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REAL IMPACT OF THE MICROCLIMA CHANGES TO WORKERS WHO CIRCULATE FROM HOT TO COLD CHAMBERS - A PART FROM AN EXTENSIVE RESEARCH INTO INDUSTRIAL ENTITY

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Abstract: The basic aim of the paper is to present a real overview of the work conditions into a real industrial entity with production activities in Republic North Macedonia. The same one has more than 100 employees in 3 locations. The basic challenge of the paper and the innovation in this matter is the created measurement instrument by our side, which was specially made with an sophisticated software in behind which could measure precisely temperature and humidity and could memorize the data every 3 seconds in mini SD card placed into the instrument. Whit this kind of an instrument we could gather a large amount of data, in small intervals, from which we could see the real conditions. Also the instrument is a portable one, and the same one could be placed on a human arm and could be transferred from one place to another as the worker is doing his job on a daily base. But one of the main reasons why this kind of an instrument is created is because the same one could be use in real entities, where workers because of their daily activities have a temperature shocks from one place to another (from 3 or even – 4 degree Celsius temperatures to even + 45 degrees Celsius). So the paper presents only a small part from an ongoing research with a main purpose to aim a real solution regarding work conditions and work instructions, but also a real health and safety protection to workers that are involved to such an activities. And at the end of the introduction part, we could say that this paper is only the beginning of a paper release from several reasons such as: multiple instrument was created and they are used on a daily base in industrial entity (not only this one), the research was done in several occasions with multiple measurement in different time frames, different outside temperatures, the measurement is also conducted with an calibrated instrument which is an professional one for this purpose and the results are with small deviations.

Key words: *Measurement, Health and Safety, Microclimate, Quality Control, OSHAS, QMS*

1. INTRODUCTION

The entity presented into the papers is a part of the multiple measurement treatment is a production capacity with production systems in three different locations in Republic North

Macedonia, and a marketing and trading activities in the country but also into the region – Balkans. The production system which was an aim of research has an production activities which according to the technology processes is divided to units which starts whit storage units for raw materials and ends with storage units for final products. The production processes into the production units are planned with a circulation of workers from the so-called hot chambers to cold chambers and often with a direct circulation of workers from hot to cold rooms. The spotted activities were one of the main reasons why the research started. At the moment of research the number of employees was from 100 to 120 employees regarding work activities, from which only a small part are the so-called administrative workers, small part (less than 10) responsible for commercial activities, and the most of them directly into production processes. More than 15 workers from the production processes are directly involved in activities with wet surfaces and a circulation from hot to cold chambers, which could be a professional problem and also a health and safety reason. So that is also one of the main reasons why multiple measurements were done in several occasions so the real picture could be seen.

2. PRESENTING THE MEASUREMENT METHOD AND THE CREATED UNIT

Considering the fact that we are speaking of a measurement instrument which was not bought as one, and speaking about a measurement from which we could see the real condition into a industrial capacity where an immediately actions should be taken – we should start this part with the system for an active collection of data.

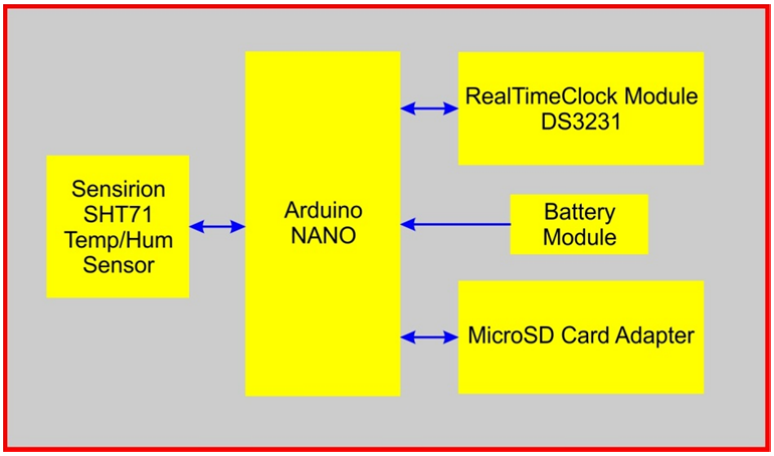

Fig.1: Temp/Hum sensor node structure

The sensor node is based on Arduino Nano MCU, with a Battery power supply. The actual time and date are obtained from the DS3231 based RTC module. The measured data is stored on a microSD card in * .CSV format.

And so we could get a real data, before we even started the measurements the created unit is compared with even 2 other high quality measurement unit – professional ones so we could get a real overview about the % of mistake and the tolerance level. And after multiple measurements into different areas we could conclude that the created measurement unit (one

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presented above) is created and calibrated so the one could be used and the data gathered could be seen as real ones.

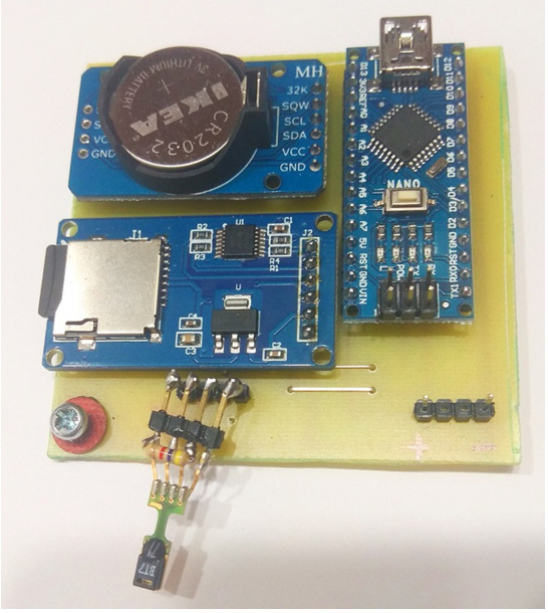
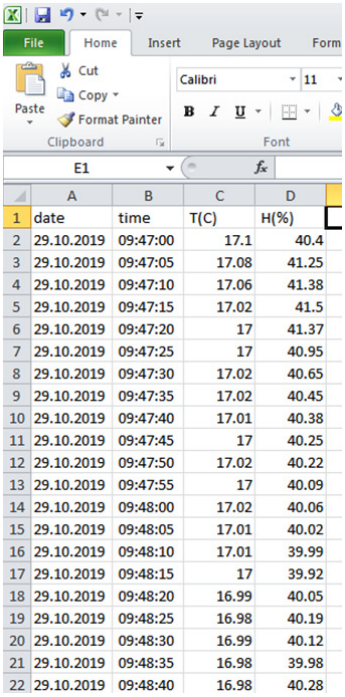


Fig.2: Temp/Hum sensor node real PCB

After numerous measurements and comparative analysis of the data, real data were obtained with very small deviations. Comparison of measurement results is done with reference instruments for measuring temperature and humidity by reputable manufacturers.



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E1

	A	B	C	D
1	date	time	T(C)	H(%)
2	29.10.2019	09:47:00	17.1	40.4
3	29.10.2019	09:47:05	17.08	41.25
4	29.10.2019	09:47:10	17.06	41.38
5	29.10.2019	09:47:15	17.02	41.5
6	29.10.2019	09:47:20	17	41.37
7	29.10.2019	09:47:25	17	40.95
8	29.10.2019	09:47:30	17.02	40.65
9	29.10.2019	09:47:35	17.02	40.45
10	29.10.2019	09:47:40	17.01	40.38
11	29.10.2019	09:47:45	17	40.25
12	29.10.2019	09:47:50	17.02	40.22
13	29.10.2019	09:47:55	17	40.09
14	29.10.2019	09:48:00	17.02	40.06
15	29.10.2019	09:48:05	17.01	40.02
16	29.10.2019	09:48:10	17.01	39.99
17	29.10.2019	09:48:15	17	39.92
18	29.10.2019	09:48:20	16.99	40.05
19	29.10.2019	09:48:25	16.98	40.19
20	29.10.2019	09:48:30	16.99	40.12
21	29.10.2019	09:48:35	16.98	39.98
22	29.10.2019	09:48:40	16.98	40.28

Fig.3: Log.csv file example

Considering the fact that this industrial entity is chosen so we could have an comparative overview, but also that we could get an real picture about the entity, the same one as an entity is chosen for the following reasons: Work regime and the technology process where a circulation of employees is a daily routine with activities in units with very different microclimate conditions

- Industrial capacity where monitoring system is already placed
- Number of employees who are enrolled in changes from minute to minute which have a negative influence to the health of the same ones.

3. PRESENTING A DAILY VIEW OF THE DATA

Considering the fact that multiple measurements are conducted into the industrial entity which is a main point of research, in several time frames – different ones, in different days in different parts of the year (winter –summer), the tabular view presented into the paper is only a day presentation. But although the same one is a day presentation of the gathered data, we could see the circulation of workers and the indoor conditions. For comparison the measurement is done in a day in which the outside temperature was 16.1 Celsius degree and the humidity was 40.1%.

The given tabular view in addition is only a small part of what we saw and measured, but what is a daily routine for the workers. The same ones (more that 15 employees) have a circulation regarding production activities from hot to cold chambers multiple times per day. So that is why the tabular view is a presentation of a 60 minute daily routine of one worker which has a various circulations: from hot to cold chamber, from production to cold chamber, from cold to hot chamber, from production to hot chamber. In addition the tabular view is the best presentation of the work conditions.

Table 1: Part of the measured results

	Time of measurement (local time)	**Temperature (^{o}C)**	**Humidity (% RH)**
1	9:00	17.9	47
2	9:15	23.1	51.2
3	9:20	21.5	56.3
4	9:25	10	62.7
5	9:30	6.9	70
6	9:35	3.2	48.5
7	9:40	13.5	51.8
8	9:50	41.6	50.8
9	10:00	19.5	50.8

Although this kind of an interoperation and presentation of data (from an hour to a hour) is with a large time gap, the same one is a real interpretation of a real condition and a circulation of a person into the industrial entity, where according to the data aimed the same one is involved in production activities with temperatures from 3.2 to 41.6 Celsius degrees

and a humidity from 47 – 70 %. But the tabular view is only a small part and a daily activity of worker. Multiple measurements were made and the same ones could be placed into future publications.

4. CONCLUSION

The paper present only a small part from an extensive research conducted with a wisely chosen methodology and created measurement unit in which 2 sensors are placed. The unit created is calibrated and comparatively involved in a measurement with a measurement unit with high price and a small tolerance. Actually what is a real thing to mention from this paper is the measurement unit created for the purpose of this measurement which has an unique software that could data every measurement with a diapason of 3 second from one to another measurement. So the same one could gather information about a real activity and a short notice change of the rooms (hot to cold, cold to hot) which could be a health and safety problem to the entity and especially to the workers. And finally seeing that the aimed data and the results from the measurement are a real data base with a large amount of data, from which a long term activities with an aim to improve the work conditions are made, some future publications are also coming in a near future.
Guidelines for further improving: Creating a sensor node with web-based application for on-line data collection using the wireless sensor networks.

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AUGMENTED REALITY HARDWARE IN THE FORM OF SMART GLASSES AND HMD DEVICES

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Abstract: *In recent times augmented reality is one of the hottest technology topics. Although is it a different technology from virtual reality we can notice great shift from developers and media. That leads to various offering to end users. Recently with the availability of ARKit and ARCore there are many applications and games available for smart phones. For more advanced tracking, recognition and overall user experience there is dedicated augmented reality hardware in the form of HMD, smart glasses or goggles. At first there was Google Glass that proved to be a failure but now we have much more advanced devices. This papers analyzes the current AR hardware offerings along with their benefits, limitations or potential for each of the devices.*

Key words: *Augmented reality, HoloLens, Meta, Magic Leap, ODG*

1. INTRODUCTION

Augmented reality opens the path for manufacturers to develop various HMD and smart glasses. The very first device marketed as AR was Google Glass which did not have the ability to track the environment or recognize markers and was an overall failure. Now we have devices like HoloLens, Meta, ODG and Magic Leap. In a Foresster report[1] it is expected that by 2025 just the USA alone will have more than 14 million workers using smart glasses. In order to reach the mass market we overview the characteristics of the available devices, the potential of future devices and the rules to be followed for a successful HMD device.

2. GOOGLE GLASS

Analyzing today’s state of the augmented reality HMD devices we can be quite certain that are based on the core principles of the Google Glass . Glass was announced by Google in 2012 and available to the enthusiasts in 2013.Glass has a limited number of functionalities like: taking a photo, recording a video, getting navigation directions, sending messages, making calls, Google searches and now the nonexistent Google+ Hangouts. Looking through the prism of augmented reality Glass did not offer the functionality of recognizing markers or

[1]https://www.forrester.com/report/How+Enterprise+Smart+Glasses+Will+Drive+Workforce+Enablement/-/E-RES133722

any type of localization which sets the question of whether it can be classified as an augmented reality device.

Although the device got the enthusiasts attention we can easily qualify it as a failure. Some may see it as a device that was ahead of its time but generally there are a couple of factors that lead Glass to failure such as health concerns, privacy concerns, the lack of "cool" factor and Google's overall dedication. These reasons clearly describe why the device was not a success but maybe the main reason is that the device's function was not made clear enough. We must note that Google's failed attempt at making the device a success with the general public does not mean it is not attractive to the enterprise. Glass Enterprise Edition is used by companies such as GE, Boeing, DHL and Volkswagen, all of them taking advantage of the device.

3. HOLOLENS

HoloLens is a Microsoft head mounted device that is stand alone and does not need to be connected to a computer. All of the computing components are inside the device. Microsoft categorizes it as a mixed reality device, a move that might be tracked back to the failure of Google Glass which was advertised as an augmented reality device. Couple of cameras including depth camera are used for understanding the environment. This enables for putting "holograms" into the real world through a screen with 1268*720 pixel resolution[2].The nature of the device is head mounted on the users head meaning the interaction differs from phones where the interaction is primarily by touching the screen. HoloLens can be interacted with Gaze which is a pointer that changes the position relative to the users attention and is the analog of a computer mouse, gestures for selecting for selecting objects or buttons which are the equivalent of a mouse click or voice input. When it comes to gestures there is the need for new ones that will recognize the natural movement of the users hands that will occur on the same level as when users will physically manipulate the objects. Many of the HoloLens applications have personal computer interfaces that might be a result of the currently available gestures. Users can also interact with a Clicker[3] device used to selecting, moving, listing or resizing objects or buttons. In the case of continuous usage of the HoloLens having the Clicker is much more practical than using hands for interacting with the virtual objects.

3.1 Field of View

The greatest weakness of the HoloLens is with the field of view[4] of the "holograms" that translates in 30 degrees[5]. Microsoft has stated that there won't be any noticeable increase in the FOV[6] but it is expected that their partners[7] will develop devices with a greater FOV.

[2] https://developer.microsoft.com/en-us/windows/mixed-reality/rendering
[3] https://support.microsoft.com/en-us/help/12646/hololens-use-the-hololens-clicker
[4] http://newatlas.com/hololens-fov-field-of-view-illustrated/44903/
[5] http://doc-ok.org/?p=1274
[6]http://www.pcworld.com/article/2937806/the-hololens-field-of-view-wont-be-getting-any-bigger-says-microsoft-exec.html
[7]http://www.techradar.com/news/wearables/this-is-how-microsoft-s-hololens-will-address-its-biggest-flaw-1322596

My personal experience with the device confirms the small FOV which is much more noticeable vertically, making only parts of the virtual objects viewable when being placed or approached at closer distance.

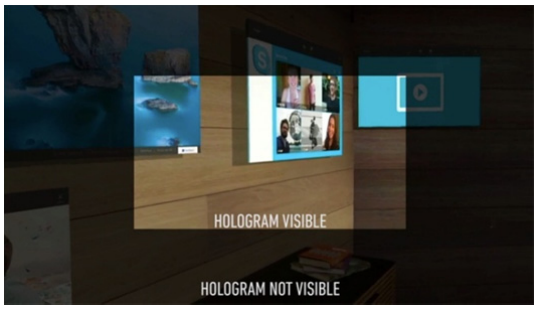

Fig 1. T*he visible part of the holograms*[8]

3.2 Range

According to the official Microsoft documentation the HoloLens ideal hologram placement is within the range of 1.25 and 5 meters[9]. This documentation states that the user experience is worsened when users approach the virtual objects closer than 1 meter. That is why Microsoft recommends cutting of or fading out the holograms once the user approaches them closer than the optimal zone. Here we must take into consideration that the users natural instinct is to approach the virtual items from up close so they can better analyze them and look into the details. Avegant and Magic Leap are developing HMDs that offer a solution to this problem.

4. META

Meta 2 is an augmented reality HMD device that at the moment is the best competitor to the HoloLens. Meta's biggest advantage is the much larger 90 degree FOV compared to the 30 degree FOV of the HoloLens. This enables the Meta's developers and users a much larger field of view that translated in many more virtual objects that can be seen at a time as well as a much more realistic experience. The device comes with a 2.5K screen with 60Hz refresh rate and 4 surround speakers. When it comes to interaction, Meta treats the "holograms" as they are physical objects. This means users interacting with the virtual objects is also different with more natural hand gestures. Virtual objects can be touched, grabbed, pushed and pulled. Meta's weakness is that the device is not wireless and standalone but it has to be connected to a computer. The minimum system requirements are: Intel® Core™ i7-6700 Processor or AMD AMD FX™ 9590, 16 GB RAM DDR4, NVIDIA GeForce GTX 1050 Ti or AMD Radeon RX 480, a HDMI 1.4b port, USB 3.0 port and 10GB free space. Having the need for a computer and the minimum system requirements we can conclude that this is a HMD device that needs powerful components so it can deliver the full potential of the

[8]https://cdn.vox-cdn.com/uploads/chorus_asset/file/3805546/fieldofview.0.jpg
[9] https://developer.microsoft.com/en-us/windows/mixed-reality/hologram

available augmenter reality technology. Having the device connected with a cable to a computer also limits the potential of the device so that it is mainly used indoors and also limits the free movement of the user.

5. AVEGANT

Avegant is the company of the Glyph Headset which instead of a screen uses led projectors beaming light to the users eyes. Although this is not an augmented reality headset Avegant are working on a mixed reality technology that uses light fields[10]. The Light Field technology uses multiple focal planes that provide the user with a more realistic and interactive experience. The functioning principle of the human eye is that when it sees objects from close distance it blurs the objects that are placed further. This is what the Light Field technology accomplishes on a hardware level and is why it is considered as the future of mixed reality[11]. Avegant at the moment has a prototype that is not a standalone device like the HoloLens. Being a prototype and not a final product might mean that the technology can be licensed and implemented by various OEMs[12].

6. ODG

ODG products are different that they basically offer smart phone components in the form of smart glasses. ODG as a company primarily is focused on B2B products like the R-7[13] smart glasses targeted at the industrial sector, medicine, security, energetics, logistics and storage. Starting from 2017 they are offering the R-9 and R-8 targeted at users[14]. Both are as close as it gets to a smart phone in the form of smart glasses. R-9[15] have a Snapdragon 835 chip, 6GB DDR-4 RAM and 128GB storage. They have two transparent screens with 1080p resolution at 60fps and 50 degrees FOV that support both 22:9 and 16:9 aspect ratios. On the connectivity side they have Bluetooth 5.0, WiFi 802.11ac, as well as a GPS/GLONASS chip. These smart glasses have various internal sensors including accelerometer, gyroscope, magnetometer and sensors for the altitude, humidity and a light sensor.
R-9 have four cameras: 13MP autofocus camera supporting 1080p with 120fps or 4K with 60fps, a wide angle camera used for tracking the environment and positioning and two 1080p depth sensing cameras. This combination of sensors allows the device tacking with 6 DoF (degrees of freedom). The depth sensing technology is different from Tango in that Tango uses Time of Flight to determine the distance and the R-9's use stereo. These smart glasses have build in stereo speakers and microphones, USB type-C connector for charging, data transfer and audio and video inputs. They are also equipped with an expansion port that allows for additional functionalities required by the use case scenario such low-light vision or

[10] https://www.avegant.com/blog/company-news/introducing-avegant-light-field
[11] https://www.fxguide.com/featured/light-fields-the-future-of-vr-ar-mr/
[12] https://uploadvr.com/testing-avegant-light-fields/
[13] http://osterhoutgroup.com/products-r7
[14]https://www.theverge.com/ces/2017/1/3/14128200/odg-r8-r9-consumer-industrial-ar-glasses
[15] http://osterhoutgroup.com/presskit/R-9-TechSheet.pdf

better scanning of the environment. R-9 uses RectileOS based on Android Nougat that is optimized for smart glasses and support[16] vuforia, wikitude, augumenta and eon reality SKDs.

Users can interact by touch on the smart glasses but they also support mouse, keyboard, smart phone or Bluetooth controller. R-8[17] are stripped down version of the R-9 and have 720p 60fps screens, smaller 40 degree FOV, 4GB DDR-4 RAM and 64GB of storage and lack the expansion port. Having components with lower specifications allows for a lower price of the glasses and for a easier market adoption. Taking the price aside, the only real benefit of the R-8's is that they are lighter, making them more comfortable for longer usage.

7. MAGIC LEAP

Magic Leap is the company believed to bring the device of the future. That is backed up by the 2.3 billion dollar investment[18] by May 2018 despite the fact that the company has not yet revealed a commercial device. The company has announced the Magic Leap One: Creators Edition device aimed toward application developers and content creators. Because the device's specifications are not revealed we cannot compare the device with any of the competitors like HoloLens or Meta. Generally the difference is that the HoloLens is a standalone device, Meta needs to be connected to a computer and Magic Leap One is consisted of goggles that are connected to a small portable processing unit called Lightpack. The goggles themselves have 6 cameras, 4 microphones and an additional processor used for environment understating as well as the ability for machine learning[19]. Interaction with the device is with a controller with a light ring that can be seen by the goggles and also has motion tracking. Detailed reviews and comparison with the competitors will be available when the company places a commercially available device to the market.

8. WHAT MAKES A SUCCESSFUL AUGMENTED REALITY HMD DEVICE

One of the speeches during AR IN ACTION was the one by Dr.Fan[20], the CEO of the company KOPIN[21]. This company has long experience with manufacturing HMD screens and has manufacturing deals and partnerships with various companies and institutions. The speech addresses the rules that HMD manufacturers need to follow in order to bring a successful device:

- Human first technology second. This emphasizes the question on why humans would wear HMD device. Those who wear glasses do so they have better vision but along with the functionality the glasses also need to be comfortable and look good. The same goes for HMD

[16] http://osterhoutgroup.com/sdks
[17] http://osterhoutgroup.com/products-r8.php
[18] https://www.crunchbase.com/organization/magic-leap#section-locked-marketplace
[19] https://www.theverge.com/2017/12/20/16800474/magic-leap-one-creator-edition-augmented-reality-goggles-announce
[20] http://arinaction.org/speakers/john-cc-fan/
[21] http://www.kopin.com/about/innovations/default.aspx

devices meaning first they need to have good enough reason to be used but also be comfortable and good looking.

- Physical over virtual world. Having too much virtual data at once can be confusing, tiresome or even irritating to the end user. Also having too much data just because the technology enables so does not mean that the end user should be overwhelmed with cluttered information. Any developer should take into consideration that the brain cannot absorb and process too much data at the same time. The right implementation would focus on information that is related or can be fitted with the physical world.
- Situational awareness. Any augmented reality experience needs to focus on enriching the physical world without interrupting the users senses. Sight and sound are the most important senses and they need not to be interrupted by too much information or a continuous sound. The physical world should be the basis on which the elements of augmented reality are placed.
- Sound over touch. Touch is the main interaction with smart phones or tablet computers but in an augmented reality HMD device sound is the most natural way to interact.
- Balance between design and benefits. The devices design needs to be attractive to the users so they wear it for a longer period and adding unneeded functions can only make a negative effect.

The same presentation brings interesting data about the adoption rate and the willingness to use HMD devices among different categories. The highest level of usage is in the military, then health and fitness, followed by enterprise (manufacturing etc) and the lowest is in the category for entertainment and games. That is why if the main target group are the regular users, the greatest focus should be on finding innovative ways on presenting the capabilities of the augmented reality technology.

Matt Miesnieks analyzes the problems[22] that need to be overcome in the next phase of augmented reality devices, the augmented reality glasses. For this category to by massively used by an extended period of time by a large number of users it needs to:

- be modern and have the cool factor because despite all of the functionalities offered by the technology if the user doesn't look good while wearing the glasses then they probably won't use them at all
- have optics that can be placed in the form of regular glasses but also can pass enough light so the glasses can be worn outside in direct sunlight
- Perfect the interaction methods. Interacting with the glasses with sound during a movie or hand gestures in public are not the best ways for the users to interact.
- Have efficient processors and sensors that will be power efficient at the same time. That means that they need to have a smaller impact on the battery but also be thermal efficient. For extended usage the glasses would need to be light, should not make uncomfortable heat and have a long lasting battery life.
- Better recognize the physical world. The start of ARKit and ARCore of recognizing horizontal and vertical planes need to perfect into recognizing the entire environment. This

[22]https://medium.com/super-ventures-blog/why-apples-glasses-won-t-include-arkit-46a1d40381fe

can be solved either by implementing depth cameras or by perfecting the Mono RGB reconstruction.

- Have the ability to share and have the effect on multiple users. This means experiences that include multiple users and in the future a cloud that will be a digital representation of the physical world.
- User interface intended for augmented reality. It is obvious that we have the same problem as the transition in interaction with a keyboard and a mouse to touch screens when the need to optimize the user interface for touch was needed. My personal experience with HoloLens confirmed the problem that nearly all of the applications had user interfaces designed for a computer.

9. CONCLUSION

Starting with Glass, today's augmented reality hardware has a lot to offer. On the one side we have smart phones that currently have the largest user base. But we also have devices like HoloLens, Meta, ODG and Magic Leap One all of them having their advantages and limitations. Some of them are independent devices, some have to be connected to a computer and some connect to a small portable processing unit. Some come in the form of HMD, some in the form of goggles and some in the form of smart glasses with phone components. We also have companies like Avegant working on perfecting light field technology that might be the future of augmented reality devices. Choosing the right hardware can be affected by the use case, budget, portability, availability and support of the device.

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IMPORTANCE OF MACROECONOMIC INDICATORS IN THE REPUBLIC OF SERBIA, TAKING INTO ACCOUNT THE SITUATION IN THE PERIOD 2007-2017 FROM THE POINT OF VIEW OF FUTURE DECISIONS TAKEN BY LEADING STATE BODIES

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Abstract: *The importance of respecting macroeconomic indicators such as: Gross Domestic Product (GDP), Exports, Exports, Foreign Direct Investment (Foreign Direct Investment) are of great importance for the decision makers of leading government decisions. In the Republic of Serbia as a transition country that has similar socio-economic problems as other Western Balkan countries such as Bosnia and Herzegovina, Montenegro, Northern Macedonia and other countries that gravitate to the said region and countries. Of the macroeconomic indicators, the highest attention so far has been given to highlighting gross domestic product. However, there are other indicators that affect the country's macroeconomic position in exports of goods and foreign direct investment (FDI). Very often, indicators such as FDI indicate the investment of foreign capital by an investor of a resident (enterprise) of one country into a resident (enterprise) of another country of interest, thus essentially showing the solidity of the economy in real space and time. This macroeconomic indicator has been given special attention by the government officials and with respect to foreign direct investment Serbia is a leader in the Balkans.*

Key words: *macroeconomic indicators, GDP, exports, imports, FDI.*

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1. INTRODUCTION

You should point out that there are price changes that use unparalleled data originating from different periods, that is, the incomparability of gross national products that are calculated at prices from different periods. For this reason, when looking at macroeconomic indicators, it is necessary to introduce categories of nominal and real gross domestic product [1; 2: 3; 4].

Nominal Gross Domestic Product is a gross domestic product that is processed at current prices, that is, at market prices of all suppliers and services, located in one market that buys and buys during one calendar year for which the gross domestic product is processed. When the nominal social product is processed, it is possible to gain insight into the real state of the economy in the year under review. In order to get a clear and realistic proposal on the movement of the Gross Domestic Product over time, it is necessary to calculate the real Gross Domestic Product.

Real Gross Domestic Product is a gross domestic product that is processed at constant prices, which has influenced inflation on the value of this arrangement. The calculation of GDP on the basis of constant prices has obtained its value, which is obvious from the influence of the increase in the optimal price level. In addition, careful national policy should focus on the observation of export of goods, import of goods, foreign direct investment, etc.

Exports of goods include all overcoats originating from domestic production or products from robust domestic transport, including so-called nationalized goods (ie goods imported and cleared so as not to change or lead to export quotas as goods designed from the country).

Imports of the garment include total goods imported from abroad, which have been cleared and released for inland transport, all for the purpose of reproduction, investment or consumer goods. Imports of dresses also include and supply various charities as well as private gift items. The trade balance represents the difference between total imports and total exports. In theory and practice, this indicator is often put in relation to gross domestic products.

Foreign direct investment means the investment of foreign persons into domestic legal ears with foreign investor acquires an association or shares in the share capital of legal entities (enterprises) which, in accordance with legal styles and all other rights arising from such investment.

Socio-economic factors [5] should be involved in political and socio-economic decision-making by government bodies, but other numerous economic and financial flows need to be included [6; 7; 8; 9; 10] and movements that indirectly return companies to the state through the business operations and indirectly create macroeconomic behavior of the widest range of entities in a country's economy.

2. SELECTED MACROECONOMIC INDICATORS IN BOSNIA AND HERZEGOVINA FOR THE PERIOD 2007 TO 2017

In the study, the authors began to review the analysis of macroeconomic indicators for a transition country more precisely for Republic of Serbia. Table 1 presents data on the movements of selected macroeconomic indicators for the period 2007 to 2017.

Table 1: Macroeconomic indicators in Republic of Serbia, (Source: Authors)

YEAR	GDP	EXPORTS	IMPORT	FDI
2007	40,29	11,42624	21,21671	4,42
2008	49,26	14,33959	26,66444	4,05
2009	42,61	11,43652	18,21151	2,92
2010	39,44	12,98759	18,89965	1,7
2011	46,46	15,78246	22,9373	4,93
2012	40,7	15,02644	21,81113	1,27
2013	45,52	18,75424	23,62488	2,06
2014	44,21	19,17388	23,97066	2
2015	37,46	17,48258	21,13493	2,34
2016	38,3	19,15766	22,01101	2,3
2017	41,43	21,73004	25,38002	2,9

3. DESCRIPTIVE ANALYSIS OF MACROECONOMIC INDICATORS

Descriptive analysis of Serbia's macroeconomic indicators shows that there is minimal variability in all indicators after the onset of the global economic and financial crisis, especially in 2009 and 2010.

Partial recovery is present in 2011 and 2012, with a sharp increase in macroeconomic indicators in 2013 and 2014. The decline in the value of indicators is present in 2015, and in 2016 and 2017 there is an increase in macroeconomic indicators.

The GDP level in 2017 is lower than the level in 2008 (when the global economic and financial crisis occurred) and slightly higher than the level in 2007.

Exports show an upward trend from 2011 to 2017, with the exception of 2015. Imports show a greater or lesser trend of growth from 2011 to 2017, with a slightly lower level of growth in 2012 and 2015.

Foreign direct investment (FDI) has a lower level of growth compared to 2008, except in 2011 and 2014, when the level of growth from 2007 and 2008 is reached.

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Table 2: Descriptive indicators in Republic of Serbia, (Source: Authors)

Statistic	GDP	EXPORTS	IMPORT	FDI
Nub of observations	11	11	11	11
Minimum	37,460	11,426	18,212	1,270
Maximum	49,260	21,730	26,664	4,930
Median	41,430	15,782	22,011	2,340
Mean	42,335	16,118	22,351	2,808
Standard deviation (n-1)	3,672	3,422	2,541	1,181
Variation coefficient	0,083	0,202	0,108	0,401

Descriptive analysis shows that the average value of GDP was $ 42.335 billion. The average export in the observed period (11 years) was $ 16.118 billion and the average import was $ 22.351 billion. The average value of foreign direct investment was $ 2.808 billion.

The variability of the observed indicators is small for GDP, exports and imports. The variability of FDI was pronounced and ranged from $ 1.27 to $ 4.93 billion. The median with which the sample contains several values ranged approximately to the level of mean (macro) economic indicators. The coefficient of variance is highest for FDI and it ranged at 40.10%, due to the high variability of the analyzed indicator.

The macroeconomic indicators presented in the previous tables can also be presented in a practical way.

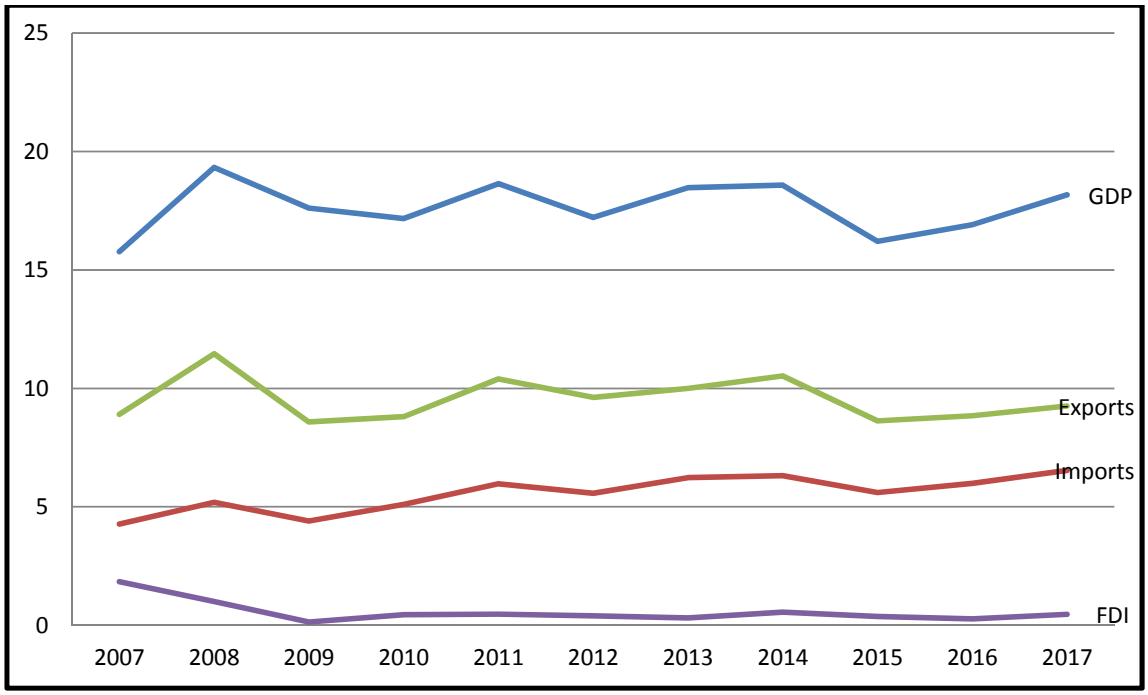

Chart 1: Macroeconomic indicators in Republic of Serbia
Source: Authors

4. VALUES OF SELECTED CORRELATION COEFFICIENTS IN REPUBLIC OF SERBIA FOR THE PERIOD 2007 TO 2017

The graph shows that the values of GDP, exports and imports reached the maximum value in 2008, and that the FDI variable reached its maximum in 2011. The graph shows that in the previous period there was a greater growth of exports, which in 2017 compared to 2007 increased by 90%.

Table 3: Values of correlation coefficients in Republic of Serbia, (Source: Authors)

CORRELATIONS						
			GDP	EXPORTS	IMPORT	FDI
Spearman's rho	GDP	Correlation Coefficient	1,000	0,903**	0,964**	0,491
	EXPORTS	Correlation Coefficient	0,903**	1,000	0,915**	0,370
	IMPORT	Correlation Coefficient	0,964**	0,915**	1,000	0,491
	FDI	Correlation Coefficient	0,491	0,370	0,491	1,000

The presented data regarding the values of the correlation coefficient show that there is a strong direct correlation between GDP (rho = 0.903) and exports (rho = 0.964). There is also a strong correlation between exports (rho = 0.915) and imports (rho = 0.915). A positive relationship between these macroeconomic indicators indicates that their relationship is also direct (they are interdependent indicators). As one indicator increases, the value of another indicator increases.

Table 4: Summary model of regression analysis in Republic of Serbia, (Source: Authors)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,893[a]	0,798	0,740	0,0294454
a. Predictors: (Constant), FDI, IMPORTS, EXPORTS				

Possible occurrence of multicollinearity between the independent variables from the regression analysis, due to the exclusion of the variable export, since it is in a strong correlation with the variable import. In this case, two independent variables make the same (or similar) contribution to the determination of the dependent variable. In such cases, multicollinearity can be said to be present. Regression analysis found that 74.0% of GDP variability was determined by the variability of independent variables (imports and FDI). The F test confirmed (F = 13,814; p value = 0.004) that the contribution of the independent variables in explaining the change in GDP was statistically significant.

Table 5: Dynamics of Movement B (Unstandardized Coefficients) and Beta Coefficients (Standardized Coefficients), (Source: Authors)

		Coefficients				
Model		Un standardized Coefficients		Standardized Coefficients	t	Sig.
1		B	Std. Error	Beta		
	(Constant)	-0,002	0,009		-0,178	0,864
	Exports	0,532	0,141	0,706	3,789	0,007
	Imports	0,068	0,039	0,329	1,763	0,121
	FDISDI,_BIH					
a Dependent Variable: GDP						

The data presented in the table show that the coefficient B1 (imports) provides a statistically significant contribution to the explanation of GDP (t = 3,789; p value = 0.007), while the contribution of independently variable FDI is not statistically significant. If the values in the Beta coefficient column (β) are compared, then it can be concluded that the impact of imports relative to FDI is twice as high (0.706> 0.329).

The regression equation based on the presented data is:

$$\mathbf{Y = 0.002 + 0.532 * X1 + 0.068 * X2}$$

The regression equation can be interpreted to mean that with an increase in imports of $ 1 billion, it leads to a GDP growth of $ 0.532 billion. With FDI growth of $ 1 billion comes GDP growth of $ 0.068 billion.

5. CONCLUSION

The developments in the Republic of Serbia, which are covered in the period 2007-2017 and analyzed by the selected macroeconomic indicators, point to the following conclusions.

The first is that at the beginning of the period i.e. 2007 GDP was 40.29 to end 41.43 at the end of the period, which is not the progress that the transition country is striving for.

Unlike the first macroeconomic indicator, the second export indicator is far better since 2007 stood at 11.42624 to be 21.73004 at the end of the period.

The third conclusion is that imports are growing but slower than exports, namely at the beginning of the period it was 21,21671 and at the end 25,38002. The fourth conclusion would be that, at the beginning of the period, foreign government investment stood at 4.42 and fell to 2.9 at the end of the period.

The aforementioned conclusions can serve as a basis for state decision makers in terms of making practical measures that will improve the overall economic environment in the Republic of Serbia. In doing so, the authors of the study fulfilled the expectations that were set at the outset, and similar research is possible and compatible with other countries in the region.

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OVERVIEW OF SELECTED MACROECONOMIC DEVELOPMENTS IN BOSNIA AND HERZEGOVINA FOR THE PERIOD 2007-2017 AS AN INDICATOR OF FUTURE DECISION-MAKING DIRECTIONS OF THE HIGHEST STATE BODIES

Jelena Vitomir[1], Sonja Tomaš–Miskin[2], Dejan Boljanović[3], Bogdan Laban[4], Dragana Popović[5]

Abstract: *Macroeconomic indicators such as: Gross Domestic Product (GDP), Exports, Exports, FDI (Foreign Direct Investment) are of great importance for the practical appreciation by the holders of social power and management by the highest government holders.*

This is especially true for transition countries such as Bosnia and Herzegovina, but also other countries in the Western Balkans, such as the Republic of Serbia, Montenegro, Northern Macedonia and other countries that gravitate to the countries mentioned.

Gross domestic product is often the focus of studying macroeconomic indicators, noting that it is not the only indicator. There are other indicators that affect the macroeconomic position of a country in the export of goods and foreign direct investment (FDI). Very often, indicators such as foreign direct investment indicate the investment of foreign capital by an investor of a resident (enterprise) of one country into a resident (enterprise) of another country of interest, thus essentially showing the toughness of the economy in real space and time.

Key words: *macroeconomic indicators, GDP, exports, imports, FDI.*

1. INTRODUCTION

The starting points for monitoring macroeconomic indicators, for example gross domestic product, are related to the presentation of the market value of all products and services produced in one country over a period of one year, which would mean that the market prices

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of goods and services in one country's market are used to calculate them. at a given time interval [1; 2: 3; 4].

This does not complete the monitoring of macroeconomic indicators, but other developments such as the calculation of gross domestic product must be taken into account in the analyzes. Essentially, when calculating the gross domestic product, it is necessary to include goods and services.

The observation period in which the gross domestic product is calculated includes only those products that were produced during the accounting year, but only if it was done through monitoring of goods and services that were legally sold during one accounting year, indicating that this macroeconomic indicator does not calculates transactions performed within the shadow economy, as well as transactions arising from criminal activities (drug sales, smuggling, etc.).

In addition, for the categorization of macroeconomic factors, it is necessary to include for the calculation of the gross domestic product of the domestic country the goods and services produced in the territory of the domicile country by foreign companies or foreign citizens. This is important because foreign workers provide part of their income to their home country, which is the case for a large number of transition countries such as Bosnia and Herzegovina, which is the focus of this study.

Socio-economic monitoring [5] is necessary for later appreciation of numerous economic and financial flows [6; 7; 8; 9; 10] and developments that directly and indirectly influence the macroeconomic input of the country.

2. SELECTED MACROECONOMIC INDICATORS IN BOSNIA AND HERZEGOVINA FOR THE PERIOD 2007 TO 2017

In the study, the authors began to review the analysis of macroeconomic indicators for a transition country more precisely for Bosnia and Herzegovina. Table 1 presents data on the movements of selected macroeconomic indicators for the period 2007 to 2017.

Table 1: Macroeconomic indicators in Bosnia and Herzegovina (Source: Authors)

YEAR	GDP	EXPORTS	IMPORT	FDI
2007	15,77	4,27367	8,902165	1,84
2008	19,33	5,188172	11,46462	1
2009	17,61	4,4025	8,581353	0,14
2010	17,17	5,097773	8,803059	0,44
2011	18,64	5,970392	10,40112	0,47
2012	17,22	5,568948	9,61737	0,4
2013	18,47	6,231778	9,997811	0,31
2014	18,58	6,315342	10,52929	0,55
2015	16,21	5,603797	8,628583	0,37
2016	16,91	5,987831	8,842239	0,27
2017	18,17	6,535749	9,257615	0,46

3. DESCRIPTIVE ANALYSIS OF MACROECONOMIC INDICATORS

Based on the table 1, it can be concluded that the descriptive analysis of Bosnia and Herzegovina macroeconomic indicators indicates the presence of minimum values of all observed variables at the beginning of the observed period. Maximum values are present in the middle of the observed period since 2011. Growth in 2013 and 2014 is particularly present. A slight decline is present in 2015 and 2016 and a rebound in 2017. Imports as a macroeconomic indicator were higher than exports in the observed period, which had an impact on the slower growth of Gross Domestic Product. Foreign direct investment has been at a low level since the onset of the global economic and financial crisis (2008). Gross domestic product is lower in 2017 than in 2008, before the global economic and financial crisis.

Table 2: Descriptive indicators in Bosnia and Herzegovina (Source: Authors)

Statistic	GDP	EXPORTS	IMPORT	FDI
Nub of observations	11	11	11	11
Minimum	15,770	4,274	8,581	0,140
Maximum	19,330	6,536	11,465	1,840
Median	17,610	5,604	9,258	0,440
Mean	17,644	5,561	9,548	0,568
Standard deviation (n-1)	1,104	0,753	0,944	0,474
Variation coefficient	0,060	0,129	0,094	0,796

Descriptive analysis shows that average GDP was $ 17.664 billion. The average value of exports was $ 5.561 billion and the average value of imports was $ 9.548 billion. The average amount of foreign direct investment (FDI) was $ 0.568 billion in the observed period.

Based on the median data and the coefficient of variation, it can be concluded that the observed data series do not contain extremely different data, except for FDI where there is a significant discrepancy between the median value and the mean value (mean).

The coefficient of variability was 79, 60%, and the standard deviation was 47.40%. In the above example, there are small discrepancies between the median value and the mean of certain macroeconomic indicators. The minimum value of GDP was $ 19.3 billion and the minimum value was $ 15.770 billion. The maximum value of exports was $ 11.465 billion, and the minimum value was $ 8.581 billion.

The maximum value of foreign direct investments was $ 1.840 billion and the minimum value was $ 0.40 billion.

The pre-defined macroeconomic indicators and their dynamics over the observed period of 11 years can be presented (Chart 1).

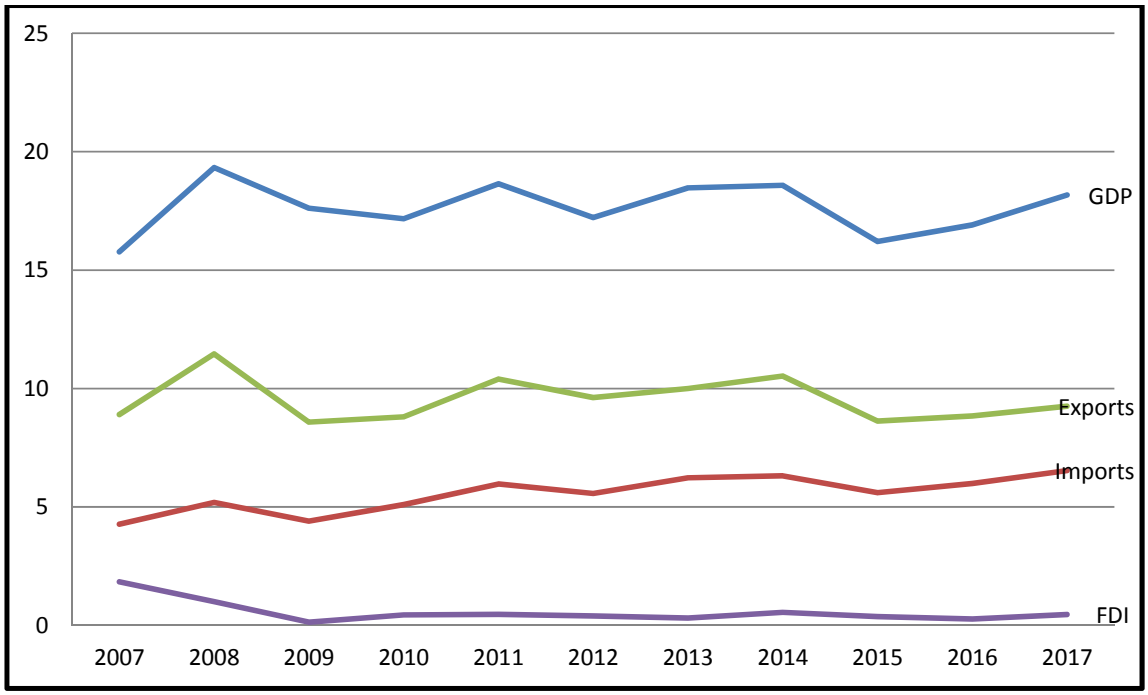

Chart 1: Macroeconomic indicators in Bosnia and Herzegovina
Source: Authors

4. VALUES OF SELECTED CORRELATION COEFFICIENTS IN BOSNIA AND HERZEGOVINA FOR THE PERIOD 2007 TO 2017

The analysis of the graph shows that the growth of GDP is related to the growth of the value of exports and imports especially until 2008 (occurrence of the world economic and financial crisis). Their significant discrepancies are present from 2009 and 2010, for their more harmonious growth to be present again from 2013 to 2014, as well as from 2015 to 2016.

Table 3: Values of correlation coefficients in Bosnia and Herzegovina (Source: Authors)

CORRELATIONS						
			GDP	EXPORTS	IMPORT	FDI
Spearman's rho	GDP	Correlation Coefficient	1,000	0,855**	0,891**	0,139
	EXPORTS	Correlation Coefficient		1,000	0,830**	0,297
	IMPORT	Correlation Coefficient			1,000	0,358
	FDI	Correlation Coefficient				1,000

The data presented in the table show that there is a statistically significant correlation between GDP and exports (rho = 0.855), as well as between GDP and imports (rho = 0.881). There is no significant correlation between GDP and FDI (rho = 0,139). Given that the correlation coefficients of GDP and exports, as well as GDP and imports, are positive, this indicates that their relationship is direct. This means that with the increase in the value of one variable, there is a statistically significant correlation between exports and imports, since their correlation is positive and amounts to rho = 0.830.

Table 4: Summary model of regression analysis in Bosnia and Herzegovina (Source: Authors)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,968[a]	0,936	0,905	0,0135865
a. Predictors: (Constant), FDI, IMPORTS, EXPORTS				

The regression analysis model shows that 90.5% of GDP variability is determined by the variability of other observed macroeconomic indicators (Adjusted R Square = 0.905). This result was statistically significant and confirmed by the F-test (F = 29,435; p value = 0.001). This means that changes occurring in macro indicators: exports, imports and foreign direct investment have a direct impact of 90.5% on changes in GDP (Gross Domestic Product).

Table 5: Dynamics of Movement B (Unstandardized Coefficients) and Beta Coefficients (Standardized Coefficients); (Source: Authors)

		Coefficients				
Model		Unconventional Coefficients		Standardized Coefficients	t	Sig.
1		B				
	(Constant)	-0,004	0,006		-0,566	0,592
	Exports	0,324	0,242	0,395	1,339	0,229
	Imports	0,466	0,180	0,735	2,587	0,041
	FDISDI,_BIH	-0,048	0,015	-0,400	-3,261	0,017
a Dependent Variable: GDP						

The data presented in the table show that the values B2 (import) and B3 (SDI) are statistically significant, since their variables make a unique statistical contribution when formulating the regression equation (import = 0.466, SDI = -0.048). The values of standardized Beta coefficients (B), which have an impact of imports of 0.735, exports of 0.395, and foreign direct investment (FDI) of -0.400, also support this.

The regression equation is:

$$\mathbf{Y = 0.004 + 0.324 * X1 + 0.466 * X2-0.048 * X3}$$

The linear regression equation shows that with imports rising by $ 1 billion to GDP growth by $ 0.466 billion. With the growth of FDI of $ 1 billion, GDP is reduced by $ 0.048 billion. This trend is present due to the developed trade sector relative to the manufacturing sector. By importing finished goods, the state earns on collecting customs duties, and by selling goods it earns on VAT and thus the full state budget.

5. CONCLUSION

In this paper, the authors pointed out that, based on the presented data, there is a statistically significant correlation between gross domestic product and exports (rho = 0.855), as well as between gross domestic product and imports (rho = 0.881).

Another conclusion is that there is no significant correlation between gross domestic product and foreign direct investment (rho = 0,139). Given that the correlation coefficients of GDP and exports, as well as GDP and imports, are positive, this indicates that their relationship is direct.

This means that with the increase in the value of one variable, there is a statistically significant correlation between exports and imports, since their correlation is positive and amounts to rho = 0.830.

Essential key conclusions can serve as a basis for state authorities to respond to macroeconomic policy measures aimed at improving the business conditions of the economy that exists in the territory of the analyzed transition country, that is, Bosnia and Herzegovina, which was the subject of analysis of the authors of this study.

This fulfills the importance of this study and may serve for further research and may be supplemented by indicators and developments of other countries, especially the Western Balkan countries.

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CULTURAL COLLABORATION ON A LOCAL LEVEL

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Abstract: *Globalization encourages focus on improving the competitiveness of the cities. Competition occurs not only in the economy but also in the aspect of the image. The rivalry comes between organizations, enterprises, cities, and regions. This is done through a variety of resources – economic, symbolic, and cultural.*

For the city as a centre of gravity, cultural events, festivals become an important tool, who creates a favourable social environment and a positive image. Cultural collaboration will be considered to be an important factor in the development of cultural life in a local environment. In modern society, cities have to search original, creative ways to present themselves to the world.

The research aim is as follows: Expose collaboration of local cultural (arts) institutions and compared to collaboration theories pay attention to obstacles and motivations. To investigate the fundamental attitudes of experts in cultural events management on the particularity of cultural collaboration.

Research: a systemic and logical analysis of research sources. In the empirical part of the research were interviewed 7 experts from the budgetary cultural institutions most of the heads of organizations, having substantial experience in events organizing. They were asked three types of questions: general questions concerning culture governance in the country and local. Special questions where regarding some urgent issues in the sphere of projects, funding, communication, sponsoring, and questions related to the main trends in the development of cultural governance.

1. INTRODUCTION

In recent years, global change in modern society has been focusing more on competitiveness, creating and promoting the urban image. Competition occurs not only from an economic point of view but also from the aspect of the image formation. Organizations, companies, cities, regions are competing between each other. Different resources are used to achieve the goal. Cultural events, festivals, city festivals become an essential tool to create an image of the city outside as inside. It is becoming increasingly clear, that culture, creativity, will be considered a significant development factor for it. Arts management is a complex phenomenon that is incorporated by historical, economic, social and cultural conditions. In current market conditions needs to find more inventive, entrepreneurial ways to attract the audience. There is a great deal of literature available on collaboration models, partnerships within the non-profit context (Austin, 2000; Tulder, Seitanidi, Crane, Brammer, 2016).

Despite that, the non-profit status of many arts organizations means that they have to be managed in a peculiar way (Colbert, 2003). Arts management is a particular field that allows combining artistic, organizational and business skills. Art organizations have to coordinate their management activities and marketing strategies with the interests of market players and create partnerships with business and non-profits organizations. It's necessary in arts management to manage cooperation with different stakeholders: donors and recipients. Otherwise in many cases is some overlap between donating and who gets donations in arts organizations programs (Chong, 2009). Colbert notices that focusing on conventional management functions in arts management causes legitimacy problems in arts and cultural management (Chong 2009).

2. LITERATURE REVIEW

2.1. Cultural Policy

The European Union's cultural policy foster the management of cultural processes autonomous to each state. From this point of view, states have to take care of their cultural policies and foster cultural traditions. International cooperation, cultural exchange programs are becoming an increasingly important topic due to the rapidly increasing mobility of the population. Old Western democracies are more successful in integrating cultural governance into a standard local policy. In Lithuania, arts management is still a young science field. Other issues, that cultural changes in society in the period of transition are developing faster than the formation of official cultural policy.

In many countries, the public sector faces obstacles by implementing various cultural projects. One of them is the lack of funding for cultural projects and events. The conflict on subsidization the culture and art are taking place because there is a lack of a current scientific debate between economists and artists (Frey,2003). The not only financial aspect is essential in arts management, but also cooperation with stakeholders, development of social art projects, involving national minorities, but disabled people and participants of other exclusive social groups are also relevant to the management of cultural events (Žemaitytė, Urbšienė, 2007). In many countries, public sector authorities are increasingly choosing private sector partnerships for providing public services and providing the infrastructure they need for the projects. Lithuanian state cultural policy currently solves not only organizational issues, coordination of cultural institutions but also economic issues by choosing optimal methods of financing structures. One of the most effective factors in cultural management would be to transfer more cultural institutions to the private sector. Art organizations with a strong marketing orientation are more successful in solving the problems of financing their activities. This is achieved through market orientation, identification, and formation. Then other questions arise of transparency and art education goals. Promotion of partnership and creation of agencies, destruction of hierarchical governance creates conditions for corruption (Smalskys, 2009).

Business-oriented artistic organizations do not have more social goals and focus on direct income from ticket sales. It may pose a threat to the commercialization of the art and the non-

implementation of the social-educational mission (Gaižutytė, 2003). Despite the social significance and benefits of an art product, customers of art organizations cannot fully cover the cost of arts institutions. Because of decreasing state support, sponsors get an vital role to play in the artistic services market, although they are often not altruistic. Sponsorship is a collaboration method that seeks to achieve the components of its marketing mix (Stotlar, 2004).

The European Union does not create a united cultural policy. Lithuania responds to the development of its own culture and the preservation of its values and identity. From 2003 till 2009 was the time of reforms in cultural policy, then Lithuania became a member of the EU and NATO, focusing on the standards of Central and Western European countries. The National Cultural Development Program has been criticized in the press for its bureaucratic structure, which does not promote the vitality of culture. The identity of Lithuanian culture has not been defined either. It has been described as the ability to preserve the roots of the Baltic culture and to transform with the Christian traditions of Europe and other cultures (Laumenskaitė, 2003). Due to a lack of patronage tradition and a lack of legally regulated forms of sponsorship, private sector support for culture is underdeveloped as well. Another aspect is that cultural policy in Lithuania is continuously changing with the new government. The Law on Patronage was only adopted in 2018. The Law establishes fields for the implementation of projects eligible for patronage, namely, personal and public health care, culture and cultural heritage, arts, science, general well-being, sports, physical training and education, but does not provide for any new incentive measures, i.e. tax exemptions, apart from those tax reliefs, which are applied to charity donors and sponsors (LRS.lt, 2018).

In the context of constant change, cultural policy arts organizations can still survive and stretch in different ways. They can pool resources with others, unite to exploit an opportunity and create partnerships (Kanter, 1989).

2.2. Collaboration in the cultural sector

Collaboration in the cultural sector is not new. The benefits are notorious to organizations that decide to collaborate within and across industries (Krane, Ebdon 2017; Alter&Hage, 1993, O'Leary, Gazley, McGuire, Bingham, 2009). To collaborate organizations, prompt the failure, inefficiency, and the possibility to gain higher levels of benefits (Bryson and Crosby 2008). The challenge of forming cross-sector collaboration emerges from the tensions caused by the interaction of institution logics of the diverse participant organizations (Ebdon, Krane, 2016) Collaboration between arts organization has become an essential factor due uncertainties of public funding and continuous search of new artistical ideas to attract audiences (Jyrama, Kajalo, Johansson 2015) Such collaboration can take different partnerships as in co-production , cooperative undertakings, infrastructure sharing (Schramme, King, 2017). Arts management is a sensitive field, because it connects different sectors artistical, often oriented to intangible ideas, education and commercial, who seek to survive and earn. Already in the internal environment of such an organization, we should look for exceptional cooperation and shared understanding.

Bryson, Crosby, and Stone (2006) systematized a comprehensive literature review on (cross-sectoral) collaboration with the framing of key concepts: initial conditions, process, structure,

and governance, contingency and constraints, outcomes and accountabilities. The framework of Ansell and Gash (2008) provide other essential key concepts that makes sense in collaborative arts management. Unlike other models, Ansell and Gash assert that collaboration goes through multiple cycles of face-to-face dialogue that depend on "good faith" negotiations to overcome the lack of trust (Ebdon, Krane, 2016).

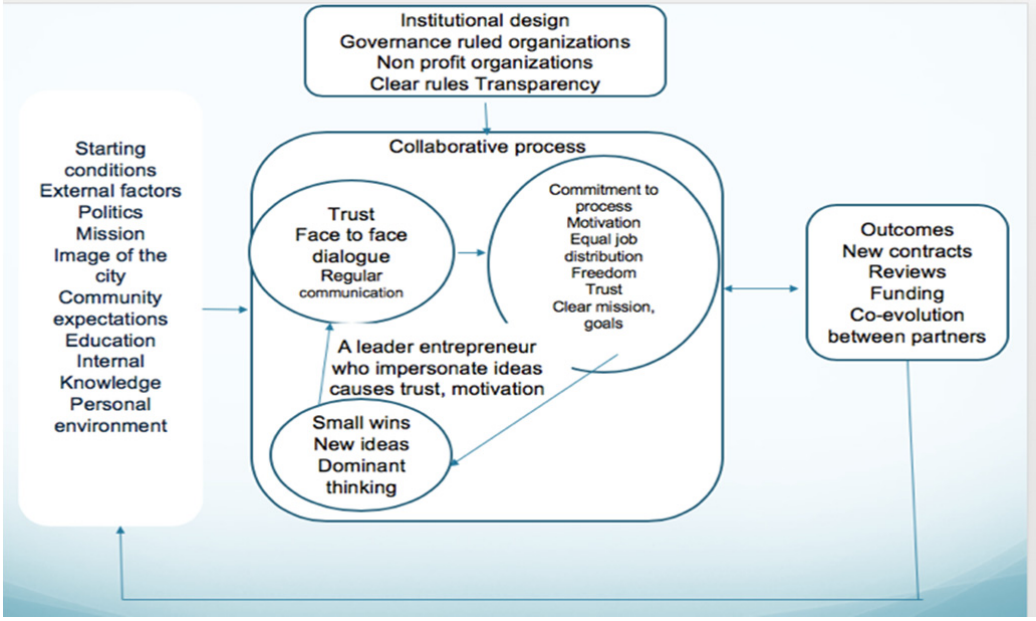

Fig.1 Cross-sector collaborations framework adopted from Ansell and Gash (2008)

This research reveals cultural collaboration at the local level of Šiauliai city and how it is reflected in the theory of cross-sector collaboration.

3. METHODOLOGY AND DATA

The study was held in 2017, and there participated seven managers from different cultural institutions. The survey questionnaire was constructed by Ansell and Gash (2008) model of collaborative governance. The research is based on qualitative exploratory and descriptive research access, which, in the case of cognition of a small object, is identified as one of the most appropriate in the scientific literature. A single case study emphasizes the possibility of conducting a more detailed case-by-case research, by deepening the contextual factors, which may contribute to identifying new theoretical links and negating previous ones (Dyer and Wilkens, 1991). Where interviewed five managers, who have 10-20 years of experience in the field of culture, one interviewer was working in the other area, but previously five years worked in the arts management sector. One interviewer with 20 years of experience was representing local cultural policy. Each interviewee is given an identification code.

4. RESULTS AND DISCUSSION

The research showed that cooperation between local cultural organizations still depends on the established traditions. “Legacy” of the Soviet era is still alive when it was intended to compete, and everyone was responsible for themselves. Even though art organizations need competitiveness for their uniqueness, they become more noticeable through exclusivity (Nooteboom, 1999), but collaborating with organizations makes it easier for them to discover resources, analyse opportunities and faster deal with responsibilities (Kanter, 1989).

4.1. Initial conditions

Analysing interviews on the first research question, to tell about the choice, drivers of organizing the events, complexity, and influence of the environment, emerged internal and external motivating factors.

Table 1 Internal, external motivating factors

Category	Subcategory	Illustrative statement
External motivating factors	The formation of the image of the city	*“My goal is to get as many people to know about the festival and our city”* (LSV2)
	contribution to the community	*“This cultural project gives much joy for our community” (LSV1)* *“Nice to see how people are happy during this festival week” (LSV2)*
Internal motivating factors	Personal proof of advantage	*“When you travel a lot, learn a lot, you understand that you can do the same in your city” (LSV2)*
	Aiming to create a favourable social environment	*“Good to see happy people, involved old and young together” (LSV3)*

4.2. Collaborative Processes

The collaboration process involves many aspects that as motivation, trust, clear motives, shared an understanding of problems, communication mechanisms (Bryson, Crosby and Stone, 2006; Ansell and Gash, 2008)

In times of change, local cultural organizations are more likely to cooperate, but this transition is slow. This is influenced by the distribution of cultural subsidies. "Everybody needs money, and the municipality allocates very little to culture. Therefore, therefore there is no sense of community; everyone suspects each other" (LSV9). One of the obstacles to collaborate for cultural organizations is unclear culture financing policy, which motivates not to cooperate but to compete. The study highlighted categories that reveal the importance and interference of collaboration with cross-sectorial cooperation.

Table 2 Managing Collaboration of Organizations

Category	Subcategory	Illustrative statement
Collaboration obstacles	Undefined funding policy	*"we have no great freedom for the program, and we even didn't know how much we would earn, because we didn't know how much we would get for the project" (LSV2)* *"It is difficult to collaborate with other arts organizations in the city. The culture is competing with each other because there is little money everywhere. Here's how the wolves attacking when there is little food and pulls on each side"(LSV5)*
	Undefined funding criteria	*„In any case, all elections, all government representatives, mayors, have difference influence. Also, there is no such specific cultural policy in any municipality so far "(LSV7)* *„Allocation of funds is based on experts advice, but there are no specific criteria"(LSV4)*
	Personal ambitions	*"There is competition between art organizations. However, it's more personal ambitions. Because they get equal funding*" (LSV7) *"Often they disagree, because of all the personalities, everyone imagines being more important than the other" (LSV5)*
	Lack of trust	*"We'd like to cooperate, but often if we offer the idea, it is misappropriated by others"(LSV4)* *"We do not trust our leader. He's not enough talkink to us"(LSV6). „It seems to me that the leader should know more about art" (LSV6)* *„I don't ask for help because they still don't understand my sphere" (LSV2)*
	Different views and expectations of art and business representatives (sponsors)	*"The Challenge When Business People Start Dictating Their Rules and Referring to People of Art" (LSV1)* *"I don't understand when an art director tells me I need money for my idea, but he doesn't realize that money for this idea won't get ... ... designs should be attractive to business people (LSV2)*
Advantages of collaboration with other organizations	Cooperation makes it possible to realize ideas with a lower budget.	*"We would not survive without cooperation with the university. Because we are not a non-profit organization. Also, student support and volunteering are important to us" (LSV2).* *„We would not even have been able to start the project, if not the sponsor. We didn't get state*

		support for the first year“ (LSV3) *“We are happy to cooperate with volunteers, without which it would be impossible” (LSV2)* *„Cooperation with other cultural organizations allows the implementation of a new entrant (LSV3)*
	Collaboration as a medium of preserving contacts	*"Must keep in touch with the sponsors, even though the project is over, so they remember you next season" (LSV3)*
	Face to face contact as a motivational tool for successful cooperation	*"We've noticed if we meet and discuss more often, everything goes smoother" (LSV7)*

4.3. Leadership

The research identified the expression of authentic leadership in cultural organizations. Leadership in collaborative governance can change a lot (Linden, 2002). Binding direction is mostly a key success for collaboration (Schramme, King, 2016). In today's world of different links, public administration that separates from primitive leadership and public sector leadership is a must (Crosby & Bryson, 2005).This is a leadership that inspires co-operation between often competing groups, following a common goal (Luke, 1998). Research results depict that arts management organizations often have several leaders that are useful for professionalism, but personal ambition sometimes makes it difficult to collaborate, both internally and externally (table 3). In an art management organization where an organization is made up of several professionals in its field, it is difficult to see just one leader. Such an organization does not have a large staff structure, so the core itself consists of authentic leaders. A genuine leader based on his thinking and behaviour.

Table 3 Leadership

Category	Subcategory	Illustrative statement
Internal collaboration	Hierarchy	*“One man's vision. This is not a true partnership” (LSV4)* *"Now, somehow, the current director would like to be one, a little discussion, which really doesn't motivate“(LSV3)*
	Personal ambitions that cause a disturbance in the organization	*"If the art director were more talkative and flexible, we would have more friends and would benefit our projects” (LSV2).* *“He just says I won't do it. He is convinced that he only must create an artistic program and nothing more” (LSV4).*

		"Different understanding often leads to conflicts between the artistic director and the general manager" (LSV6).
Leadership in the organization	Authentic leaders in the organization	*"There is no single leader, and it is sometimes positive, but sometimes the opposite. That leads to disagreement" (LSV6)* *"She is a great leader, and she could sell everything to everyone"(LSV1)* *"Too many leaders in this organization, but in the sphere of art all are personalities" (LSV7)*
		I see many leaders in the organization — former Director of Leadership, Artistic Director as well as Leader in his field (LSV3). *We all are leaders here (LSV1)*
Employees expectations of an effective leader	Collaborative leaders	*"The leader should have a passion. Because through passion, real things are born"* (LSV1) *"Clever, loving people. Courage to tell the truth" (LSV7)* *"True leader has to have a knowledge and passion for selling an idea" (LSV2)* *"She was a great leader, and she could sell everything to everybody" (LSV1)* *"True leader has to be connecting person between person and organization" (LSV6)* *„Leader must lead to confidence" (LSV7)*

5. CONCLUSION

In the article was tried to reveal the experience of cultural collaboration on the local level, basing on collaborative theories. The survey shows that deepening in cultural collaboration in arts management creates new significant categories one of most relevant is an aspect of trust, the collaboration between different stakeholders who must combine economic and artistic interests. It shows that more in-depth research and unique theoretical models for art management are needed. One case study revealed that each cultural organization seeks recognition, instead of a common goal. It would be useful to create a new system, one team or board with representatives from all organizations, who could coordinate the artistic work of all organizations because cultural policies are only seen as an opportunity for subsidies. Also, clear political and transparency in funding mechanisms commitment is needed.

Personal ambitions, different attitudes of artists and managers are often obstacles for cultural collaboration. Desirable to include local community cooperation with cultural organizations, that would reduce cost, increasing self-confidence and strengthens of community and prides itself on its city.

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THE AUGMENTED REALITY PIVOT FROM TANGO TO ARKIT AND ARCORE

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Abstract: *Augmented reality is the technology allowing devices to place virtual objects in the physical world. Devices can be HMD, smart glasses or smart phones. Looking at smart phones, Tango was the most advanced technology available on the market. Being a hardware solution required special cameras that increased the devices price and was limited to only new future phones. The announcement of ARKit brought large attention from the developers making Google in order to be competitive to pivot to ARCore as a software solution.*

Key words: Augmented reality, Tango, ARKit, ARCore

1. INTRODUCTION

Augmented reality can be used for different purposes such as adding additional information’s, visualizing products, entertainment, marketing, use in military, medicine, industrial design, tourism and education.
At first augmented reality was enabled by using computers with special peripherals. The need for HMD (Head mounted display) devices was obvious for building a portable system. These systems were mainly computers placed in backpacks. With the rapid growth in processing power computers were replaced with tablet computers and UMPC (Ultra Mobile Personal Computer). The same growth enabled augmented reality on smart phones and later the development of Google Tango devices containing wide angle and depth camera for better understanding of the environment.
While there were a lot of augmented reality SDKs available to develop applications on regular smart phones, few could image the effect of a ARKit and the pivot of Google to ARCore.

2. GOOGLE TANGO

Tango is a platform developed by Google for creating applications that can understand the position of the device relative to the environment. The very first beginnings are from 2014 in the form of two devices: Peanut phone and Yellowstone tablet. Both of the devices were primarily targeted at researchers and application developers. To this day we have only two commercially available phones: the Lenovo Phab 2 Pro and the Asus ZenFone AR. Tango

devices have three cameras: standard RGB camera, depth sensing camera and a wide angle camera tracking the motion of the device.

Tango devices are different from regular phones in that they provide:

- Motion tracking with the combination of the accelerometer and the gyroscope with the wide angle camera which provides the position and orientation of the devices with 6 degrees of freedom. This technology alone does not enable the device to remember past movements meaning every motion tracking starts from a relative starting point. Additionally when tracking for continuous time period and larger distances the sum of small tracking errors and drifts can lead to larger errors to the absolute position of the device. The solution for these limitations as well as enabling the technology to understand the environment is the technology that enables
- Area learning by remembering the visual features such as edges and corners and the other unique features which can be later recognized. This learning is done by storing a mathematical description of the visual features in a searchable index. That enables the device to compare the features that are seen at the moment to the features that have been seen in the past.
- Depth sensing enabled by including three different technologies: Structured Light, Time of Flight or Stereo. The first two technologies require infrared projector and sensor and the Stereo technology requires dual camera. The two commercially available phones, the Lenovo Phab 2 Pro and the Asus ZenFone AR use the Time of Flight technology. ToF gets the distance of the camera and the physical objects by beaming infrared signals and calculating the time for the signal to reflect back to the sensor.

Tango has the functionality for the depth data to be stored in a point cloud in x,y,z coordinates for the points that allows for their calculation. Each of the dimensions is a decimal value and represents the distance in meters.

These characteristics allow the user to explore the physical world with special Tango applications in a Google Play Store[1] category.

Starting from autumn 2017 the Google Expeditions program expanded into Google Expeditions AR. This program[2] allows the schools to apply[3] so their students get the opportunity to experience the Tango technology.

2.1 Hardware and software limitations

Depending on the use case having a Tango device for recognizing markers that are placed at a greater distance is not suitable for this technology. That is due to the depth sensing camera range that is optimal for distances in the range of 0.5 to 4 meters. The upper limit of 4 meters is set because the range directly effects the battery consumption.

It is worth noting that the depth sensing camera uses infrared light making it not suitable for outdoor usage. If objects are placed in direct sunlight it would translate in imprecise

[1]https://play.google.com/store/apps/collection/promotion_3001310_project_tango_featured
[2] https://edu.google.com/expeditions/ar/#about
[3]https://docs.google.com/forms/d/e/1FAIpQLSfhJfHuSFzmFvjlNBoYuNMd20Vy1EyoYvGNJQmILDAf0ZSAYA/viewform

recognition or even with no data on the distance from the objects. The depth sensing camera gets the best results indoors and when being faced with lesser reflective surfaces. Reflective surfaces like mirrors or glass contribute to bad results for the depth data.

The announcement of Hopak version of Tango in 2017 featured the ability to recognize fiducially markers in the form of QR or AR tags. This enables Tango to recognize the corners and positions of the fiducially markers.

The problem with Tango is that it cannot recognize objects without fiducial markers but by using natural features of a marker. Technically this problem can be solved by using Tango in a combination with some of the other SDKs that enable recognition based on natural features. The limitation of using Tango with another SDK is the exclusive ownership of the camera. In one case[4] this is solved by redirecting the camera frames from the other SDK (in that case ARToolKit) at the expense of decreasing the resolution. Although that case uses fiducial marker, ARToolKit has the functionality of recognition of natural features.

Lenovo Phab 2 Pro being the first commercially available Tango device got negative critics on the choice of Snapdragon 652 chip taking it as not powerful enough for Tango applications. From this we can conclude that using Tango in a combination with another AR SDK is not effective.

3. ARKIT

With the introduction of iOS 11 Apple introduced the ARKit framework intended for placing virtual objects in the physical environment. Before creating ARKit Apple had bought Metaio which was one of the leading companies and had one of the most popular tools between the developers and got access to the software, patents and the experience in augmented reality. All the know-how, the intellectual property and the team of Metaio, as part of Apple was complemented with the acquisition of Flyby Media[5], Vrvana[6] and SensoMotoric Instruments (SMI)[7].Tracking of the environment in ARKit is done by using VIO (Visual Inertial Odometry), a technique that merges the data from the camera and the m-coprocessor. The m-coprocessor is embedded in the A processor and has the task to collect, compute and transfer data from the accelerometer, gyroscope, compass and barometer. This methodology is easy on the computing on the main processor and enables battery saving. The tracking in ARKit is a light SLAM compared to Tango or HoloLens which both use depth cameras. Because the physical world is in 3 dimensions and the phones display is in 2, there is the need for the virtual objects to be places in a way that corresponds with the physical world. This puts the question on how to get 3 dimensions with just one camera. Two views from a scene are required to get a stereoscopic calculation[8] of the position of the device. Using a single camera with the data from the internal sensors enables those two views even so when the user is

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holding the device still the internal sensors read the movement and time. This reading occurs around 1000 times in a second. In comparison the data from the camera is read 30 times (frames) per second. Combining these sensors means that calibrating and error removal is key. Additionally the data about the lightning of the environment is used to apply the correct lightning and shadows to the virtual objects.

Made with ARKit is a web site where the best applications developed with ARKit are handpicked. On Twitter the hashtag #madewithARKit is used to promote applications developed with ARKit. Searching with this hashtag can result in pretty intuitive ways of using ARKit such as using computer generated graphics for recording a video[9].

ARKit's greatest advantage is that is can be used on devices that were out in the market before its announcement. Tango being a hardware solution required the three specific cameras: standard RGB camera, wide angle camera and a depth camera. Although having the combination of those specific cameras gets to a more precise tracking, OEMs wanting to develop a Tango device faced the increased cost of materials for the cameras. Therefore only by having a mass production of multiple Tango devices would decrease the cost of the cameras. Although there are lot of scenarios where applications will use the full potential of ARKit there are a number of limitations that can be explored from different aspects. First ARKit is only supported on devices that have at least the A9 processor such as : iPhone 6s/6s plus/SE and the iPad (2017) and their successors. This means that devices running on the Android operating system are not supported to run applications using ARKit.

The first experiences with ARKit that are shared on social media[10] suggest high battery consumption. This is expected for an augmented reality application where the effect on the battery is comparable to graphically intensive games. In the very first version ARKit was limited to only recognizing horizontal planes. Also ARKit did not have the ability to recognize markers through their natural features. This inclusion of this feature was expected when we take the fact that Metaio's SDK featured it before being acquired by Apple.

With iOS 11.3 Apple included ARKit 1.5[11] which included the detection of vertical planes. According to the initial testing[12] of this feature the detection of vertical planes (in most of the cases walls) is not on the same level as the horizontal planes. Detecting vertical surfaces is good when there are images, text or art placed on the walls. This version also includes the recognition of 2D images[13] used in scenarios such as bar codes placed on food packaging[14] for providing additional data on the nutrition facts and recognition of books[15] for displaying additional data such as user reviews and ratings. ARKit 1.5 also increased the operating resolution from 720p to 1080p. In a UBS report by Steven Milunovich, cited by Business

[9] https://twitter.com/Trashgames/status/891419824752087040/video/1
[10] https://twitter.com/damian0815/status/872194002778558464
[11] https://developer.apple.com/arkit/
[12] https://medium.com/inborn-experience/arkit-1-5-another-brick-in-the-wall-what-wall-ed1888a35b4a
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[15]https://twitter.com/AndrewProjDent/status/958759429473734657?ref_src=twsrc%5Etfw&ref_url=https%3A%2F%2F9to5mac.com%2F2018%2F02%2F01%2Farkit-1-5-improvements-ios-11-3%2F

Insider[16] it is stated that more than 1000 employees in Apple are working on a project related to augmented reality. From this we can see that ARKit is only the beginning for Apple in augmented reality and in the near future we can be nearly certain that the "next big thing" might be an augmented reality device.

4. ARCORE

As an answer to ARKit, Google announced ARCore[17]. The core augmented reality technologies are based on the three year experience with Tango. At the very beginning it was offered as an early preview for the developers to experiment with different augmented reality user experiences. This approach gave the developers the opportunity to give feedback for the early API versions. In the case of ARCore there isn't the need for additional hardware which makes it easy to be ported on devices that are already on the market. The very first supported devices were the Samsung S8 and the Pixel phones, but with the collaboration with companies such as Samsung, Huawei, LG, ASUS and others Google is targeting at 100 million devices[18].

ARCore works with JAVA/OpenGL, Unity and Unreal and offers:

- Motion tracking: by tracking the feature points via the camera and the IMU sensors it determines the position and orientation of the phone relative to the physical world. This enables for a precise positioning of the virtual objects with a perspective delivering them as they are part of the real world.
- Environmental understanding: by tracking a cluster of feature points that are part of horizontal or vertical surfaces such as the floors, tables and walls it creates planes that can be used to put virtual objects on them. Because of the nature of detection with feature points surfaces with textures and details are much better detected than blank surfaces such as white walls.
- Light estimation: by gathering information of the lighting of the environment the ARCore determines the average intensity and colour correction of the camera image. This enables for putting the corresponding light to the virtual objects making them more realistic.

ARCores code is available on GitHub where it can be downloaded and developers can report bugs or problems. On Stack Overflow there is an official ARCore tag for posting questions. Having only a limited number of devices being supported by ARCore followed a modified version posted on GitHub allowing it to be executed on various devices[19] as well as a table in which developers can contribute with the status of functionality of their device.

With the first official version ARCore was available for a larger number of devices such as: Google Pixel, Pixel XL, Pixel 2 and Pixel 2 XL; Samsung Galaxy S8, S8+, Note8, S7 and S7 edge; LG V30 and V30+ (Android O); ASUS Zenfone AR; and OnePlus 5[20].

[16] http://www.businessinsider.com/ubs-apple-1000-engineers-ar-2017-2?r=UK&IR=T
[17] https://developers.google.com/ar/discover
[18] https://www.blog.google/products/google-vr/arcore-augmented-reality-android-scale/
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5. ARKIT AND ARCORE COMPARISON

Besides the naming of the technology being used both ARKit and ARCore offer the same functionality to the application developers. The main difference consists in that ARKit is for Apple devices and ARCore is for Android devices.

ARKit has the starting advantage because of the tight hardware/software integration mainly by calibrating the sensors that leads to more precise tracking. On the other side ARCore has the previous experience with Tango that gives it advantage in mapping of the environment. Generally speaking these differences are hardly noticeable by the end users.

At first a lot more users will be able to use ARKit applications delivering Apple a much larger user base. This is expected because of the previous generations being able to support ARKit just by updating to the latest version of iOS. Google on the other hand has their Pixel devices but it also has to work with OEMs to bring ARCore to other devices. One of the greatest limitation is the positioning of ARCore as a part of Google Mobile Services which limits the China the largest market for mobile devices. It is still early for comparing the quality of the applications made with ARKit and ARCore and it is generally up to the developers on the quality of their applications.

6. ECONOMIC PREDICTIONS

Tim Merel in a techcrunch[21] post made an analysis about the expected profitability of ARKit and ARCore. A single indicator cannot lead to a conclusion because there are a few key factors when determining the profitability such as: adoption rates, user bases, average revenue per user, in-app purchases, premium apps, ad spend and e-commerce sales.

ARKit is available to a couple of generations of Apple devices and ARCore on only a few devices from different OEMs. This means that ARKit developers already have a large user base that they can place their applications.

On the other hand starting from 2018 ARCore will enlarge the number of supported devices. Calibrating the devices is a key to delivering quality user experience. Therefore one of the potential problems is if OEMs decide to include ARCore only in their flagship devices. Having such a situation would lead to a slower adoption rate.

ARCore being part of Google Mobile Services means there need to be a different solution for the China market. Digi Capital's[22] expectations are that in 2018 ARKit applications will be installed on a much larger number of devices than ARCore application but in 2019 the market will change in that ARCore and the ARCore version for China will exceed the ARKit installed applications. The same report expects that in 2018 the average revenue per user for ARKit will be twice the size of ARCore meaning every ARCore developer will need twice the users for each ARKit user. Although the difference in the average revenue per user is expected to decrease it is still significantly large. This could mean that developers will primarily focus on developing ARKit applications with the option of developing ARCore

[21] https://techcrunch.com/2017/10/07/why-arkit-will-make-more-money-than-arcore-or-camera-effects-for-now/
[22] https://www.digi-capital.com/reports/

versions in the future or even not developing an ARCore application at all. Looking at the paid applications and games available for iOS and Android it is expected for ARKit applications to be developed in a larger number compared to ARCore applications. The same goes for in-app purchases. The growth of the ARCore user base in the next couple of years would mean larger revenue from advertisements in ARCore applications. The overall revenue of paid applications, in-app purchases and advertisements will be greater for ARKit until 2019 but from 2020 it will shift to benefit the ARCore applications.

7. THE "TANGO" FUTURE

The very first announcement of ARCore set the question about the future of Tango. Until the announcement of ARKit the market had only two Tango devices. On one side we had Google collaborating with OEMs in order to bring new Tango devices. On the other side Apple's ARKit was immediately available to two generations of devices with a simple update. Google had to keep the competitiveness by pivoting the path to a software rather than a hardware solution for its augmented reality offering. This step allows for a larger number of applications on a larger number of devices. Developing a quality augmented reality application requires tight hardware/software integration. Although the first iterations of ARCore are inferior to Tango's offerings it s a solution that can be implemented on a much larger number of devices.

My prediction is that in the near future all of the attention will be put towards creating creative and innovative applications based on ARCore and ARKit. The possible actualization of future Tango devices depends on two key factors:

- Reducing the cost of components. The additional hardware such as the wide angle and the depth camera affects the final price of the device. That is why reducing the cost of the components would lead to more competitive pricing.
- Including a depth camera on some of the next iPhones. Apple has a great influence on the mobile phone marker. That is seen by the capacitative touch screens, the removal of the headphone jack and even the screen notch all of which were then taken as a standard by the Android OEMs. That is why implementing a depth camera in any of the future iPhones will open the path for Samsung, LG, Huawei or any other OEM to include a depth camera.

The iPhone getting Tango like functionalities will contribute to the following:

greater precision and better tracking of the virtual objects, better understanding of the environment and better addressing of the occlusion (covering of the real objects positioned in front of the virtual ones) and new ways of interaction, hand gestures. The same report looks into the market for depth cameras using the ToF (Time of Flight) sensors. They are Infineon Technologies AG, Sony Corp., STMicroelectronics NV and Panasonic Corp. Infineon Technologies AG the makers of sensors found in the two Tango devices the Lenovo Phab 2 and the ASUS Zenfone AR. STMicroelectronics NV are the makers of the sensor used in the iPhone X.

Sony is one of the largest manufacturers of camera sensors that are used by many of the most popular phones. That is why it is expected for Sony to focus on perfecting the Time of Flight

technology. According to a Bloomberg[23] report Sony are developing sensors for phones and augmented reality devices which can later be implemented in drones, autonomous vehicles, gaming consoles, industrial equipment and other machines that need to interact with the environment. Satoshi Yoshihara, Sony's general manager for the sensors division, expects that sensors will become one of the primer pillars of the company. As previously stated, implementing a Time of Flight sensor in a future iPhone will radically increase the demand for these types of sensors.

With the announcement of ARCore as a direct competitor to ARKit, CNET's reporters came to a conclusion that Tango is a failed experiment[24]. But if future phones include depth sensing cameras and the applications are ARCore based then we can take it more as a rebranding than anything else.

8. CONCLUSION

Google had Tango phones as the most advanced technological phones enabling augmented reality. Requiring special cameras resulted in higher component cost for OEMs in a very competitive market. Also being a hardware solution meant that only new devices could be Tango enabled and that the solution was not backwards compatible. Having a hardware solution as "the" augmented reality device proved not to be the right formula.

At start ARKit was available to millions of phones and attracted large amount of developers. Google had to pivot from Tango to ARCore that is a software solution also available to millions of users. Both ARKit and ARCore essentially offer the same functionalities to developers and users can't generally notice any differences. The next few years are set for a much larger number of devices that support ARKit and ARcore and many more applications using them. That will result in different methods of valorisation such as premium applications, in-app purchases, advertisement and e-commerce. Future "Tango" devices might not be Tango branded but any of the next iPhone versions containing rear facing depth camera will open the path to other OEMs to build competitive products based on the principles set by the Tango technology.

[23] https://www.bloomberg.com/news/articles/2017-10-24/sony-s-big-bet-on-sensors-that-can-see-the-world
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APPROVAL OF MACROECONOMIC INDICATORS ANALYSIS IN TRANSITION COUNTRIES AS A THEORETICAL APPROACH TO BASIC MACROECONOMIC ANALYSIS

Sonja Tomaš–Miskin[1]

Abstract: *There are a number of macroeconomic indicators used in theory and practice in macroeconomic analysis. In this paper special emphasis is placed on macroeconomic indicators such as: gross domestic product (GDP), exports, exports, FDI (foreign direct investment), all of which are practically applicable in countries such as: Bosnia and Herzegovina, Republic of Serbia and Montenegro, Northern Macedonia.*
Gross Domestic Product is said to represent the market value of the total mass of products (tangible goods and manufacturing services) produced in a country over a period of time, which is usually one year.
Analysis of the most important macroeconomic indicators, such as GDP, exports of goods and foreign direct investment (FDI). Therefore, foreign direct investment means the investment of foreign capital by an investor of a resident (enterprise) of one country into a resident (enterprise) of another country for the pursuit of common interests.

Key words: *macroeconomic indicators, GDP, exports, imports, FDI.*

1. INTRODUCTION WITH THE IMPORTANCE OF IMPORTANCE OF APPROACHING MACROECONOMIC ANALYSIS

Macroeconomics has developed a large number of macroeconomic indicators for the purposes of its analysis, and each of them, depending on the method of calculation and its structure, is an adequate indicator of the results or structure of results of the economic system of a country.

One of the most used macroeconomic indicators, both in economic analyzes of a particular economy and in its comparison with other economies, is gross domestic product (GDP). One definition in practice is that a Gross Domestic Product represents the market value of the total mass of products (tangible goods and manufacturing services) produced in a country for a

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given period of time, usually one year. GDP therefore measures the value of all social production in one year

2. NOTES THAT HAVE A SIGNIFICANT IMPACT ON GROSS DOMESTIC PRODUCT, ESPECIALLY IN TRANSITION COUNTRIES

In order to better understand the essence of Gross Domestic Product Indicators, it is necessary to pay special attention to a few important points, namely:

(1) Gross domestic product represents the market value of all products and services produced in one country over a period of one year, which would mean that the market prices of goods and services on the market are used to calculate it.

(2) When calculating the gross domestic product, certain values are not included as intermediate products, because their value has already been calculated in the value of the final products. Just as flour will not be included in the calculation of the gross domestic product (although the flour is the final product for the flour producer itself) if it was used to produce bread during the accounting year (in this case the flour is not the final product but a material), excluding intermediate Gross Domestic Product calculation avoids the calculation of the same products several times, flour that has been put in stock and not sold during the accounting year can be considered as a final commodity temporarily, its value will increase the gross domestic product, but when that flour is in progress next year, used to make bread, its value will be transferred to the final product as part of the price of the final product.

(3) Gross Domestic Product calculation includes goods and services, which would mean that when using cosmetic treatment, the Gross Domestic Product calculation will include the market price of the cosmetic products used in the treatment itself (as goods), but also the market price of the treatment itself (as services).

(4) The gross domestic product includes only those products that were manufactured during the accounting year, which would mean that the market price of the car would be part of the gross domestic product in the accounting year in which the car was manufactured, and in the case where the same car is sold as a used car by the same owner. car, its market value achieved at that point will not enter into the gross domestic product calculation.

(5) Only goods and services that have been legally sold during one accounting year are included in the calculation of gross domestic product, indicating that this macroeconomic indicator does not account for transactions performed within the informal economy or for transactions arising from criminal activities (drug sales, smuggling, etc.).

(6) the calculation of the gross domestic product of the home country also includes goods and

services produced in the territory of the country of origin by foreign companies or foreign citizens: for example, the engagement of a Serbian worker in Germany is part of German gross domestic product (because his work produced certain product in the territory of

Germany), as is the work of a German citizen on certain temporary work in Serbia as part of the gross domestic product of the Republic of Serbia.

It is also important to emphasize the fact that the gross domestic product is a macroeconomic indicator that simultaneously expresses two quantities: (1) total income of economic entities, and (2) total costs of all goods and services in a given economy. Consequently, total income always equals total cost.

The essence of this equality can be better understood if, if a citizen of the Republic of Serbia pays a car repair for him, this transaction will be a cost. For the car mechanic who made the repair, that transaction will represent income. In this way, within one economy, total income and total costs are exactly the same.

Due to the fact that money in the economy is constantly circulating between economic entities (individuals, households, enterprises, the state, etc.), this means that the gross domestic product can be calculated in two ways: (a) by adding up the costs of all economic entities, (b) by adding up the incomes of all business entities.

Both of these methods of calculating the gross domestic product are possible precisely because each income in one economy is at the same time one's expense, and each cost is simultaneously the income of someone else [15; 16; 17; 18].

3. GROSS DOMESTIC PRODUCT INDICATOR

Gross domestic product is both an indicator of the output of a particular economy and of its consumption. Total gross domestic product, which is realized within a certain economy, that is, national economy, is divided into different types of consumption.

When we analyze the structure of gross domestic product in terms of its consumption, we come to the realization that a certain economy uses the limited resources at its disposal.

4. GROSS DOMESTIC PRODUCT STRUCTURE

The structure of the Gross Domestic Product is represented by the following formula:

$$\mathbf{GDP = P + I + G + (E - M)}$$

The preceding formula shows that every dinar of Gross Domestic Product is spent in a certain way. For this reason, the components of the gross domestic product should be set up as:

Product would be: (1) consumption (P) - includes final or final consumption of individuals, or households, households spend their entire income or some of their income on savings, (2)

investments (I) - relate on the consumption of enterprises as economic entities and include the purchase of fixed assets, facilities, equipment and the like, (3) government spending (G) - includes the total expenditure of the state apparatus, from the process of investing in the construction of modern roads to the salaries of civil servants (these salaries are part of the

state expenditures because the state pays them the labor of the labor force it hired), but they do not include so-called transfer payments (such as pensions, social security benefits, various subsidies to companies), because these types of payments are not an expression of production, and therefore cannot be part of government spending, (4) difference between exports and imports, i.e. net exports (E - M) - exports increase gross domestic product, while imports decreases.

Most modern economies are so-called open economies, where means that they exchange goods and services abroad (as opposed to closed economies that do not) and therefore have to include export and import components in the calculation of their gross domestic product. It should be noted that many authors have the importance of standard financial studies [1; 2; 3; 4; 5; 6] in the management structure of the economy [7; 8; 9; 10, 11], which can be fundamentally influenced by top management [12; 13; 14] in the short term, unlike many macroeconomic factors that have been influenced by very limited and limited ones.

The structure of the Gross Domestic Product can be viewed from both a value and a natural point of view. When viewed from a natural point of view, the gross domestic product is a set of large numbers of qualitatively different products and services.

Gross domestic product, viewed from the natural aspect, is divided into products intended for production consumption, i.e. re-production and products intended for final consumption. The process of calculating the gross domestic product expressed naturally would be a very complicated computational operation, both because different products are expressed in different units of measurement (kilograms, centimeters, liters), and because collecting data on them would be a laborious task.

5. CONCLUSION

The basic conclusions drawn from the presentation of the theoretical bases for further analysis, as well as the insights into the relevant macroeconomic indicators for Bosnia and Herzegovina, Serbia and Montenegro, Serbia and Northern Macedonia, show very similar, if not identical, trends.

The following conclusion could be presented, that in the Western Balkan countries during the analyzed period minimum values are present in the initial years (2000-2007) and maximum values in the final years of observation (2007-2017).

At the same time, the last conclusion could be that macroeconomic indicators can serve as a basis for the practical management of companies first large and then medium and small companies, as these indicators show the general business conditions that are important for the functioning of top management in the decision-making process. Companies have little or no impact on these metrics.

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CROSS-STUDY OF DIGITAL CONSUMER PREFERENCES

Katalin Tari[1]

Abstract: *The appearance of Industry 4.0 has had a significant impact on the logistics and management processes of many companies. The study of this topic is also relevant because new shopping habits and marketing strategies on the internet have evolved and transformed with the popularity of online shopping. This study shows comparable habits of online consumers as well as the differences between Hungary and the United States in this regard. The study was based on the results of an online questionnaire. The standardized questionnaire was completed by students from Szent István University and Murray State University, Kentucky, and their friends, and I used the Survey Monkey page for this purpose. The Hungarian survey was conducted between 23.09.2016 and 07.01.2017, and the American one between 24.02.2017 and 01.05.2017. For processing the data obtained during the research I used the IBM SPSS Statistics 21 statistical software package. This analysis focuses on demographic data and on consumer behaviours that reduce the risks associated with online consumer habits. I used quantitative research techniques in order to reveal more precisely the consumer behaviour of the target group. During the basic research I conducted a non-representative survey on a sample of 932 people. Of these, Hungarians represented 729 people, Americans 203 people. The answers to the questions were first subjected to descriptive statistical analyses (mean, standard deviation, and frequency). The Likert scale was used, ranging from 1-5, forming a continuous ordinal scale. Accordingly, I applied a parametric procedure to examine the relationships between the statements of my questionnaire. Multivariate analysis of variance was used to examine the groups created during the analyses and the differences and relationships between them. The analysis of the Hungarian and American samples showed significant differences in income, place of residence and highest educational level; therefore, these variables were included in the analysis when comparing the answers of the questionnaire internationally. In summary, in the multivariate analysis of variance, the dependent variable was the value of responses to each of the online shopping statements, while the independent variables were nationality, income, place of residence, and highest educational attainment.*

Key words: *e-market, cross-study, online marketing, customer behaviour. online customer, online shopping.*

1. INTRODUCTION

The focus of this paper is to characterize consumer behaviour when shopping online in

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Hungary and in America. My choice of subject was greatly influenced by the research scholarship that was established between Murray State University and Szent István University, which allowed me to work overseas. The primary purpose of my research is to highlight which variables and information play a key role in influencing online consumer behaviour of the populations of the two countries. This includes mapping the factors behind the risk reduction behaviours associated with online consumption based on the responses of the sample participants. Before starting my research, I assumed that convenience, speed and the possibility of buying food from home, even using VR glasses, play an important role in the e-shopping (shopping on the Internet) habits of Hungarian and American consumers.

The number of American online buyers was 197.6 million (MINIWATTS, 2018). In Hungary, this value is much lower, exceeding 3 million people only in 2017 (ORIGO, 2018). Compared to the EU average (65%), the number of Hungarian online buyers (47%) from among internet users is lower (PORTFOLIO, 2016).

In terms of online commerce, retail sales (as well as number of sellers) increased significantly in 2015. Online purchases accounted for 2.5% of total retail sales in Hungary; their turnover was 229 billion HUF, and since 2010 they have grown on average by 38% annually compared to the previous year (NAGY, 2016). The Technology Acceptance Model (TAM) should be mentioned with regard to the online purchasing decision, which shows the potential for developing technological responsiveness, positive consumer attitudes and positive confidence (DAVIS-BAGOZZI¬WARSHAW, 1989, FEHÉR ¬ SZAKÁLY, 2015). SAM ¬ CHATWIN (2015) first summarized the characteristics of online consumer behaviour in the Online Customer Style Inventory (O-CSI) based on the original CSI (Customer Style Inventory) created by SPROLES and KENDALL (1986). Of the original 8 factors, 7 have been identified which can also be found in the online marketplace. These are: online consumers' pursuit of high quality, brand loyalty, fashion, price sensitivity, product portability, website content, and website design (SAM ¬ CHATWIN, 2015; FEHÉR, 2017).

When looking at factors influencing consumer behaviour, there are many definitions. At the microeconomic level, consumers are characterized by economic, political, legal, technological, infrastructural and cultural conditions within the country (REKETTYE et al., 2015).

KNOKE and KOVÁCS (2018) also mention that the internet can introduce and create new business models by opening gateways to potential retail dealers for potential market niches; however, it rewards large companies with a multitude of network and threshold effects, which in many cases can lead to monopolies. Innovative solutions and new development strategies at micro and macro levels are therefore also highly important. According to a study conducted by IVSZ (2017), with the advent of Industry 4.0, in the digital world ever-increasing value is being given to state subsidies. In 2018, an opportunity and a source of financing was provided for the development of related software and applications.

2. ANALYSIS

2.1 Methodology

The results of the research are based on Hungarian and American online buyers in 2017. The

analysis begins with the demographic characterization of the sample. During the demographic analysis I found a special statistical relation between age groups, gender and income. Next, I examined the importance of grocery shopping in terms of online commerce (market place). However, it is important/meaningful/significant to map the range of products and services purchased online by nation. This analysis is given by the multi-dimensional variance analysis of the responses to the questions. Through those responses, I examined the preferences of online buyers.

The study was based on the results of an online questionnaire. The standardized questionnaire was completed by students from Szent István University and Murray State University, Kentucky, and their friends, and I used the Survey Monkey page for this purpose. The Hungarian survey was conducted between 23.09.2016 and 07.01.2017, and the American one between 24.02.2017 and 01.05.2017. For processing the data obtained during the research I used the IBM SPSS Statistics 21 statistical software package.

The analysis focuses on behaviours that reduce the risks associated with online consumer habits.

I used quantitative research techniques in order to reveal more precisely the consumer behaviour of the target group. During the basic research I conducted a non-representative survey on a sample of 932 people. Of these, Hungarians represented 729 people, Americans 203 people, and respondents claiming to have extreme (unrealistic, such as 1,999,999 HUF or 666,666 HUF) per capita net income were excluded.

The main subjects of the online survey included willingness to shop online, trust, online grocery shopping with VR glasses, and ordering from home. This was based on my earlier study on the popularity of online shopping and how to build trust.

The answers to the questions were first subjected to descriptive statistical analyses (mean, standard deviation, and frequency). The Likert scale was used, ranging from 1-5, forming a continuous ordinal scale. Accordingly, I applied a parametric procedure to examine the relationships between the statements of my questionnaire. Multivariate analysis of variance was used to examine the groups created during the analyses and the differences and relationships between them. The analysis of the Hungarian and American samples showed significant differences in income, place of residence and highest educational level therefore these variables were included in the analysis when comparing the answers of the questionnaire internationally. In summary, in the multivariate analysis of variance, the dependent variable was the value of responses to each of the online shopping statements, while the independent variables were nationality, income, place of residence, and highest educational attainment..

2.2 Characteristics of the sample

In this research, total of N=932 people participated in the survey. Based on the answers provided, out of the total number, 371 are men (40.1%) and 555 are women (59.9%). Having split the sample by nationality, it seemed professionally justified to separate the respondents into four age groups. These were adolescents (16-20 years), young adults (21-25 years),

early-stage adults (26-30 years), and mature adults (over 30 years). The oldest respondent was 73 and the youngest was 16. The rounded average age was 27. The age distribution of Hungarian and American respondents was similar. Most of the people who participated in the research were aged between 21 and 25 and between 26 and 30 (following a similar pattern for both nations).

On the whole it can be said that Hungarian consumers have a lower income than their American counterparts in the sample (Chi2 (4) = 77,391, p <0.001). A significantly higher proportion of Hungarians have well below average incomes. 24% of Hungarian women, 18.4% of men, 4.3% of American women, and none of the American men belonged to this income category. A significantly higher proportion of Americans fell into the category of average or above-average income. Most American respondents (76.3%) lived in rural areas, 14.5% in the capital and 9.1% in cities. Almost half of the Hungarian respondents (47.4%) live in the capital, while 40.5% lived in cities and only 12% in villages.

2.3 Limitations of the analysis

It should not be ignored that the sampling of the research is not fully representative and that there are many differences between Hungarian and American students, such as fundamental cultural and technological differences. Taking all of this into account, I will conduct analyses that highlight the similarities and differences and may serve as a basis for further research.

3. RESULTS

3.1 Factorial ANOVA

In order to examine the preferences of online consumers, I analysed the responses to the 12 statements, i.e. ‘items’. The responses were on a Likert scale ranging from 1 to 5 (1 - strongly disagree with the statement, 5 - strongly agree with the statement). A plus variable was the ‘Do Not Respond/Don't Know’ option, which, if chosen, was always excluded during the analysis. I examined the two nationalities separately, the descriptive statistical indicators of which will be presented at the conference but this table shows that both Hungarian and American consumers showed the highest average values for more choice and flexibility of time, while comfort was the third. In addition to the averages, the frequency data for each category on the 1-5 scale also show 79.3% of Hungarians gave responses of 4 and 5, with 84.7% of Americans responding in the same way. Because the Hungarian and American samples showed significant differences in income, place of residence and highest educational level, these variables were further considered when comparisons of the 12 statements between the two countries were included in the analysis. Thus, I examined the main effect of nationality and the following interactions already mentioned in the methodology:

1. Nationality: residence of response (American or Hungarian)
2. Nationality compared with place of residence
3. Nationality compared with education
4. Nationality compared with income

The main effects, discrepancies and interactions obtained in the analysis are highlighted in gray.

Table 1: Test of Within - Subject Effects Based on Nationality and on the Interaction of Analysed Demographic Data (source: own data)

Preferences for Online Shopping	**Nationality**			**Nationality compared with residency**			**Nationality compared with education**			**Nationality compared with income**		
	F	p	η^2p	F	p	η^2p	F	p	η^2p	F	p	η^2p
It is cheaper to shop online	0.128	0.721	0.00	1.571	0.180	0.01	2.522	0.040	0.01	2.096	0.034	0.02
Shopping online is faster.	2.237	0.135	0.00	1.862	0.115	0.01	0.401	0.808	0.00	1.902	0.057	0.02
I get better quality products if I shop online.	5.652	0.018	0.01	1.778	0.131	0.01	2.963	0.019	0.02	2.275	0.021	0.02
Selection is bigger online.	0.480	0.488	0.00	1.181	0.318	0.01	0.936	0.442	0.01	1.080	0.375	0.01
I choose it because of a flexible schedule.	0.215	0.643	0.00	0.672	0.611	0.00	0.117	0.976	0.00	0.382	0.930	0.00
I can only purchase these products online.	5.194	0.023	0.01	0.668	0.615	0.00	1.807	0.125	0.01	1.478	0.161	0.02
I just compare the products online with each other.	4.891	0.027	0.01	1.433	0.221	0.01	0.207	0.935	0.00	2.262	0.022	0.02
I prefer not to buy anything online because I can't touch it.	0.346	0.557	0.00	1.519	0.195	0.01	1.865	0.115	0.01	1.314	0.233	0.01
I prefer not to buy anything online because it is not sure that I will get it.	0.682	0.409	0.00	1.114	0.349	0.01	1.258	0.285	0.01	1.313	0.233	0.01
I shop online because it is comfortable.	54.052	0.000	0.07	0.612	0.654	0.00	1.413	0.228	0.01	0.836	0.571	0.01
I think if I am shopping online than it is safer.	0.113	0.737	0.00	0.742	0.563	0.00	0.605	0.659	0.00	0.996	0.438	0.01
If I could shop the groceries online with the help of VR glasses then I would be open to this solution.	0.908	0.341	0.00	0.382	0.821	0.00	1.016	0.398	0.01	1.574	0.129	0.02

For the answer to the first statement ('Buying online is cheaper'), the interaction of nationality compared with educational' attainment (F (4,770)=2,522; p=0.040) and nationality compared with income' (F (8,770) =2.096; p=0.034) was statistically significant.

In the case of the 'nationality compared with education' Hungarian consumers with primary and secondary education were more likely to agree (mean: H_{middle}=3.77) that products purchased online are cheaper than American consumers with the same educational level (A_{middle}=3.48). The opinion of Hungarian and American consumers with higher educational levels did not differ significantly on this question (see mean: $A_{college}$=3,60, $H_{college}$=3,49; $A_{university}$=3,76, $H_{university}$=3,76), as shown in figure 1:

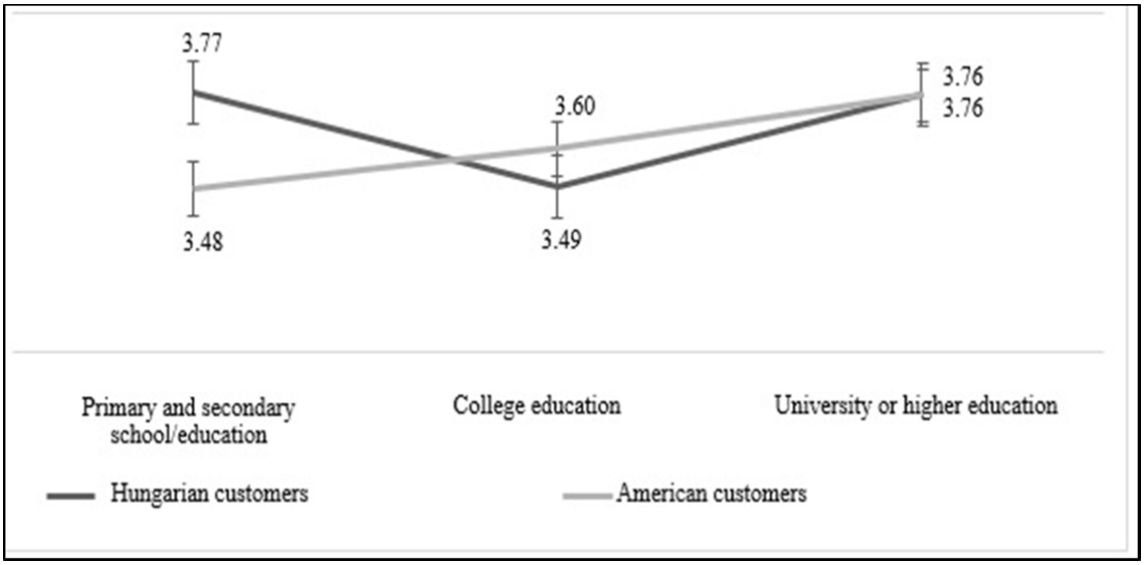

Fig. 1 Analysis of the 'Shopping online is cheaper' Statement Based on 'Education compared with Nationality'

In the case of 'nationality compared with income' interaction, Hungarian consumers were more likely than American consumers to agree that the product purchased online was cheaper. The monthly net income of the household (interaction), in the well-below average income categories (means: $A_{below.income}$=3,04, $H_{below.income}$=3,43), and well-above average (net) income categories (means: $A_{above.income}$=3,38, $H_{above.income}$=3,75) was also a factor.

Hungarian consumers were statistically significantly more likely to agree that online purchases are of higher quality (mean: 3.14) than American consumers (mean: 2.82). The interaction between nationality x education (F (4,767)=2,963; p=0.019) and nationality x income (F (8,767)=2,275; p=0.021) was statistically significant. At each level of education, the Hungarian consumers were more likely to agree with the 'better quality' statement for the nationality x school education interaction; however, Hungarian consumers with primary and secondary education and those with higher education showed a greater difference compared to American consumers.

They buy online because products purchased online are of better quality than American consumers with the same educational level.

In the case 'nationality compared with income' namely, taking into account the household's monthly net income per capita during the research, the incidence of agreement with the statement varied across all income categories. American e-shoppers in all income categories were less likely to agree that they buy online because of the higher quality of products there.

Significant differences were found between people with average income (means: $A_{average.income}$=2,87, $H_{average.income}$=3,27),and those with well-above average incomes (means: $A_{well.above.average.income}$=2,51, $H_{well.above.average.income}$=3,09) in examining the consumer habits of the two nations. This is illustrated in figure 2:

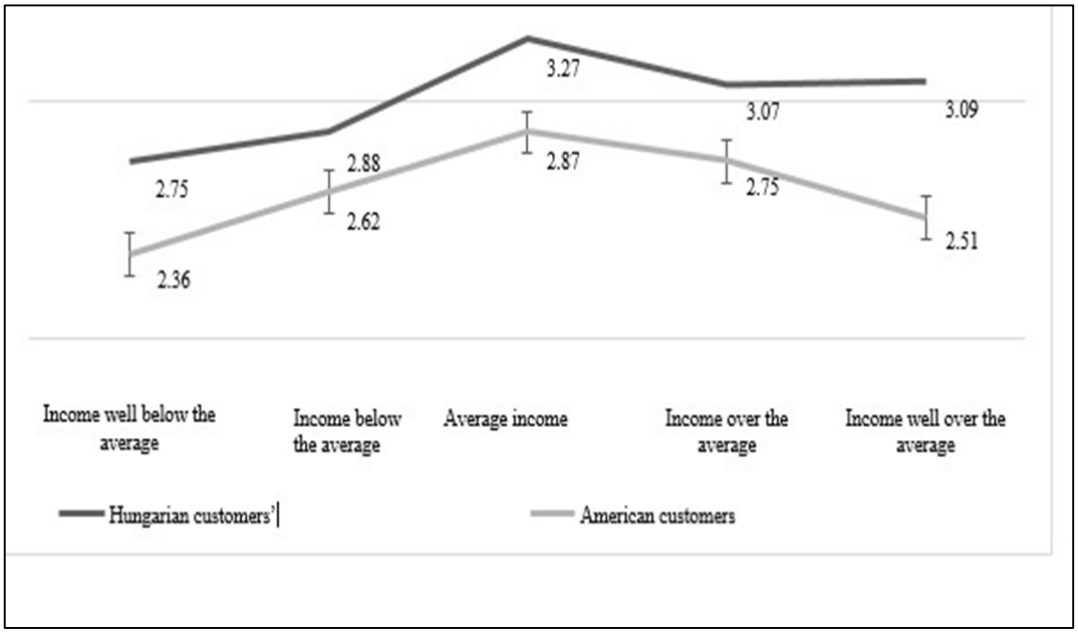

Fig. 2 Analysis of the 'I Get Better Quality If I Shop Online' Statement

Nationality played a statistically significant main effect in the answers to the sixth statement ('You can only buy the product online') (F (1,758)=5.194; p=0.023). American e-buyers were significantly more likely to agree that online purchases can only be purchased online (mean: 3.16) than Hungarian consumers (mean: 2.63). Nationality played a statistically significant main effect in response to the seventh statement ('I only compare on the Internet') (F (1,752)=4.891; p=0.027). American consumers agreed significantly that they only compare the product they want to buy online (mean: 3,16), while Hungarians agreed less to that statement (mean: 2.69). The interaction of nationality x income (F (8,752)=2,262; p=0.022) was statistically significant. Figure 5 illustrates the interaction of nationality x income, where American and Hungarian consumers showed almost the same value only in the well-below-average income category. In the other income categories, Americans were more likely to agree that they were browsing the internet because they were only comparing products than Hungarian consumers with the same income. This shows figure 3:

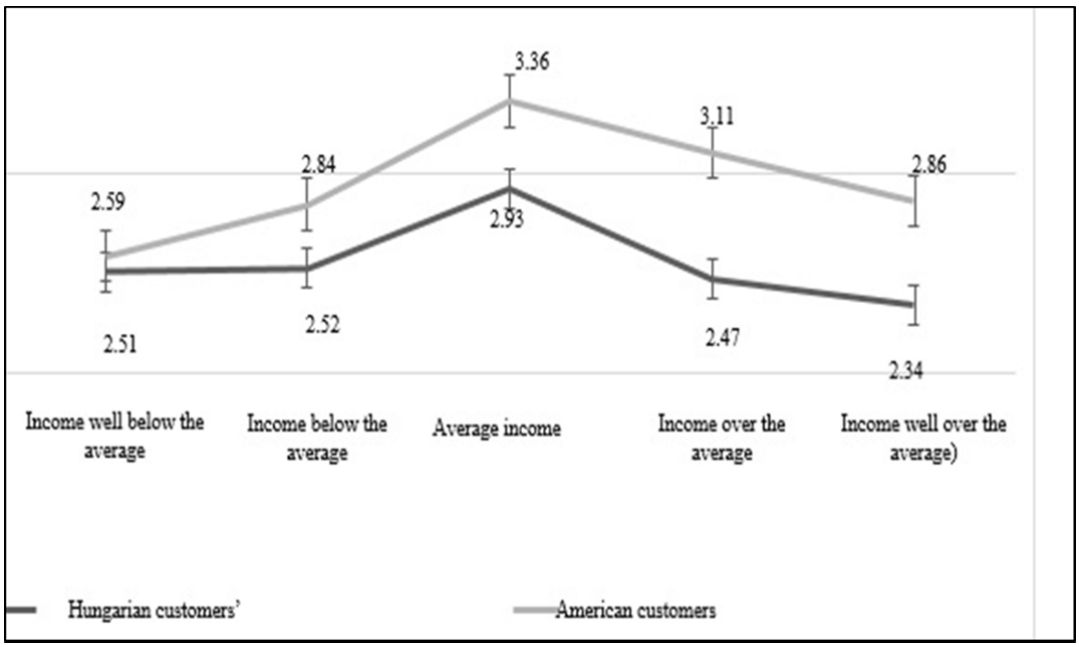

Fig. 3 Analysis of the 'I Just Compare the Products Online' Statement

Nationality played a statistically significant main effect when analysing the tenth statement ('Online shopping is more convenient') (F (1,767)=54,052; p=0.000). In this regard, American consumers were significantly more likely to agree to prefer online shopping for convenience (mean: 4.07) than Hungarian consumers (mean: 2.58). Other main effects and interactions did not show statistically significant results.

4. CONCLUSION

The topic selection is timely because we use the World Wide Web every day in the office and at home. This research analysed, on the basis of a non-representative sample, the national and demographic identities and differences of Hungarian and American online buyers. The first objective of this article is to explore the attitudes of different national categories toward online products and services by analysing research results. The majority of Hungarian consumers in the survey chose hot meals, food and daily consumer goods as their most frequently-purchased online product and/or service category, and 1/5 of them indicated that they used the sites of online insurance and banks. The Americans surveyed tended to buy mostly fashion products, clothing, and accessories online. Further research has revealed that one of the main reasons for different consumer habits (for example, daily consumer goods, semi-finished products, etc.) is given. A further research objective was to explore, based on the results of the study, which variables and information could play a role in favouring online shopping. This is included in the 'justification for online shopping' statements in Table 1, which summarizes the advantages and disadvantages of online shopping. When examining consumer preferences, there was a significant difference in terms of nationality between 'better quality', products 'only available for purchase online' and 'convenience' and 'I just

compare the products online with each other'. In addition, in the case of 'better quality', demographic differences between nations (such as individuals' educational attainment and income) significantly influenced the results obtained. As an example, in the 'well below average income' category, American and Hungarian consumers showed nearly the same value. In the other income categories, Americans were more likely to agree that they were browsing the internet because they were only comparing products than Hungarian consumers with the same income. In the case of the 'I only compare on the Internet' statement, the study showed a significant difference by income level. On the subject of online grocery shopping with the help of VR glasses, I studied consumers 'attitude toward buying food online at home, where the response was a moderate, relatively neutral value for both nationalities. Thus, I did not receive a clear, positive result on the possibility of virtual shopping in the grocery store. Based on the results of my current questionnaire survey, additional potential research topics have emerged in many scientific disciplines (e.g. robotics and software development), which I will investigate in further research.

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