

THE USAGE OF DECISION SUPPORT SYSTEMS IN NORTH MACEDONIAN COMPANIES

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Abstract

The increased complexity as well as the fast pace changes and the escalation of risks that are faced by the companies and their managers imply the need of a computerized support in their decision making process. The increased need for information also imposes the need for these systems whose purpose is to create and make a better use of the information. Managers can better perform when they use the right information at the right time. In order to be competitive, North Macedonian companies need to accept and adapt to the new trends that include information systems and technologies in executing their business activities.

The use of this type of systems offers multiple opportunities for the companies and has certain influence in the workload of the companies. Integrating decision support systems (DSS) companies can make better management decisions by strengthening the decision maker in processing the knowledge, by stimulating the managers in new approaches when thinking about problems, by reducing the time and cost of decision making and by increasing the pleasure level in the process of decision making.

The aim of this research is to review the state of North Macedonian companies regarding the implementation of decision support systems, their usage, the different developed system types and the management level that they are used on.

Key words: decision support systems, management decisions, information systems, knowledge processing.

INTRODUCTION

Decision support systems are interactive, computer based systems that help their users when choosing alternative solutions (Druzdzal, Flynn, 2002: 6). According to Turban, DSS represent interactive, flexible and adaptable computer based information systems, developed to enable decision support of unstructured managerial problems that make the decision making process better (Turban, 1995). These systems allow for data storage and locating and improve the traditional approach to information and their location by using developed models.

Our goal is to determine whether managers in North Macedonian companies use DSS systems, the managerial level on which DSS are used and the DSS purpose. We created a questionnaire that was answered by managers of middle and large companies. To analyze the data we applied descriptive statistics method with the usage of SPSS statistical package.

Decision support systems are usually implemented for strategic and tactical decisions on a higher management level, for low frequency decisions and high outcome potential, as well as decisions in where the time factor for thinking and modeling the problem is a key factor (Druzdzal, Flynn, 2002: 6).

Ada and Ghaffarzadeh (2015) discuss the concept, characteristics, types of MIS and highlight the impact and role of MIS in the decision making process.

Asemi and Safari (2011) discussed the decision making process of MIS and DSS as concepts, discussed their characteristics and relations and determined the connections of the concepts to the decision making process. They presented different models and figures to enrich the discussion by highlighting the status of MIS and DSS in the organizational decision making.

Hakimpoor and Khairabadi (2018) conducted a study that included 250 managers from 17 public organizations on the usage of management information's systems. By using artificial neural networks they discovered that MIS and conceptual dimensions of information's quality have positive effect on the quality on managerial decisions.

Bostan and Durmus (2017) developed reliable data obtaining tool for exploring the decision stage that is sufficient for managers in the public and private sector. They developed a scale that included the manager's recommendations and presented the results under for factors that affect the managerial decisions.

Al-Shargabi and Sabri focuses on the organizations challenges while implementing and managing MIS systems and projects by exploring the challenged and providing a model to tackle them and lead to a successful MIS system organization.

Hasan, Mahdi and Nat (2017) focus on the senior managers problem with providing clear, relevant and accurate information required for making efficient decisions. They concentrate on evaluating the existing information systems and investigating the impact of EIS implementation on the decision making processes in the top management.

The need for decision support systems in companies

According to the traditional approach to decision making process, the decision is correlated to making a choice in: choosing an action (Simon, 1960), choosing a strategy (Fishburn, 1964), choice that leads to the desired goal (Churchman, 1968). In the decision process, certain amount of alternatives are identified and one of them is chosen, but the number of identified alternatives to be considered can be very large and each alternative can be of a high complexity. When the decider is faced with this situation, couple of questions occur: Where are the alternatives coming from? How many alternatives are enough? How to manage the large amount of alternatives in a way that none of them is forgotten or mixed? In this case, computer based systems can be very useful when reviewing the alternatives as well as determining and following the alternatives implications' in a systematic way.

Here we have to note that understanding the alternatives implications does not help in choosing an alternative, but it does help in reviewing and comparing the alternatives in their implications'. According to Keen and Scott Morton (1978) decision support systems are of high importance when making half-structured and unstructured decisions. When making unstructured decisions, decision support systems can be designed to ease the knowledge inspection and synthesize the solution methods. They allow different perspectives to the problems stimulate creative abilities for

the decider. Systems support of half-structured decisions have the same characteristics with the ability of additional pre-specified procedures that aid the decision making. With structured decisions, decision support systems can be used for automatic extraction of completely specified procedures. The main benefit of using these systems is the increased efficiency and the reduced probability of a human error in the decision process.

Decision support system types (DSS)

- Communication managed decision support system (DSS)

Communication managed DSS uses network and communication technologies to ease the decision making process via collaboration and communication. This type of DSS enables for more than one person to work on a shared task. The hybrid network and electronic communication technologies connect the deciders by creating an environment that provides resources and the ability to share information. The dominant component of these systems are the communication technologies and the used software designed to help the groups work together and more efficient via video conferences and computer based boards (Power, 2008: 129).

- Data managed decision support systems

Data managed DSS enable access and manipulation of structured data and can display company data in real time or in time intervals (Power, 2001:431-436). Systems that include data storage allow data manipulation with computer tools developed for a specific task and enable increased functionality. Data managed DSS with online analytical processing allow for the greatest level of functionality. The decision support is connected with analysis of large databases of historical data. Executive information systems and intelligent business systems are examples for data managed DSS that enable the highest level of operation and decision support (Dhar, Stein, 1997).

- Document managed decision support systems

Document managed DSS is a relatively new field in decision support systems. Though the years, document management became more and more important to the companies and therefore the need for a system that would store and manage the multiple documents. Today the development of document managed DSS is enabled by large databases containing documents as well as web technologies. According to Holsapple and Whinston (1996) these systems are also called text oriented DSS. This type of DSS is oriented

on searching and managing unstructured documents (Power, 2002). Document managed DSS is similar to the communication managed DSS but servers more as an infrastructure. Document managed DSS supports decision making by searching and collection the right documents, using computer data storage and processing technologies with the goal of collecting and analyzing the needed documents and therefore the primary tool that helps the decision making in this type of DSS is the searcher (Power, 2008: 130).

- Knowledge managed decision support systems

Knowledge managed DSS originate from intelligent decision support systems or in greater sense artificial intelligence (Negnevitsky, 2005). These are computer based systems where artificial intelligence, expert systems, data mining and communication mechanisms are integrated into one system. Knowledge managed DSS aim to identify the specific meaning by using multiple techniques and data mining tools. Companies are focused on automating as many of the processes so therefore managing the data is of a key importance for decision support.

- Model managed DSS

Model managed DSS are complex systems that help analyze the decisions and choose among the different alternatives (Ghaffarzadeh, 2015: 102). These systems emphasize the approach and manipulation of financial, optimization or simulation model. By definition, one or more quantitative models are the dominant components that enable the primary functionality of model managed DSS (Power, 2004). These systems offer the highest level of functionality by using simple quantitative models. Systems use limited data and parameters provided by the deciders, helping them analyze a certain situation and that is why these systems are not dependent on large data bases. Models that use algebra, especially the ones developed in electronic worksheets are the most used ones in model managed DSS.

Application of decision support systems

DSS focus on efficient decision making when the company is facing half structured or unstructured business problems. That is why DSS need to be designed and developed to help companies reach their goals. Multiple authors have researched the DSS application in various fields. According to Eom, Lee, Kim and Somarajan, DSS are most applicable in the following fields: production and operative management, marketing, finance, strategic management, human resources, accounting. DSS are least applicable in multinational business. Application of DSS in production and operation

management is seen as an effective tool for factory automation and to simplify the technological process with using “just-in-time” production (Eom, Lee, Kim, Somorajan, 1998: 111). DSS in marketing can be used to measure the direct sales profitability, forming competitive prices, designing distribution systems, planning logistics and vehicle schedule and in advertising DSS is used for media planning and choosing the right medium and timeframe. Financial DSS are applied with corporate financing by managing assets and liabilities such as cash, capital budget, financial analysis and evaluation of financial risk. DSS in financial institutions is used for financing strategic product development, planning and connecting companies and acquisitions and the choice to inspect and develop project. In the field of strategic management DSS are applied to: analyze the outside surroundings and trends in the industry, placing specific product (on a specific market), managing company crises, as well as support in integrated processes for strategic planning. Regarding human resources DSS can help the user in planning the workforce but also settle complaints in managing the workforce. In multinational business DSS are used to allocate investment funds in multinational corporations, to analyze the opportunities in international investment, to help plan the global logistics and also plan the global marketing, production and distribution. Lee-Post and Chung in their research show the application of DSS in operative management regarding the time dimension, including the long term decisions including: operative strategy, capacity planning, location planning, product design or the process and integration of the design in production; then mid term and short term decisions that affect the planning and production control, material planning, resource and production planning, distribution planning, company resource planning and the operation schedule. According to their research, many different DSS are developed and used to ease the decision process in operative management for decisions related to structural planning of production and control activities as well as unstructured strategic decisions in operative management. Lee-Post and Chung emphasize the need for DSS in operative management as a result of the rapid growth of information and communication technologies that change the way operations are managed and supported. Research is done to determine the managerial level on which DSS are most used on. The results show that as time goes the use in decision support on strategic level is increasing and the use on operative level is decreasing but still most of the DSS are developed for operation and tactical management level (Eom, Kim, 2005: 8). Here we have to note that the nature of strategic decisions is widely different, starting with the primary company strategies and all of the decisions in extended and virtual companies.

Usage in Republic of North Macedonia, analysis and results interpretation

To measure the DSS usage in Republic of North Macedonia we created a survey that included 52 companies. From the gathered results in Table 1 we can see that 57,7% or 30 managers use DSS and 42,3% or 22 managers don't use DSS.

Table 1. DSS company usage

		The company uses DSS			Cumulative
		Frequency	Percent	Valid Percent	Percent
Valid	NO	22	42,3	42,3	42,3
	YES	30	57,7	57,7	100,0
	Total	52	100,0	100,0	

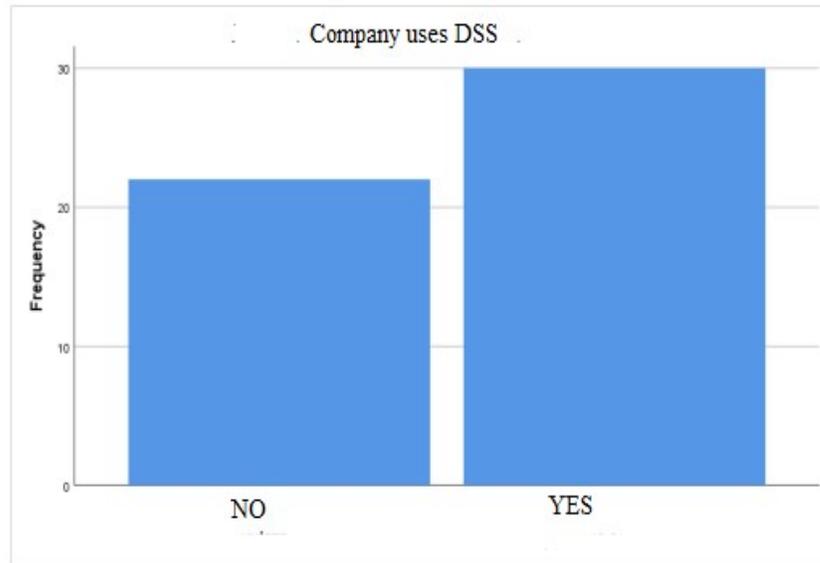


Image 1. DSS company usage

Regarding the types of DSS used in the process of managerial decision making, 51,1% use managerial information systems, 26,7% use decision support systems and 22,2% use executive information systems. The answers from this question are displayed in Table 2. Having offered multiple answers on this question we noted that some managers use a combination of DSS systems. Having 51,1% using managerial information systems we can conclude that managers in Republic of North Macedonia use these systems to help them control, organize and plan everyday operations in the company. Managers with these type of systems gather information, mostly in reports that support the effective decision making and allow for return feedback on daily operations.

Table 2. Types of DSS used in the company

		Responses		Percent of Cases
		N	Percent	
DSS use ^a	Managerial information systems	23	51,1%	76,7%
	Decision support systems	12	26,7%	40,0%
	Executive information systems	10	22,2%	33,3%
Total		45	100,0%	150,0%

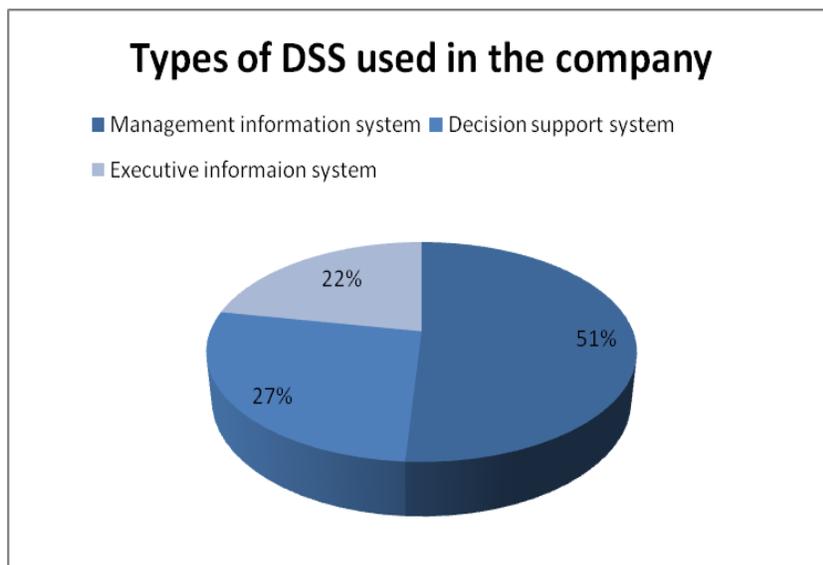


Image 2. Types of DSS used in the company

We also asked on which managerial level are the systems used. From this question we can see that at 50% most of the DSS are used on operational level, 24,4% are used on tactical level and 28,6% are used to make strategic decision. From these results, displayed in Table 3, we can confirm that company managers in Republic of North Macedonia mostly focus on operational level and developed systems are used on this level. We can also confirm the fact that the systems are more used on strategic level compared to tactical level.

Table 3. DSS usage on managerial level

		Responses		Percent of Cases
		N	Percent	
DSS usage on managerial level ^a	DSS used on operational level	28	50,0%	93,3%
	DSS used on tactical level	12	21,4%	40,0%
	DSS used on strategic level	16	28,6%	53,3%
Total		56	100,0%	186,7%

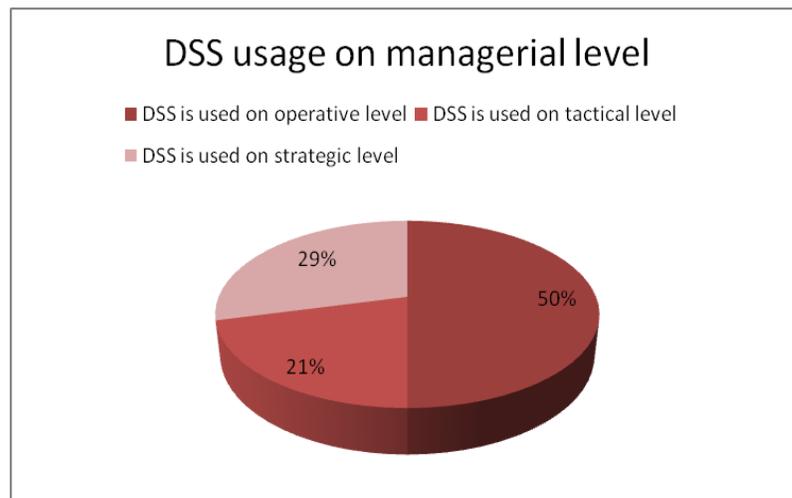


Image 3. DSS usage on managerial level

We also asked about the purpose usage of DSS in companies. From the responses showed in Table 4 we can see that document searching from data bases is the most used scenario (23) with 29,5%, then we have 19 respondents or 24,4% that use DSS to simulate, optimize and analyze data and 11 managers or 14,1% use it for knowledge discovery. Only 8 managers or 10,3% use DSS for online analytical processing. From these

results we can conclude that managers in North Macedonian companies mostly use document managed DSS that functions on methods and technologies for storage and processing. Then we have model managed DSS that uses optimization and analytic methods and is used for multiple choice decisions. Managers that use DSS for document online sharing actually use the communication managed DSS based on network technologies that have the widest usage when deciding in groups. We noted that 14,1% use knowledge managed DSS that includes intelligent support and data mining methods with combination of artificial intelligence. Small number of managers use data managed DSS based on data storage with online analytical processing as a method such as the executive information system.

Purpose usage of DSS

Purpose usage of DSS ^a	Responses	Percent	
		N	t
document searching in data bases	23	29,5%	76,7%
document online sharing	17	21,8%	56,7%
online analytic processing	8	10,3%	26,7%
simulation, optimization and data analysis	19	24,4%	63,3%
knowledge discovery	11	14,1%	36,7%
Total	78	100,0%	260,0%

Table 4. DSS purpose usage

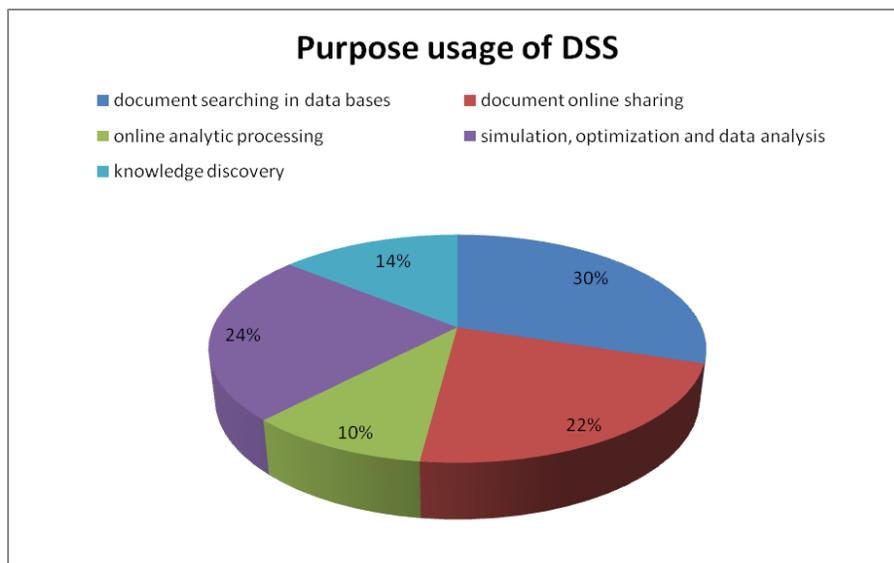


Image 4. Purpose usage of DSS

With this research we concluded that companies in Republic of North Macedonia use DSS in the process of managerial decision making.

To test out hypothesis we applied the non parameter χ^2 technique. Our assumptions based on non parameter techniques are that the samples need to be random and the observations independent in a sense that each observation can be counted once and that the data of one subject can not affect the data of other subjects. The executable assumptions in the non parameter test in this research are completed with the sample being randomly chosen and that the data from one subject do not affect the data from other subjects. To test the hypothesis we applied the χ^2 method to test the fitting quality and examine the cases in a category of one variable and matching them with hypothetical values. For this test we needed a database that included only one category variable. On Image 5 we can see a graphical representation of the companies in Republic of North Macedonia that use DSS where 57,7% use DSS in their managerial decision making and 42,2% don't use DSS.

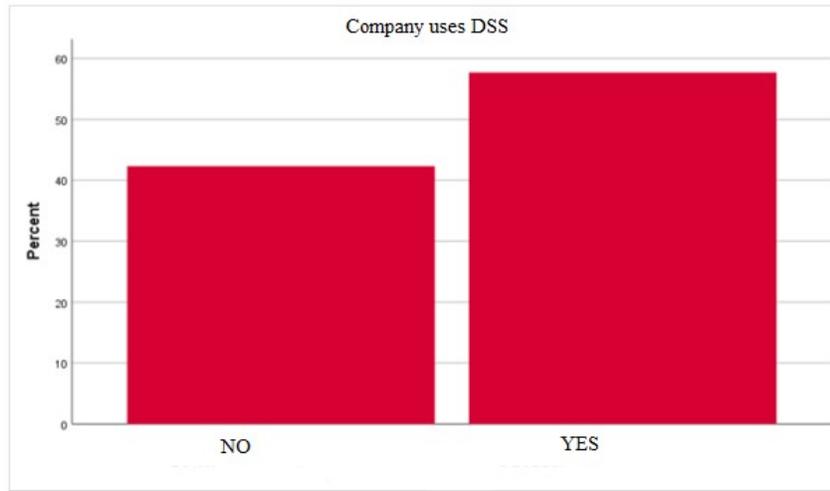


Image 5. Company uses DSS

In Table 5 we can see the classification of companies that use DSS in a column of observed subjects compared to a column of expected DSS usage. We set the expected values at 50% each or 26 companies that will confirm and 26 companies that will decline the use of DSS. In Table 6 we can see the test statistics needed to provide us with the information of the statistical relevance of the data.

Table 5. Classification of companies that use DSS

The company uses DSS			
	Observed N	Expected N	Residual
NO	22	26,0	-4,0)
YES	30	26,0	4,0
Total	52		

The results from the X^2 test in Table 6 show us the statistical relevance of the observed data compared to the expected values. Statistical relevance or $p= 0,267$ not being lower than $0,05$ does not provide statistical relevance and therefore the test is rejected. This means there is not enough difference between the companies that use and the companies that don't use DSS in the decision making process.

Table 6. χ^2 for the usage of DSS in North Macedonian companies

Test Statistics	
The company uses DSS	
Chi-Square	1,231 ^a
df	1
Asymp. Sig.	,267

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 26,0.

With the X^2 test results with 26 (50%) expected and 30 (57,7%) companies using DSS and the low gap of expected and observed companies we can confirm that the hypothesis is accepted

Conclusion

We made a research that included managerial decision making in companies in Republic of North Macedonia to determine the usage of DSS. We concluded that companies in North Macedonia use DSS systems. Most of the used DSS are based on managing information and on operational managerial level and that is why many DSS systems are developed to support the operation decisions. The operative decisions aim to bring the efficiency of the resource converting process and the momentarily operations income to a maximum level.

Strategic decisions address the external problems or the problems that affect the entire company and the company surroundings on a long term. A lot of information's are required for these decisions and there is no standard for combining the information's. The tactical decisions focus on structuring the company resources with the goal of creating executive alternatives and achieving the best results. Between the two we noticed that DSS systems are more used on a strategic compared to a tactical level.

From the results we noticed that the managers in North Macedonian companies mostly use document managed DSS that function on the searching methods and technologies for storing and processing documents. Then we had managers use DSS that uses optimization and analytical

methods which is used to choose between multiple options. Managers that use DSS for documents online sharing are actually using communication managed DSS that is based on network technologies and is mostly used by group deciders. Smallest number of managers use data managed DSS that is based on data storage and includes online analytical methods.

Analyzing the purpose usage of DSS we noticed that the usage is spread between document searching in data bases with 30%, document online sharing 22%, online processing 10%, simulation, optimization and data analysis 24% and knowledge discovery 14%. From these numbers we can conclude that there are different usage purposes of DSS.

Future work can be conducted for the usage of DSS in specific fields such as production, health, agriculture, tourism etc. Future work can also be done in integrating the decision support systems and the technologies to improve the decision performance.

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