept of GO DIGITAL is promoted, this process of electronic exchange of invoices should be digitized as soon as possible and all the benefits it brings with it. The great benefit of such an electronic invoice exchange solution opens the door to start exchanging data (in this case documents) between ERP software solutions between businesses that has never been done as a general possibility even on the same ERP solutions. Implementation of such or similar solution would be a serious step in providing such an interaction of ERP solutions that will have a strong impact on changing the business environment as well as a new vision for the development of ERP solutions. The idea behind the possibility of some invoicing web solutions can also integrate businesses that do not have ERP solutions and still be able to use this

opportunity for electronic invoicing. The implementation would also contribute to the development of new challenges for digital integration between business partners and to enhance and automate greater and more objective control of their cooperation.

Implementation of such or similar concept for electronic invoice exchange will mean a leap in the development of the invoice exchange process between businesses and it will bring about a number of positive changes to the process that have not seen significant changes despite advances in technology. We hope that this paper will contribute to encouraging research in our country to support the global concept of GO DIGITAL.

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THE E-COMMERCE IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract:

The Internet revolution is expanding in the field of the commerce. Instead of traditional commerce, more and more companies are offering their goods and services over the Internet, and more and more consumers are choosing to purchase the necessary goods and services online. The e-commerce, eliminates the geographical limitations, enables the consumers from their home to buy goods and services from anywhere in the world more easily, and allows merchants to do their business without special conditions. This paper will analyze the legal framework of the electronic commerce in the Republic of North Macedonia, the compliance with European Union acts (acquis Communautaire), the application of electronic commerce in the Republic of North Macedonia, the disadvantages and the obstacles of the legal framework for the functioning of electronic commerce. Finally, we will propose measures that will contribute to improvement and bring down the barriers that limit the development of this sector.

Key words: e-commerce, legal framework, obstacles, measures.

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Intruduction

1. Definition and development of e-commerce

E-commerce is a commercial activity conducted with the help of the electronic technology. E-commerce primarily consists of distributing, buying, selling, marketing and servicing products and services through electronic systems, such as Internet or other computer networks. E-commerce as a multidisciplinary concept is increasingly revolutionizing the habits of the consumers and the global way of trading. The development of the e-commerce is an inverse dynamic and unpredictable process whose beginnings relate to the 70's of the 20th century in which the e-commerce was reduced to ordinary electronic data exchange or web page exchange (electronic brochures) with different content for certain types of products among the companies. Things had changed dramatically after the creation of the global computer network - the World Wide Web (www) in 1992 and the emergence of Amazon.com when the world first strictly started to speak about the development of the e-commerce. This happened because people all over the world started to have easy access to computers and to the World Wide Web. The expansion of the e-commerce was also aided by the creation of the first web global browser NCSA Mosaic in 1993, the creation of the first Internet payment rules in 1995, the establishment of the Digital Subscriber Line in 1997 which sped up the Internet connection for 50 times compared to the standard modem and dial up access which had been available at that moment, as well as the emergence of Pizza Hut with the implementation and enforcement of online orders for its products. Due to the rapid development of the Internet, the electronic commerce is gaining a new development dimension. The real proof of this is the ability to create marketing strategies and do business in anywhere in the world via internet as well as the emergence of the smartphone which allows users to buy any product regardless of where they are located. The fact that the e-commerce is on the rise is also illustrated by the fact that in 2017 two billion people made online transactions via smartphone, as well as NUA Internet Surveys data, which currently says that there are half a billion internet users. E-commerce in the 21st century is getting a whole new face with the help of the social networks: Facebook, Instagram, Youtube, PhotoBucket that attract over 30 million visitors per month and as such are the ideal place for retailers to connect with consumers.

2. International legal regulation of the electronic commerce

The revolution in technology that has triggered the e-commerce has inevitably opened up the need to create a legal framework that will regulate the regime of the business transactions - the legal framework of e-commerce. This is because the e-commerce, due to the globalization and the breakdown of trade barriers, increasingly distorts the traditional ways of doing business. It is for this reason that in June 1996 the United Nations Commission on International Trade Law (UNCITRAL) adopted the UNCITRAL Model Law on Electronic Commerce with Guide to Enactment. E-commerce and lately in 1998 adopted the additional article 5 bis⁴.

The decision of the United Nations Commission on International Trade Law to regulate the matter of the electronic commerce in a Model Law rather than in a Convention was fully expected and proper, because e-commerce is a "modern matter" that yet have to be regulated in the national legal systems.

⁴https://uncitral.un.org/sites/uncitral.un.org/files/media-documents/uncitral/en/19-04970_ebook.pdf

The Model Law on Electronic Commerce with Guide to Enactment, are a soft law instruments (have no binding force), but they are solid basis for regulating e-commerce globally. This is because they are an example for the national legislators in countries where e-commerce is not regulated at all, i.e they are an inspiration for the legal reform of the national legislation where e-commerce has been regulated inappropriately with outdated methods⁵. Undeniably, the UNCITRAL rules on e-commerce are invaluable because they offer any national legislator a set of rules on e-commerce that any national legislator can hardly reach in quality alone. It is for this reason that the UNCITRAL rules on electronic commerce are also an inspiration to the European legislator. This is proven by the fact that the EU e-commerce directives are not new rules on e-commerce but an attempt of the European legislator to transpose the international rules on e-commerce into European law and as such to facilitate the free movement of goods, services, capital and people in the single European market. In the EU the most important legal acts regulating electronic commerce are: the Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market ('Directive on electronic commerce')⁶, the Directive 97/7/EC of the European Parliament and of the Council of 20 May 1997 on the protection of consumers in respect of distance contracts⁷, the Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a Community framework for electronic signatures⁸ and the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)⁹. As can be seen, mostly the European legislature does not impose the e-commerce matter as binding, but rather opens up the national legislators of EU Member States and EU aspirant states to self-regulate e-commerce whilst following basic European legal normative practices as harmonization tools. This is done on one hand in order to stimulate e-commerce in the EU, but on the other hand for the sake of predictability and legal certainty in e-commerce in the single European market.

3. Legal regulation of the electronic commerce in the Republic of North Macedonia

The need for legal regulation of the electronic commerce in the Republic of Macedonia raised because the electronic commerce matter was at the crossroads of contract law, intellectual property law, international private law, consumer law, personal data protection law, the rules of the regulation of electronic signatures, the rules for domain registration and the use, taxation and other regulatory areas. Due to this and under the influence of the UNCITRAL Model Law, but also for the purpose of the harmonization with the EU legislation (primarily the Directive 2000/31/EC, 'Directive on electronic commerce'), the Republic of Macedonia as a country aspiring to EU membership in the early years of the 21st century adopted the Law on Electronic Commerce. The Macedonian legislator adopted the

⁵As the The General Assembly Recommends that all States give favourable consideration to the Model Law when they enact or revise their laws, in view of the need for uniformity of the law applicable to alternatives to paper-based methods of communication and storage of information; UNCITRAL Model Law on Electronic Commerce

with Guide to Enactment 1996 with additional article 5 bis as adopted in 1998, p.2.

⁶Official Journal of the European Communities, L 178, 17 July 2000, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000L0031&from=EN>

⁷Official Journal of the European Communities, L 144, 4 June 1997, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31997L0007&from=en>

⁸Official Journal of the European Communities, L 13, 19 January 2000, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0093&from=EN>

⁹Official Journal of the European Union, L 119, 4 May 2016, <https://publications.europa.eu/en/publication-detail/-/publication/3e485e15-11bd-11e6-ba9a-01aa75ed71a1/language-en>

Law on Electronic Commerce relatively late due to the initial negative conflict of the competences over which ministry was competent to draft the Law. Thus, after the disagreements was resolved, and after the Ministry of Economy drafted the Law on Electronic Commerce and took the responsibility to supervise the implementation of the law. The Law on Electronic Commerce was published in the Official Gazette of the Republic of Macedonia on 02.11.2007 and entered into force on 10.11.2007. This was the first time when the Republic of Macedonia regulated the electronic commerce in accordance with international (The UNCITRAL Model Law) and European standards for electronic commerce ('Directive on electronic commerce'). The Law on Electronic Commerce of the Republic of Macedonia is based on the Directive on electronic commerce and it was introduced with the aim to develop the electronic commerce by providing legal certainty in the business relations. The Law on Electronic Commerce regulates the information society services related to electronic commerce, the liabilities of the information society service providers, the commercial communication and the rules related to conclusion of contracts in an electronic format. From the subject of the regulation it can be concluded that the Law on Electronic Commerce is not the only law that regulates the electronic commerce in the Republic of North Macedonia. Other relevant regulations on electronic commerce that supplement the Law on Electronic Commerce as a *lex generalis* are: Law on Data in Electronic Form and Electronic Signature, Law on Electronic Telecommunications, Law on Trade, Law on Consumer Protection, Law on Payment Operations and the Criminal Code. The Law on Electronic Commerce of the Republic of Macedonia was also changed and completed in 2011 and 2015¹⁰.

4. Application of the electronic commerce in the Republic of North Macedonia

The trend of e-commerce, purchasing of products via Internet, is becoming more and more present in our country. According to the data of the Eurostat and the State Statistical Office presented by the Association of E-commerce of Macedonia (AETM) in its analysis of the state of e-commerce in the country, the online commerce is dominated by natural persons. Of the total transactions in 2017 made through e-commerce, the largest share is of natural persons, accounting for 79% of total transactions. The average value of a transaction of natural persons is 1538 denars and it is decreased, compared to the previous year, while for legal entities this value is increased to an average of 2271 denars. On a year-over-year basis, in 2017 Macedonian citizens abroad achieved 70% of the value of online transactions and spent approximately 73 million euros to purchase products and services online. The increase compared to 2016 is 18%, while for legal entities it is 24% and for natural persons it is 16.5%¹¹. In the Republic of North Macedonia, according to data for 2018, approximately 1,841,000 payment cards have been issued, there are approximately 870 online shops and e-commerce has achieved an annual turnover of € 139 millions of Euros¹².

In the first quarter of 2017, 79% of people aged 15-74 who shopped online had one to two online orders for private use, and only 2.7% of them have made orders more than 10 times. Mostly, 66.8% of on-line purchases are valued at less than 50 euros, or 92.1% of on-line purchases are valued at up to 100 euros and at least only 0.4% of on-line purchases are valued at over € 1,000. Also, 64.1% of the products and services ordered online were related to clothing and sports equipment, 19.5% to electronic equipment (and cameras), 10.2% to hotel and other accommodation, 6.7% event tickets (cinema, theater, etc.), and 5.8% books, magazines, newspapers, e-books¹³. It shows that the average

¹⁰ Official Gazette of the Republic of Macedonia No.17/2011, 104/2015 and 192/2015.

¹¹I. Petrovski.(2018)The profile of the Macedonian online buyer, Economy.<https://kapital.mk/profil-namakedonskiot-onlajn-kupuvach/> (accessed 20.09.2019)

¹² Data published on the website of the E-commerce Association of Macedonia [26.09.2019]

¹³ State Statistical Office. (2018). Makstat SELECTION 2018 p. 57.

Macedonian consumer mostly buys clothes and sports equipment through e-commerce, usually valued up to 50 euros.

In the first quarter of 2018, of the total population aged 15-74 years, 79.2% used the Internet, and 68.7% used it daily or almost daily. 31.6% of people who have ever used the internet have ordered / purchased goods or services over the last 12 months, and the majority (54.9%) have purchased clothing or sports equipment¹⁴.

The trend of home buying is an inevitable part and the Macedonian economy shows also the figures, analyzed in the past 10 years. So if in 2007 less than 2% of the population ordered or bought a product or service online after 10 years, in 2017 this figure is around 15%¹⁵.

Worldwide, according to the 2014 B2C E-commerce Index, calculated on the basis of the percentage of people using the Internet, the number of credit cards issued, Secure Internet Servers (per 1 million people) and Percentage of population having mail delivered at home The Republic of Macedonia is at 41 places better than Greece (42 places), Bulgaria (49 places), BiH (53 places) and Albania (55th place), worse than Croatia (37th place) and Slovenia (23rd place)¹⁶.

5. Reasons that slow down the functioning of the electronic commerce in the Republic of North Macedonia

Despite the adequate legal framework of the e-commerce that is in compliance with the international (UNCITRAL Model Law on Electronic Commerce) and European (the Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market) standards for e-commerce it can be said that there is lack or very poor control in this area. The fear of fraud, the insufficient knowledge of the functioning of e-commerce and ineffective consumer protection contribute to the low use of e-commerce in our country.

Thus, the State Market Inspectorate, which is the competent body to conduct the inspection supervision of the implementation of the provisions of the Law on Electronic Commerce, in terms of Information to be provided and Information to be provided for the purposes of concluding a contract, in 2018, conducted only 3 inspection supervisions in accordance with the Law on Electronic Commerce¹⁷. Due to the increased number of complaints of the fraudulent consumers about products or services that had bought electronically, as well as the fact that this mode of trade has not yet been legally described in detail, and that the function of the State Market Inspectorate as a state consumer protection body is still limited, this body points for the minimum information online merchants must make publicly available and for information to be provided at the conclusion of an agreement in electronic form are followed.

Often consumers due to insufficient control in this area and lack of education acquire goods and services from persons who are not registered to perform any kind of commerce or individuals who do not make the necessary information publicly available and offer goods or services electronically.

¹⁴ State Statistical Office. MAKSTAT. News release No:8.1.18.29 from 22.10.2018

¹⁵ State Statistical Office. (2018). Makstat SELECTION 2018 p. 59.

¹⁶ UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT. (2015). *INFORMATION ECONOMY REPORT 2015 Unlocking the Potential of E-commerce for Developing Countries*.pg.101

¹⁷ State Market Inspectorate. (2004). *Annual work report of the State Market Inspectorate for 2018*. p. 12.

In this way, in the event of any violation of consumer rights, they remain completely unprotected as they have no information about the service provider against which they would exercise their rights through judicial or administrative proceedings.

The Consumers Organization of Macedonia¹⁸ with the aim to make consumer protection effective in Macedonia and fit for the country's new market conditions, carries out its mission through promoting legal regulation that improve consumer protection; inputting in the formulation of national consumer policy; educating, informing and counseling consumers and representing their interests. The Consumers Organization of Macedonia has produced the brochures: "Consumer Rights at Purchasing Distance"¹⁹ and "Top 10 Ways to Be Safe Online as a Consumer"²⁰. The purpose of these brochures is to educate the consumers and prevent or reduce the number of dissatisfied or damaged consumers.

Conclusion

The Republic of North Macedonia, has good legal framework in line with international and European standards for electronic commerce. The statistical indicators show that the number of electronic transactions in Macedonia is also increasing year by year, although there is an area for greater use of the e-commerce by both the business community and customers. Despite the good legal framework, the state control over the application of the e-commerce regulations is lacking, hence there is a high risk for a large number of deceived consumers. The insufficient education and awareness of the consumers about their rights and benefits of purchasing goods and services online, requires another caution and extreme, and this is the minimal use of e-commerce. Also the other link - the business community prefers a more conventional way of trading. In order to make greater use of e-commerce, to follow the world trends and benefits, it is necessary to educate and increase the capacities of e-commerce through various promotional campaigns, educational events, seminars and similar events intended for the business community as well as consumers. However, in any case, increasing the state control over the application of the regulations would increase the legal certainty, which would certainly have a positive impact on the wider and wider application of electronic commerce.

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HOW CAN BIG DATA CONTRIBUTE TO THE HOTEL'S DIGITAL MARKETING SUCCESS?

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Abstract:

Each day information shared digitally increases significantly. The digital era has brought a ton of data, which marketers nowadays can only leverage to make better strategic marketing decisions through more accurate insights, such as big data. And since in this digital era, "data is king", important marketing decisions are now determined by big data. Big data in general, helps the digital marketing to get the attention of customers (through personalized services) and understand the market or industry conditions, i.e. to get knowledge about the industry trends and future prospects (staying ahead of the game). Being able to provide this, big data have compelled many businesses to adapt this tool to its digital marketing, and to evolve and improve their digital marketing campaigns.

In the industry of hospitality, where hotels offer highly competitive services and products, big data has proven to be a necessity for digital marketing, so for each hotel to have the opportunity to distinguish itself. Just by analyzing past guest profile information, past booking history, service preferences, purchasing habits while on property, affiliation with the hotel guest loyalty program, booking channel preferences, preferences for auxiliary services with big data, the marketing is targeting and engaging present and future guests, and therefore fulfilling its overall strategy - higher percentage of bookings i.e. income and compete in the today's market.

This paper was conducted mainly with a view to identify and summarize why big data matters to digital marketing, and how the future of digital marketing will be grounded in data. A focus is given and discussed is how our big data excavates information and what hospitality do with it. Narrative review was used where related articles, reports and studies were selected and later summarized.

Keywords: *digital marketing, big data, hotel, guests*

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Introduction

The big data's potential in digital marketing is colossal and with data being generated and collected in real-time, around the clock, seven days a week, the marketing industry is now able to see what people are buying, following or communicating about (Barutçu, 2017). Gaining those insights come from the huge amount of data that customers produce every day, thanks to digitalization and accelerating growth of the Internet of Things (IoT). As data has become a major priority for businesses of all sizes, marketing has faced with the need of analyzing that huge amount of data that goes beyond the capacity of traditional databases and software techniques.

Therefore, now important marketing decisions are determined by big data. The understanding of big data is a crucial issue for marketing, by providing insights from the data to the most appropriate product and service in a particular market, insights on how to advertise on the market, through what channels should the communication happen, at what point, suitable time and for what price, supported by selected promotional and advertising activities (Amado *et al.*, 2018). Big data can impact and benefit for digital marketing in many different methods by making it easy for marketing to get a better idea regarding the changing customers' tastes and preferences. Big data also make it easy to develop the personalized marketing strategies to the firm's target customer base (Mohammad *et al.*, 2018).

What is big data?

The term big data apply to information that could not be processed using traditional tools or processes. Back in 1997, Michael Cox and David Ellsworth were the first authors to relate to the term "big data", defined as the challenge of storing large databases for visualization purposes (Cox and Ellsworth, 1997). Some believe that, John Mashey, a US computer scientist is the inventor of the term big data, or he was at least responsible for the start of the buzz around the concept in the 1990s (Diebold, 2012). Since then, big data are still seen as a fairly new term, where many authors have given their opinions and definitions to the technology. Big data are defined as contemporary hype (d'Amore *et al.*, 2015). Several authors have described it as a type of cure, mainly due to its popularity, capable of providing rich and useful insights into many aspects of the lives of individuals, organizations, and markets (Mayer-Schönberger and Cukier, 2013; McAfee *et al.*, 2012). Mayer-Schönberger and Cukier (2014), later described big data as the focus of data collection with unprecedented breadth, scope and depth to solve current problems. Big data are also described as data that goes surpass or beyond the business's ability to store or analyze for accurate and timely decision making (Heudecker *et al.*, 2013). Other authors have described it as a cultural, technological, and scientific phenomenon that relies on interaction with technology, analysis and even mythology (Ekbia *et al.*, 2015; Boyd and Crawford, 2012).

Big data are widely discussed topic since the digital transformation has started to create an influence on daily activities of individuals and the amount of data increased exponentially as a result of this process. The conversion rate of data generated comes from the rapid growth of the Internet of Things (IoT), cloud computing and improved search engine efficiency, leading to the growth of big data (Mehdipour *et al.*, 2016). Thousands of sets of information are generated in social media, mobile transactions and user-generated content; there is also intentionally generated content through sensor networks or business transactions such as sales and purchase transactions (George *et al.*, 2014). Embedded devices include things like RFID readers and chip cards, smart cars, vending machines, smart meters, medical implants, security cameras generate additional data via the systems as they interact with shopping malls, traffic grids or cellular networks. Data as such, is so large and complex that none of the traditional data management tools can store or process it efficiently except big data. Unlike traditional analytics that deal with small datasets with a limited analytics platform, big

data works with much larger, unstructured and complex datasets that require new and advanced storage, management and analysis technologies (Chen *et al.*, 2012).

In the era of big data as said, the amount of data being processed is much larger than traditional datasets. Existing data were in petabytes (PB) (Katal *et al.*, 2013), which was already problematic; so, since 2016 it has increased to zettabytes (ZB) (Pappas, 2016), and this is primarily due to the increased use of mobile phones and devices and social networks. IDC estimates that the amount of digital data generated will increase from 33 ZB by 2018 to 175 ZB by 2025 (Coughlin, 2018).

Knowing this, it's no wonder that big data has become a popular area of research with the potential to add tremendous value to products and services in industry and business (Ang and Seng, 2016).

Big data, bigger digital marketing

Digital transformation has already changed our lives in dramatic ways, and is poised to become an even more crucial component of the business world. When it comes to marketing, going digital has had massive consequences. Now the properties of digital media such as more accurate metrics, combined with the interactivity, have created whole new marketing opportunities. Digital marketing is an umbrella term for the marketing of products or services using digital technologies, mainly on the Internet, but also including mobile phones, display advertising, and many other digital medium (Khan and Siddiqui, 2013). In general, digital marketing is seen as marketing designed for products/services using digital technologies like emails, websites, online forums and newsgroups, interactive television, mobile communications, etc. to reach the consumers (Kotler and Armstrong, 2009). Digital marketing in basis uses the technologies for the help of the marketing activities in order to improve customer knowledge by matching their needs.

Recognizing the impact of our daily lives, customers have changed with digitalization as well as their expectations. Today, customers expect relevant content in relation to what they're doing anytime, anywhere and in the format and on the device (mobile, desktop, iPad or other) of their choosing. The digital savvy customers nowadays are comparing the prices of products, or checking reviews, all within seconds thanks to the digital transformation. With more and more customers using digital technologies, it makes sense that the created world's data has risen to these high levels. Customers create massive, almost incomprehensible amount of information, and if treated accordingly present useful tool to the relevant digital marketing interests.

In digital marketing, understanding consumer behavior is key for marketing success as consumers have embraced utilizing the Internet and online socializing tools (Vinerean *et al.*, 2013). As a result of these rapid changes and the huge amount of data accumulated, businesses in general and marketing, in particular, are obliged to turn to big data as is becoming more and more a portion of an organization's essence and its policy (Mohammad *et al.*, 2018). The complex data sets, run by big data operate with the huge volumes of both structured or unstructured data created with the customers' characteristics, and lead to better marketing decisions and strategic moves. With big data as right chosen technology, digital marketing improves the quality of the decision-making process and detailing process. Big data empower digital marketing by being able to target the core needs of the customers just by collecting data. For example, collecting cookie files; big data give out data to the digital marketing as information about the customers' activities as they browse the Internet, generalizing personal data in the process. Digital marketing is even able to develop buying personas using big data like customer behavior, purchasing patterns and favorites. The knowledge given by big data allows digital marketing to increase customer engagement, ensure customer loyalty, and hence lead to an increase in revenue.

Using big data to enhance digital marketing in hospitality

The hospitality industry segment works on the core principle of serving others and to nurture the guests. Hospitality caters to millions of guests every day, each of them arrives at the hotel with their own expectations. Guests nowadays turn to the Internet to find services such as hotels, restaurants, spas, and other recreational services. With the increase use of digital tools, the guest's engagement behavior has led to a change in the marketing strategies of the accommodation providers of the hotel sector (Leite and Azevedo, 2017), whereas in this competitive digital age, hotels turn to digital marketing because it has become the most viable way of getting to potential guests, establishing a brand, and developing a group of loyal guests. Therefore, the need for digital marketing has been felt like never before in the hospitality industry wherein guests have instant access to all kinds of information on the latest offers and best prices. Today digital marketing plays a critical role in the success of each accommodation provider which exists in the hospitality industry (Kaur, 2017).

Data, from how the rooms are booked (direct hotel bookings via OTA bookings), to guests' feedback from different social media channels, online guests' reviews from travel websites such as TripAdvisor, Booking, Yelp, Trivago is being created because of digital transformation. Hotels can use this data to offer a personalized experience to their guests, ranging from suggesting local restaurants to finding a price for a particular offer that is irresistible to the guest (Ristova, 2019) all to do properly create digital marketing strategies. Since, understanding the needs and requirements and meeting expectations is the key for guests to return, more and more hotels are turning to advanced analytical solutions that will help satisfy their guests (Shabani *et al.*, 2017). There is no doubt that today's big data will be identified as a major trend affecting the hospitality industry, as it offers many opportunities to improve current guest service, improve hotel business efficiency, create better digital marketing strategies and thereby maximize production and profitability (Gupta *et al.*, 2017). As data has become one of the most valuable resources for digital marketing thanks to the rapid digital transformation, collecting customer data has become a major priority for the hospitality business. In the age of constant connectivity, smartphones and the Internet of Things (IoT), customer data is being collected right around the clock. The author discusses several ways of how hotels can collect data about their guests:

- **Web mining:** Web mining became an easy and important platform for retrieval of useful information, because customers prefer the WorldWide Web more to upload and download data (Mughal, 2018). Hotel's digital marketing by using certain tools for web mining gets to understand structured as well as unstructured data gathered from guests' browser activities, server logs, and guests' site structure on the WorldWide Web.
- **Search information:** Use of the Internet search data is used to learn about customer behavior, as the content of searches can shed light on a wide variety of customers' concerns and expectations (Rubinstein, 2013). This is data that hotels can get derived from browser activity through the use of special tools to track search information and detect guest behavior and intent.
- **Social media:** Social media has evolved over the last decade to become an important driver for acquiring and spreading data in marketing. The growth of social media usage opens up new opportunities for analyzing several aspects of, and patterns in communication. For example, social media data can be analyzed to gain insights into issues, trends, influential actors and other kinds of information (Stieglitz *et al.*, 2018). Millions of users visit social networks on a daily basis, leaving the hotels to gather tons of various data from personal preferences to brand loyalty. The hotel's digital marketing gets to track guests through social media and use it to their advantage when starting next marketing campaign.

- **Crowdsourcing:** Crowdsourcing generally refers to the participatory online activity of calls for individuals to undertake a task voluntarily. Crowdsourcing benefits of getting data from the collective intelligence of online communities. Online communities are in this case called crowds. Members of these online crowds are given the opportunity to respond to crowdsourcing calls (forums, surveys, polls) and they are motivated to respond for a variety of reasons (Benedek *et al.*, 2015). Digital marketing uses crowdsourcing as a data of main feedback form in order to get a true opinion of a hotel's guests, get extremely useful information and improve future campaigns (Richard *et al.*, 2016).
- **Transactional:** Voluminous data are being exchanged during banking transactions internally and externally (Chedrawiet *et al.*, 2018). Banks have a vast variety and amount of customer data due to an increasing number of transactions through various devices, that can be used to generate insights and enhance the customer experience (Somal, 2017). Tracking and analyzing these transactions (purchases, requests, insurance claims, deposits, withdrawals, flight reservations, credit card purchases) can help hotels understand the patterns of their guests while booking, and plan digital marketing campaigns accordingly.
- **Mobile:** Smartphones now offer the promise of collecting behavioral data unobtrusively, as it unfolds in the course of daily life. Data can be collected from the onboard sensors and other phones logs embedded in today's off-the-shelf smartphone devices (Harari *et al.*, 2016).

After determining the sources from where does hospitality can accumulate an incredible amount of data, the analysis of the data gained with big data can result in improving digital marketing strategies of hotels and drive to greater success by below ways as listed by the author:

- **Personalized / targeted campaigns**—The digital transformation has empowered businesses to personalize and customize marketing messages in order to communicate with stakeholders. This has started a development of personalized marketing and reshaped the way businesses target and segment markets, create dialogues and challenge the old approach to mass marketing (Påhlman and Waldenskiöld, 2013). Digital marketing campaigns created for different guests' personas using big data, tracks data such as customer behavior, favorites and frequent purchases. The data can be simple insights like basic demographic information; or more specific like niche interest, buying intent and behavioral patterns. Besides being personalized, big data enable digital marketing to target its campaigns in the hospitality industry for bigger chances for conversion as majority of targeted guests are seeking information online on the Internet of Things (IoT) that the hotel may supply and have a greater chance of purchasing hotels' products or services should they decide to cater to the need they may have.
- **Price optimization** – Previously, hotels priced products and services using basic information like product cost, competitor pricing, perceived value of the product from the customer and demand. Now, with big data, businesses can proceed with data-based pricing decisions, from the desired marginal profit per unit and the competitors' pricing options for the wider financial situation, customers' habits and willingness to pay (Lianget *et al.*, 2018). In hospitality, digital marketing uses big data for price optimization as big data provides descriptive guest's analysis based on site behavior, transaction history and data from a guest's online search. The previously discusses personalized / targeted campaigns for hotel guests, can even get an optimal price identified in a more targeted way for a hotel product or service, for example, pricing a hotel room for a particular geographic location, such as a state or a suburb, within a city or a rural area.

- **Appropriate Web Content** - Content marketing is a marketing technique that creates and distributes valuable contents to attract and acquire audience (Kaakinen and Purkayastha, 2016). The writers no longer rely solely on their creativity when developing content for promotional purposes. They have entire teams behind them, analyzing big data and suggesting types of content, themes, topics, and stylistic variations that would work better. Hotel's digital marketing can use various forms of content like: high-quality images, videos, written copy, virtual reality, social media, etc. and they all have value in engaging potential customers. For example, from hotel to start using virtual reality as part of their digital marketing strategy is a guest experience win-win. Not only does it make it easy for the guest to get involved, it can also lead to increased brand awareness and engagement with your content. Virtual reality can give the hotel guests a way to experience the hotel products, beyond just looking at a picture on the hotel website (Ristova *et al.*, 2019).

Hotel's digital marketing can use big data in different ways, but for that, they have to identify what they want to achieve from big data, so, they can take advantage of the insight based on their requirements. A perfect strategy with big data will surely help digital marketing to shape better marketing campaigns for the hotels.

Conclusion

Without a doubt, big data are changing the marketing landscape of many businesses, no less hospitality. Digital transformation has created a new world that allows hospitality to track digital activities of millions of consumers / guests through a variety of different techniques that allow hotels a personal look at guests' behavior and purchasing habits. It is this data collection that has propelled hospitality forward, keeping hotels abreast with the current times. Big data is the process of examining these data in order to uncover hidden patterns, market trends, customer preferences and other useful information in order to make the right marketing campaigns. And as it is today, digital marketing is all about understanding the consumers, i.e the audience, so important marketing decisions is now determined by big data. Digital marketing in hospitality, but in general as well, has a job of: collecting data, crunching numbers and statistics, deriving trends, targeting individuals (creating personalized offers) and finding the right channel among the hundreds to reach out to their target customers. Using big data for creating digital marketing campaigns is that it takes the guesswork out of determining what customers want. Big data application into the hotel's digital marketing allows hotels the opportunity of getting to know their guests better, assessing the level of guests' satisfaction, understanding reliability of the offered hotel service that provides the needs, finding new ways and implementing them to enhance the guests' trust and developing the new digital marketing campaigns on demand. The question left for now is for the digital marketing to take action into embracing such new potential into the performance strategies of hospitality to build a meaningful insight and enhance their efficiency.

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UPDATING MARKETING – CONTEMPORARY ISSUES

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Abstract:

Over the last few years a large number of companies have been making huge efforts to update their marketing. Changes in the dynamics of the environment draw attention to the new technologies and the possibilities for these technologies to be directly or indirectly used for marketing purposes. Being accessible to both companies and end users, makes innovative technologies particularly attractive in various spheres. The unquestionable advantages of implementing them for the marketing tools' dynamisation, integration and fine-tuning, will bring about an even wider use of innovative technologies. Reported positive impacts of applying marketing innovations are very promising for companies that envisage marketing updates in the next few years. The balance of business and consumer benefits, stemming from new technologies in marketing, will keep on fuelling both parties' interest in all innovations that help improve the socio-economic conditions, accelerate processes and improve marketing effectiveness across all levels.

Key words: *real-time marketing, marketing automation, mobile marketing apps*

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Introduction

The rapid development of technological innovations over the last years has attracted marketing specialists' attention in view of their implementation and effective use. This has also been the reason for traditional marketing losing positions over the last decade. There are several arguments for companies seeking opportunities to update their marketing. To begin with, traditional instruments are less effective than they used to be. Secondly, the environment has so markedly changed, that it is impossible for company marketing to remain unchanged (for example increased competition and the risk of commoditization (Ernst & Young, 2011)). Thirdly, new technologies' potential and the economies of scale are so significant, as to seem particularly attractive, given that they are easily accessible and relatively low-cost.

And whereas in the initial years of marketing transformations mostly distribution channels and products were affected, these days marketing innovations are evenly registered in all spheres. The last few years have witnessed exceptional progress of marketing technologies in communications, pricing and research. Special attention is paid to marketing processes speed.

The aim of this paper is to present contemporary aspects of marketing updates at a company level.

Several important issues concerning the updating of marketing

One of the major questions companies have to answer is whether they effectively use marketing in real-time. Under the new circumstances of widely available information, companies are supposed to use it effectively and take the said information under consideration when decisions are made about developing and maintaining a market. The capabilities of real time marketing are particularly relevant for companies in the service sector and have not yet reached their full capacity. Registering the changes in key variables of the environment in real time and considering them when marketing decisions are made is a prerequisite for effective capacity management for companies in all possible spheres.

The second question refers to whether companies make use of the advantages of implementing marketing automation. New technologies help towards a partial or complete automation of marketing activities and raising the effectiveness of marketing decisions. Automated solutions are increasingly and ever more aggressively offered at the marketing technology market. The demand for them, however, is still limited to predominantly high-tech companies and The Big ones from various industries.

Is the potential of self-made marketing effectively used to the benefit of companies' product and market development under conditions of automation? Consumer involvement in company marketing activities is a priority for high-tech companies. Using consumer experience, their consumer expertise and experiment are a major starting point in the implementation of marketing innovations.

The third question is as follows: What are the advantages of using mobile marketing apps in the company business? Over the last decade we have seen a boom in the development and implementation of mobile apps for marketing purposes. Among the most popular of these are location-based apps, weather-based apps, content-based apps, event-based apps and usage-based apps and other. Apart from using multi-purpose apps, for their business objectives companies will continue developing specific mobile apps to facilitate and accelerate orders.

Real time marketing and the possibilities for marketing automation

One of the greatest challenges facing contemporary marketing is real time marketing. The transformation of conventional marketing into dynamic marketing is absolutely necessary. The intensity of changes in the environment suggests activity through instruments that are environment-sensitive and adequate in any situation. The scope of real time marketing is constantly expanding (table 1).

Table 1

Applied aspects and advantages of real-time marketing

Applied aspects	Advantages
Capacity management	Adequate capacity management with immediate registering of environment changes. For example, capacity management by channels, segments, etc.
Updating offers	Providing a complex marketing offer that is adequate to circumstances, consumer demand and consumer expectations.
Making use of opportunities resulting from favourable changes in the environment	Marketing flexibility in order to achieve better sales, prices and profits.
Compensation marketing	Possibility for quick compensation of poor results. For example, failure to reach targets, client withdrawal, reduced average purchase value, etc.
Adequate marketing tools	Improvement of the overall marketing performance of the company.

The last decade has observed the growing role of marketing automation. Not only processes but also marketing decisions are being automated. Big Data and real-time transfer of information are a prerequisite for improving marketing decisions effectiveness and speed. Among the challenges of marketing automation are the following: pricing automation, distribution and logistics automation, as well as automation of product development and product supply, marketing research and other.

Table 2

Areas in marketing automation

Areas	Peculiarities
Automation in communications and CRM	Use of marketing automation platforms for communication and CRM purposes with positive effect on marketing efficiency (Todor, 2016).
Pricing automation	Pricing automation is characterized by speed, relevance and validity. Mathematical models are used in order to cover key variables that affect a particular product price under particular circumstances (Tonkova, 2017). Special attention is paid to the price optimization (Stanković & Đukić, 2013) based on different variables.
Distribution automation	Distribution automation will continue to be a driver for improving economic effectiveness. The use of vending machines and 3-D print technologies will enable the application of self-made marketing and Just in Time concepts.
Product development and production automation	Creation of open innovation platforms involving consumers has been on the rise over the last years (Hossain, 2018). Product formatting and product offer automation definitely have positive effects in company and market development.
Research and decision making automation. Big data and big research (Gordon & Perrey, 2015).	Innovations in marketing research automation are connected with all components of the marketing information system and marketing decisions. Specific channels and instruments to match consumer profiles are sought.

Marketing automation will go on developing at a quick rate. Overcoming subjectivism in marketing decisions will be a primary argument in favour of moving from conventional to automated marketing.

Mobile applications in marketing

The recent growth in using mobile devices, as well as consumers' desire to shop quickly, safely and conveniently, increase companies' interest in using mobile apps for marketing purposes. Part of these are offered by technological giants, others are being developed tailored to business needs, taking into consideration product specifics, customers, purchase behavior, roles, purchase motivation, stimulus response, etc.

Table 3

Mobile applications in marketing

Mobile Apps	Specifics
Location-based applications	Consumer location, their movement, the objects they visit will remain a focus of observation for marketers. Such apps will predominantly be used for targeting, consumer filtering, navigation and consumer offering. In marketing the range of geographical restrictions will expand.
Weather-based applications	Using weather-based apps makes marketing more relevant and more effective. It is particularly efficient in capacity management, offering by distribution channels and pricing.
Content-based applications	Content and search will continue to be in the centre of marketing activity. Search history and content consumers download will remain a priority in marketing activity. In addition to the undisputed benefits for companies, such benefits exist for consumers, too – adequate offering, suitable advertisements and distribution channels.
Event-based applications	Events have always been important for marketing. They can be defined as the place where company marketing can be noticed. At present companies do not seem to make use of an event's full potential, in particular its sales potential and contact potential.
Usage-based applications	Usage-stage marketing, which is not that developed in conventional marketing, finds a very favourable environment in marketing apps. Among the best-performing applied aspects are: consumer navigation during product and service usage, assistance, reminding, risk warning, etc. This type of marketing apps aim to make consumption more effective and reduce risks for all parties.

Mobile apps for marketing purposes (table 3) are expected to demonstrate growth in new developments and patents in the forthcoming years. In addition to the business sphere, they will be more widely used in the non-profit sector such as education, healthcare (mHealth, 2011), etc. The environmental motive for their implementation in view of nature conservation and creation of a healthier urban environment will play a role, too.

Conclusions

In its pure form, conventional marketing is bound to lose ground. Increasingly companies will aim for spatial, temporal and market independence. On-line market regulation, including personal data

protection, will render communication and shopping safer for both companies and consumers. Greater attention will be paid to marketing processes speed, channel integration and product and service accessibility. Consumers will increasingly end up in the centre of marketing decisions and will be able to actively participate in product formatting and influence the values and benefits distribution in the course of selling and purchasing. Real-time compensation marketing will play the leading role of a balancing factor in the interests of companies and consumers over the next decade.

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PUBLIC FINANCE SUPPORT FOR DIGITALIZATION IMPLEMENTATION WITHIN THE SME'S IN PELAGONIJA REGION

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Abstract:

The modern concept of SME development is based on the digital economy and its approach. Public finance as a vehicle for public policy management and its central part is widely accepting the concept on development based on several pillars- and among the others SME development. Yet most of the studies for SME development are including digitalization of the SME's. Public finance support currently goes towards various sets of measures on expenditures and revenues budget side. The theory on regional growth is widely based on the SME development. Currently there are no studies on impact of the digital SME's in Macedonia. In Pelagonija region there are 3790 active businesses out of which 32 are large enterprises and the rest are SME's. GDP in 2016 was 1,078 billion EUR and on national level SME's contribute with 64.5% of value added to the GDP. Survey was undertaken on 131 SME's from Pelagonija region in order to determine the current level of SME digitalization within the region, to compare with EU average and to make conclusions on the impact of the SME digitalization to region GDP growth as well as revenues collection.

1. Digitalization and SME's from Pelagonija region

Digitalization is attracting widespread interest along various industries and politics. It can be defined as “ability to turn existing products or services into digital variants, and thus offer advantages over tangible product”.¹Digital SME's and its impact in regional development is widely recognized in many studies. There are examples of regions in most developed countries where regions are trying to provide greater level of incentives in order digitalization of SME's to be achieved to the highest level².However there are still lack of studies that are establishing link between public finance spending towards digitalization of SME's as well as measures on the revenues side like tax cut in favor of digitalization process implementationinside SME's.

Regional development processes in underdeveloped country such as Macedonia has to be one of the government public finance priorities. Investment decision making tool integrated into the regional development policy should be integral part.

Digitalization of the SME's many times mean more cheap option as compared with Large enterprise.³Digitalization of the SME's Though the compelling economic factors as well as enforcement from the government in form of various schemes and programmes has led to greater adoption of digital technology by these firms. In our country there are approximately SME firms and traditionally these were exposed to an informal credit system due to lack of access to formal credit system. Productivity gap of SME's can be overcome through intensive digitalization of SME;s.⁴ According to Financial Institutions Practice at Boston Consulting Group, this process will help increase the access to formal credit system among 85% of SMEs by 2023. As of now, low level of awareness, unavailability of talented human resource and cost of adoption etc. are the impeding factors in the process of digitalization. Apart from it, the absence of an understanding about the benefits that could be reaped through the use of technology, lack of guiding forces towards integration of technology and its institutionalization into the business, inhibitions towards upfront investment oriented costs have also been the causes that led to low adoption of digitalization among SMEs.⁵ In the area of ecosystem, most findings are consistent with previous research. The difficulty of defining the ecosystem's borders is supported by the interviews as well as by literature⁶. Though researchers analyzed this field for more than 20 years, its practical relevance is still low. Thus, we aim to bridge the gap and

¹Tackling the digitalization challenge: how to benefit from digitalization in practice,Parviainen et al. *International Journal of Information Systems and Project Management* , 2017

²Randall L, Berlina A, Teräs, J & Rinne T (2018), *Digitalisation as a tool for sustainable Nordic regional development: Preliminary literature and policy review*. Discussion paper prepared for Nordic thematic group for innovative and resilient regions, January 2018, Stockholm.p-18

³Study on Impact of Digital Transformation on MSME Growth Prospects in India Pankaj Mishra Assistant Professor, Amity Business School, Amity University Madhya PradeshIJRAR- *International Journal of Research and Analytical Reviews*,2019 p.2

⁴Study on MSMEs Participation in the Digital Economy in ASEAN, 2018 p 10

⁵Study on Impact of Digital Transformation on MSME Growth Prospects in India Pankaj Mishra Assistant Professor, Amity Business School, Amity University Madhya PradeshIJRAR- *International Journal of Research and Analytical Reviews*,2019

⁶Platforms, Markets and Innovation, AnnabeleGawer, 2009 p. 3

highlight the relevance of the topic for SMEs. Still, it needs to be considered, that these results describe the relation between roles in ecosystems and stages for digitalization in a qualitative way based on the findings of the case studies.

Digital skills are crucial for SMEs if they are to improve their productivity and especially if they want to scale up. ⁷Digital technologies can allow SMEs to improve their relationship with their customers through customer relationship management (CRM), improve and speed up accounting, resource planning and people management processes, delivering efficiencies, especially in terms of staff time.⁸

2. Level of Digitalization of Pelagonija region SME's

Trying to approach more widely local SME's we have divided their core business into two basic segments products and services . Total of 36 production companies (that are producing physical products) and 95 services sector companies were surveyed. They were asked to provide answers about their level of digitalization as per the segments of business operations that they are dealing with. Both products and services sector are dealing with four core areas where they can implement digitalization solutions : General management, Finance, Production and Marketing. As shown within the table below level of the digitalization is higher within the General management business process and lowest level of digitalization is within the Production processes within the Production companies and for the Services companies the lowest level of digitalization can be found within the Marketing.

Table1 . Survey on level of digitalization of Pelagonija SME's answers

Production Sector			n=36		Services sector		n= 95	
In which area do you use digitalization					In which area do you use digitalization			
General Management	32	88.89%			General Management		85	89.47%
Finance	36	100.00%			Finance		91	95.79%
Production	4	11.11%			Service product preparation		22	23.16%
Marketing	20	55.56%			Marketing		50	52.63%
Production					Services			

Next table shows the level of digitalization within the specific within the business sectors of the companies that are SME's . At the General Management sector there is widespread use of digitalization tools. Mostly there is use of phone apps as well as e-mail (although not all of the respondents are using e-mail both within the products and within the services sector). Very small percent of the respondent companies are using the special software for general management. Also within the general management only small portion of the companies are using platforms (which are very popular and commonly used by the competition abroad) . Within the finance sector only in the

⁷Productivity and Digitalisation in Europe: Paving the Road to Faster Growth , Bart van Ark,2014

⁸Enterprise Research Centre, State of small Business Britain Report 2018, (2018), p 30. Sage Group, for example, have estimated that digital tools could save SMEs on average 120 days a year if they digitalised their administrative processes (Sage Group (SBP0027)). See also: Federation of Small Businesses, Digital skills gap in small firms holding back productivity, (December 2017).

field of accounting companies are 100% digitalized if we can agree on it that accounting software is a digitalization tool and it is used both insourced and outsourced by the companies that are part of the survey. The situation is different within the other sectors like bank correspondence and money market. In the products sector 11.11% of the respondents are using digital means such as online account checking and payment orders processing. Within the services sector such percentage is 33.68%. Yet this cannot be seen only as tool of the companies but even most tool of the banks and respondents are only passive users. In the analysis of this part of business operations also Financial markets are included. Basically in this part companies were asked to answer whether they buy foreign exchange and the definition was given broader meaning by whether they communicate with stock exchanges through buying or selling stocks (of other companies). Here the digitalization is lower that is probably both due to the lower levels of money and financial markets development but also due to the low level of knowledge of digital tools. Within the field of production the situation can be found as more relevant for explanation of the digitalization level within the Pelagonija region SME's. These differences in the adoption of key digital technologies indicate that different needs are prioritized in each industry. For instance, the need for robotic and automated machinery is higher in the food sector than in the construction sector due to the nature of the production processes in this industry. Interestingly within EU industries adopt social media technologies at a high rate, which may imply that there is a greater need to engage with customers than to improve production processes; while on the contrary, in both industries, 3D printing technology is only adopted by a low percentage of firms in each industry.⁹ Hence, through the digitalization process within the product or services creation many of companies are building their competitive advantage and the same situation counts for the Pelagonija region SME's. As expected more companies that are within the services sector are digitalized in the field of production process. The level of use of digitalized machines is 11.11% within the services sector while such figure is only 23.16% within the production sector. Probably the situation above is due to the fact that technology for services has advanced more it is easier to be implemented and costs are lower than the production sector. However if regional and national economy wants to be more competitive it has to improve much more within the area considered. If the situation of digitalized machines companies are also technology takers. Those company owners that are following the technology, have access to it and can finance can decide to buy it. The situation is even worse within the field of use of automated software within the production process where only 11.11% of the production companies surveyed have provided answers that they are using automated software for the production process. Situation is not better within the services sector where 14.74% of the companies are using the automated software. Again here are used available software applications (for example Archicad within the construction design or Adobe Illustrator within the graphic services), tools that are widely available and can be easily adopted to the services production. Situation can be different in the field of specially developed and tailored software for company's purposes. The most symptomatic area is robotics where none of the companies surveyed responded positively – none of them are using robots although robotics are one of the key elements of the so called fifth technological revolution. Industry 4.0, which will be driven by a new generation of information technologies such as Internet of Things (IoT), cloud computing, big data and data analytics, robotics, artificial intelligence, machine learning, virtual reality and 3D printing.¹⁰ Certainly use of robots can be key competitive advantage element both for production and services companies within the Pelagonija region.

⁹Digital Transformation Scoreboard 2018, European Commission 2018, p.25

¹⁰Digitalisation Support to SMEs, European Commission 2017. P10

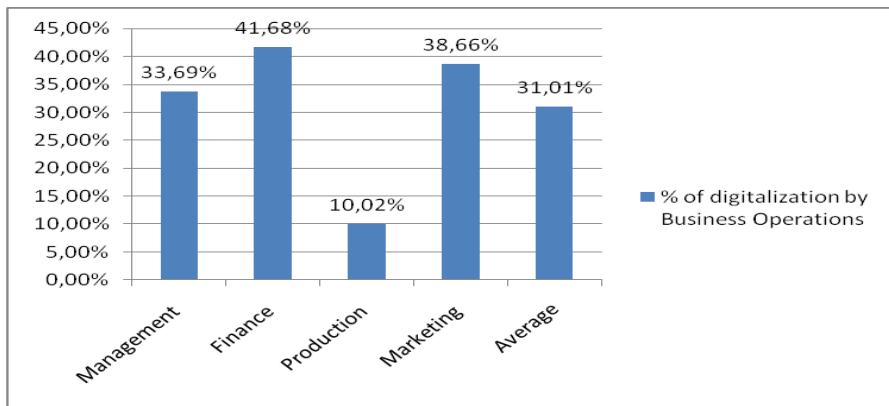
The area of marketing is interesting not only for measurement of digitalization level but also for measurement of the overall marketing tools use for the companies surveyed. We have focused only of digitalization but we think that there is a strong correlation among the use of digital marketing tools and overall marketing tools, models and concepts implementation within the 4P concept. In this area companies are using mostly their own websites although still about 1/2 (50.00% are using) in the products area and 3/5 (40.00% are using) in the services area are not having web sites. Such situation within the products area can be related to low knowledge and need of a part of the companies while in the services sector can be related to moving towards more advanced ways for communication with stakeholders such as platforms (for example logistics companies are using platforms), business tools of social media etc. As expected companies are using free social media advertising tools (such as opening profiles under company name and posting products and services info) and they are also using paid advertising tools. Even all surveyed companies in the products sector are using free social media advertising tools and almost 9 out of 10 services companies are using the same media. But paid advertising tools such as google, facebook and Instagram ads are used to a lesser extent since there are about 1/4 of the companies that are surveyed.

Table 2. Pelagonija SME's digitalization by business processes

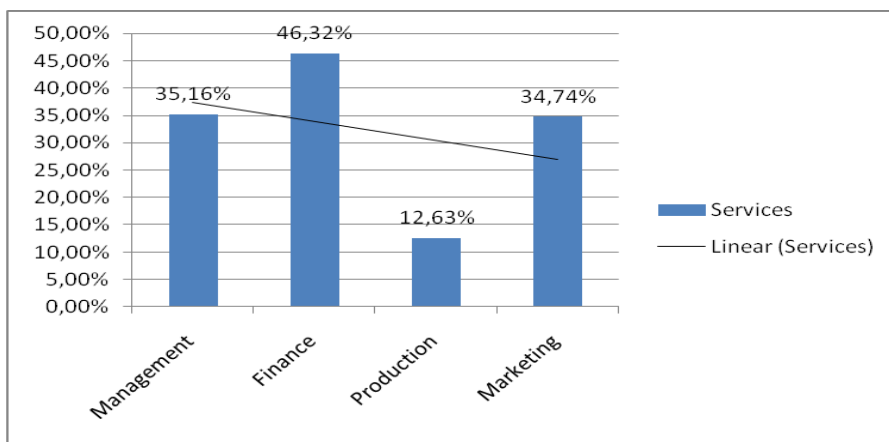
Which tools do you use mostly?			Which tools do you use mostly?				
Production			Services				
General Management			General Management			Average	Management
Phone apps	36	100.00%	Phone apps	95	100.00%	100.00%	49.47%
E mail	31	86.11%	E mail	95	100.00%	93.06%	
Special software (company tailored)	4	11.11%	Special software (company tailored)	15	15.79%	13.45%	
Platforms	5	13.89%	Platforms	22	23.16%	18.52%	
Digital markets	10	27.78%	Digital markets	16	16.84%	22.31%	
		47.78%			51.16%		
Finance			Finance				Finance
Accounting software	36	100.00%	Accounting software	95	100.00%	100.00%	67.45%
Bank correspondence	32	88.89%	Bank correspondence	95	100.00%	94.44%	
Financial market	0	0.00%	Financial market	15	15.79%	7.89%	
		62.96%			71.93%		
Production			Service product preparation				Products
Computerized machines	5	13.89%	Computerized machines	28	29.47%	21.68%	14.53%
Automated software	1	2.78%	Automated software	39	41.05%	21.92%	
Robots	0	0.00%	Robots	0	0.00%	0.00%	
		5.56%			23.51%		
Marketing			Marketing				Marketing
Web sites	28	77.78%	Web sites	63	66.32%	72.05%	61.98%
Free advertizing tools	36	100.00%	Free advertizing tools	71	74.74%	87.37%	
Paid advertizing tools	10	27.78%	Paid advertizing tools	24	25.26%	26.52%	
		68.52%			55.44%		

The graph below shows digitalization of the business operations of the products creating companies.

Graph 1. Product creating Pelagonija region SME's Digitalization of Business processes

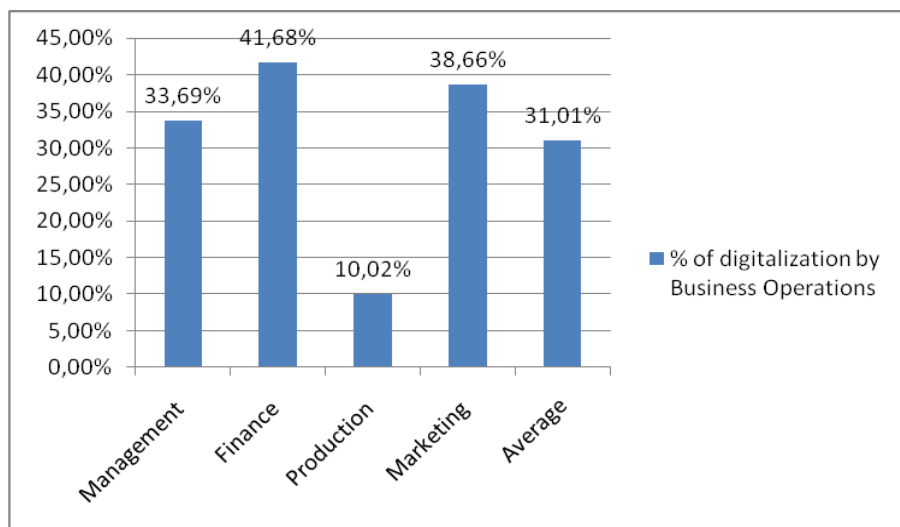


Graph 2. digitalization of the business operations of the services producing companies



The following graph show overall level of the digitalization by business operations:

Graph 3. Level of digitalization by business operations among the Pelagonija region SME's



As it can be seen above the level of digitalization is highest within the finance departments. That is due to the fact that all of the companies that were surveyed are using software for accounting and even although the current law permits this part of finance to be kept in paper form the public revenue body is encouraging use of digital tools and communication more than 10 years ago and all of the companies and accountants have switched to the digital forms of accounting. The lower level of digital business operations can be found within the production processes that is 10%.

If comparison is to be made with Compared with the EU DESI Business Digitalization Index where mean value is above 40%, SME's Within Pelagonija region should significantly improve.

If in particular comparison is to be made with key indicators for tracking o the digitalization processes where the average fo the SME;s is 34.72 % Pelagonija region SME's are still below the EU average . There is a room for improvement and also state policy can benefit from it if proper measures are tailored and implemented in order SME's to benefit towards digitalization improvement. Our aim is to provide data on how much state budget is losing from the non-satisfactory level of digitalization of the companies.

Table 3 .Key indicators tracking digitalization processes

Key Indicator	% of EU SME's that have adopted
Having a web site or homepage	76.00%
Website has some interactive functionalities	58.00%
Use any social media	47.00%
>50% of persons employed use computers and internet	40.00%
Fastest broadband connection is at least 30mbs	37.00%
Have ERP software package to share information	33.00%
Use Customer Relationship Management (CRM)	32.00%
>20% of workers with portable devices for business use	32.00%
Employ ICT specialist	18.00%
Selling online (at least 1% of turnover)	17.00%
Share electronically supply chain management data	17.00%
Exploit B2C eCommerce	7.00%

Data as of 2017 ¹¹Source : European commission services based on Eurostat Data.

¹¹Europe's Digital Progress Report 2017 European commission p.4

3. Importance of SME digitalization for Pelagonija Region GDP and its impact to revenues collection

In order to show the financial cost for the state from the current non-acceptable level of the SME's digitalization level provide data on the level of the GDP's growth influence of the better digitalized companies at least to the EU average and to provide data on the tax lost due to such reasons we need data on the GDP growth with the current level of digitalization and to provide trend extrapolation of the GDP's growth. Also we need data on the tax collection. Since there is no precise statistics on the level of the value added of the SME's to GDP by region we have added the general ponder of the 64.5% level within the value added of Pelagonija region SME's to the region GDP.

Table 4. Level of contribution to GDP of SME's in Macedonia

	Million EUR	% of share
Micro	818	21.9
Small	836	22.4
Medium	758	20.3
SMEs total	2412	64.5
Large	1327	35.5
Total	3739	100

Source: 2017 SBA Fact Sheet, Macedonia , European Commission 2017.

The following table shows the levels of GDP by regions in Macedonia in 2016

Table 5. Level of contribution to GDP of statistical regions in Macedonia

Region	GDP in MKD in million	GDP in EUR in million
Macedonia	594 795	9671.46
Vardar	46 172	750.7613
East	46 975	763.8264
Southwest	48 810	793.655
Southeast	59 332	964.7411
Pelagonija	65 057	1057.835
Polog	42 487	690.8381
Northeast	29 655	482.1924
Skopje	256 308	4167.611

Source : Macedonian Statistics Office last available data for 2016

The table below shows an estimate of the contribution in GDP of the SME enterprises within the Pelagonija region.

Table 6. SME contribution to GDP in Pelagonija region

Level	Gross domestic product (in million denars)	Gross domestic product (in million EUR)	Estimate of share of SME into GPD,%	Estimate of share of SME into GPD, million of EUR
Macedonia	594 795	9671.46	64.50%	6238.09
Pelagonija	65 057	1057.835	64.50%	682.30

Source : DZS (Macedonian Statistics Office)

In 2016 the level of the taxes collected by Public revenues office in Pelagonija region was 127.561 EUR. The table below shows the level of SME contribution towards public revenues collection:

Table 7. Share of SME into all companies tax collection in Pelagonija region

Total taxes collected from Pelagonija Region in Million of MKD	Total taxes collected from Pelagonija Region in Million of EUR	Contribution of the SME;s
7845	127.561	82.27683

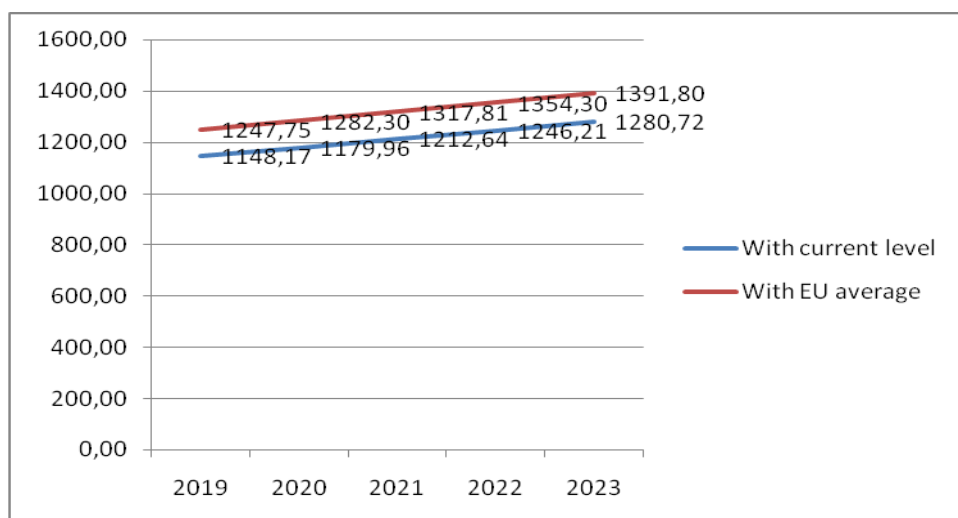
Source : Macedonian Public revenues collection office

Having considered the data below we have extrapolated trends in two fields for Pelagonija region : A) GDP growth with and without EU average level digitalized SME's and B) Public revenues growth with and without EU average level digitalized SME's. As a baseline value we have extrapolated the need for growth of digitalization. Supporting growth and development of SMEs as well as innovative policies targeted at fostering their growth should belong to the state-level priorities.¹²

The graph below shows the level of GPD prediction with the current state of SME digitalization vs level of GPD prediction growth if the level of digitalization is to be upgraded to the EU average. Current SME digitalization in Pelagonija region is estimated at the level of 31.01% while the EU average is 34.72%. That says at least there is a need for 3.71% absolute improvement or 10.68% relative improvement. If it is assumed that at least for that level the company productivity will be increased (although there is data for higher company benefits and in particular profit) .

¹²Ruchkina, G., Melnichuk, M., Frumina, S., & Mentel, G. (2017). Small and medium enterprises in regional development and innovations. *Journal of International Studies*, 10(4), 259-271. 2017

Graph 4. Difference in GPD among current and potential level of digitalization meeting the EU average



The graph above depends on the following basis for forecast:

- Annual growth of GPD with no digitalization of SME's of 2.7% taken as average of GPD growth of Pelagonija region for the years 2013,2014,2015 and 2016 as years for which the data is available.
- 10,68% difference in the digitalization to be improved within local SME's in order EU average of 2017 to be reached . 10.68% is current level of relative difference between level of digitalization of the Pelagonija SME's and average level of EU SME's digitalization
- Relative contribution of SME's to regions GDP at national average level of 64.5%.

Above mentioned data shows that if the EU average level of SME digitalization is achieved GPD will grow for additional 94.2 million of EUR

The table below shows the projection difference among the current contribution of SME's within Pelagonija region GDP with current level of digitalization and contribution of SME's within Pelagonija region GDP with EU SME digitalization average as of 2017 achieved.

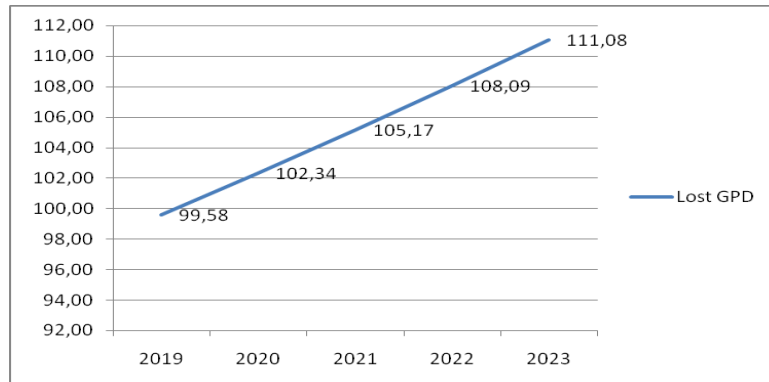
Table 8. Difference in GPD projection growth in Pelagonija region with EU average SME digitalization achieved.

In million of EUR

	2019	2020	2021	2022	2023
With current level	1148.17	1179.96	1212.64	1246.21	1280.72
With EU average	1247.75	1282.30	1317.81	1354.30	1391.80
Difference	99.58	102.34	105.17	108.09	111.08

Lost GPD is shown at the graph below:

Graph 5. Lost GPD for Pelagonija region due to the current level of digitalization of the SME's



As per the data of Public revenue collection office the level of taxes collected from business entities is 3.778 million of MKD or 61.43 million of EUR. Following the ratio of 64.5/35.5 of percentual contribution of SME's and large companies the contribution of SME in revenues is 39.62 million of EUR that is 3.74% of the annual GPD. If we assume that this portion will not increase (by the means of higher level of tax burden), the last is taken as baseline amount that can be increased in revenues collection if Pelagonija region SME's digitalization level is upgraded to EU average. Below are shown the levels of the taxes lost due to the current level of SME's digitalization.

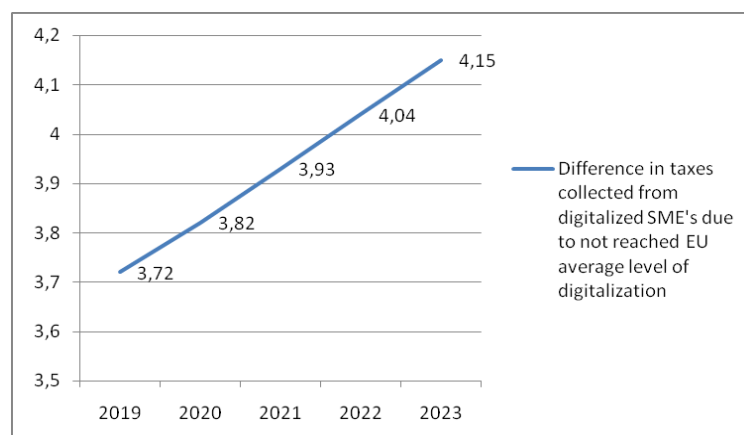
Table 9. Difference in taxes collected due to not reached EU average level of digitalization of SME's

In millions of EUR

	2019	2020	2021	2022	2023
Difference in GDP due to not reached EU average level of digitalization	99.58	102.34	105.17	108.09	111.08
Difference in taxes collected from digitalized SME's due to not reached EU average level of digitalization	3.72	3.82	3.93	4.04	4.15

Graph 6. Difference in taxes collected due to not reached EU average level of digitalization of SME's

In millions of EUR



Conclusion

There is great room for improvement of digitalization level of Pelagonija SME's. Current state of digitalization as per survey undertaken on total of 131 companies out of which 95 are from production sector and 36 are from services sector the overall level of digitalization is 31.1%. Compared with EU average that is measured through EU SME digitalization index this level is lower than the average. Namely in 2017 this level was 34.72% . That shows the fact that there is a evident need for state and regional policy makers should act towards providing climate and incentives for digitalization improvement. Such incentives will not provide benefit only for SME's and GDP. They will also provide direct financial revenues for the state since it is expected level of taxes that will be collected from SME's that advanced in digitalization will bring additional 3.72 million EUR in the year 1 and 4.15 million EUR in the year 5 if the EU average level of digitalization is going to be achieved from the SME's from Pelagonija region. That questions the debate on how incentives should be provided. Public finance incentives are to be introduced and they should be considered as investments that will be returned within the budget on medium run.

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THE KNOWLEDGE AND SKILLS PROFILE OF ACCOUNTANT 4.0

Assoc. Prof. Eleonora Stancheva-Todorova, PhD¹

Abstract:

Businesses are nowadays experiencing extensive transformation due to technologisation, automation and digitalisation of their production processes and operations. The knowledge and competences of employees is a very important factor for a company to cope with those challenges in the most competitive way. Organisations have to increase their Digital IQ to capture the expected benefits from technology investments. Workers need digital culture and skills to feel comfortable performing their job tasks and it turns out that people could be constraints for putting digitalisation into place. Firstly, it refers to hiring the proper personnel. The so called digital natives should be attracted, trained and retained and the HR specialist are more than concerned how to co-ordinate the HR strategy with Industry 4.0. Identification of the required employees' profiles and the missing skills and abilities are now of a higher priority. The necessary knowledge transfer, part of the strategic HR management, is facilitated by the convergence in research and development within regional conglomerations of companies along a common value chain. Secondly, it is a matter of investing in training programmes and continuous professional development to manage the missing expertise within organisation boundaries.

The paper is inspired by the increasing digitalisation of businesses and the impact of technology innovations and their augmented application on the accounting profession. The aim of the research is to outline and discuss the accounting professional's profile in terms of the required knowledge and skills imposed by company's transformation in the Industry 4.0 context. There are many implications due to digitalisation of organisation business model, value chains, products and services that should be considered. The author's attempt is to perform and present a comprehensive analysis of their impact on the current status of the profession and future trends of development in terms of the required job skills and competences.

Keywords: *Industry 4.0, accountant's profile, knowledge and skills.*

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Introducing the research problem

Industry 4.0 or the “fourth industrial revolution” is a term² for referring to the next stage in the development of manufacturing industry. It is a response to the vast changing business environment, characterised with customer-driven markets, quicker product lifecycles, increasing variety of product variants and enhanced transparency in the global competition (KPMG, 2016, p. 17). Businesses are experiencing extensive transformation due to technologisation, automation and digitalisation of their production processes and operations.

Some argue that Industry 4.0 is not yet a reality but a concept and view it as an evolution rather than a revolutionary change of economic patterns (KPMG, 2016, p. 16). It is driven by digitalisation and integration of vertical and horizontal value chains, digitalisation of products and service offerings, and digital business models and customer access. Digital technologies as mobile devices, 3D printing, smart sensors, cloud computing, augmented reality, etc. are at the core of this transformation. Through the convergence of technologies, industrial structures, media and solutions, business efficiency, product quality and customer satisfaction are improving and additional value added is generated (PWC, 2016, p. 6; KPMG, 2016, p. 17). Some argue that due to such mergers, the boundaries between the real and virtual world evaporate thus resulting in the so called cyber-physical production systems (CPPs). CPPs could be described as “a smart network of machines, properties, ICT systems, smart products and individuals across the entire value chain and the full product life cycle” (Deloitte 2015, p. 4). In addition, machines are linked to plants, networks, humans, etc. via sensors and other tracking elements. CPPs lies at the heart of the so called “smart factories”³.

How companies react to the aforementioned drivers of the change is a complicated issue as there are many prerequisites for the successful transition to “digital enterprises”. Business adaptation in the digital era requires good strategy for the right technology implementation. Companies with high degrees of digitalisation and integration, the so called “first movers”, have already been receiving the returns from their significant investments and considerably enhanced digital capabilities and expecting both revenue gains and cost reduction (PWC, 2016, p. 12). Despite the inevitability of the process, there are many implications from technological improvements that should be considered. Of central importance for the successful digital transformation of businesses are the human resources. The investments in staff recruitment and training areas important as the investments in IT infrastructure. Moreover, they are interdependent and related in certain ways.

The knowledge and competences of employees is a very important factor for a company to cope with the challenges of Industry 4.0 in the most competitive way. Organisations have to increase their Digital IQ⁴ (PWC, 2017) to capture the expected benefits from technology investments. Workers need digital culture and skills to feel comfortable performing their job tasks. It turns out that people could be constraints for putting digitalisation into place. Firstly, it refers to hiring the proper personnel. But the so called digital natives should be attracted, trained and retained and the HR specialist are more than concerned how to co-ordinate the HR strategy with Industry 4.0. Identification of the required employees’ profiles and the missing skills and abilities are now of a higher priority. The necessary knowledge transfer, part of the strategic HR management, is facilitated by the convergence in research and development within regional conglomerations of companies along a common value chain

²Another equivalent terms, mainly used in the English-speaking countries and USA, are: “the internet of things”, “the internet of everything”, “internet of things, services, data and people” and “the industrial internet” (Deloitte 2015, pp. 3-4).

³also called “factories of the future” or “digital enterprises”.

⁴Digital IQ - the measurement of an organisation’s abilities to harness and profit from technology (PWC 2015, p. 10; 2017, p. 3).

(KPMG, 2016, p. 15). Secondly, it is a matter of investing in training programmes and continuous professional development to manage the missing expertise within organisation boundaries.

Aim of the paper and research methodology

The paper is inspired by the increasing digitalisation of businesses and the impact of technology innovations and their augmented application on the accounting profession. The aim of the research is to outline and discuss the accounting professional's profile in terms of the required knowledge and skills imposed by company's transformation in the Industry 4.0 context. There are many implications due to digitalisation of organisation business model, value chains, products and services that should be considered. The author's attempt is to perform and present a comprehensive analysis of their impact on the current status of the profession and future trends of development in terms of the required job skills and competences.

The author is aware that a pinpoint precision is not possible due to the evolutionary rather than revolutionary way of transformation driven by the "internet of things, services, data and people" and the time needed to test and confirm the profile, its integrity and adequacy for performing the finance function within the "digital enterprise". On the other hand, the company's needs for certain accounting expertise has already been experienced by the profession representatives. Few surveys and other documents, prevailing those issued by the Big Four companies, are used as a frame of reference and as a focal point for the research.

General implications of Industry 4.0 convergence, digitalisation and exponentially growing technologies

Convergence, digitalisation and exponentially growing technologies are the features of Industry 4.0 with an overall impact on the skills profile of employees in "the factory of the future".

Their effect on accounting professionals is unarguable and they should be considered the main drivers for the changing role and functions of the profession in the era of "the fourth industrial revolution".

Industry 4.0 is characterised as an interdisciplinary and all-encompassing due to many *convergences* leading to integrated manufacturing systems and customer-oriented units in the modern enterprise. This specific merger of the online and offline worlds impacts the required employee's broad professional profile. Due to the convergence and interactions of different systems, and the increasing complexity of the production process, employees are exposed to more challenging requirements regarding their qualification. Fundamental knowledge and expertise will be of a great demand for companies' successful transformation. It is obvious, that in such complicated organisation environment accountants should become interdisciplinary experts with an in-depth knowledge in many other areas beside their accounting and financial reporting competences. They need a profound understanding of company's business model and very good comprehension of its processes, production and logistics

(KPMG, 2016, pp. 12-13, 39-40). Moreover, accountants will increase their participation in the decision-making process, strategic management and problem solving. They will transform to some kind of internal consultants giving advices to company's management and actively participating in company's activity forecasting, planning and control (ICAEW, 2017). The budget-oriented planning will be replaced by the more precise weekly, rolling corporate planning and will be based on current corporate data instead of outdated historical information (KPMG, 2016, p. 26). Changing their role as preparers of historical financial figures, accountants will have to work intensively with data analytics (Gamage, 2016), which complemented by purposefully developed business awareness and understanding, and their strong numeracy skills, could place them well across organisation boundaries.

In 2013, the Association of Chartered Certified Accountants (ACCA) and the Institute of Management Accountants (IMA) predicted in their joint report (ACCA & IMA, 2013) that in the future accounting profession will be transformed into some kind of professional hybrid, due to the interaction of finance, technology and information skills and competences. This statement supports the argument about the interdisciplinary expertise needed from accountants in Industry 4.0 context, which in our opinion should be reflected in their professional education and training.

Digitalisation is the second dimension of “the fourth industrial revolution” with a great impact on the skills profile of the future accountant. In 2016 PWC performed a survey exploring the benefits of digitalisation of company’s vertical and horizontal value chains, products and services. The key findings show that there are many benefits especially for “the first movers”. They are forecasting significant cost reduction and revenue gains of more than 30% at the same time and also expecting efficiency gains from their digital transformation and integration. The competitive landscape has already been changing with a very fast pace (PWC, 2016). In such organisation environment employees’ digital culture and skills are considered as the main driver for the change and one of the top management challenges. A successful strategy for companies will be to invest not only in technologies but also in appropriate training programmes for employees. Cyber security is another area which needs more specialised expertise especially for those processing and analysing huge volume of sensitive data.

Industry 4.0 is accelerated by *exponentially growing technologies* as robots, artificial intelligence, 3D printers, smart sensors, drones etc. They are at the core of businesses transformation and impose some additional demands in terms of the required knowledge and skills. Accountants should be familiar with the legal requirements and tax implications caused by the augmented application of digital technologies. Of central importance for the company’s wellbeing will be to provide remedies for a whole host of legal and tax issues, product liability and protection of intellectual property (Deloitte, 2015).

The most important issue when discussing the interdisciplinary skills and competences required from accountants in “the factory of the future” context, is the identification of the missing knowledge and abilities that should be acquired or developed from the profession due to the increasing impact of Industry 4.0 drivers. To manage with the missing expertise, accounting education and professional training should be adapted and continuously linked to the changing labour market requirements and employers’ demands for qualified human resources.

Outlining the knowledge and skills profile of Accountant 4.0

Industry 4.0 is changing the structure and scope of accountants’ qualification profile by imposing new challenging requirements regarding their skills and competences. To feel comfortable in the organisation environment of “the digital enterprise” and perform successfully their job tasks, accounting experts should transform into hybrids with interdisciplinary knowledge and plenty of diversified skills and abilities (figure 1). Each element of the so proposed profile will be briefly discussed in terms of Industry 4.0 characteristics and the main drivers for industry transformation.

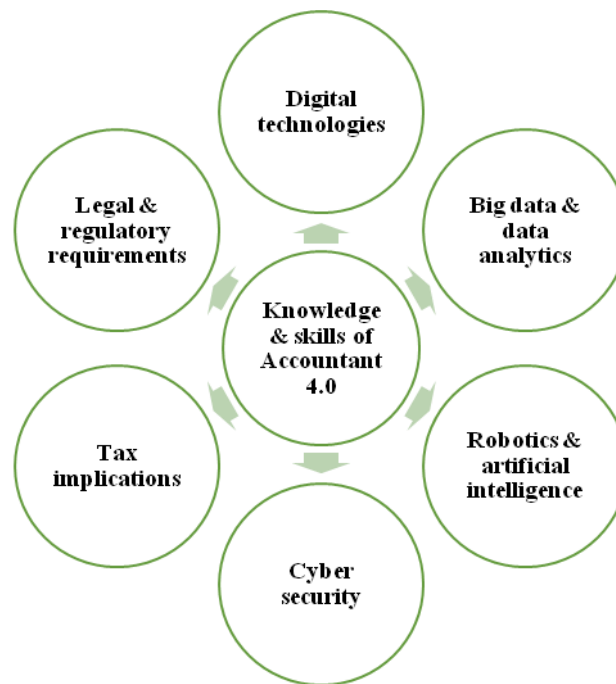


Figure 1 Knowledge and skills profile of Accountant 4.0

Digital technology competences

In the context of digitalisation of businesses and the emerging technologies and their augmented application, accountants as many other experts within organisation, should develop digital skills in such technology-rich environment (PWC, 2016). The working patterns for accounting profession are changing due to mobile technologies, modern tools for social collaboration, cloud computing, digital service delivery, blockchains, augmented and virtual reality, etc.

For accountants in the finance function the *mobile technologies* are revealing new ways for communication and collaboration within and outside the company. Combined with cloud services, a permanent access to company’s financial data is provided for the benefit of the management. Accounting professionals in practice now have a very powerful tool for attracting new customers despite the geographical boundaries and increasing clients’ satisfaction from services performed. Collaboration with customers is enhanced by the *social media*, now heavily exploited by businesses. Social platforms as Facebook and Twitter are used as effective tools for fast distribution of company’s data among its stakeholders. According to ACCA survey there are few benefits for accountants beside the aforementioned overcoming of barriers to communication. Decision-making and productivity will be enhanced and new investment opportunities will emerge. Another positive effect could be the time-saving for the month-end processing. Profession representatives should adapt their work performance patterns to this new environment and pay special attention and due care to the risk of sensitive data leakage, different financial implications and the more strategic role of the finance function within organisation (ACCA, 2013).

Cloud-based accounting software is another powerful tool for strengthening the relationship with clients, gaining a real-time access to company’s financial information. In fact, “the cloud” is changing the traditional way of “keeping the books” through speeding up and optimising the document flow and processing, time for recording of business transactions and data storage. It is also a driver for transforming accounting services in practice. Accounting practitioners could now take the leading role in the strategic planning of their clients’ businesses and act as virtual financial directors because of their greater business insights and awareness. Cloud accounting is providing many opportunities for

expanding services offered, realising efficiency gains and extra profits (Preece, 2015). Unfortunately, despite the positive effects, there are some challenging issues. First of all, it is difficult to budget and manage the IT costs associated with the usage of cloud-based infrastructure, which makes the cost/benefit analyses useless in this case. Moreover, the possibility for 24-hours online access to the IT systems is extremely exaggerated. Accountants can improve their own practice through both delivery and usage of *digital services* thus providing and gaining access to resources. Self-service features of services offered electronically will provide customers with an easy access to company's statutory and management reports, facilitate daily operations and improve efficiency and client satisfaction. For accounting practitioners, digitalisation of their business models will become a very important cost-saving factor, which requires relevant digital culture and skills.

Augmented and virtual reality and its impact on the profession is another area for consideration in the context of the business world digitalisation. How could accountants benefit from this innovation depends on their perception of technologies and their abilities to choose and implement the right ones with the most potential for accounting service improvements. Attracting new clients and developing new business lines are among the few opportunities for business expansion. The more effective usage of financial data will extract new business insights and improve decision-making and company's outcome. Other skills related to the required digital literacy that should be addressed in our discussion are the *blockchain technologies*, which introduce new payment systems and the usage of virtual currencies thus changing the traditional concept of money, methods of exchange and the existing business models (ACCA, 2013; Stancheva-Todorova, 2019b). Electronic banking and alternative online payment platforms impact accounting practice in many ways and challenge the profession representatives. Firstly, automated links with the bank accounts are integrated in almost every accounting software, thus saving time and efforts from the minimised human interaction. Secondly, the number of users and retailers accepting "digital" currencies are increasing progressively. Their benefits of moving to a Bitcoin system comprise of lower transaction fees, instantaneous transfer, international competitiveness, fraud prevention and reduced liability. From the accounting perspective, cryptocurrencies offer a potential for development. The CEO of the International Federation of Accountants, Faye Choudhury, stated that "Bitcoin poses opportunities to strengthen and expand the scope of what accountants do and how we do it." (CAANZ, 2015, p. 26). The accounting firms could expand their business advisory services and the profession could develop new specialisations. They could also exploit the first mover advantage by offering services that meet the tax and other legal regulations as anti-money laundering and counter-terrorism financial rules. Despite the plenty of opportunities, many challenging accounting and financial reporting issues should be addressed. Still the lack of a proper and widely accepted classification and reliable measurement basis for the transactions with cryptocurrencies is a area of concern. Bitcoin and other digital currencies have unique nature stemming from the way they are "mined" but not issued by the government authorities as compared to the traditional money. The existing disclosure problem should not be understated as well (Stancheva-Todorova, 2019b). Chandra, Ettredge and Stone argue that certain disclosures of cryptocurrency transactions will allow investors and creditors to assess the information asymmetry between different parties involved and will also help the users of financial statements to reduce the costs for gathering information (Chandra, Ettredge and Stone, 2006). Accounting regulators and standard setting bodies have to consider the impact of cryptocurrencies and blockchain technology on companies' accounting and financial reporting and develop an adequate regulatory framework to ensure reliable and transparent information for users (Stancheva-Todorova, 2019b).

An action plan for accountants in terms of company digitalisation and technologisation is presented in table 1. It is based on the ACCA 2013 study on the impact of technology trends on the global accountancy profession. The survey summarises the activities required from accountants to cope with some of the challenges associated with digital technologies and their augmented business application.

Table 1. Digital technology trends and actions needed from accountants

Digital technology trends	Actions
Mobility and social collaboration	<ul style="list-style-type: none"> • identify and deploy effective mobile solutions that can work in the decade ahead • manage the transition to full mobility in a consistent and safe manner • consider the potential offered by an interconnected internet of things, from mobile devices to appliances, cars, and industrial equipment.
Cloud	<ul style="list-style-type: none"> • explore ways of establishing actual costs • educate those outside the finance function (including practice clients) on the complexity of total cost calculations • clarify national and international tax regulations and complications • demand more granular use of, and price data from, cloud vendors – particularly infrastructure providers
Digital service delivery	<ul style="list-style-type: none"> • recruit those with the required digital literacy skills and/or develop them • plan tactically and strategically to deliver competitive advantage • consider the implications of businesses, advisers, regulators, and others becoming progressively more connected and exchanging data automatically
Augmented and virtual reality	<ul style="list-style-type: none"> • explore new ways to attract talent and deliver and access training • develop new approaches to measuring and analysing costs and return on investment • consider new ways to conduct business/enhance services by applying augmented reality
Payment systems	<ul style="list-style-type: none"> • acquire new skills to adapt and exploit new money paradigms and methods of exchange • use their experience and insight to innovate current systems and adapt to new and emerging payment systems • position themselves as advisers and guides as peer-to-peer platforms reduce dependency on banks • develop expertise and guidance on areas such as online and virtual payments and their taxation.

Source: ACCA, 2013, pp. 4-7, 12.

Big data and data analytics

In a data-driven organisation, data analytical skills are of a central importance for the successful career of accountants both in the finance function and in practice. Big data sets are used to provide new insights on businesses leading to better decision-making, risk management and strategic business solutions. Because of their diverse and complex nature and large volume, they require special technologies but also new job skills for managing the data to be analysed and audited. Data quality and security are also important areas and require special knowledge and competences. Accounting

professionals are challenged to build such skills through proper education and training (ACCA, 2013; Stancheva-Todorova, 2018).

Professional accounting bodies as ACCA, the Institute of Chartered Accountants in England and Wales and the Chartered Global Management Accountants (CGMA) have already started to change their qualification modules content by introducing information technologies into the syllabi. For instance, in April 2019, ACCA introduced a new data analytics unit as part of the Ethics and Professional skills module thus giving a direct response to “digitalisation and the latest technological developments affecting global business” (Bennett, 2019). In fact, some of the ACCA exams as Business Reporting and Strategic Business Leader have already introduced Big Data, disruptive technology and cyber attacks through various business scenarios. CGMA has also added some material on Big Data analytics in their 2015 syllabus (Gamage, 2016). Accounting educators are also experiencing high pressure to enhance the technological content of accounting courses. Programmes’ curricula and modules’ syllabi should be adapted to the current labour market requirements and employers’ expectations from graduates (Stancheva-Todorova, 2019a).

Robotics and artificial intelligence

Accounting profession has been estimated as having high probability for automation. Bookkeeping is the most routine, time consuming and unquestionably susceptible to automation part of the accounting work. Complex business transaction are easily disaggregated, described in accounting terms and recorded into the ledgers. The process can be fully automated by using the machine learning technologies. The accuracy of accounting data will be improved as well as the timing of recording. Fraud prevention and detection is another area where artificial intelligence (AI) applications are possible and desirable. Another job task where AI is likely to be beneficial is the revenues forecasting (ICAEW, 2017). The accuracy of the revenues forecast is crucial for an operations budget and all other budgets derived from it. The use of predictive models, based on machine learning algorithms, can improve quality of the forecast data and consequently the processes of budgeting and strategic management. Financial accounting and reporting is another area with great potential for automation. A practical challenge is the increasing number of regulations that need to be transformed into if-then rules and decision trees suitable for AI algorithms (Stancheva-Todorova, 2018).

Accountants can benefit from the intelligent systems as by using their capabilities they will be able to support decision-making by providing better and cheaper data, provide more profound analysis of data and give new insights on business and focus on more valuable tasks after freeing up working time due to AI applications (ICAEW, 2017, p. 8). An important question is what are the new skills required of accountants to benefit from deployment of AI technologies and create more value to the businesses.

One of the most required skills is the technical expertise in machine learning and the depth of knowledge depends on the organisation’s size, investment policy and innovation strategy. Despite these factors, it is important for accountants to understand the significance of quality of the data used. Machine learning implies recognition and application of patterns based on existing data points or examples, deriving own algorithms and refining them in time (Shimamoto, 2018). “Teaching” the computer by using data sets requires special attention to their quality as mentioned earlier. Internal control procedures should be implemented to mitigate the risk associated with the inherent biases and other limitations of AI applications.

Communication skills and critical thinking will become increasingly important in the AI age (ICAEW, 2017). The ability to think critically is considered as a prerequisite for a successful transition from the classroom to the professional workplace. In addition, leadership skills will become more important with the changes of accounting roles. As the professionals increase their participation

in company's strategic management and collaboration and partnership with other parts of the organisation, certain types of leadership will become indispensable. Among them are: strategic and organisational leadership; coaching and mentorship; a strong sense of ethics and cross-functional leadership.

Cyber security

The increased usage of personal and business information in our digital world raises the question of cyber-crime risk management. It is reported that the theft of digital information is the most common fraud (ACCA, 2013, p. 10) though the industrial espionage, sabotage by competitors and terrorist attacks on Industry 4.0 infrastructure should not be underestimated (KPMG, 2016, p. 57). Accountants will play an important role in risk identification, assessment and mitigation as they process, analyse and archive huge sets of sensitive data. They have to be familiar with and regularly review company's policies and procedures on data privacy and security. Special expertise on cyber-crimes, which turns out to become more complex over time, will be crucial for prevention and detection of cyber threats. Assurance on company's controls and policies associated with data privacy and security should become a focus of the internal audit function.

Taxation

Tax dimension of "the fourth industrial revolution" brings many challenging issues to the accountancy profession. Restructuring of value chains and intangible assets allocations requires revision of the transfer prices systems and reconsideration of tax basis in terms of services location. Accountants in practice should be familiar with Industry 4.0 tax implications and the areas for tax optimisations internal group transfer pricing structures, withholding tax on licence payments, value added tax and customs duties, national and international tax rate differentials, etc. (KPMG, 2016). Assistance in the electronic audits expected in the near future is also required. Accountants in the finance function will rely on the expertise of company's tax department. The efficient communication is a prerequisite for the proper accounting treatment of company's activity in terms of taxation.

Legal and statutory requirements

Transition to Industry 4.0 imposes a whole host of challenges due to the new and complex transactions and events of "the digital enterprise", which proper accounting treatment requires interdisciplinary knowledge and efficient internal communication within the organisation. Accountants should have the needed knowledge and expertise on plenty of legal issues and be familiar with the existing legal and statutory requirements in the areas of: data traffic and storage, patents and licenses, exposure to liabilities and other commitments, intellectual property, employment, foreign trade, etc. (KPMG, 2016). Profession representatives should work more closely with other business units and with the legal department in particular.

Conclusion

Digitalisation of businesses and the exponentially growing technologies are changing the role and functions of the accountancy profession, which turns into a hybrid due to the expanding demands of the labour market and employers. The qualification profile of Accountant 4.0 encompasses many interdisciplinary knowledge and skills in different areas for both, accountants in the finance function and in practice. There are many challenges on the road to the "factory of the future" and a

very important factor for the profession to cope with them in the most competitive way is to adapt to the new competence requirements and invest in proper accounting education, training programmes and continuous professional development.

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DIGITAL TRANSFORMATIONS IN HIGHER EDUCATION INSTITUTIONS THROUGH E-LEARNING DEVELOPMENT: THE EXPERIENCE OF UARD

Ekaterina Arabska¹

Abstract:

The transformations in contemporary universities aiming at gaining the most benefits of the flexibility and openness of e-learning opportunities have led to the trends for significant changes in the traditional mode of study in classrooms and the use of information and communication technology in teaching and learning. Current study aims to present the e-learning concept applying digital technology in education and training but also reaching learning objectives through a new student-oriented model and relationships for developing creativity and new thinking, and thus enhancing the digital transformations into the system of higher education driven by the modern reality. Putting the concept into practice through the so-called “blended learning”, combining e-learning with traditional classroom learning, is presented through the example of the University of agribusiness and rural development (UARD) in Bulgaria which has put the focus on development of e-learning and distant learning in order to provide an easier access to higher education and lifelong learning courses. Results of an investigation on the satisfaction of a students’ group with e-learning are presented and some conclusions and recommendations for further development are provided.

Key words: *e-learning, information and communication technology, qualification, lifelong learning.*

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Introduction

Nowadays there is a transformation of activities in traditional universities towards “more flexible and open education”, incl. in universities in which traditional face-to-face learning prevails (Gubiani, Cristea&Urbancic, 2019).The changes in the traditional classroom and teaching and learning process enhanced by the advanced improvements in technology makes courses “exciting, entertaining and challenging” containing up-to-date information and offering low-cost and flexible modes of learning and e-learning has become common in universities and companies, incl. the adaptation of learning materials to users’ knowledge and behavior (Hammad et al. 2018).Two factors have contributed to “the boom” of e-learning: hard (increase in the number of courses offered, the number of platforms, the number of users, relationship with mobile phones) and soft (development of system software for e-learning, courses diversity, quality, incl. that generated by technological development (Diba, Onete&Albastroiu, 2018).E-learning provides opportunities people of different age and level of training to get high quality training according to their individual characteristics and wishes (Galustyan et al., 2019).It was found that when engaged with more e-learning materials, learners show increased academic achievement (Firat et al., 2019).E-learning is considered to be “a strategic approach to contribute to (more) sustainability in higher education” and it provides tools delivering and promoting of teaching and learning regarding sustainable development in an innovative way overcoming demographic and other boundaries for global education (Otto & Becker, 2018).

Current paper analyzes and presents e-learning as “an important activity of the Internet economy” which defines “the totality of educational situations in which the information and communication technologies are used in a significant way so that it is not necessary for the teacher and trainees to be simultaneously in the same place or in the same space” (Diba, Onete&Albastroiu, 2018). The main aim is to consider and present contemporary significance, state and use of digital technology for educational purposes through the development of the concept and the practice of e-learning and the opportunities of its application into higher education institutions through the example of University of agribusiness and rural development in Bulgaria.

Digital technology for educational purposes: e-learning concept and practice

As a direct result of the integration of technology and education e-learning has emerged as “a powerful medium of learning” (Al-Fraihat et al., 2019) and the main elements of its conceptual model and the evaluation of success are connected to design, acceptance and beliefs and outcome (fig. 1).

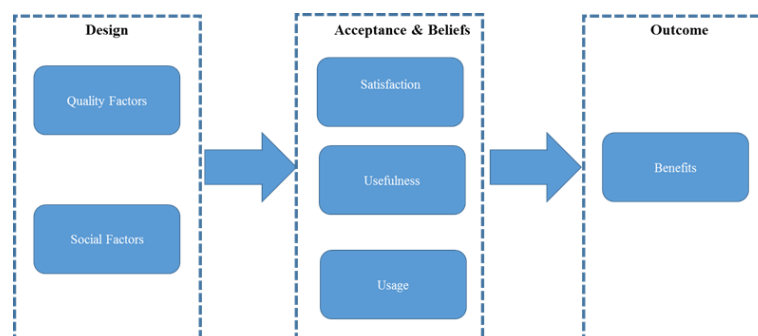


Fig. 1. The simplified conceptual model for evaluating the success of e-learning system

Source: Al-Fraihat, D., Joy, M., Masa'deh, R., Sinclair, J. (2019). *Evaluating E-learning Systems Success: An Empirical Study. Computers in Human Behavior.* <https://doi.org/10.1016/j.chb.2019.08.004>.

E-learning is determined as “one of the most effective ways of using digital technology for educational purposes” (Javorcik&Polasek, 2019) and its evolution is really fast (fig. 2).

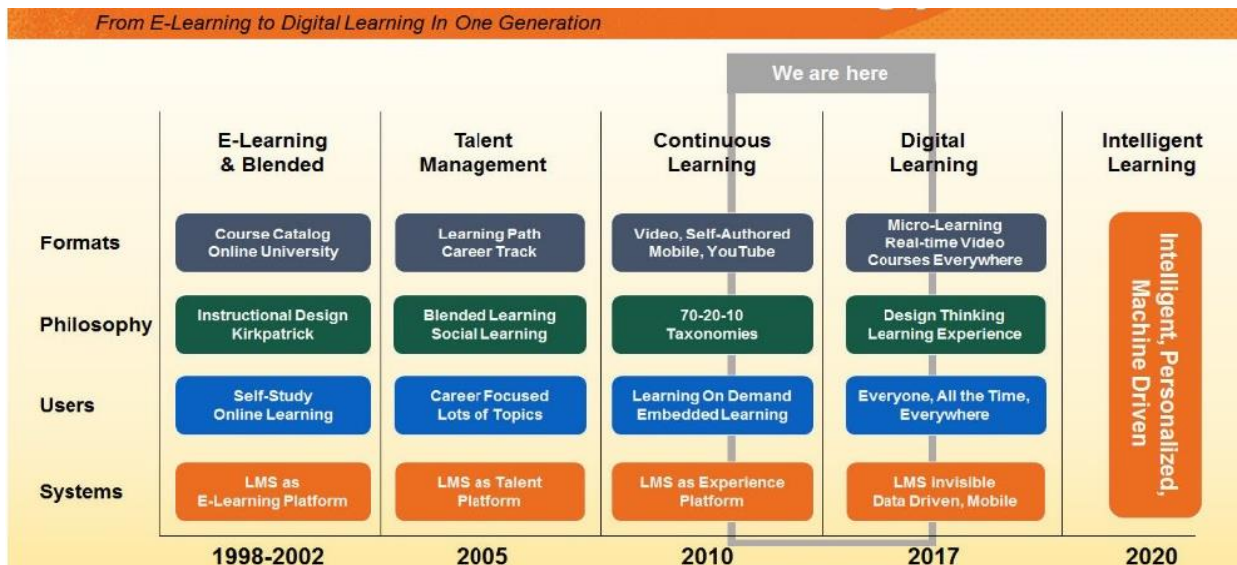


Fig. 2. Evolution of trends in using digital technology in education

Source: Javorcik, T., Polasek, R. (2019). Transformation of e-learning into microlearning: New approach to course design. AIP Conference Proceedings 2116, 060016 (2019). <https://doi.org/10.1063/1.5114051>.

E-learning is accepted as “a large collection of applied software and educational methods, including computer-based education, web-based education, and virtual classrooms” (Akbarilakeh et al., 2019). Unlike distant learning (assuming separation of teacher and student) e-learning is intended to support teaching and learning processes by the use of Information and communication technology (ICT), incl. virtual learning, blended learning, content sharing platforms, etc. (Otto & Becker, 2018). However, e-learning is “more than online learning, virtual learning, distributed learning, networked or web-based learning” and it includes “all educational activities that are carried out by individuals or groups working online or offline, and synchronously or asynchronously via networked or standalone computers and other electronic devices” (Pauline Chitra&Antoney Raj, 2018). In e-learning physical and temporal distances are not an obstacle to communication and interaction between the actors in the study process both in hybrid and fully online courses (Queiroz&Agnolotto, 2019). Furthermore, distance is not defined by geographical separation but by its psychological and communication aspects and that distance is shorter when dialogue and flexibility are greater and the role of teacher is significant in using advantages and overcoming disadvantages of the means of asynchronous communication (Queiroz&Agnolotto, 2019).

In e-learning it is important to guarantee that learning objectives have been reached not only in terms of knowledge but also developing understanding and confidence (Kaleci&Akleman, 2018). In order to achieve learning objectives the content is not the only one important thing – courses must be designed and adapted so that to maintain motivation, involvement and engagement of students in the study (Oancea, Barsan&Bouleanu, 2018) through an integrated approach in a new student model (fig. 3). In that relation it is important to assure quality in training and to involve the processes of the quality assurance systems of educational organizations, incl. higher education system (Dimitrov, 2013). Of special importance are also the questions of: the application of new teaching methods (Stoichkova,

2018), the contribution of higher education institutions to sustainable regional development (Dimitrova, 2013), the relationship between e-learning and e-business (Tosheva&Gancheva, 2015) and the role of career development centers (Nenkova, 2018).

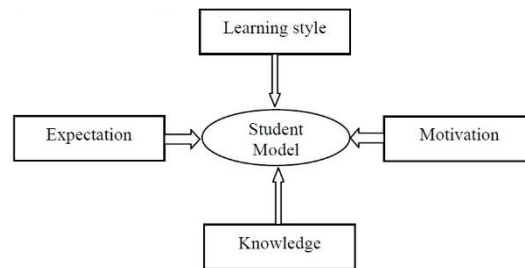


Fig. 3. Student model

Source: Oancea, R., Barsan, V.-A., Bouleanu, I. (2018). *Adaptivity in e-learning systems. International Conference Knowledge-based organization, Vol. XXIV No 3, DOI: 10.1515/kbo-2018-0138, pp. 66-69.*

Furthermore, in training and education it is important to support students to find their potential for future professional development paying a special attention to creativity which is analyzed in relation to producing ideas, finding original and unusual solutions, using non-traditional patterns of thinking (Shubina, Kulakli&Zolkover, 2019).The relationship between creativity and e-learning technology in a contemporary educational context can be studied by two main questions: how can the creativity be enhanced in contemporary education system and how can e-learning enhance development of creativity in students (Shubina, Kulakli&Zolkover, 2019).

The success of e-learning is dependent on the attitudes of teachers towards e-learning and their understanding (Akbarilakeh et al., 2019) but this is only the one side.Collaborative learning in the e-learning environment also raises a number of questions related to the challenges to the engagement of teachers and students in “a real collaborative teaching-learning process, allowing the emergence of a productive virtual learning community, in which there are sharing of knowledge and socio-pedagogical relationships” and the critical issue is not the technology (which is the communication channel) but the human factors and people relationships and interactions peculiarities (Simonette, Queiroz&Spina, 2019).

Five main factors and eighteen sub-factors were identified as critical success factors (CSFs) in e-learning implementation (Raman, Othman &Danaraj, 2019). The main categories are connected to teachers and students, information technology, design and content, and the role of the organization (fig. 4).

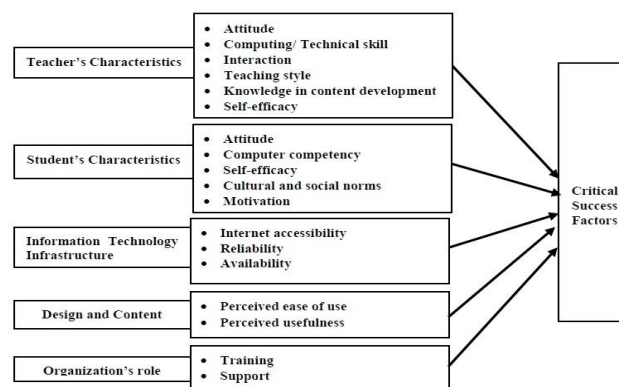


Fig. 4. Conceptual framework based on the critical success factors (CSFs)

Source: Raman, K., Othman, N., Danaraj, G. (2019). Investigating key factors for successful e-learning implementation. *Asia Proceedings of Social Sciences* 4 (2), pp. 49-52.

E-learning framework has been proposed (Daniels, Sarte&Dela Cruz, 2019) embracing main elements and resources in e-learning (fig. 5).

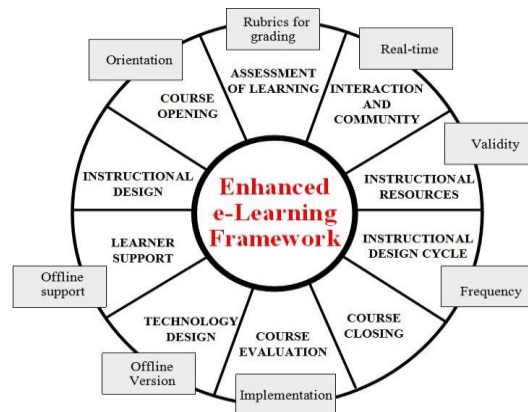


Fig.5. Proposed e-learning framework

Source: Daniels, M.M., Sarte, E., Dela Cruz, J. (2019). Students' perception on e-learning: a basis for the development of e-learning framework in higher education institutions. *IOP Conf. Series: Materials Science and Engineering* 482 (2019). doi:10.1088/1757-899X/482/1/012008.

The benefits of e-learning for students are found in connection to the following: how the content is accessed, consumed, discussed and shared depending on availability and comfort; the opportunity for a quick delivery cycles and individual speed, saving time and resources; a higher degree of coverage to communicate in a consistent way with the target audience; less impact on environment (Pauline Chitra&Antoney Raj, 2018).

The way e-learning is combined with traditional classroom methods is expressed by the term “blended learning” which is determined as “a new, hybrid teaching methodology” changing the way of work of teachers and students². The focus in the next part of the study will be put namely on such a kind of experience in the specialized higher education institution University of agribusiness and rural development which main campus is situated in Plovdiv, Bulgaria.

Putting e-learning into the university practice: the experience of UARD

University of agribusiness and rural development (UARD) is a Bulgarian private university founded in 1992 as Higher school “Agricultural college” first, based on the model of a British college. Its mission has been formulated in four general directions: (1) to provide easier access to education and training; (2) to provide education and training of high quality at all the levels in higher education system but also in lifelong learning in the field of agribusiness, rural development, tourism, economics, management and administration, etc.; (3) to be an educational, research and expertise center in today’s knowledge-based economy; (4) to respect and enhance economic, historical and cultural traditions of regions (<http://uard.bg/>).

Following the successful implementation of the project called “Development of electronic forms of distance learning in UARD” (BG051PO001-4.3.04-0056) in the period 2012-2014, supported by the

² What is blended learning? - <https://www.mindflash.com/elearning/what-is-blended-learning> (accessed 27.08.2019).

national Human resources development Operational Program 2007-2013 co-financed by the European social fund of the EU, an integrated e-learning platform was developed and introduced into the university's practice - <http://elearn.e-uard.bg/>. Moreover, specific trainings were organized for the university staff so that to assure motivation and necessary competences development (Dimitrov et al., 2014).

After the project ends this platform continued its improvement, incl. outside the borders of traditional distant learning courses in the university, and now it is intensively used into the courses of continuing education and training. It is a moodle-based platform benefiting the opportunities and the advantages of different tools for communication and interactions bearing in mind that moodle is "a full working substance administration framework" and it allows to introduce full content by "one oversight utility" (Hussien&Khaudair, 2018). Furthermore, it is supplemented by additional instruments for videoconferencing, e-repository and virtual library, electronic and multimedia textbooks, etc. (fig. 6).

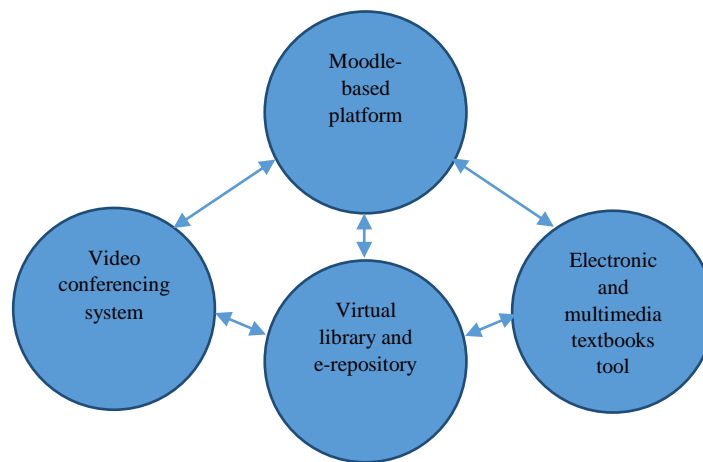


Fig. 6. E-learning platform of UARD

For the period from 2015 till now first by importance are the courses in the field of agribusiness which are designed as short (30 hours) or long-term (150 hours) blended learning courses. They have different participants' shares (fig. 7) showing the prevalence of short-term ones (68%).

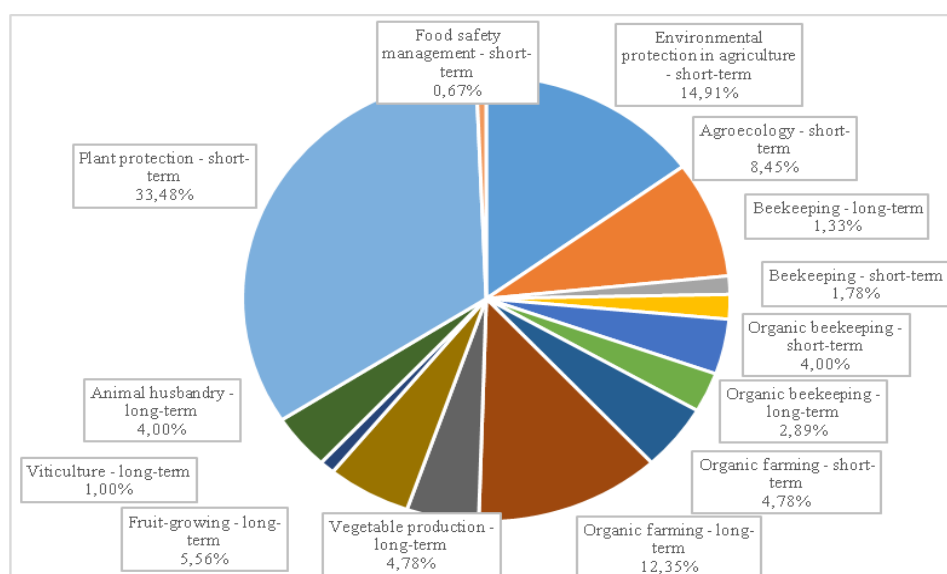


Fig. 7. The most popular short and long-term courses shares (in terms of number of participants – total of 899) for the period 2015-2018

The interest and the satisfaction of these courses measured by questionnaires is very good but here it should be noticed that these courses are obligatory for farmers which are beneficiaries for some of the measures of the national Rural development program so that the interest could be explained by that fact, the satisfaction by the certification needed for the support (which is the main goal of participants) and the problems in the sector as a whole (Plachkov, 2019).

Next is the training for the professional qualification “teacher in economics” which contains 3 semesters of blended learning making the greater use of the e-learning platform. For that a special questionnaire was prepared and distributed in 2018-2019 collecting the feedback on the following issues: the motivation to study for a teacher, to choose UARD, the satisfaction of training and e-learning. The interesting point here is that the assessment is made by “current or future teachers” involved in the qualification which are in the role of learners and they are expected to have get to some conclusions for their own about the advantages of e-learning. This could also be another stimulus and motivation for its application in their practice.

The motivation (open question) to enroll in the courses for the professional qualification “teacher” is linked to the opportunities for professional realization and the essence of work. On the open question for the choice of UARD the answers could be summarized around the opportunities for good education and e-learning, as well as good reviews of relatives for that.

Regarding the assessment of knowledge and skills over 80% of respondents answer that they are topical and oriented towards the needs of the practice. The use of e-learning is assessed by all as good and giving opportunities for independent work. On the question which opportunities e-learning provides some specific skills and competences development the respondents answer positively for all: creative thinking, decision taking, team work and communicative skills development (fig. 8). Individual and group assignments are assessed as useful and necessary by 93% of respondents.

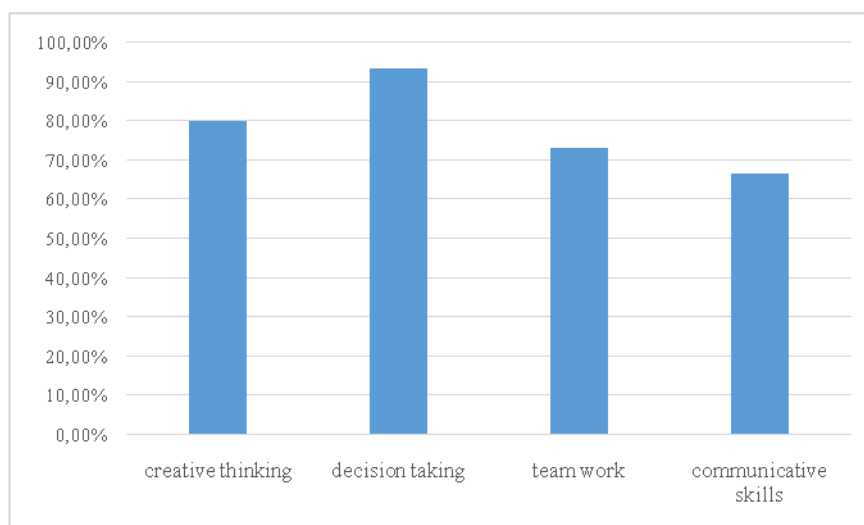


Fig. 8. Assessment of the opportunities of e-learning in the professional qualification of teachers (the question is with multiple answers)

The assessment of the teachers is also highly positive (fig. 9). Furthermore, over 86% share the opinion that creativity, initiative and independent thinking are encouraged, 80% answer that there is a respect of individual abilities and encouragement of students' individual development. Knowledge and skills gained are also well-assessed (fig. 10). According to the respondents e-learning provides opportunities for: flexibility in learning and motivation for development, focus on the things which students are interested in, stimulating independent thinking, development of digital skills, and critical thinking on the way of learning (fig. 11).

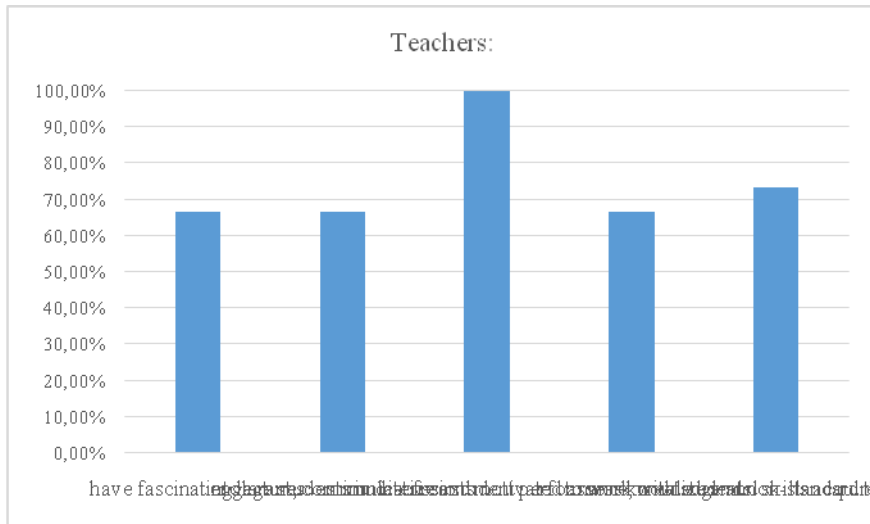


Fig. 9. The opinions collected for the teachers (the question is with multiple answers)

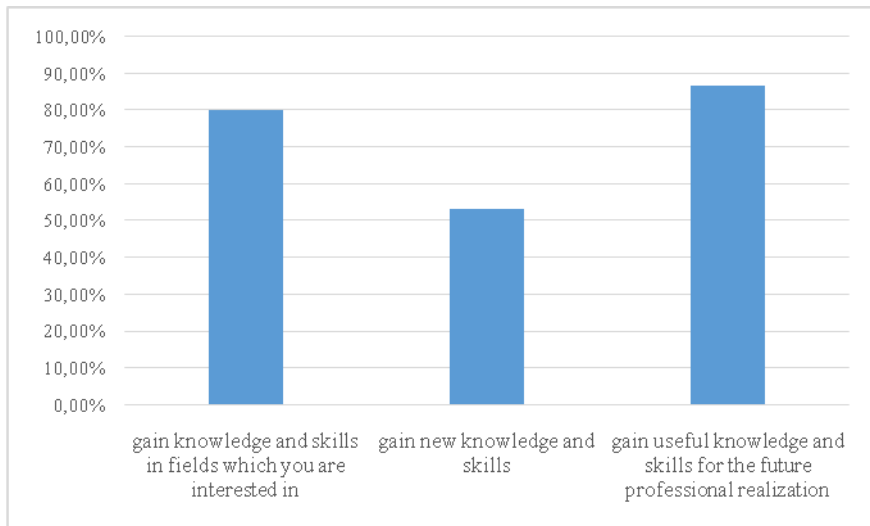


Fig. 10. Results from the assessment of knowledge and skills gained (the question is with multiple answers)

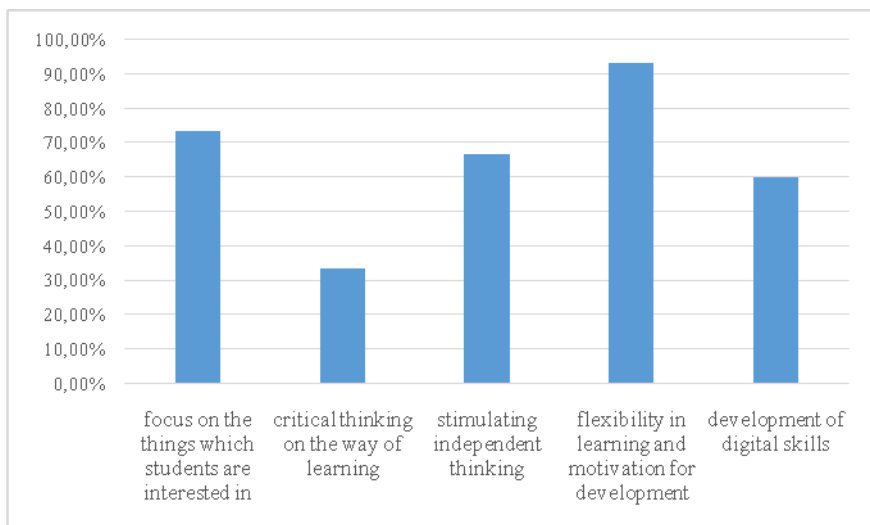


Fig. 11. Opportunities provided by e-learning (the question is with multiple answers)

To the open question of comments and recommendations the answers are oriented towards the flexibility in study process in the blended learning because the obligatory practice in a school is difficult to be organized in convenient time for all.

All the respondents answer that they will recommend such training to their friends and relatives (or that they already did it). Over 90% would continue their training in some master programs in UARD if the education offered is flexible as e-learning in that qualification or as distant learning.

There should be noticed that UARD provides opportunities for distant learning in the most of its specialties and since the end of 2018 it has applied blended learning in all bachelor and master programs based on the experience with the courses describes in two more separate platforms: for distant learning (<http://vuarr-dist.com/>) and for e-learning (<http://isao.vuarr.com/>). However, one of the main obstacles in the application of distant learning and e-learning and increase of share of specialties is connected to the national accreditation procedures which retain lots of conservatism and burdening requirements.

On the other side are the great opportunities of the implemented projects in the university under the Erasmus+ program which are mainly oriented to development of e-learning courses and platforms (<http://uard.bg/>) and are connected to some of the most topical issues of sustainable development and management.

Conclusion

E-learning is a powerful tool for increasing the competitiveness of contemporary university through the opportunities it offers for a greater flexibility and an easier access to education and training and for a greater satisfaction of students with the learning experience and skills development. In order to be successfully applied in a higher education institution or other educational organization there is a need of comprehensive inquiries and preparation activities considering the critical factors in its development and success, incl. human and information resources and infrastructure development.

With the fast development of technology and ongoing digital transformations into the whole society the biggest challenge will be that to “track” the last achievements in digital technology and to put them into the study practice and to keep the staff motivated for e-learning, well-trained and self-confident. Educational institutions should develop and implement concise strategies for e-learning development in agreement with the increasing requirements of accreditation and quality assurance.

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TOWARDS PARTICIPATORY DIGITAL SOCIETY USING THE DIGITAL TWIN PARADIGM: CITIZEN DATA MODEL

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Abstract:

Historically, societal challenges have been handled as complicated ones by dividing responsibilities into various organizations that are then mandated to provide needed solutions and services from their own perspective. It has also defined the enterprise architecture that has had a tendency to mimic organizational structures and its responsibilities. Today, modern societies are facing complex challenges, such as climate change, that can't be solved without a paradigm shift of problem-solving. It also challenges information systems capabilities to co-operate in a cross-sectoral manner. Advances in ICT and its adaptation and penetration rate in every part of society introduce new possibilities that can only be benefitted in full by providing more integrated information systems. Moreover, the level of citizens' expectation has raised due to other systems that liberally connect data from different sources. To meet new goals, societal services should become more proactive and personalized, satisfying citizens' needs as they emerge. In this paper, we propose using a holistic model of digital twin paradigm for societal applications. The proposal builds on using a citizen 360-data model that reflects the characteristics of citizens that act as service users. Based on the data model, societal information systems can propose actions and provide proactive services that are mass-tailored to meet individuals' needs.

Key words: Digital twin Public administration Human-centricity Digital society Mydata

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1.Introduction

In the coming years and decades, many societies will face major challenges such as ageing populations and high rates of structural unemployment. These challenges linked with the rapid technological development and global threats like climate change may be transforming the world faster than ever before. The so-called ‘wicked’, deeply intertwined problems cannot be resolved without more systematic efforts to harness the opportunities offered by technological advances and digitalisation to promote citizens’ welfare.

To solve such problems, public and societal services need improved capabilities as well as new ways of thinking about citizens, their needs, and the role of society. Historically, challenges have been solved by dividing responsibilities into various organizations that are then mandated to provide needed services from their own perspective (Bourgon, 2017). For example, tax administration provides their own services to collect taxes. This paradigm has been very effective in organizing services from organizational perspective and service design has increased it further on. However, we have come to a situation where services do not form a clear picture from the citizens point of view. Also, legislation does not support co-developing seamless service paths with various organizations from public, private and third sector for the benefit of people’s well-being.

To meet new goals, societal services should become more proactive and personalized, satisfying citizens’ needs as they emerge. At the same time, associated information systems should be managed more effectively and proactively, which in turn offers organizations better opportunities to regenerate their operations, deliver savings and improve the availability, quality and customer experience with better matching of their services just-in-time with citizens real need.

In this paper, we propose applying the digital twin paradigm (Alam and El Saddik, 2017) for societal applications. The proposal builds on using a citizen data model that reflects the characteristics of citizens that act as service users. Based on the data model, societal information systems can propose actions and provide services that are mass-tailored to meet individuals’ needs. In addition, we introduce a case study where the approach and its core concepts have been evolving.

The rest of this paper is structured as follows. In Section 2, we provide background for this work, covering the new possibilities of increasing societal data reserves. In Section 3, which forms the core, we introduce the citizen data model. In Section 4, we present a case study that demonstrates the use of the data model. In Section 5, we provide an extended discussion regarding our observations and lessons learned. Towards the end of the paper, in Section 6, we draw some final conclusions.

2.Background

The use of data and novel technological solutions provide new tools for building a human-centric and participatory society by respecting people’s own basic rights to their own mydata. In respect to the new demands the technological development poses to the working life, people continuously need new skills during their careers and to stay employable. Despite the fact that there is a range of digital learning and employment services available, it is usually difficult for citizen themselves to identify suitable services from the vast selection. In addition, advice on continuous learning and personal career paths is limited and usually too expensive for the society.

Smart and co-operative digital services and related service chains can help users analyse their competencies and possibilities for competence development and employment. As a part of the preliminary study of the National AuroraAI Programme in Finland (<https://vm.fi/en/auroraai-en>), a trial was concluded in which information was collected and produced about various alternatives for using AI in the context of lifelong learning and employment, taking into account responsibility, data privacy and ethical questions. The solution produced in the trial maps the user's competencies and compares them with existing educational and job offerings. This is made possible by using the digital twin paradigm in order to allow users to utilize their personal data in the network of services. The network aims to predict the user's needs and improve the service experience and provisioning by formulating a coherent overall view of each user's digital twin or the so-called DigiMe. In the AuroraAI network, DigiMe refers to the way a user can form a digital representation of her/himself by utilising her/his personal data located in various databases in public, private, and third sector organisations. DigiMe can be then utilised in the AuroraAI network to improve the effectiveness of the services and decrease utilising services that really doesn't add value for the citizen. Services that are based on personal data provide users with better understanding and control over their welfare and the ability to activate services in real time. The key feature is that the user is able to manage their own data and edit them into situational, temporary profiles in order to access a personalised service offering. That is to say, the key feature is that the user is able to manage their own data and edit them into situational, temporary profiles in order to access a personalised service offering in a cross-sectoral manner.

The DigiMe concept can be developed in cases where the connection between the real-world person and their digital persona needs to be made invisible. The user collates their personal data to produce a compilation or summary that can be processed by the network without connecting it to the user's source data. The development and controlled testing of such a concept can be seen as important methods in the transition towards a human-centric society in which users can trust data privacy.

The intelligent and dynamically evolving service chain mines and matches profile data, future data, foresight data and information about educational and job market offerings to help user to analyse competencies and job opportunities. In the future, the solution should lead to getting information about competence development needs and suitable opportunities in order to address skill gaps. Expert advice and guidance would be available whenever needed.

In the long term, the solution and the personalised service offering it facilitates could help resolve the skills-matching problem as competence needs evolve. The greatest benefit would come from continuous use, which would give the tool continuous feedback about the user's choices and personal development, and enable it to learn and produce increasingly accurate suggestions about suitable job openings and competence development opportunities. This however implies that there is personal presence online, even when the citizens themselves are offline.

3. Digital Twins for Societal Use: Citizen Data Model

Digital Twin is originally a concept where the aim is to create an "exact" cyber copy of a system to the Digital World (Alam and El Saddik, 2017). While initially, Digital Twin concept was developed for improving manufacturing systems, today, Digital Twins are being re-defined as

digital copies of living and non-living entities (El Saddik, 2018). Creating such copies, however, requires much information from the entity and its environment. Such demand is typically addressed with Cyber-Physical Systems (CPS) and Cyber-Physical-Social Systems (CPSS). Cyber-Physical Computing leverages data from physical “real” world and cyber world processes, and send this to the Digital Twin for computation (Alam and El Saddik, 2017). Physical-Cyber-Social (PCS) Computing extends these systems by adding a third dimension to this equation that is inherent for humans: the social world. PCS Computing considers the social world processes and relationships while encompassing data, information, and knowledge coming from these three worlds, and then to integrate, correlate, interpret, and provide human-understandable abstractions that are contextually meaningful (Sheth, Anantharam, and Henson, 2013). According to the authors, such a process can be used for improving the human experience in computing (Sheth, 2009), which is also a goal of the Digital Twins. Sheth, Anantharam, and Henson initially presented PCS Computing (2013), but others have presented similar ideas that are often referred as Cyber-Physical-Social Systems (CPSS) as shown by the survey from Zeng et al. (2016). Some of the oldest CPSS references are from 2010 to 2011 (Wang, 2010; Liu et al., 2011).

In a human-centric society, Digital Twin concept needs to be applied with the citizens, as well. The more we build societal understanding of who our citizens really are and what they really need, the better we can focus public impact on people’s well-being. Understanding the well-being of the citizens as a multi-dimensional, emergent issue is overlooked by conventional income measurements (Stiglitz et al., 2009). Also, well-being indicators to indicate well-being at a societal level have been introduced by OECD (2011). These together form a baseline to build a Digital Twin of a citizen (Figure 1).

With a proper Citizen Data Model, societies can enormously increase their understanding of people’s real situation and what services are really needed and by whom. It can lead to a societies where services can be proactively orchestrated around people’s real need. Citizen Data Model also helps organisations to decrease failure demand of their services by providing services to citizens only when they really bring value (Kjøller and Rasmussen, 2017).

However, implementing a whole and holistic Citizen Data Model might be too difficult to be done at once. Also, data challenge shouldn’t be considered as an easy one to tackle. Even though one can identify the needed elements for data, numerous challenges occur when building a model in practice. Many of these challenges are related to data usability as seen in the studies done by Lacity and Willcocks (2018). Also, the use of data is restricted by legislation such as General Data Protection Regulation (GDPR). The other challenges are related to leadership, investments, know-how of organisations and citizens, technological capabilities, digital trust and information policies in both public and private sectors.

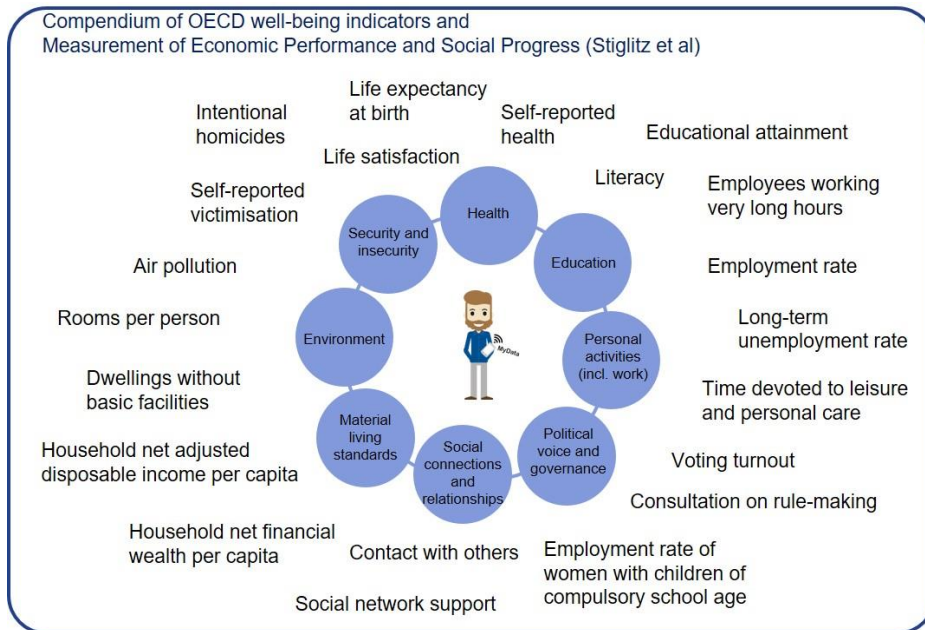


Figure 1. Citizen Data Model is based on various indicators of citizen multidimensional well-being proposed in compendium of OECD well-being indicators and Measurement of Economic Performance and Social Progress (Stiglitz et al., 2009).

To summarize, Citizen Data Model should be built through chosen business cases. From the citizen's point of view, business case is considered as a life event, where numerous service needs occurs at the same event. In order to build a proper Citizen Data Model for chosen life event, design approach needs to be applied and work should be started with building a situational understanding of people's well-being in chosen life event. That is done by gathering experts around every organisation that are involved with chosen life event into a public-private-people-partnership co-operation. Participants together forms a shared understanding of what really happens in chosen life event and what data is needed to understand it better. Data can also be gathered by interviewing people experiencing chosen life event. As a result, situational analysis visualises the differences of people's multidimensional well-being in chosen life event, as illustrated in Figure 2.

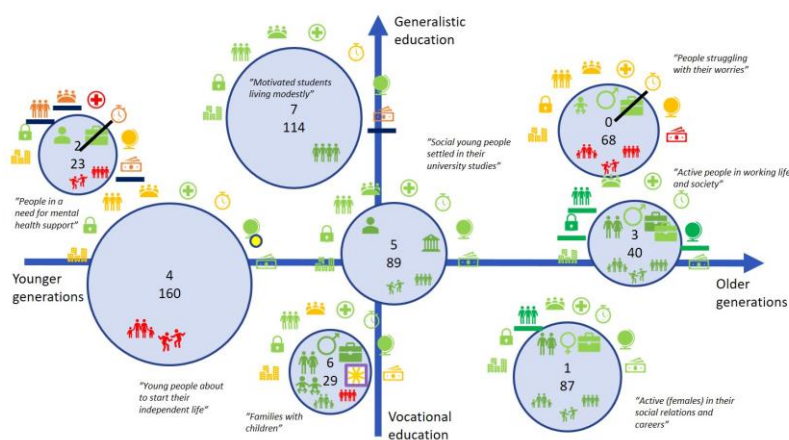


Figure 2. Machine learning can be applied to deepen the understanding of people's well-being in chosen life events. Cluster analysis can be done by utilising Citizen Data Model.

4. Case Study

In today's labor market, people continuously need new skills during their careers. To meet such demand, there is a range of digital learning and employment services available. However, for an individual, it can be difficult to identify suitable services from the vast selection. Furthermore, in many cases advice on continuous learning and personal career paths is limited. To understand the challenges of the field, we have carried out a trial on gaining a foothold in working life through competence development.

In the trial, information was collected and produced about various alternatives for using AI in the context of lifelong learning and employment, taking into account responsibility and ethical questions. The trial was participated by numerous partners, including representatives from the National Agency for Education, the Ministry of Education and Culture, the Ministry of Employment and the Economy, and the following enterprises: Osaamisbotti, Headai, Accenture, Fjord and Suomen Tilaajavastuu Oy (Kopponen and Ruostetsaari, 2019, pp. 38-42). In addition, development was assisted by students, learning and employment experts from various sectors, and the Aurora AI developer community.

Test setup was technically made in co-operation of three private organization. These organizations were Suomen Tilaajavastuu Oy, who's responsibilities involved authorizing use of mydata. Osaamisbotti Oy was responsible of skill mapping and continuous support. The third organization was Headai that was responsible for analysing skills and making job suggestions for citizens.

Suomen Tilaajavastuu Oy's MyData Wallet enables to utilise citizen's mydata to personalise and optimise services based on people's real profiles and needs. With MyData Wallet, citizens are able to control their own data flows and decide in which services mydata is utilized. In this test setup, citizen wants to map his/her skills with labour markets by giving permission for Headai service to utilise mydata from his/her MyData Wallet. In order to do that, a citizen triggers an information request where Headai requests to use her/his skill map found from MyData Wallet. Citizen is able to see the exact purpose of utilisation of mydata and where is it going to be utilised. In order to proceed, citizen gives the permission to utilise mydata. Citizen is able to remove permission anytime she/he wants. If so, Headai can't access her/his skill map anymore. MyData Wallet also gives an overview for citizens to understand all the given permissions for every services and purposes her/his mydata is utilised.

After permissioning utilisation of mydata, citizen skill profile is to be done. That rises two challenges (Kopponen and Ruostetsaari, 2019, pp. 38-42): Firstly, the expression of knowledge/skills is very difficult, and, each citizen has a unique skill profile. In other words; there are no two identical citizen skill profiles. Secondly, young people especially can find it difficult to articulate their skills. To tackle these issues, a conversational chatbot technology was utilised as a personal interface to map citizen skills, described in detail in (Lacity and Willcocks, 2018). In test setup, students were discussing 10 minutes with a chatbot, that built a customised skill profile based on discussions for each students, who were then able to utilize it in services found from AuroraAI network. One key finding was to see that citizen's shouldn't be left alone just with a chatbot. It is important to keep conversation open also with real student counselor or career coach. This key finding is supported with other studies of utilising robotic process automation (RPA) and cognitive automation (CA) tools. Those studies suggest to invite customers to try the automation, but keep other channels open, even though major part of discussions are with chatbot.

Completed skill profile includes hidden skills, interests, motivation, and even her/his dreams. A citizen can utilise her/his profile as a DigiMe in AuroraAI network. In this test setup, DigiMe was transferred to Headai service to make natural language based analysis to understand what skill related words is found from it. Headai also creates a digital twin from labor market. Thus, Headai service links DigiMe

with digital twin of labour market to show the interdependencies of citizen skills with real needs in the labor market and what kind of vacancies and opportunities one can find for her/himself. Interdependencies are done with analysing meanings of discussions with a citizen, not by just finding and matching keywords. It is also important to visualise matching skills for citizens, whether or not they are hidden or proven, since citizen her/himself might not actually understand her/his skills that might be relevant in the labour market. Also, any lack of skills or potential to improve on some areas should be visualised in order to empower people to improve their skill set.

The differences between a keyword search and using machine learning in reasoning is enormous. A keyword search doesn't account any smart understanding of what a citizen really means or needs. A machine learning in reasoning, on the other hand, enables to build an understanding of intentions and who citizens are and what they really need. In this set up, Headai used AI to create a maximum labour market value for citizens instead of just matching open vacancies with skills. In order to do that, labour market data is deeply analysed to create an understanding of what skills are really needed, not just by looking after job titles. By comparing previous year with this year and how skill searches have changed, and combining that with educational information and curriculum, Headai provides an analysis of what we really are training in our society and does it fit with real need in the labour markets. It also reveals hot spots of lacking skills in the labour market. Visualising mismatches also enables decision makers build better understanding of what skills citizens should build for themselves. Furthermore, citizens different situations can be analysed through segmentation or cluster analysis.

5. Discussion

Obviously, there are numerous technical and operational issues that should also be considered. Any large operation that involves numerous stakeholders can create complications regarding the stakeholders' views and responsibilities, and our needs are by no means different. The stance taken by us in the trial is that by committing to the platform's fundamental compatibility requirements, it is possible to integrate just about any system in the system.

The societal dimension of the work calls for certain special characteristics, such as accountability, which imply that the requirements also include policy and operations related issues. To govern these, a trust council has been established, and several contractual aspects are considered. Furthermore, all the associated services are subject to direct monitoring as well as to applications such as Saidot.ai that offer transparency and other desirable functions for various stakeholders, including also individuals.

A further technical and operational dimension to be considered is Intellectual Property Rights (IPR) and associated responsibilities and opportunities for further monetization of existing implementations in other contexts. With the increased interest in platform economy, a key challenge is which parts of the system being designed are scalable enough for generalization towards society as a service, and how should such a system be governed. Obviously, this may also mean reconsidering the role of the government in general when considering its role as a societal stakeholder in ICT.

6. Conclusions

In our quest to build a human-centric society, where information technology is used proactively to help citizens' daily activities, we have only taken very first steps. In the trial presented in this paper, we have so far demonstrated the technical capabilities as well as the feasibility of public-private-people-partnership as the underlying model for the development. Furthermore, it has also become apparent that

while politics change, information technology is so deeply embedded in the Finnish society that initiatives do not directly follow political guidance.

Despite the fact that the trial version has been successfully deployed, there are numerous identified challenges that will need special attention. While it is almost universally agreed that the state and municipalities should support its citizens, aiming to implement this ideal with computers and software provokes reactions. While building understanding regarding citizens' needs, there is a fine line between empowering and controlling the individuals, and with the trial version, we have only scratched the surface of what is acceptable and what is not. Furthermore, this line is different for different individuals, not to mention different nations. Additional challenges emerge when considering regulation and ethical issues in more general as they evolve. What is now possible may not be acceptable in the future, and vice versa. Hence, although individual services, key design decisions, and learnings of AuroraAI are reusable in other countries, detailed data sets or behavioral patterns are probably not.

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KNOWLEDGE DISCOVERY DATABASES (KDD) PROCESS IN DATA MINING

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Abstract :

Data Mining is a powerful tool for companies to extract the most important information from their data warehouse. These tools allow you to predict future trends and behaviors in order to be able to provide activities based on specific knowledge. Volume of information is increasing every day that we can handle from business transactions, scientific data, sensor data, Pictures, videos, etc. So, we need a system that will be capable of extracting essence of information available and that can automatically generate report, views or summary of data for better decision-making.

Data mining is used in business to make better managerial decisions by:

- *Automatic summarization of data,*
- *Extracting essence of information stored,*
- *Discovering patterns in raw data.*

Data Mining also known as Knowledge Discovery in Databases, refers to the nontrivial extraction of implicit, previously unknown and potentially useful information from data stored in databases.

Key words: *Data Mining, tools, databases, data warehouse, knowledge.*

Introduction

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Knowledge Discovery in Databases (KDD) is an automatic, exploratory analysis and modeling of large data repositories. KDD is the organized process of identifying valid, novel, useful, and understandable patterns from large and complex data sets. *Data Mining* (DM) is the core of the KDD process, involving the inferring of algorithms that explore the data, develop the model and discover previously unknown patterns. The model is used for understanding phenomena from the data, analysis and prediction. The accessibility and abundance of data today makes knowledge discovery and Data Mining a matter of considerable importance and necessity. Given the recent growth of the field, it is not surprising that a wide variety of methods is now available to the researchers and practitioners. No one method is superior to others for all cases. The handbook of Data Mining and Knowledge Discovery from Data aims to organize all significant methods developed in the field into a coherent and unified catalog; presents performance evaluation approaches and techniques; and explains with cases and software tools the use of the different methods.

The goals of this introductory chapter are to explain the KDD process, and to position DM within the information technology tiers. Research and development challenges for the next generation of the science of KDD and DM are also defined. The rationale, reasoning and organization of the handbook are presented in this chapter. In this chapter there are six sections followed by a brief reference primer list containing leading papers, books, conferences and journals in the field:

1. The KDD Process
2. Taxonomy of Data Mining Methods
3. Data Mining within the Complete Decision Support System
4. KDD & DM Research Opportunities and Challenges
5. KDD & DM Trends
6. The Organization of the Handbook

The special recent aspects of data availability that are promoting the rapid development of KDD and DM are the electronically readiness of data (though of different types and reliability). The internet and intranet fast development in particular promote data accessibility. Methods that were developed before the

Internet revolution considered smaller amounts of data with less variability in data types and reliability [2]. Since the information age, the accumulation of data has become easier and storing it inexpensive. It has been estimated that the amount of stored information doubles every twenty months. Unfortunately, as the amount of electronically stored information increases, the ability to understand and make use of it does not keep pace with its growth. Data Mining is a term coined to describe the process of sifting through large databases for interesting patterns and relationships. The studies today aim at evidence-based modeling and analysis, as is the leading practice in medicine, finance and many other fields. The data availability is increasing exponentially, while the human processing level is almost constant. Thus, the gap increases exponentially. This gap is the opportunity for the KDD/DM field, which therefore becomes increasingly important and necessary.

1. The KDD Process

The knowledge discovery process (Figure 1) is iterative and interactive, consisting of nine steps. Note that the process is iterative at each step, meaning that moving back to previous steps may be required. The process has many “artistic” aspects in the sense that one cannot present one formula or

make a complete taxonomy for the right choices for each step and application type. Thus, it is required to understand the process and the different needs and possibilities in each step. Taxonomy is appropriate for the Data Mining methods and is presented in the next section.

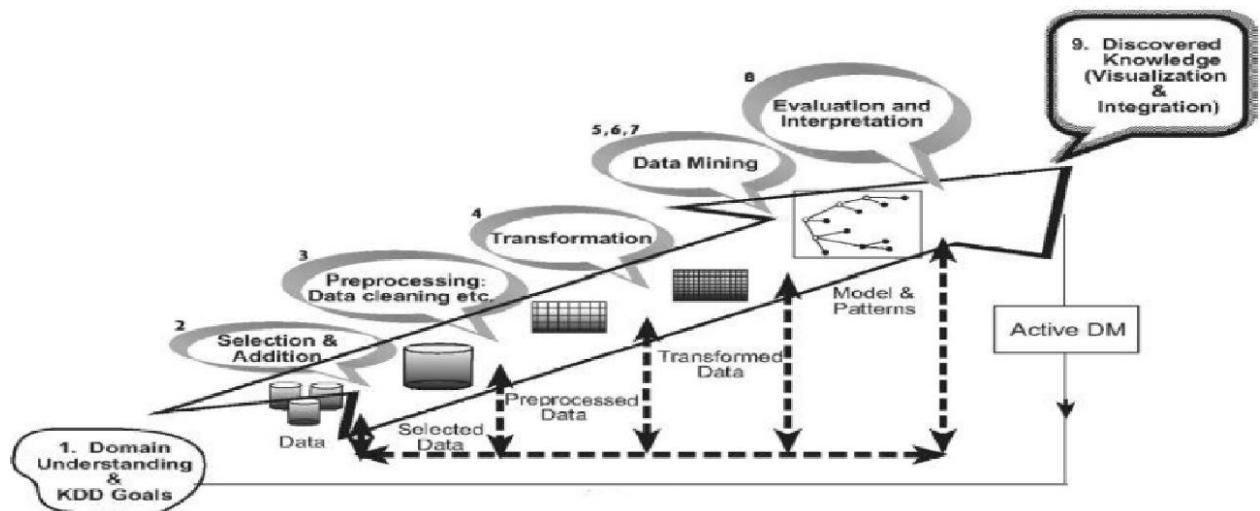


Figure 1. The Process of Knowledge Discovery in Databases.

The process starts with determining the KDD goals, and “ends” with the implementation of the discovered knowledge. Then the loop is closed – the Active Data Mining part starts (which is beyond the scope of this book and the process defined here). As a result, changes would have to be made in the application domain (such as offering different features to mobile phone users in order to reduce churning). This closes the loop, and the effects are then measured on the new data repositories, and the KDD process is launched again.

Following is a brief description of the nine-step KDD process, starting with a managerial step:

1. Developing an understanding of the application domain This is the initial preparatory step. It prepares the scene for understanding what should be done with the many decisions (about transformation, algorithms, representation, etc.). The people who are in charge of a KDD project need to understand and define the goals of the end-user and the environment in which the knowledge discovery process will take place (including relevant prior knowledge). As the KDD process proceeds, there may be even a revision of this step. Having understood the KDD goals, the preprocessing of the data starts, defined in the next three steps (note that some of the methods here are similar to Data Mining algorithms, but are used in the preprocessing context);

2. Selecting and creating a data set on which discovery will be performed.

Having defined the goals, the data that will be used for the knowledge discovery should be determined. This includes finding out what data is available, obtaining additional necessary data, and then integrating all the data for the knowledge discovery into one data set, including the attributes that will be considered for the process. This process is very important because the Data Mining learns and discovers from the available data. This is the evidence base for constructing the models. If some important attributes are missing, then the entire study may fail. From this respect, the more attributes

are considered, the better. On the other hand, to collect, organize and operate complex data repositories is expensive and there is a tradeoff with the opportunity for best understanding the phenomena. This tradeoff represents an aspect where the interactive and iterative aspect of the KDD is taking place. This starts with the best available data set and later expands and observes the effect in terms of knowledge discovery and modeling.

3. Preprocessing and cleansing. In this stage, data reliability is enhanced. It includes data clearing, such as handling missing values and removal of noise or outliers. There are many methods explained in the handbook, from doing nothing to becoming the major part (in terms of time consumed) of a KDD project in certain projects. It may involve complex statistical methods or using a Data Mining algorithm in this context. For example, if one suspects that a certain attribute is of insufficient reliability or has many missing data, then this attribute could become the goal of a data mining supervised algorithm. A prediction model for this attribute will be developed, and then missing data can be predicted. The extension to which one pays attention to this level depends on many factors. In any case, studying the aspects is important and often revealing by itself, regarding enterprise information systems.

4. Data transformation. In this stage, the generation of better data for the data mining is prepared and developed. Methods here include dimension reduction (such as feature selection and extraction and record sampling), and attribute transformation (such as discretization of numerical attributes and functional transformation). This step can be crucial for the success of the entire KDD project, and it is usually very project-specific. For example, in medical examinations, the quotient of attributes may often be the most important factor, and not each one by itself. In marketing, we may need to consider effects beyond our control as well as efforts and temporal issues (such as studying the effect of advertising accumulation). However, even if we do not use the right transformation at the beginning, we may obtain a surprising effect that hints to us about the transformation needed (in the next iteration). Thus, the KDD process reflects upon itself and leads to an understanding of the transformation needed. Having completed the above four steps, the following four steps are related to the Data Mining part, where the focus is on the algorithmic aspects employed for each project:

5. Choosing the appropriate Data Mining task. We are now ready to decide on which type of Data Mining to use, for example, classification, regression, or clustering. This mostly depends on the KDD goals, and also on the previous steps. There are two major goals in Data Mining: prediction and description. Prediction is often referred to as supervised Data Mining, while descriptive Data Mining includes the unsupervised and visualization aspects of Data Mining. Most data mining techniques are based on inductive learning, where a model is constructed explicitly or implicitly by generalizing from a sufficient number of training examples. The underlying assumption of the inductive approach is that the trained model is applicable to future cases. The strategy also takes into account the level of meta-learning for the particular set of available data.

6. Choosing the Data Mining algorithm. Having the strategy, we now decide on the tactics. This stage includes selecting the specific method to be used for searching patterns (including multiple inducers). For example, in considering precision versus understandability, the former is better with neural networks, while the latter is better with decision trees. For each strategy of meta-learning there are several possibilities of how it can be accomplished. Meta-learning focuses on explaining what causes a Data Mining algorithm to be successful or not in a particular problem. Thus, this approach attempts to understand the conditions under which a Data Mining algorithm is most appropriate. Each

algorithm has parameters and tactics of learning (such as ten-fold cross-validation or another division for training and testing).

7. Employing the Data Mining algorithm. Finally, the implementation of the Data Mining algorithm is reached. In this step we might need to employ the algorithm several times until a satisfied result is obtained, for instance by tuning the algorithm's control parameters, such as the minimum number of instances in a single leaf of a decision tree[4].

8. Evaluation. In this stage we evaluate and interpret the mined patterns (rules, reliability etc.), with respect to the goals defined in the first step. Here we consider the preprocessing steps with respect to their effect on the Data Mining algorithm results (for example, adding features in Step 4, and repeating from there). This step focuses on the comprehensibility and usefulness of the induced model. In this step the discovered knowledge is also documented for further usage. The last step is the usage and overall feedback on the patterns and discovery results obtained by the Data Mining:

9. Using the discovered knowledge[5]. We are now ready to incorporate the knowledge into another system for further action. The knowledge becomes active in the sense that we may make changes to the system and measure the effects. Actually, the success of this step determines the effectiveness of the entire KDD process. There are many challenges in this step, such as losing the "laboratory conditions" under which we have operated. For instance, the knowledge was discovered from a certain static snapshot (usually sample) of the data, but now the data becomes dynamic. Data structures may change (certain attributes become unavailable), and the data domain may be modified (such as, an attribute may have a value that was not assumed before).

2. Taxonomy of Data Mining Methods

There are many methods of Data Mining used for different purposes and goals. Taxonomy is called for to help in understanding the variety of methods, their interrelation and grouping. It is useful to distinguish between two main types of Data Mining: verification-oriented (the system verifies the user's hypothesis) and discovery-oriented (the system finds new rules and patterns autonomously). Figure 2 presents this taxonomy. Discovery methods are those that automatically identify patterns in the data. The discovery method branch consists of prediction methods versus description methods. Descriptive methods are oriented to data interpretation, which focuses on understanding (by visualization for example) the way the underlying data relates to its parts. Prediction-oriented methods aim to build a behavioral model, which obtains new and unseen samples and is able to predict values of one or more variables related to the sample. It also develops patterns which form the discovered knowledge in a way which is understandable and easy to operate upon. Some prediction-oriented methods can also help provide understanding of the data. Most of the discovery-oriented Data Mining techniques (quantitative in particular) are based on inductive learning, where a model is constructed, explicitly or implicitly, by generalizing from a sufficient number of training examples. The underlying assumption of the inductive approach is that the trained model is applicable to future unseen examples.

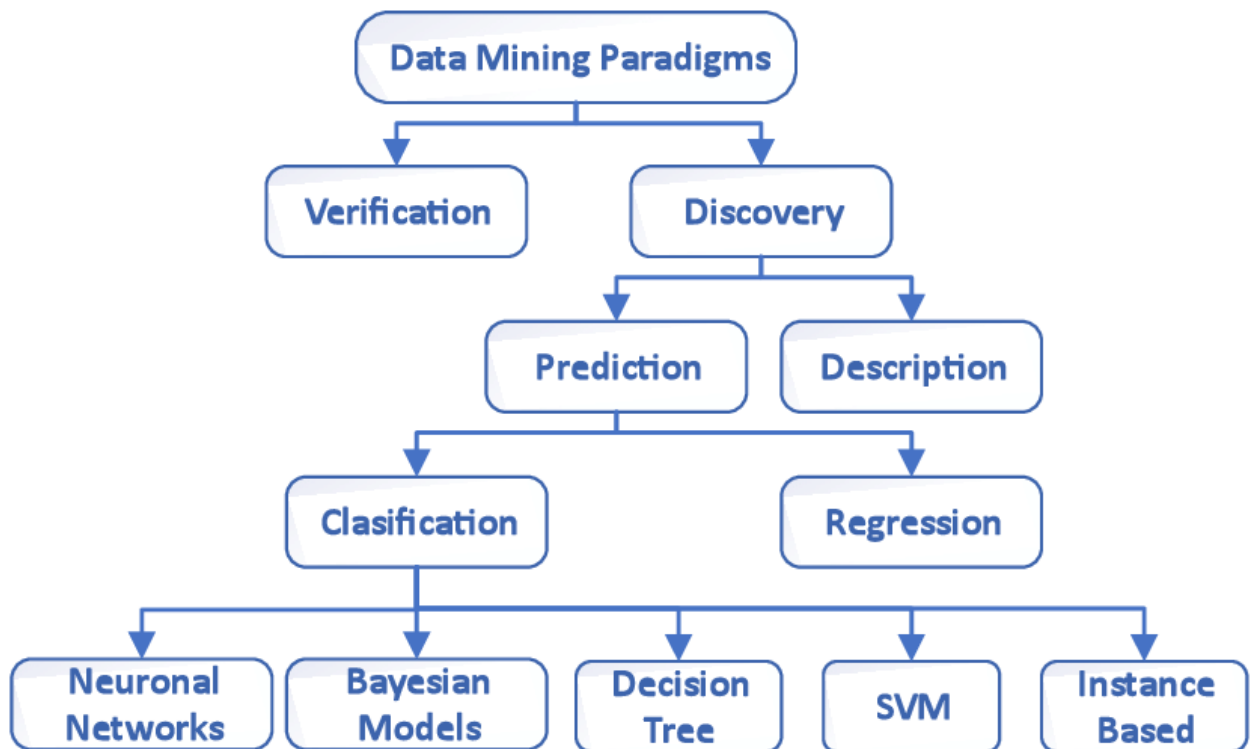


Figure 2. Data Mining Taxonomy.

Verification methods, on the other hand, deal with the evaluation of a hypothesis proposed by an external source (like an expert etc.). These methods include the most common methods of traditional statistics, like goodness of fit test, tests of hypotheses (e.g., t-test of means), and analysis of variance (ANOVA). These methods are less associated with Data Mining than their discovery-oriented counterparts, because most Data Mining problems are concerned with discovering an hypothesis (out of a large set of hypotheses), rather than testing a known one. Much of the focus of traditional statistical methods is on model estimation as opposed to one of the main objectives of Data Mining: model identification and construction, which is evidence based (though overlap occurs).

Another common terminology, used by the machine-learning community, to the prediction methods as supervised learning, as opposed to unsupervised learning. Unsupervised learning refers to modeling the distribution of instances in a typical, high-dimensional input space. Unsupervised learning refers mostly to techniques that group instances without a prespecified, dependent attribute. Thus, the term “unsupervised learning” covers only a portion of the description methods presented in Figure 1.2. For instance, it covers clustering methods but not visualization methods. Supervised methods are methods that attempt to discover the relationship between input attributes (sometimes called independent variables) and a target attribute sometimes referred to as a dependent variable). The relationship discovered is represented in a structure referred to as a model. Usually models describe and explain phenomena, which are hidden in the data set and can be used for predicting the value of the target attribute knowing the values of the input attributes. The supervised methods can be implemented on a variety of domains, such as marketing, finance and manufacturing. It is useful to distinguish between two main supervised models: classification models and regression models. The latter map the input space into a real-valued domain. For instance, a regressor can predict the demand for a certain product given its characteristics. On the other hand, classifiers map the input space into

predefined classes. For example, classifiers can be used to classify mortgage consumers as good (fully payback the mortgage on time) and bad (delayed payback), or as many target classes as needed. There are many alternatives to represent classifiers. Typical examples include, support vector machines, decision trees, probabilistic summaries, or algebraic function.

3. Data Mining within the Complete Decision Support System

Data Mining methods are becoming part of integrated Information Technology (IT) software packages. Figure 3 illustrates the three tiers of the decision support aspect of IT.

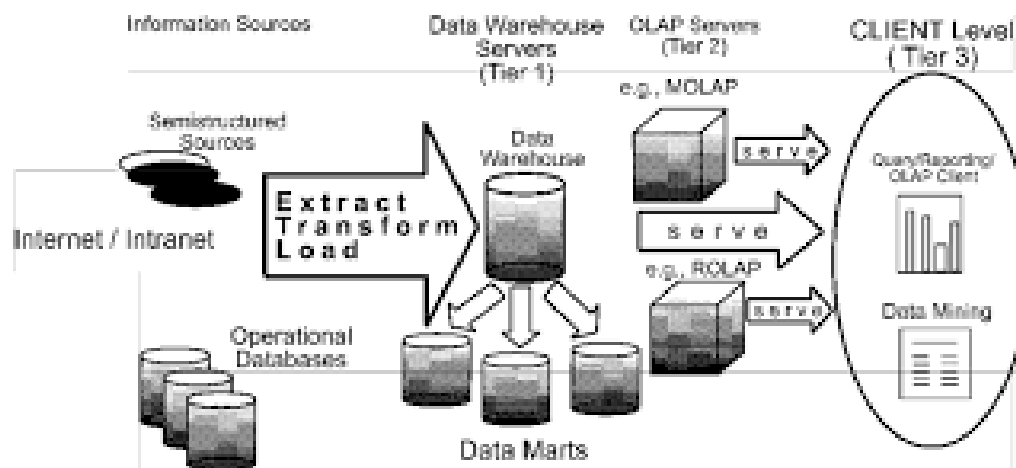


Figure.3. The IT Decision Support Tiers.

Starting from the data sources (such as operational databases, semi- and non-structured data and reports, Internet sites etc.), the first tier is the data warehouse, followed by OLAP (On Line Analytical Processing) servers and concluding with analysis tools, where Data Mining tools are the most advanced.

The main advantage of the integrated approach is that the preprocessing steps are much easier and more convenient. Since this part is the major burden for the KDD process (and often consumes most of the KDD project time), this industry trend is very important for expanding the use and utilization of Data Mining [6]. However, the risk of the integrated IT approach comes from the fact that those DM techniques are much more complex and intricate than OLAP, for example, so the users need to be trained appropriately. This handbook shows the variety of strategies, techniques and evaluation measurements. We can naively distinguish among three levels of analysis. The simplest is achieved by report generators (for example, presenting all claims that occurred because of a certain cause last year, such as car theft). We then proceed to OLAP multi-level analysis (for example presenting the ten towns where there was the highest increase of vehicle theft in the last month as compared to with the month before). Finally a complex analysis is carried out in discovering the patterns that predict car thefts in these cities, and what might occur if anti-theft devices were installed. The latter is based on modeling of the phenomena, where the first two levels are ways of data aggregation and fast manipulation.

4. KDD & DM Research Opportunities and Challenges

Empirical comparison of the performance of different approaches and their variants in a wide range of application domains has shown that each performs best in some, but not all, domains. This phenomenon is known as the selective superiority problem, which means, in our case, that no induction algorithm can be the best in all possible domains. The reason is that each algorithm contains an explicit or implicit bias that leads it to prefer certain generalizations over others, and it will be successful only as long as this bias matches the characteristics of the application domain. Results have demonstrated the existence and correctness of this “no free lunch theorem”. If one inducer is better than another in some domains, then there are necessarily other domains in which this relationship is reversed. This implies in KDD that for a given problem a certain approach can yield more knowledge from the same data than other approaches.

In many application domains, the generalization error (on the overall domain, not just the one spanned in the given data set) of even the best methods is far above the training set, and the question of whether it can be improved, and if so how, is an open and important one. Part of the answer to this question is to determine the minimum error achievable by any classifier in the application domain (known as the optimal Bayes error). If existing classifiers do not reach this level, new approaches are needed. Although this problem has received considerable attention, no generally reliable method has so far been demonstrated. This is one of the challenges of the DM research – not only to solve it, but even to quantify and understand it better. Heuristic methods can then be compared absolutely and not just against each other. A subset of this generalized study is the question of which inducer to use for a given problem. To be even more specific, the performance measure needs to be defined appropriately for each problem. Though there are some commonly accepted measures it is not enough. For example, if the analyst is looking for accuracy only, one solution is to try each one in turn, and by estimating the generalization error, to choose the one that appears to perform best. Another approach, known as multi-strategy learning, attempts to combine two or more different paradigms in a single algorithm [7]. The dilemma of what method to choose becomes even greater if other factors such as comprehensibility are taken into consideration. For instance, for a specific domain, neural networks may outperform decision trees in accuracy. However, from the comprehensibility aspect, decision trees are considered superior. In other words, in this case even if the researcher knows that neural network is more accurate, the dilemma of what methods to use still exists (or maybe to combine methods for their separate strength).

Induction is one of the central problems in many disciplines such as machine learning, pattern recognition, and statistics. However, the feature that distinguishes Data Mining from traditional methods is its scalability to very large sets of varied types of input data. Scalability means working in an environment of high number of records, high dimensionality, and a high number of classes or heterogeneousness. Nevertheless, trying to discover knowledge in real life and large databases introduces time and memory problems. As large databases have become the norm in many fields (including astronomy, molecular biology, finance, marketing, health care, and many others), the use of Data Mining to discover patterns in them has become potentially for the enterprise. Many companies are staking a large part of their future on these “Data Mining” applications, and turn to the research community for solutions to the fundamental problems they encounter.

While a very large amount of available data used to be the dream of any data analyst, nowadays the synonym for “very large” has become “terabyte” or “pentabyte”, a barely imaginable volume of information. Information-intensive organizations (like telecom companies and financial institutions) are expected to accumulate several terabytes of raw data every one to two years.

High dimensionality of the input (that is, the number of attributes) increases the size of the search space in an exponential manner (known as the “Curse of Dimensionality”), and thus increases the chance

that the inducer will find spurious classifiers that in general are not valid. There are several approaches for dealing with a high number of records including: sampling methods, aggregation, massively parallel processing, and efficient storage methods.

5. KDD & DM Trends

This handbook covers the current state-of-the-art status of Data Mining. The field is still in its early stages in the sense that further basic methods are being developed. The art expands but so does the understanding and the automation of the nine steps and their interrelation. For this to happen we need of the KDD problem spectrum and definition.

The terms KDD and DM are not well-defined in terms of what methods they contain, what types of problem are best solved by these methods, and what results to expect. How are KDD/DM compared to statistics, machine learning, operations research, etc.? If subset or superset of the above fields? Or an extension/adaptation of them? Or a separate field by itself? In addition to the methods – which are the most promising fields of application and what is the vision KDD/DM brings to these fields? Certainly, we already see the great results and achievements of KDD/DM, but we cannot estimate their results with respect to the potential of this field. All these basic analysis have to be studied and we see several trends for future research and implementation, including [8]:

- Active DM – closing the loop, as in control theory, where changes to the system are made according to the KDD results and the full cycle starts again. Stability and controllability which will be significantly different in these type of systems, need to be well-defined.
- Full taxonomy – for all the nine steps of the KDD process. We have shown a taxonomy for the DM methods, but a taxonomy is needed for each of the nine steps. Such a taxonomy will contain methods appropriate for each step (even the first one), and for the whole process as well.
- Meta-algorithms – algorithms that examine the characteristics of the data in order to determine the best methods, and parameters (including decompositions).
- Benefit analysis – to understand the effect of the potential KDD/DM results on the enterprise.
- Problem characteristics – analysis of the problem itself for its suitability to the KDD process.
- Expanding the database for Data Mining inference to include also data from pictures, voice, video, audio, etc. This will require adapting and developing new methods (for example, for comparing pictures using clustering and compression analysis).
- Distributed Data Mining – The ability to seamlessly and effectively employ Data Mining methods on databases that are located in various sites.
- This problem is especially challenging when the data structures are heterogeneous rather than homogeneous.
- Expanding the knowledge base for the KDD process, including not only data but also extraction from known facts to principles (for example, extracting from a machine its principle, and thus being able to apply it in other situations).
- Expanding Data Mining reasoning to include creative solutions, not just the ones that appears in the data, but being able to combine solutions and generate another approach.

The last two are beyond the scope of KDD/DM definition here, and this is the last point, to define KDD/DM for the next phase of this science.

6. The Organization of the Handbook

This handbook is organized in eight parts. Starting with the KDD process, through to part six, the book presents a comprehensive but concise description of different methods used throughout the KDD process. Each part describes the classic methods as well as the extensions and novel methods developed recently. Along with the algorithmic description of each method, the reader is provided with an explanation of the circumstances in which this method is applicable and the consequences and the trade-offs of using the method including references for further readings. Part seven presents real-world case studies and how they can be solved. The last part surveys some software and tools available today. The first part is about preprocessing methods, starting with data cleansing, followed by the handling of missing attributes. Following issues in feature extraction, selection and dimensional reductions are discussed. These chapters are followed by discretization methods and outlier detection. This covers the preprocessing methods (Steps 3, 4 of the KDD process).

The Data Mining methods start in the second part with the introduction and the very often-used decision tree method, followed by other classical methods, such as Bayesian networks, regression (in the Data Mining framework), support vector machines and rule induction.

The third part of the handbook considers the unsupervised methods, starting with visualization (suited for high dimensional data bases). Then the important methods of clustering, association rules and frequent set mining are treated. Finally in this part two more topics are presented for constraint-based Data Mining and link analysis.

The fourth part is about methods termed soft computing, which include fuzzy logic, evolutionary algorithms, reinforcement learning, neural networks and ending with granular computing and rough sets.

Having established the foundation, we now proceed with supporting methods needed for Data Mining in the fifth part, starting with statistical methods for Data Mining followed with logic, wavelets and fractals.

Having covered the basics, we proceed with advanced methods in the sixth part, which covers topics like meta-learning in, bias vs. variance and rare cases. Additional topics include mining high dimensional data, text mining and information extraction, spatial methods, imbalanced data sets, relational Data Mining, web mining, causality, ensemble and decomposition methods, information fusion, parallel and grid-based, collaborative and organizational Data Mining.

With all the methods described so far, the next section, the seventh, is concerned with applications for medicine, biology, manufacturing, design, telecommunication and finance. The next topic is about intrusion detection with Data Mining methods, followed by software testing, CRM application and target marketing.

The last and final part of this handbook deals with software tools. This part is not a complete survey of the software available, but rather a selected representative from different types of software packages that exist in today's market. This section begins by public domain open source research-type software, Weka, followed by two integrated tools (Data Mining tools integrated with database, data warehouse and the entire support software environment) represented by Oracle and Microsoft. These software systems employ various Data Mining methods discussed in detail previously in the book.

7. Summary

Knowledge Discovery in Databases is answering a need to make use of the mountains of data that is accumulating daily. KDD enlists the power of computers to assist in the recognizing patterns in data, a task that exceeds human ability as the size of data warehouses increase. New methods of analysis

and pattern extraction are being developed and adapted to KDD. Which method is used depends on the domain and results expected. The accuracy of the recorded data must not be overlooked during the KDD process. Domain specific knowledge assists with the subjective analysis of KDD results. Much attention has been given to the data mining phase of KDD but earlier steps, such as data cleaning, play a significant role in the validity of the results.

The potential benefits of discovery driven data mining techniques in extracting valuable information from large complex databases are unlimited. Successful applications are surfacing in industries and areas where data retrieval is outpacing man's ability to effectively analyze its content. Users must be aware of the potential moral conflicts to using sensitive information.

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DIGITISATION OF THE CLASSROOM IN THE MACEDONIAN EDUCATIONAL INSTITUTIONS

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Abstract:

Implementation of the Information Communication Technology (ICT) into the teaching and learning process at the Macedonian educational institutions is a prospective area to explore since the research on this topic has shown that professors take a moderate use of technology into the classroom. Therefore, a structured research shall give important insides on how to implement ICT including the benefits, the influence and the consequences that the access of technology and the internet in the classroom have on students and professors. However, it is essential to analyse the teaching methods and approaches and then propose the most appropriate and effective teaching methods for teaching English using ICT. Thus, the current teaching methods used and the use of ICT in the teaching process at the Macedonian educational institutions shall be analysed including the benefits and the disadvantages for the students and the professors. In the middle of the debate on how the new technologies are affecting our everyday lives and the risks and the opportunities of the evermore adoption of technology in every single part of our lives, we need to discuss, research and implement a responsible use of technology by promoting but also creating benefits and achievements by using ICT in the classroom.

Key words: *E-learning, ICT, digital classroom, blended English teaching, teaching apps*

Introduction

Technology has become an essential and inevitable part of our lives. The debate about the use of technology, its benefits and disadvantages, has been going on for a while now but that has not stopped the raising evolution of technology in the everyday functioning of the modern world. However, it is also debatable how much each one of us can control the use and the influence of technology in the day-to-day activities. Therefore, as digital societies, not only we need to work on implementation and digitalisation on our societies but also we need to focus on responsible use of technology as well. We need to manage the use of technology so we can bring the benefits into the classroom, maximize the advantages and minimize the weaknesses. It is interesting to analyse Japan since it is one of the most technologically advanced country. After several reports conducted in the country regarding the use of ICT in improving education goals, in 2006 the Japanese government has introduced “IT New Reform Strategy” in order to encourage the higher educational institutions to implement ICT in their classrooms by 2010. More than 73 per cent of the higher educational institutions in Japan have implemented ICT by 2008, the research conducted in 2008 by the Japanese National Institute of Multimedia Education has shown and concluded that the adoption of ICT in the teaching process has greatly increased students’ achievements. Even though the Macedonian government in 2006 promoted the project “Computer for every child” and tried to show the government’s determination to start introducing ICT in education, the project had numerous obstacles not only in installing the hardware and the software, but also keeping the systems working and its maintenance. Additionally, the teaching staff was not properly trained to use the ICT installed nor were the students prepared for the implementation. That is why we first need to discuss, explain and understand the meaning of digitisation of the classroom in this paper. We consider a digital classroom the one that is not only equipped with appropriate ICT, but one that creates an e-learning environment where different appropriate software, apps and other digital and internet materials are used. If we discuss digital classroom then we also need “digital” educators, those prepared to use the ICT and blend it into the teaching and learning process and of course students that are well prepared to take the most benefits of such digitalised learning process. In other words, the implementation of ICT into the teaching process requires new pedagogy, new teaching methods, development of different syllabi and learning materials where the role and the training of the teacher and the students is changed and has to be adapted in order to have successful digitisation of the classroom. Therefore, in this paper, I shall focus on the methods practiced in teaching English in the country as well as the current implementation and use of the ICT in the Macedonian educational institutions. In addition, I shall focus on the benefits of the blended English learning in the country and the challenges that Macedonian educational institutions face in implementing ICT in the classroom and in digitalising the teaching and learning process in the country.

Teaching Methods

For this research it is essential to analyse the teaching methods and approaches for teaching English and then propose the most appropriate and effective teaching methods for implementing ICT in the classroom so that Macedonian students can benefit the digital development in learning.

Teaching methods are required to enable educators to facilitate their instructional materials and strategies for the benefit of the students. These methods were created and developed according to the different processes that educational systems undergo, thus honing it to achieve the best kind of instruction towards the students. Progressive educational institutions provide a variety of seminar and

training to its teaching staff in order to achieve an optimum kind of method that will exhibit not only the educators' skills and competence in teaching but also provide students with the best and most accomplished kind of learning development while studying.

The development of teaching methods enables an educator to use the most extensive and most progressive strategies that augment his/her capacity to teach, as well as use instructional materials that can augment the students' learning experience. This, thus, extends not just the educational institution's ability to provide better learning for students but also a progressive career for the educators. The varying strategies also enable new forms of teaching to be categorized according to how it affects educator, students, and instructional materials in the event of teaching. From this perspective, it can be assessed that teaching methods are very significant elements in the educational system, as well as in designing curriculum for the implementation of a better and more progressive teaching and learning process at the educational institutions.

There are many teaching strategies developed throughout the years but these are categorized into four major methods. These methods are the following: instructor/teacher centered, learner-centered, interactive/participative methods, and content-focused.

Current Teaching Methods Practiced in the Macedonian Educational Institutions

In the Macedonian educational institutions, the three teaching methods categorized are still used but some specific approaches are used more frequently than the others. With the advantage of technology, teachers and their respective curriculum have come up with wider and more effective methods in teaching students, especially in language studies. Language acquisition now includes not only instructional materials such as textbooks, practice books and vocabulary drills but also added computer software and application programs to further augment the learning of English.

Educational-crucial elements are now used in order to optimize the way students learn and maintain learning in educational institutions. Teachers have applied the teaching methods with technology and still use traditional materials, to provide the most extensive way of learning English. However, three teaching methods are expansively used in the Macedonian educational institutions and in language studies, thus exhibiting its vital role in teaching.

Learner-Centered Method – the Discussion Approach

The discussion approach falls under the category of learner-centered method. This is used in the country in the context of self-instruction, in computer aided instruction as well as in traditional classroom settings. Laura Hosman and Maja Cvetanoska (2013) discuss the importance of discussion in computer aided instruction and learning because it is a prevalent teaching method by the Macedonian teachers. Moreover, having a learner-centered method enables the teachers to provide more guidelines and practices which the students can use in order to learn the basic elements of the English language.

One category is the ESP learners. They are adult students and have had General English studies in their primary and secondary education thus making it easier for them to have discussions during their classroom lessons. Business English teachers, for instance, use discussion approaches when it comes to identifying whether a student is competent enough to pass the course. Moreover, the discussion

enables the students to become more acquainted in using the language inside the academy and outside in their communities.

Content-Based Method

Content-based method in teaching is pursued by the Macedonian educators as it uses various instructional materials that emphasize the technical aspects of learning. Basically, students are learning the language through a topic, by the content and the technical terms regarding the particular topic. Therefore, its practice books and textbooks are full of study readings that are technical in content. Even computer aided instruction is full of technical content that aims to teach students the variables that are important in understanding and learning their lessons properly.

Interactive/Participative Teaching Method

Brainstorming and role-play are two of the most used and highly integrated forms of teaching approaches that Macedonian educational institutions currently use. In the event of English language studies, role-play is more integrated by giving situational cases for the students to study. In the case of ESP, case studies are given in order to make the students apply the theories and models as well as the terms they have learned while studying ESP. This acts as a way to encourage students to extend their studies, as well as properly apply the specializations they have learned in their ESP course. Brainstorming is also included in the advent of doing assignments.

These three methods are used to fully enable students to become competent English speakers and writers, thus extending their higher education into its practical use. The teachers, on the other hand, also extend their teaching strategies by using these methods and provide evidence that these methods, when used with advancing technology, can contribute to the welfare and future of the students.

Blended English Instruction

Blended English teaching method, according to Bonk and Graham (2005), provides flexibility for teaching approaches and learning. However, the authors likewise stated that the opportunities for learning will always be present and the same even when the approach is through a different teaching model. Additionally, Bonk and Graham (2005) also stated that the blended approach to teaching gives educators the prospects to use various resources and supplementary materials that can contribute to a more effective and efficient approach to teaching Business English and learning of the language other than the traditional face-to-face teaching method.

MacDonald (2006) identified three significant conceptualizations of blended teaching methods. First conceptualization refers to the participation of students in asynchronous activities that are being held through the internet and on-campus meet-ups. The second conceptualization pertains to the blending of asynchronous activities with meetings that are synchronous in nature. It also refers to the utilization of technologies partnered with the traditional face-to-face meetings as well that make up the course structure. The third and final conceptualization entails the amalgamation of both online and campus students interaction while learning.

With this, it is apparent that with the blended approach to teaching English as Second or Foreign language, the classroom will move away from the established notion of students as receivers of information and towards a more dynamic and interactive learning environment. This model will give students the chance to construct their own paradigm of knowledge founded on interactions and other intellectually motivated activities.

In the study conducted by Zlatkovska (2010), the author stated that the Macedonian education and the methods of teaching have shifted to a paradigm that is primarily student-centred. While this may be the case, Zlatkovska (2010) acknowledged the fact that the country is struggling in the implementation of a student-centred approach of teaching. One of the challenges that are being faced by the Macedonian educational system is the lack of the integration between teaching the English language and the utilization of technology. In the study conducted by Zlatkovska (2010), the author focused on the utilization of WebQuest and training the EFL teachers on how to use the technology to amalgam the methods of teaching English as Foreign Language and technology to achieve success.

WebQuest, according to Hubbard and Levy (2006) is “an inquiry-oriented activity in which most or all of the information used by learners is drawn from the web. It is designed to use learners’ time well, to focus on using information rather than looking for it, and to support learners’ thinking at the levels of analysis, synthesis, and evaluation.”

Through observation, interviews, meetings, and training sessions over a period of time, Zlatkovska (2010) concluded that the utilization of technology to enact an interactive learning environment must be promoted in the Macedonian universities. Such study is founded on the research conducted by Prapinwong (2008) on the subject of learning English as Foreign Language using the WebQuests.

Prapinwong (2008) made an observation on the experiences that the English teachers acquired during the incorporation of WebQuests in their teaching methods at a college level. To measure the success, or the lack thereof, of blending teaching instructions and technology in the context of English as a Foreign Language, Prapinwong (2008) compared the vocabulary test results of the students, pre-test and post-test. The oral proficiency of the students was likewise measured. After all the data was gathered, analysed, and statistically treated, the author reported a positive outcome. The test results showed that the students exhibited a significant improvement in their vocabulary. With this, the adoption of WebQuest was recommended by both students and teachers.

In another study conducted by Veselinovska and Kirova (2013), the authors explored the manner of blending the teaching of environmental matters and English as a second or foreign language in the Macedonian educational institutions. According to them, blended teaching enhances the learning process involved in English as Second or Foreign Language education by enhancing vocabulary and knowledge of the meaning of the words. It can be adduced that such claim by Veselinovska and Kirova (2013) is valid due to the fact that environmental terminologies, words, and definitions are being introduced to the students. As a result of which, students are learning technical terms and concepts that pertain to the environment. Students can apply these words and their knowledge of the issue once they graduate from university, for instance, and explore the world of their professions.

Moreover, Veselinovska and Kirova (2013) reported that blended teaching also helps students to concentrate better during class. This is because of the fact that teaching English and environmental education at the same time provides a re-processing of content. As a result of which, the duration of the concentration of the students are being prolonged as well (Veselinovska & Kirova, 2013). Furthermore, it is reported by Veselinovska and Kirova (2013) that exposure to other education taught

simultaneously with English as Second or Foreign language eradicate the fear of foreign languages. It cannot be denied that as students get exposure to technical terms and successfully learned the language, the limitations, fears, and tensions are reduced as well.

But then again, it can be said that one of the disadvantages of this teaching method is the fact that not all educational institutions are equipped with the required technology to implement the ICT in the teaching and learning process. The studies performed at the Macedonian educational institutions have also shown that even those that are equipped are not always functioning and teachers are not able to realize their classes using ICT. Thus, the research conducted by Sonja Petrovska, Despina Sivevska, et al. (2015) regarding the application of ICT in teaching in the Macedonian secondary schools has shown that the most common problems for teachers when implementing ICT in teaching are - malfunction of technical equipment and inadequacy of software that interferes with the realization of their objectives of the subject.

In addition, not all students and teachers have an advanced or appropriate knowledge of technology. Hence, it can pose a problem when it comes to teaching and learning. Before the blended teaching method can be adapted and implemented successfully, the professors and the students must be given proper training of the technological aspect of the curriculum. The absence of which, will prove futile to the goal of teaching English effectively and efficiently. It can also affect in a negative manner the outcomes of learning. This is another issue Macedonian professors face. They are not well trained to use technology in the classroom. Thus, 41 per cent of the teachers rated their computer skills as elementary, even though large percentages (99%) of the teachers agree on the fact that the application of ICT in teaching can increase the creativity among students (Sonja Petrovska, Despina Sivevska, et al. 2015). Therefore, according to the research, almost half of the teachers require additional training on how ICT tools can be used in the promotion of creative learning and innovative teaching. The complexities of technology can also discourage the students to learn and they might lose the motivation. This is particularly true in the sense that some students might think that learning a second language is already a complicated lesson and to combine it with a complicated technology can make it too much to handle for the students not only for the professors.

Another issue in implementing and promoting ICT into the classroom is the knowledge of English as a requirement for the professors to be able to use the ICT tools. In our research this is not an issue since we only research the teaching of English, however, in order for the students to fully benefit from using the technology as an educational tool, ICT needs to be adopted for all courses and all teachers are supposed to be able to implement it. The research conducted by Sonja Petrovska, Despina Sivevska, et al. (2015) regarding the application of ICT in teaching in the Macedonian secondary schools has shown that almost 50 per cent of the teachers, who were part of their study, had poor or average level of English and most of them always needed help in using ICT.

Finally, we also need to pay attention to what is called responsible use of technology. The technology era is something we need to accept and cannot change. Many studies concern the negative influence of technology in the everyday life of people. We, as educators, must find a way to implement, introduce and use ICT for its advantages but also be responsible towards technology, not only in the classroom but also outside the classroom. The equipment must be properly used and protected by both the teachers and the students. In addition, students must be properly educated for the different malware and other malicious software that can harm the devices they use and how to prevail such issue. Teachers and parents as well need to educate students on using only trusted digital content on the internet but also content that is appropriate for their age. The school can prevent certain type of information to be available on the schools' network. In addition to that, teachers can provide students

approved web resources they can use in school but also outside when preparing their homework or other school activities. There are also intellectual property and copyright concerns that teachers should explain to students. On the whole, teachers should promote responsible use of technology themselves and always justify the use of technology in class so the students understand the purpose and the benefit of using it and thus encourage students to be more creative, use the possibilities the internet and the technology offer but do so purposefully.

Apps for Digitising the Classroom

It is crucial to also discuss the educational tools available for the teachers and how much are Macedonian educators familiar and trained to use the available technology to enhance the teaching process in the country. In the second part of their research, Sonja Petrovska, Despina Sivevska, et al. (2015), tried to determine what type of technology teachers use in the classroom. The research has shown that technology is used occasionally and most used hardware is projectors, computers, DVD, Video and TV. Unfortunately, more than 60 per cent of the teachers have not used mobile devices such as smart phones or tablet computers (61,5%), neither do they use interactive (electronic) boards or virtual learning environment (66,1%), the research showed. However, the hardware is only one part of the implementation of ICT in the classroom, we need the right software to fully integrate technology into the teaching process in the Macedonian educational institutions. In terms of using teaching software by the Macedonian teachers, the results are not satisfactory again. Office applications, such as word processing and spreadsheets (47,7%) and digital learning games (49,5%) are only used occasionally by almost 50 per cent of the teachers (Sonja Petrovska, Despina Sivevska, et al. 2015).

The results of the studies show that the Macedonian educational institutions are far from digitising the classroom, especially in using the new and enhanced tools available for the educators. As mentioned earlier, in terms of technology the Macedonian educators only occasionally use technology and mostly use Power Point Presentations, Word, Youtube and rarely any special software or platforms developed for e-learning. For instance, there are number of applications that can be used that truly transform the traditional classroom into a digital classroom and in combination with the right teaching methods it is a great opportunity for both the teacher and the student. The number of applications is continuously rising and improving, we will only mention few that we have used in our teaching and that can really help teachers in motivating, inspiring and fully engaging their students.

Plickers – a great application for preparing quiz and multiple-choice questions and for formative assessment, to prepare the class for the new theme, to debate the answers or to just review their knowledge. Students give their input with the Plickers' cards anonymously and there is no need for them to have internet access or any electronic device. With the combination of the interactive board or projector students get the results instantly.

Kahoot – is another application that can be used for making the class more interesting by using games during your teaching. You use Kahoot's website to prepare your questions and answers into a playable game. For this app, students need internet access and computers to download the app as well and then join in the game.

Google Classroom – this application goes beyond the classroom and connects you to the students outside the classroom as well. It can be used to distribute and then grade different assignments for the

students, organise your teaching materials but also send announcements to students and open discussions and debates.

Conclusion

Despite the fact that Macedonian institutions vow for reforms, changes and advancements, very little has been made in the past in order to improve the educational system in the country. E-learning and the implementation of the various ICT tools available have proven that they can change teaching and create more skillful and future-prove students and this transformation shall greatly improve the teaching process in the country. Unfortunately, different studies in the country has shown that not much has been changed and achieved in the past decade in terms of digitisation of the classrooms in the Macedonian educational institutions. Digital classroom, as explained in the introduction, is much more than putting a projector or an interactive whiteboard in the classroom. Digitisation of the classroom and digitalisation of the teaching and learning process in the country can only be achieved if everything in the process is well thought out and prepared for such process. There are number of steps that are required in order to implement ICT in the Macedonian classrooms and they are all important and dependent on each other. Not only is important to acquire and install the hardware educational tools in the educational institutions, installing the appropriate available software applications to assist educators in enhancing the teaching process is also a key to a successful implementation of ICT into the classroom. Finally, prepare and train the teaching staff but also the students, as core in the teaching and learning activities, is inevitable if we wish to properly utilize technology for improving the education in the country but also educate a responsible use of technology. Finally, we recommend implementing ICT in the teaching and learning process in the Macedonian educational institutions to become a key reform in the Macedonian educational system which is fundamental for the economic development of the country by developing competent, knowledgeable and skilful workforce.

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DIGITALIZATION IN SPORTS MEDIA

Kiril Borisov¹

Abstract:

Sports media are part of the media entertainment industry, which has established itself as a separate business in which investments are increasing. Some of the most successful and lucrative practices in the sports industry are oriented toward and include: sports clubs and organizations, events, competitors, broadcast rights, and related sports media reflect these successes: television, programs, websites, the press, and channels. In addition to being a money machine, these sports media also manage to reach the minds of numerous fans, followers and consumers. There is a dynamic development in the sports industry.

Transformations are underway, such as: the discovery of innovative approaches and products, through which the aforementioned parties involved - clubs, competitors, sports organizations, their followers and the media that reflect them - create new communication platforms through which opportunities for profitable business models are opened. The topic is extremely relevant as globally, the advent of technological innovation and increasing internet addiction has led many traditional media businesses to rethink classic TV and news strategies in their coverage of sports content.

The purpose of the publication is to identify the state and trends in the field of sports media in which digitalization is entering and posing new problems to solve.

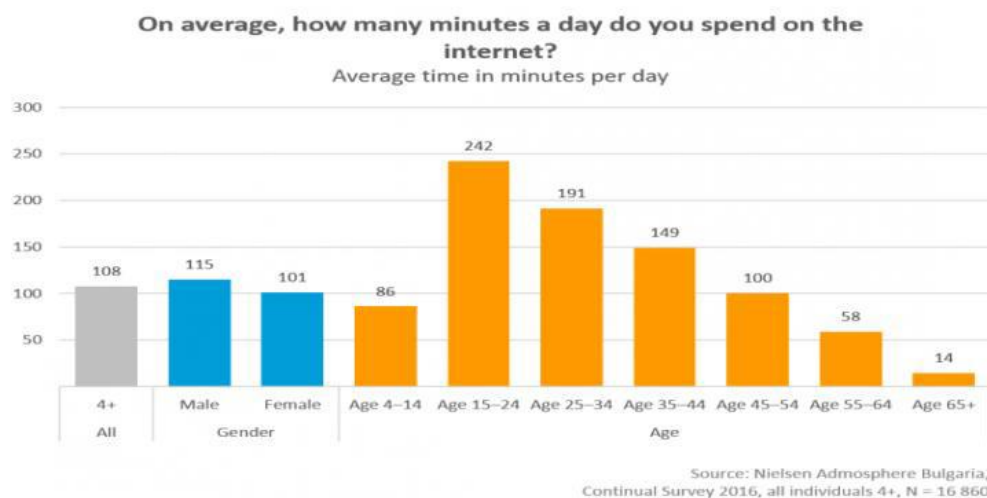
Key words: *media sports industry, digital platforms OTT and VOD, media market,*

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1. The media sports industry in Bulgaria

In Bulgaria, the media entertainment industry does not deviate significantly from global trends, but changes and innovations take longer to gain mass character. The classic TV viewership surveys in recent years have also seen interesting trends in terms of rising internet consumption. According to a Nielsen Admosphere survey² covering 2016 and published in 2017 in Bulgaria, men and women spend a short period of time on the Internet (men with 14 minutes more per day), but there are relatively large differences across age groups. Most people spend 15-24 years on the Internet (242 minutes a day). With increasing age, the length of time spent on the Internet decreases: representatives of the 25-32 age group spend 191 minutes a day online, the 35-44 age group 149 minutes, and lastly, with the least time in the internet is ranked by people over 65. The time that Bulgarians spend on the Internet is increasingly noticeable than the time spent watching television. However, in Bulgaria people continue to watch a lot of television. In 2018, Bulgarians between the ages of 18-49 continue to watch on average about 2 hours and 53 minutes (173 minutes) of television per day³. Three years earlier, in 2015, the time spent watching television was 4am. and 13 minutes (253 minutes) per day⁴. Sport and the media business are an integral part of the media entertainment industry. According to KPMG, sports worldwide account for about 1% of the global industry and equate to between \$ 600 billion and \$ 700 billion annually⁵.

Table 1. The time spent on the Internet of the Bulgarian users by age and gender, 2016⁶



²NielsenAdmosphereBulgariaNewsletter – юни 2017 <http://www.nielsen-admosphere.bg/news/nielsen-admosphere-bulgaria-newsletter-62017>

³NielsenAdmosphereBulgaria- *месец Април 2018* <http://www.nielsen-admosphere.bg/files/2018/05/Nielsen-Admosphere- Bulletin-April-2018.pdf>

⁴NielsenAdmosphereBulgaria- *месец Април 2015* http://www.nielsen-admosphere.bg/files/2015/05/Nielsen-Admosphere_BULETIN_April-2015.pdf

⁵Thebusinessof Sports – KPMG – October 2016, KPMG India, Partof KPMG International

⁶NielsenAdmosphereBulgariaNewsletter – юни 2017 <http://www.nielsen-admosphere.bg/news/nielsen-admosphere-bulgaria-newsletter-62017/>

This includes sports infrastructure, sporting events, accommodations, training processes, production and sale of sporting articles, and more. According to the report, the main indicators for the success of the sports industry are sports and technical results, viewership, sponsorships and broadcasts, and the impact and importance of broadcasting, sponsorships and broadcasting rights on the size and growth of the market is increasing. Back in 2011, AT Kerney published a report⁷ saying that the global sports business is an industry worth between \$ 480 billion and \$ 600 billion, which compared to the 2016 KPMG report. - shows at what rate of growth the market is moving. The business structure accompanying the sports industry is quite complex and involves a variety of parties involved, from rightsholders (clubs, leagues, federations, athletes) through sports agencies, sponsors and advertisers, to media partners and broadcasters.

According to the famous consulting company Deloitte, the revenues of the most famous European football clubs during the season - 2017/18. are shown in millions of euros. There are mainly three indicators: matchday; commercial income (sponsors, merchandising, etc.) and broadcast income. The clubs in the top twenty places for the 2017/2018 season have totaled over 8 billion euros. The major part came from the sale of broadcasting rights - 43%, which is due to SKY's contracts with the English Premier League.

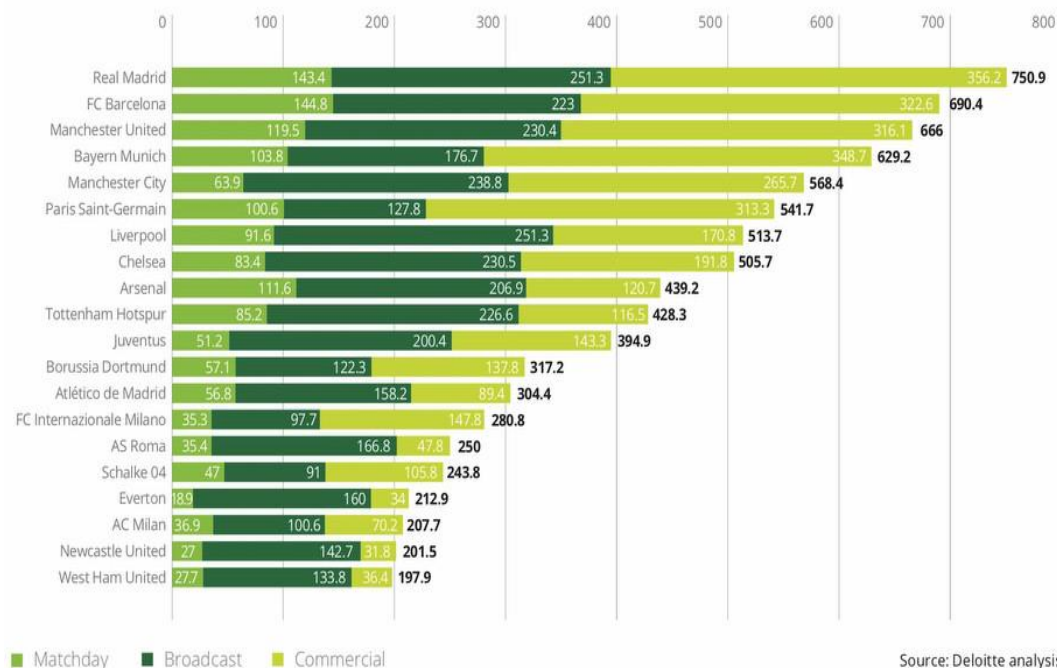


Figure 1. The income of the most famous European football clubs during the season - 2017/18

Live sports events have been proven to be of the utmost importance to the industry. During live events, different countries may interfere with different interests - on the one hand, they may be public and free to watch broadcasters, such as traditional national TVs, which seek as much viewers and advertiser revenue as well as paid TV services that aim to build a loyal customer base. There are serious prerequisites for growth in the sports business in every respect - size, structure, revenue and parties involved.

The March 2017 Nielsen Report outlines the most important trends in the global sports industry. This is a growth of the technological innovation market in the general media entertainment industry,

⁷The Sports Market IndustryReport- AT Kerney 2011, HervéCollignon, NicolasSultan, ClémentSantander

including in the sports media⁸. Politically, socially and technologically, the world is in the process of active innovative processes and this is affecting investment in sport, especially in terms of how sports content is created and disseminated. The relationship between rights holders, sponsors and fans is changing.

The rapid period of change in sports business models is influenced by the changing moods and attitudes of consumers and viewers about the way content is consumed, causing a boom in direct sports content suggestions to these end users (OTT for Sport). Key to the development of the media entertainment industry are: augmented and virtual reality - AR VR; e-sports - eSports; streaming and video: OTT/VOD and multichannel networks. The term OTT is used to categorize new digital media platforms, including sports. OTT (Over The Top) - means the provision of content to the user directly from the source of the rights and / or content creator. The technology behind the OTT model is exactly what is expected to compete with the classic cable / TV media and content carriers. "Video On Demand" VOD means watching content on demand by the user - without the need for software restrictions; a consumer need that is very comfortable with OTT technologies and platforms due to their digital nature

OTT technology and the direct provision of content to consumers and the sport in the form of digital platforms and other traditional TV services is a significant trend in this as well as in other reports. Before considering and analyzing other important trends in the sports business in other reports, the key summaries that Nielsen provides must be noted. One is related to the findings and other reports on general trends in the media entertainment industry, related to the ability of ordinary users to generate content and the growing power of video content. From Presidents to Street People: This is an era where everyone has the ability to be a television broadcaster. And content has never been more valuable. Two major acquisitions of sports content in 2016 reinforce the view: the acquisition of the Ultimate Fight Club by WME-IMG (UFC) and the acquisition of Formula One's Liberty Media, which ultimately are content investments and intellectual rights in sport. At the same time, rights holders around the world are trying to add value by developing their own content, often in partnership with brands or distributors, or on their own. Not too many competitors are also becoming media owners in a variety of ways, from special apps and YouTube channels to bigger investments in digital distribution such as basketball player LeBron James with "Uninterrupted" and baseball player Derek Jitter with "The Player's Tribute." Both applications allow athletes to communicate with fans directly, authentically and on their own terms.

On the other hand, sports rights holders are considering ways to repackage, reorganize and move sports events to better respond to the changing structure and behavior of fans and consumers. Against the backdrop of intense competition for attention, the impact on rightsholders is significant and has led to a great deal of research and analysis, which in turn has led to shifts in schedules and revisions to established sports and technical formats. For example, from the American Football League, the NFL introduced football on Thursday night, and the English Premier League football developed a package of live games on Friday night. New cricket format, on the other hand - Twenty20 cricket, is an example of changes in the rules of the sport, aiming at shorter and more interesting formats due to changing spectators' attitudes. Sports such as tennis, golf and basketball are developing and commercializing abbreviated versions of games. Fans' interest in brand new sports, such as drones and e-sports, eSports, has increased.

Overall, it seems that sports are becoming more involved and closer to show entertainment formats. Rights and sports infrastructure holders are looking to improve viewers' experiences - on-site, during events and for those watching from a distance - by adding entertainment items such as concerts, specialty service and catering areas, as well as greater access to star athletes. The NFL's Super Bowl is

⁸NielsenCommercialTrends in Sports, March 2017

an example in this respect, and many other concerts and events accompanying major sports forums add to the feeling that sports are a show that should be guaranteed to the viewer. There are also many examples of new entertainment and events built around the sports element, including Andy Murray Live, the US Gymnastics Tour of 36 cities in the country, joint NFL and Cirque du Soleil projects Times Square in New York, and others.

On the other hand, thanks to technology, fans are increasingly expecting live content - streaming, video and interview distribution, on-demand content, embedded and embedded data and statistics, and analytics. For the real fan and user, these services should be available to them whenever and wherever they are. OTT content is beginning to take hold in the sport, such as established broadcasters, newer digital broadcasters, rightsholders, telecommunications companies, social media platforms and tech giants - they are all in the game in one form or another. Amazon, Google and Apple are all active in content creation and distribution, while rightsholders are actively developing and experimenting with their own digital media platforms - the PGA Tour Live, the Olympic Channel, Dugout and many more examples. Those rights holders who own their own channels can also generate data that gives a richer, deeper picture and audience experience, and opens up new potential revenue streams around goods, tickets and content.

In terms of advertisers and sponsorships, which largely drive the majority of the sports media market, Nielsen argues that there is a growing desire to have accountability and adequate investment reporting. From this point of view, digital technologies and information technologies imply more tangible development of reports and decision-making based on data and statistics, as long as sports media have such digital information measurement tools in place. They certainly have a better chance of justifying sponsorships when using digital media platforms than they do with traditional TV services and audience measurement and viewing models. Quantitative tracking is mandatory for brands and more specific analytical frameworks are in place to evaluate the relative effectiveness of sports assets. Increasingly, opportunities are sought for rightsholders to begin to predict the return on brand / sponsor investment that can be expected during the process of investing in sports events and content.

The numerous innovations and dynamic changes observed in the media entertainment and sports media business are very well summarized in a report by PwC which mentions that for 2017 sport is the most transformative of all industries worldwide⁹. OTT models and digital platforms for sports content are entering the sports business world more and more, changing the way sports content is consumed. PWC even points to new digital content platforms as the most distinctive factor that will transform the sports media business. Combined with changing consumer habits in terms of sports content, ever-increasing levels of internet usage and industry fragmentation across companies and corporations, sports content distribution strategies and relationships across all parties involved will a key place in the strategies of all market players.

In Bulgaria, the sports media and the sports business market are closely linked to the attitudes and prerequisites of the population to engage in sports and leisure. The differences between the athletic technical level of athletes and the high athletic performance observed in the last two decades and what has been achieved by previous sports generations are noticeable. Sports infrastructure and mass sporting events are the focus of the Ministry of Youth and Sports. However, it seems that in the last 1-2 years there has been a movement, literally, as well as in the figurative sense, and more and more people are beginning to become interested in activities and sports activities, which naturally attracts the attention of business and market analysts. According to a Gallup poll in 2015, sports as an interest and a hobby remains a male territory, with men willing to spend an average of about \$ 14 a month on

⁹PwC Sports Industry Survey 2017, DavidDellea

sports and fitness, with women at \$ 10 a month¹⁰. On the Bulgarian market there is a tendency to use prepaid card services offering access to sports infrastructure, specially adapted for the working and official of private companies. One of the leading companies in this field has managed to reach over 50,000 users in two and a half years to connect with over 600 sports sites. The link between major employers and sports centers is already well-developed, and activities and sports are well-publicized and promoted. There is a huge percentage of non-sporting and inactive young Bulgarians in Bulgaria who can view themselves as an underdeveloped market with potential that not only the countries involved in card access schemes for gyms have an interest in, but also more and more manufacturers and traders of sports goods and equipment, as well as organizers of sporting events, and owners of sports infrastructure. Marathons, tournaments, running, all kinds of sports activities give reason to believe that this segment is moving and has signaled a positive change in the last few years.¹¹

Against the background of the improving or rather slow-moving sports culture in Bulgaria, the situation with the sports media and the sports content market in Bulgaria should be analyzed. There are not many sports media and broadcasters in the Bulgarian media space that rely on a different set of content to reach a relatively equal number of target audiences from interested end users. Most of the sports content that Bulgaria is interested in is mainly owned by foreign sports leagues and organizations, and interest in native sporting events and athletes is extremely small, which increases with the success of international competitions and events. According to a Gallup poll in 2016, 50% of Bulgarians watched the European Football Championship, and they also intended to watch the Rio Olympics¹².

The sports fan in Bulgaria is primarily interested in football, and then his interest is mainly divided into volleyball and tennis. The only Bulgarian sports events in which there is market value and broadcasting rights are the subject of commercial relations are the Bulgarian Football League and the Bulgarian Volleyball League. Both sports events are distributed on a classic TV model in paid channels. The number of sports channels, most often paid (either directly to the respective broadcaster or indirectly through the cable / TV service package) in Bulgaria is not small. In addition to the aforementioned Bulgarian sporting events, giants of international sports content such as the Champions League, various football championships in Europe, basketball championships, motor sports, martial arts, extreme sports, American sports, e-sports and more are found in these paid channels. The mass distribution of this sporting content in Bulgaria is currently based on the traditional prepaid TV / cable model, and it is only in the last year or two that digital projects that are still too small in scale and scale, often complement the viewing experience of a traditional TV model. The rough size of the sports audience in Bulgaria, ready to search, to be interested, and to pay for watching sports content, is nearly 300,000 people. Recent studies on the watchability of individual sporting events under new digital models indicate that around 6,000 people at one time would be prepared to pay a separate and extraordinary amount (outside the prepaid traditional monthly packages) of up to \$ 10 to watch a particular sporting event once per live or on-demand recording, as is the case with KubratPulev's boxing matches.

2. Future development of the media entertainment and sports media industry

From the analysis of the main trends and the current state of the media entertainment business and sports media in particular, it is clear that times of innovation and changing technologies and consumer

¹⁰GallupInternetaionalBulgaria – изследване за „Жената днес“, проведено през 2015<http://www.gallup-international.bg/2015/237-Second-Part-of-the-Special-Survey-for-Zhenata-dnes-Magazine>

¹¹https://www.capital.bg/politika_i_ikonomik/bulgaria/2018/02/16/3130709_pazarnite_muskuli_na_multisport/

¹²Gallup International Bulgaria – темите на лято 2016 – спорт <http://www.gallup-international./2016/296-Summer-Issues-Sports-and-Death>

habits are being observed. Despite the serious possibility of seeing serious surprises due to the nature of the situation, several projections and projections for further development, supported by the opinions of analysts and reports, could be shared in the following lines.

OTT and VOD content digital content platforms will continue to grow not only in the overall agenda of entertainment and events, but also in sports. Although classic TV viewing and the number of cable subscribers will continue to decline, this decline will not be as sharp. There will be more opportunities to supplement the media, multichannel, and share content of one nature (entertainment or sports) through collaborative media (TV plus digital plus online; live plus recording, etc.). Cable trimming will continue to dominate the analysis and trends of classic TV and cable users, but in the field of live sports, it will remain for some time a major and reliable source. However, much of the additional content accompanying sports and entertainment events will begin to diversify and spread across multi-channel models and in new formats, benefiting from the growth in the use of new digital sports media platforms and the ability to watch preferred video content in preferred preferred device / screen moment.

Increasingly, fragmentation and diversification will occur, not only among the major players in content rights but also in sports formats. More and more media and events will begin to draw the attention of fans and consumers through increasingly innovative channels and more and more unconventional formats. Sporting content has traditionally created special emotional connections for fans, consumers, and most advertisers as well as players involved in the media entertainment and sports media business. They will try to retain their audiences and win new ones by earning as much business dividends for their brands. It will provide more and more innovative opportunities for fans to relate and relate to specific events and experiences. This trend will create prerequisites for even newer formats and rules for traditional sports, as well as the increasingly tight filling of unfilled calendar time positions with events / content, even beyond traditional and classic prime time positions and familiar seasonal attitudes.

Events and content related to show programs, entertainment and hobbies will increasingly mix with sporting events. More and more entertainment will be competitive, more and more of the most popular sports will be turned into shows. Whether for sports or entertainment, the locations where the events will take place will become more technological and try to offer complex services to the increasingly demanding ticket buyer. Those who watch the events as on-screen viewers will want more and more broadcast or recording quality, as well as more embedded analytics, statistics, and other information that is available 24/7 with minimal effort. Fans and consumers will want to consume their favorite content as often as possible through personal mobile devices, knowing that their favorite emotions are always with them in their pockets, and realizing the ever-growing ways of paying and shopping - namely via mobile devices.

In a world of more professional formats and claims for the rights and revenue sharing of professional leagues and sports, the next few years are also expected to see more and more attention paid to non-professional sports events and competitors: amateur, student, student and hobby activities and initiatives. In these environments, the main source of content will continue to be the contestants themselves and their family and friendly environments. More and more sponsors, media and analysts will monitor the development of these communities and will await convenient opportunities to benefit from the potential of these micro-organizations, which are not characterized by high market potential but provide access and emotional connectivity for loyal and regular brand users.

Conclusions

Globally, there is a tangible strain on traditional TV and cable models for the distribution of media entertainment content, which includes sports content. A new digital model for the consumption and consumption of media and video content through digital platforms called OTT is coming to the fore,

which is preferred by the viewer as it does not bind it to programming and time constraints in a world where it is increasingly relying on the Internet and its mobile devices to provide the necessary information and content upon request. Consumers and viewers are beginning to shift cable services to internet platforms and digital services that are more technologically advanced and flexible at the expense of TV models. Video formats reign in ways of consuming information, and more and more organizations in the media and sports media are relying on it. Competitions and battles for quality content are stepping up, leading to a rise in the price of content and opportunities to look for alternatives to organizations seeking to deliver quality content, including sports events.

The media market is fragmenting, especially the sports media market as more sponsors, distributors and sports leagues/federations want to become loyal to the emotionally addicted fans who become target consumers as they are willing to pay for it. to have information and content about your favorite sport, which should however be delivered in an increasingly convenient and intriguing way. As much as the dynamics of relationships, on the one hand, change between sports organizations, leagues, federations and athletes who hold the rights to the content they create, on the other hand, the distributors and agencies that buy and market those rights, as well as the media platforms and channels that secondarily reflect and provide access to what is happening around athletes - content is being created that relies increasingly on video web formats. Live events continue to be most adequately consumed by fans on site, but with the right conditions and with guaranteed picture quality and added values to the broadcast.

The user is interested in more and more formats and content, but the battle for his attention is serious and in this battle the technologies that accompany him daily and make the consumption of content more enjoyable and easy play a serious part. In Bulgaria, global trends also apply, although changes are observed at a slower pace. In Bulgaria, there is an increased interest on the part of the media organizations to provide more and more innovative ways of consuming sports content for consumers, who are increasingly beginning to build higher levels of sports culture.

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