Sabrina Šuman[1]
Maja Gligora Marković[2]
Berta Jadro[3]

Preliminary communication
UDK 65.012.123

DECISION SUPPORT AND BUSINESS INTELLIGENCE – WHAT NEEDS TO BE LEARNT?[4]

ABSTRACT

Decision makers should have comprehensive knowledge to be able to make quality decisions. The development of intelligent technologies and specific supporting decision tools has been accelerated during the last ten years, so managers of all strategic levels should keep track of this development and have timely access to adequate modalities and quantity of knowledge necessary for the optimal business management. The domain of the required knowledge is broader at higher managerial positions, while at lower positions it becomes narrow so more profound knowledge of certain area is required. Consequently, managers should know what basic knowledge employees should develop on different hierarchical levels. The purpose of this paper is to provide insight into the domain of Decision Support Systems, which are, according to the authors, essential for understanding the importance and purpose of their usage. The following concepts have been discussed, due to their proved importance in Decision Support Systems, according to the previously analyzed corresponding literature: strategic methods, methods oriented to performance, measurements, techniques and specific tools. The paper elaborates on reasons of their usage, as well their interconnections. The dynamics of these concepts' development during the last two decades has also been analyzed. The correlation analysis indicated which domains have been developed with similar dynamics. This review should serve as a guidebook for further analysis of the domain of concepts related to Decision Support System, but also to all individuals interested in gaining the complete insight into a wider area related to Decision Support Systems, including students, managers and others.

Key words: *Decision Support System, Business Intelligence, Business Excellence, Total Quality, Knowledge Management*

1. INTRODUCTION

Today's business is exceptionally dynamic: shorter product life cycles, distributed units of companies, complex supply chains, strong competition on a global level, enormous overflow of information, accelerated ICT development. Managers should continuously adjust to competitive challenges and seek new ways of exploiting technology to act faster and smarter, bearing in mind the satisfaction of clients and other participants (Power, 2013). Though the development of technology could become an obstacle for managers, knowledge of new technologies and the

[1] Mag. edu. math. et inf., Lecturer, Polytechnic of Rijeka, Vukovarska 58, Rijeka, Croatia. E-mail: ssuman@veleri.hr
[2] MSc, Senior Lecturer, Polytechnic of Rijeka, Vukovarska 58, Rijeka, Croatia. E-mail: mgligoram@veleri.hr
[3] Professional Bachelor of Informatics, student, Polytechnic of Rijeka, Vukovarska 58, Rijeka, Croatia. E-mail: bjadro@veleri.hr
[4] Received: 20. 2. 2014.; accepted: 5. 5. 2014.

context of their usage will become a basic solution to manager's problems. Given the above, in the technological environment of modern organizations, comprised of computers, mobile devices, Internet, wireless communications, managers should make decisions that will enable competitive position of their companies. Basic concepts that support decision making are different definitions, facts and principles of how to use information and communication technology in the decision-making process. Understanding of these basics helps managers to evaluate and implement necessary software, a crucial step in the future successful business. Manager possessing the required knowledge uses the potential of the Business Intelligence analytic tools, as well as the functionality of decision support software, adjusted to specific business situations with the help of a technological specialist. The aim of the paper is to give managers a list of key terms in the domain of decision support and Business Intelligence that will help them acquire adequate knowledge for performance of their business function. The paper will categorize concepts into technical and managerial ones, with technical concepts implying the domain of specific tools and methods which should be thoroughly understood by technical specialists and not managers, while concepts in the managerial category will include meaningful connecting of the essential areas, approaches and philosophies, whose understanding is required for implementation of the best Decision Support System that will enable business excellence. Managers should understand concepts of the technical category to the extent that they can successfully realize purchase of an adequate software solution and choose adequate profile and number of professional personnel. There are several areas that stand out for their wide domain and are analyzed in numerous publications, (Luftig, Quellete, 2012; Porter, Tanner, 2004), durable existence in business and academic environment and proven importance in understanding of all other related concepts (Turban, Sharda, Delen, 2011). The paper continues with the overview and the analysis of chosen concepts, their development and connection to other domains.

2. BUSINESS EXCELLENCE AND TOTAL QUALITY MANAGEMENT

In the conditions of modern business described above, many organizations have adopted a set of methods that improve different organization levels and business aspects. The involvement of all employees in continuous improvement and transformation of business processes, with a view to realizing different user demands is of paramount importance when it comes to striving to improve quality and excellence. Concepts improvement and excellence include detailed knowledge of present conditions of certain process, project and company as a whole, precise and regular measurements and analysis and development of actions needed for improvements. During the eighties of the last century, many organizations recognized quality as a strategic factor for differentiating market companies, and not just for fulfilling the functional prerequisites in quality control. At the same time, basic understanding of quality changed and quality control gradually turned to efforts in providing quality, with the emerging acceptance of the ideas referring to managing the complete quality within an organization (Total Quality Management, TQM). TQM as an approach and philosophy had the greatest impact on the development of the field of business excellence. Presently, there are numerous business excellence models (Porter, Tanner, 2004) that companies use as the nucleus of their

improvement and development in the fields of self-evaluation or external evaluation based upon TQM concepts, though supplemented with guidelines and requirements for better organizational integration. TQM is primarily considered as an approach focused on the improvement of effectiveness, efficiency, timely satisfaction of clients' and other stakeholders' needs by using employees' skills and competencies with a purpose of achieving tested improvements in organization performances (Porter, Tanner, 2004). One of the critical success factors in TQM is strong leadership that motivates and authorizes employees to participate and engage. Organizations that implemented the TQM approach have outperformed their counterparts.

During the 90s of the last century, Business Process Reengineering (BPR) and Balanced Scorecard (BSC) developed as solutions that influenced development of different business excellence models. The main goal of BPR is to remodel crucial business processes due to decreased costs, increased product quality and better clients' satisfaction. BSC is basically a measurement system, enabling an efficient translation of strategy into action. BSC tries to connect the dimensions of learning and developing employees with the efficient processes that provide quality products and services according to the dimensions of satisfying customer needs, and finally according to the financial dimensions. The influence of BSC on the excellence models can also be perceived, since they all include this conceptual frame. Six Sigma should also be mentioned as a group of methodologies whose application has rapidly increased during the last ten years. Six Sigma uses a set of techniques in collecting data and techniques for analyzing the same, trying to improve organizational processes. Approach is focused on modalities helping the organization to deliver its products and services faster, better and cheaper, influencing the improvement of process capability by fulfilling a higher number of user demands. Six Sigma enables identification of costs not influencing added value, neither for clients nor those processes influencing the key product characteristics from the user's standpoint.

Some companies combined these initiatives with BSC initiatives due to the increased possibilities of progress enabled by the Six Sigma initiative. This helped to directly connect companies' quality initiatives with their strategic goals. The same principle was used by Gupta (2007) when developing a hybrid methodology named Six Sigma Business Scorecards that underlines differences between these methodologies and the need for their integration. Shortly, BSC is focused on improving the strategy, while Six Sigma is focused on process improvement. Due to these differences, most companies treated BSC and Six Sigma as individual initiatives, though Leahey (2005) claimed that true advantages cannot be realized unless both concepts are integrated.

The key dimensions of areas related to Business Excellence, as described by Porter and Tanner (2004), are as follows: Leadership, Focus on Clients, Strategy Alignment, Learning, Development and Innovations, Focus on Employees, Development of Partner Relationships, Process Management Based on Facts, Focus on Results and Social Responsibility.

3. DECISION SUPPORT AND BUSINESS INTELLIGENCE

The purpose of this paper is not to describe development of the concept of decision support, but instead to connect crucial concepts elaborated in the paper. Holsapple (2008) describes, in a comprehensible way, Decision Support System as a computer based system that represents and analyses knowledge from the aspects that ensure decision support procedures to be more productive, agile and innovative. Apart from the fact that it can be treated as digital knowledge storage, DSS enables acquisition of additional knowledge from external sources, focus on choosing the internal knowledge, generating new knowledge that could influence decisions, representation of knowledge through desired formats, coordinating outflow of knowledge among decision makers, controlling and the integrity/safety of outflows, and evaluation of participants and decision processes as a basis for future improvements.

Among Decision Support Systems, special attention should be given to decision making. To be able to understand decision making, one should understand the importance of information and knowledge processed according to that information. Knowledge management is related to distribution and assemblage of knowledge, while acquiring new knowledge refers to techniques of collecting and analyzing data and information. The authors Bolloju, Khalifa and Turban (2002) perceive the importance of integrating the Knowledge Management (KM) processes within Decision Support System so that decision makers can combine different types of knowledge (explicit and tacit) and data (internal and external), available in different formats.

When defining and describing Business Intelligence System (BI or BIS), one should start with information, one of the most important business resources, though their value is only potential. If companies want to use information to be successful, they should exploit them within the business processes for more quality decision making, processes performing and satisfying customers' demands (Prajogo, McDermott, 2005).

There are numerous definitions and descriptions of the BI or BIS concepts, e.g. Negash (2004) who defines BI as a system that combines data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers; (Azvine, Cui and Nauck, 2005) for Azvine et al. (2005) BI is all about how to capture, access, understand, analyze and turn one of the most valuable assets of an enterprise — raw data — into actionable information in order to improve business performance. Lönnqvist and Pirttimäki (2006) stated that the term, BI, can be used when referring to the following concepts: 1. Related information and knowledge of an organization, which describe the business environment, the organization itself, the conditions of the market, customers and competitors and economic issues; 2. Systemic and systematic processes by which organizations obtain, analyze and distribute the information for making decisions about business operations; Turban and associates (2008) shortly and generally describe Business Intelligence as an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies. For the purpose of encompassing the complete domain and meaning of BI, authors propose the following definition: Business Intelligence System includes collecting and storing of comprehensive, correct and timely data that

are converted through different tools and techniques to information and submitted to decision makers in the appropriate format, so they could subsequently, supported by this information, act according to the strategic goals.

This definition is supported by the claim that successful implementation of Business Intelligence System within a specific company is related to using the correct, updated and valid, integrated data as means that will transform data into information required for decision making (Zeng et al., 2006).

The interrelated functioning of huge integrated enterprise systems such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM) systems with DSS and BIS is presently an exceptionally important field, where the Business Intelligence analytics developed upon integrated databases of the whole company can directly influence better, updated and flexible decision support, while decisions will subsequently influence the efficiency of CRM and SCM.

4. CONCEPTS RELATED TO THE SYSTEMATIC UNDERSTANDING OF DECISION SUPPORT AND BUSINESS EXCELLENCE

One of the goals of this paper is understanding and implementation of system thinking in certain areas related to the Decision Support Systems, such as acquiring the knowledge of the complete relevant system before considering its parts. Kanji (2005) claims that this attitude is opposed to the majority of modern managers' philosophies and actions. Most companies are divided into sectors, departments, sections, with managers perceiving their segment of organization as an entity itself, so they try to improve and optimize only their segment of organization (sub-optimization), which leads to more damage than benefits. Optimization implies defining the best balance for the complete system or organization, while sub-optimization connotes optimizing a part of the system without guaranteeing the improvement of a whole. What is crucial in the center of system thinking of an organization are the relationships and connections within the organization and between the organization and the environment. Hence, main inputs, processes, outputs and feedbacks should be well perceived. Main inputs (e.g. humans, materials, equipment and money) should be processed into main outputs (e.g. products and services, fallouts), all of this coordinated and managed through the implementation of business policies, supported by adequate measurements, decision making and execution of actions. One of the major advantages of system thinking is the capability of understanding a large number of mutual relationships between system's parts that will improve goal setting, implementation of policy and organizational structure. According to this standpoint, several concepts have been chosen and used as the basis for this paper. Table 1 presents a list of chosen areas, description of the purpose of knowledge of a specific area and its relation to other areas, and a category (managerial or technical). Knowledge categorized as managerial is required for the consciously, optimally and purposely used analytic and technical tools and methods (areas categorized as technical). Both categories are intended for all individuals interested in understanding a wider area encompassed in the paper. On the other hand, managers need not necessarily understand the described tools in detail in order to be able to successfully decide and manage.

Table 1. List of chosen terms and areas

Key terms and areas	Description	Category
Decision Support	Decision making basics and a need for support	Managerial
Decision Support Systems Computer Based Decision Support	Possibilities and integral parts of computer supported Decision Support System. The present challenges are connecting and interacting with other large systems, e.g. ERP, CRM or SCM	Managerial
Decision Support tools Decision Support methods Decision Support techniques Decision Support technologies	A need for concretization and realization of the specific Decision Support System. Modalities of development, modeling, gathering and presenting information, different performances and possibilities of individual tools, techniques and methods.	Technical
Business Intelligence	Domain and importance of Business Intelligence and Business Intelligence Systems	Managerial
Decision Support + Business Intelligence	Connection between these two crucial areas	Managerial
Business Intelligence tools Data Warehouse or Data Warehousing Online Analytical Processing Data Mining Text Mining Web Mining	Concretization of data browsing and analysis, knowledge of the concepts and role of Data Warehouse (DW), a need for knowledge of basic categories, tools and understanding their application. Each tool has its own features and is designed to address specific needs and situations. Knowledge of techniques used in the analysis of structured and unstructured data (text and web mining)	Technical

Data Management Business Analytics Knowledge Management Knowledge Discovery	The necessity of managing data flows and paying attention to receiving valuable information through adequate analytics. Managing the creation, sharing, storing and exploitation of knowledge. The necessity of integrating KM within DSS.	Managerial
Business Performance Management Corporate Performance Management	Business processes, methodologies, metrics and technologies used by companies for measurements, monitoring of and handling business performance	Managerial
Customer Relationship Management Customer Satisfaction	Planning and implementing strategies for managing customer relationships with a view to satisfying their needs and organizational needs for feedback	Managerial
Quality Management Business Excellence Performance Excellence Total Quality Management	Understanding the connections between business and process excellence and Total Quality Management. Basics of the TQM model (management philosophy, culture of quality in organization, clients, satisfaction and constant improvement) as a guideline for excellence.	Managerial
Six Sigma, Six Sigma Tools Balanced Scorecard Business Process Reengineering Key Performance Indicators	Group of tools and methods for the efficient process management in compliance with strategy, aimed at satisfying clients' demands. A need for understanding the integrated implementation of process-oriented and strategically oriented methods. Measuring the goals' realization.	Technical and managerial
Enterprise Resource Planning	The importance of knowing the purpose of modern ERPs, their additional and basic functionality within Business Intelligence and Decision Support.	Managerial
Supply Chain Management	Prerequisites for implementing a flexible, agile, reliable supply chain as an important characteristic of business excellence.	Managerial

Source: authors

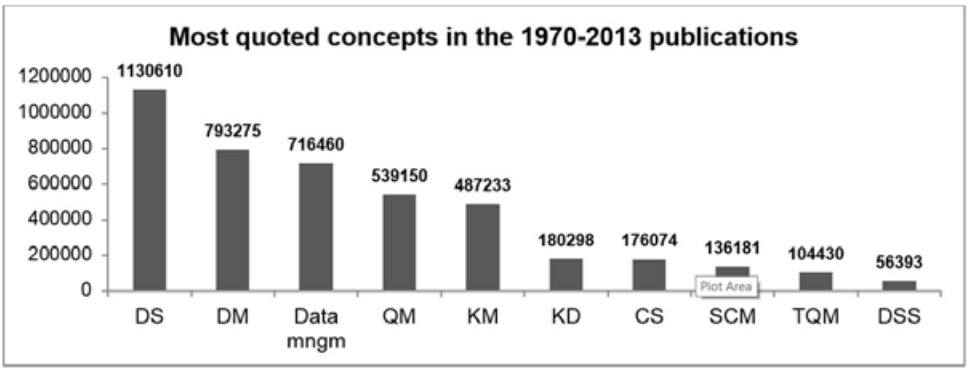
5. RESEARCH METHOD

The research was conducted in several stages. During the first stage, the frequency of quoting the described concept or a combination of several concepts was observed over decades, i.e. throughout the 1970-2013 timeline. Research was done through Google Scholar. Quotes and patents were excluded, and the advanced search option was not used because the idea was to examine the frequency of quoting the concepts in all sorts of publications. The concepts used in search tools were combined with the operator OR, which indicated browsing of publications containing at least one of the concepts in their title, while each concept in the expression had quotation marks, thus specifying publications closely related to the context. The second research method included expressions given by the combination of two and more concepts with the quotation marks and the operator +, thus aiming to encompass all publications containing all of the mentioned terms. Considering the current year 2014, the observation of the last decade was limited to the 2010-2013 period, while the escalations in frequency of the observed areas were compared to 2000-2003 (in Appendix 1 marked as (d2-d1)/d2, in the form of percentage). Other annual ranges were analyzed as well, as it can be seen in Appendix 1. Decision Support Systems, data management, and quality management date back to the 1970s. Hence, 1970 was taken as the starting year. The aim of the first part of the research was to show the dynamics of the observed areas through a longer period of time – a decade, for which analyses of their frequency in publications of unspecified category were conducted, and to show the velocity of development of given areas as a percentage of frequency differences during a decade (equation given in the table as $((x_{ij}-x_{(i-1)j})/x_{(i-1)})$, i=2,3,4 j=number of rows).

6. RESEARCH RESULTS AND DISCUSSION

In Appendix 1 three arrows were used to demonstrate the three categories of the velocity of concept development, while each column containing arrow was regarded as a whole when determining percentiles. Upward arrow demonstrates concepts developing at a speed higher than the 75th percentile; the right arrow demonstrates concepts of an average speed between the 25th and 75th percentile, while the down arrow refers to the concepts developing at the slowest rate in a given period of time, with the speed average below the 25th percentile. It should be underlined that the above mentioned categories, i.e. arrows, show the velocity of concept development in comparison to other concepts of the time, while the development of individual concepts should be analyzed through rows, e.g. the concept of "balanced scorecard" recorded the speed of quotations of 8% in the 1980-1989 publications compared to the 1970-1979 period when it was among the slowest developing concepts (down arrow). During the period of 1990-1999 it increased a total number of quotations by 68 times, in comparison to 1980-1989, or 6830%, with arrow upwards implying that, aside from other concepts analyzed in the same period, it recorded one of the highest increases of frequency. The term "balanced scorecard" was, during the 1990-1999 period, one of the most quoted concepts used within different publications. Appendix 1 also clearly indicates chronological growth of quotation frequency for all the considered concepts, showing the relevance of all observed concepts in terms of scientific and business perspective. Graph 1 displays the most quoted concepts in the 1970-2013 publications.

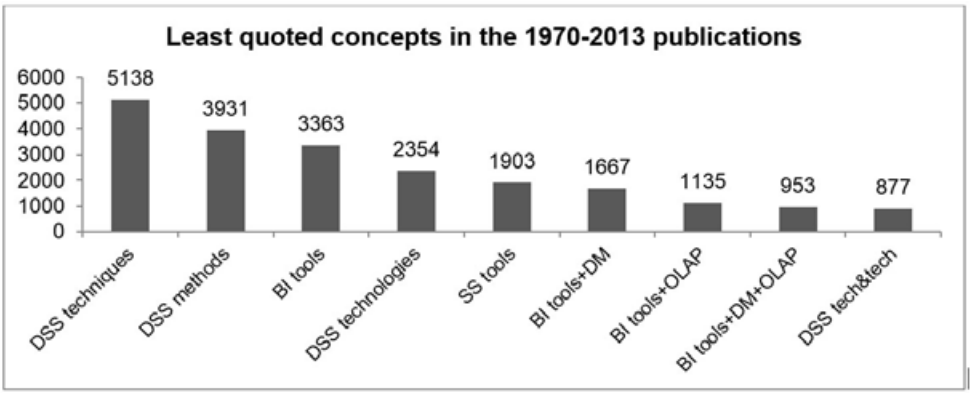
Graph 1. Frequency of the most quoted concepts for the period 1970-2013



Source: authors

In the following illustration, Graph 2, the concepts with least frequency recorded in the same period were displayed.

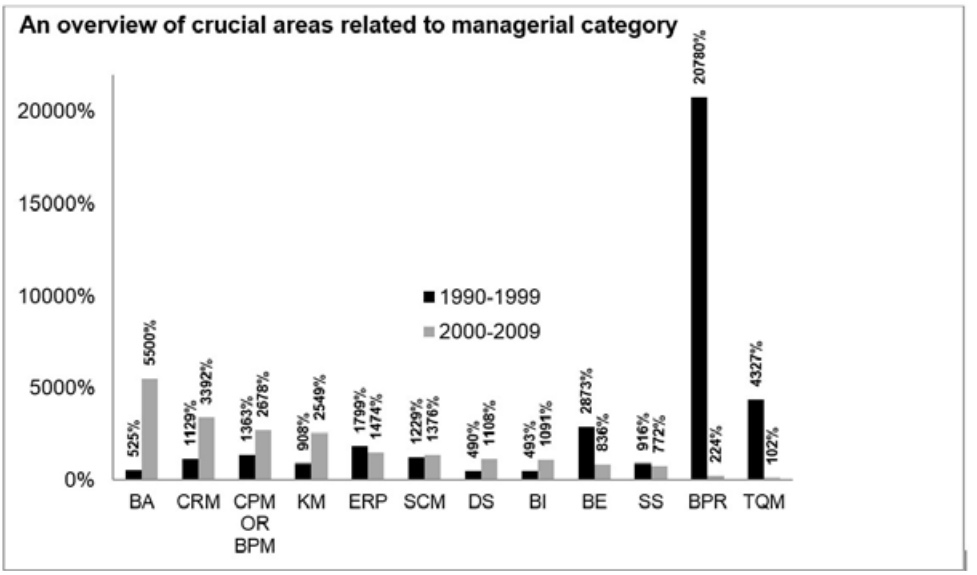
Graph 2. Frequency of most quoted concepts for the period 1970-2013



Source: authors

Graph 3 shows an overview of the crucial areas related to managerial category, or, in certain examples, to managerial and technical category. Two periods were considered since they were crucial for the development of the observed concepts. BPR recorded a significant increase of frequency in 1990-1999, in comparison to 1980-1989, alongside TQM, BE, ERP and SS, as the most quoted concepts in the same decade. The other concepts recorded a higher increase of frequency during the period 2000-2009 in comparison to 1990-1999, than during the period 1990-99 in comparison to 1980-1989.

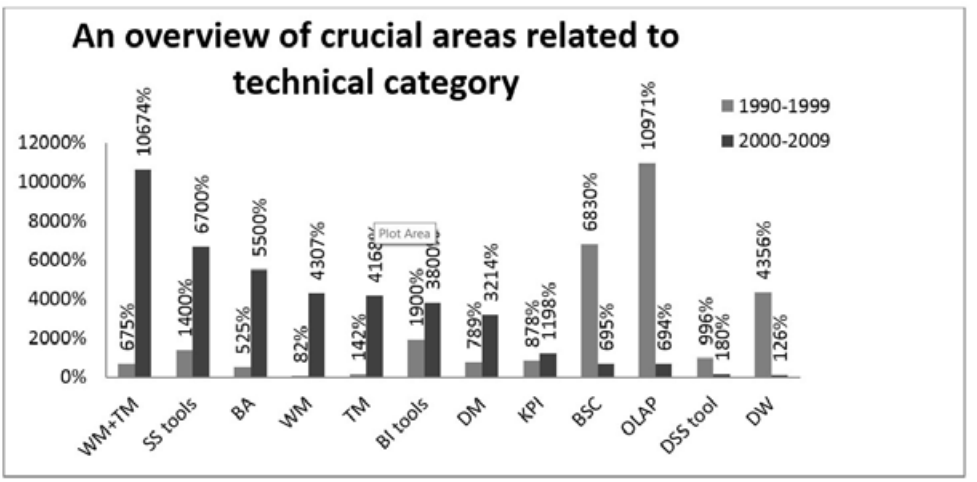
Graph 3. An overview of the crucial areas related to managerial or managerial and technical category over two decades



Source: authors

Graph 4 was designed on the same principle displaying the concepts categorized in technical category, due to the functionalities of processing, modeling, storing, measuring etc. It can be noticed that in the 2000-2009 period, in comparison to the previous decade, the most developed areas were WM+TM (+ denoting publication containing both concepts), SS tools, BA, following WM and TM as individual concepts, BI tools and DM, while other concepts recorded the highest growth in the 1990-1999 period.

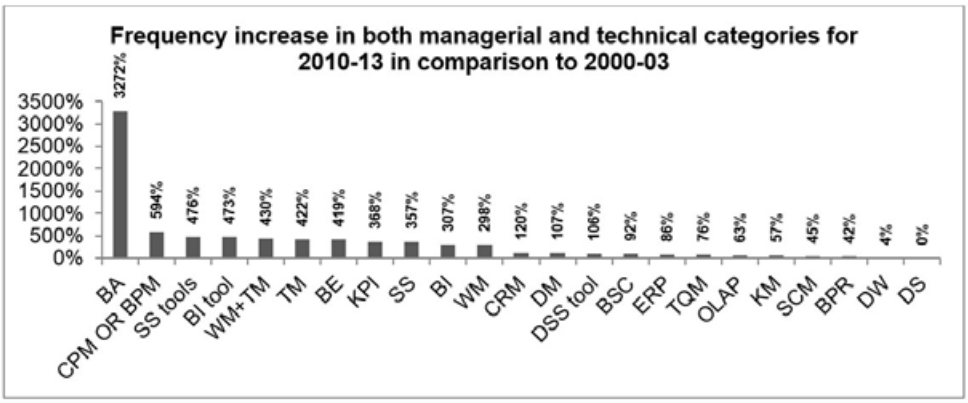
Graph 4. An overview of the crucial areas related to technical category over two decades



Source: authors

Graph 5 shows increase of concepts included in graphs 3 and 4, referring to the interrelation between triennial figures about frequency starting from 2010-2013, in comparison to 2000-2003. It can be concluded that BA recorded the highest increase, followed by CPM/BPM, SS tools, BI tools, WM+TM, Tm, BE, KPI, SS, BI.

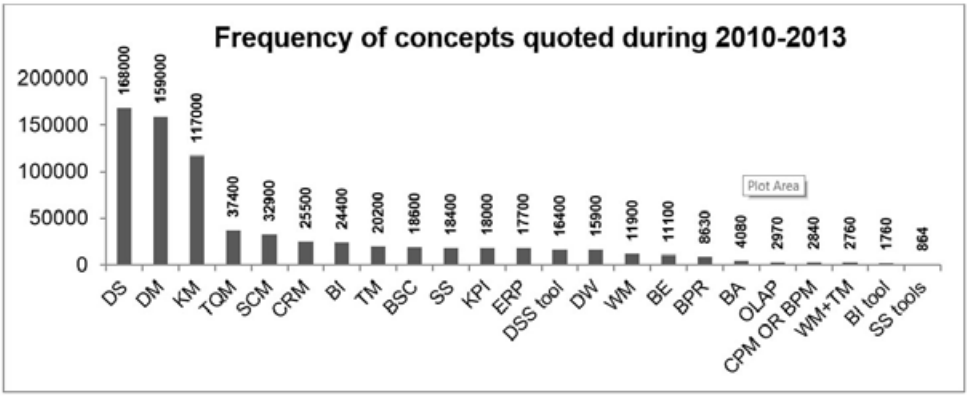
Graph 5. Frequency increase in both managerial and technical categories for 2010-2013 in comparison to 2000-2003



Source: authors

In order to specify the concepts most frequently quoted in publications edited in the recent period 2010-2013, Graph 6 was prepared to show their frequency. It can be concluded that the concepts DS, DM and KM are evidently more frequently quoted in the recent publications, followed by the concepts TQM, SCM, CRM, and BI.

Graph 6. Concepts most frequently quoted in publications edited in the recent period 2010-2013



Source: authors

The second part of the research analyzed the frequency of quotations for concepts named in Appendix 1, separately for each year in the 1980-2013 period, summing up 34 years, with a purpose of specifying the most correlating concepts (the ones with the most similar frequency dynamics). For this purpose, the SPSS software was used, the version 19, combined with the correlation analysis and correlation matrix containing all concepts. The prepared matrix was used to extract correlations with r>0.98 and p<0.01, which were displayed in Appendix 2. The correlations with r>0.99 were underlined and written in bold fonts, which has helped to highlight the highest correlation between the concepts, as shown in Table 2.

Table 2. Concepts with highest correlation, (r>0.99, p<0.01)

Concepts with max correlation	**r**	**Concepts with max correlation**	**r**
BSC with SCM	**,995**	CRM with BSC	**,996**
BSC with DW	**,989**	CRM with SCM	**,994**
ERP with SCM	**,993**	CRM with PE	**,990**
ERP with BSC	**,991**	(DSS+KM) with ERP	**,996**
SS with SCM	**,992**	(BPM/CPM) with SCM	**,992**
SS with ERP	**,992**	(BPM/CPM) with SS	**,990**
PE with SCM	**,996**	DM with KM	**,996**
PE with BSC	**,991**	(BMI+DM+OLAP) with SCM	**,991**
BE with KPI	**,996**	(BI+DM) with KPI	**,995**
CS with PE	**,995**	BI+DM with BE	**,995**
CS with SCM	**,993**	BI with KPI	**,993**

Source: authors

7. CONCLUSION

This paper offers an insight into areas mutually connected by the fact that their domain is interrelated in order to achieve business excellence in all aspects of business: processes, products, clients and the environment. The motivation behind this standpoint comes from the fact that the research area is exposed to a multitude of concepts, philosophies, approaches, methods, tools, and techniques, so there is a need for a certain guidebook-overview offering the list of areas whose knowledge (detailed or general, depending on the function of employee or interested reader) is essential in understanding the complete business reality of modern times. As it was mentioned in the first chapters, several concepts address a wider domain (BE, TQM, DSS, BIS) than others, so these were used as basics when observing the interrelations to the other concepts. Browsing, storing, analyzing, interpreting and application of information for quality decision making and acting is a simplified course of the business cycles. The choice of software solutions, methods, material resources, and profiles of employees who will participate in the system is made by personnel holding the highest positions in a company, so their knowledge and competence is a required prerequisite for achieving the business excellence. This necessity was substantiated in the second and the third chapter of this paper.

The research results were used to describe the frequency of quotations for chosen concepts through several periods of time so as to determine which concepts developed most rapidly and to what degree they are more represented or "popular" in a certain time period than others. The authors noted that concepts related to the technical category (Table 1) mostly developed after 2000, their frequency being lower than that of theoretical concepts belonging to the managerial category, while technical concepts were leading in terms of percentage increase in the 2010-2013 period when compared to 2000-2003 (Graph 5). This conclusion implies that the frequency of certain concepts in publications is not the absolute measure of their relevance and importance, with the percentage increase between time periods being an equally important indicator, especially considering the last decade.

The second part of the research evaluates the correlation of chosen concepts, and the latter are extracted in Appendix 2 displaying the couples of concepts achieving the correlation $r>0.98$, $p<0.01$, and separately displayed couples correlating $r>0.99$ (Table 2). The correlations indicated that areas chosen in the paper are strongly interrelated, thus making one system that should be regarded as a whole, but separately as well.

Future research will be directed toward formalization of knowledge requirements for Business Intelligence department employees, which will facilitate personnel recruitment and targeted education of employees.

REFERENCES

Azvine, B., Cui, Z., Nauck, D. D., (July 2005), Towards real-time Business Intelligence, *BT Technology Journal*, Vol. 23, No. 3.

Bolloju, N., Khalifa, M., Turban, E. (2002) Integrating knowledge management into enterprise environments for the next generation decision support, Decision Support Systems, Vol. 33, pp.163–176.

Gupta, P., (2007) Six Sigma Business Scorecard, McGraw-Hill Education.

Holsapple, C., (2008) Supporting Decisional Episodes, in Adam, F. and Humphreys, P. (eds.), Encyclopedia of Decision Making and Decision Support Technologies, London: IGI Global.

http://businessfinancemag.com/technology/one-two-performance-punch, Leehy, 2005

Kanji Gopal, K.,(2005), Measuring Business Excellence, Routledge

Lönnqvist, A., Pirttimäki, V. (2006) The measurement of Business Intelligence, Information Systems Management, Vol. 23, No. 1, pp. 32–40.

Luftig, T. J., Ouellette , S. (2012) Business Performance Excellence, Bloomsbury Publishing.

Parikh, A.A., Haddad, J., (October 2008), Right-Time Information for the Real-Time Enterprise, Retrieved on February 2012 from DM Direct

Porter, L. J., Tanner, S. J. (2004) Assessing business excellence, Elsevier Butterworth-Heinemann

Power, D. J. (2013) Decision Support, Analytics, and Business Intelligence, Business Expert Press, 2013

Prajogo, D. I., McDermott, C. M. (2005) The relationship between total quality management practices and organizational culture, International Journal of Operations & Production Management, Vol. 25, No. 11, pp. 1101–1122.

Solomon, N. (2004) Business Intelligence, *Communications of the Association for Information Systems*, Vol. 13, Article 15

Turban, E., Sharda, R., Aronson, J. E., King, D. (2008) Business Intelligence: a managerial approach, Prentice Hall

Turban, E., Sharda, R., Delen, D., (2010), Decision Support and Business Intelligence Systems, Pearson

Appendix

Area	Abbreviation	x1	x2	x3	x4	d1	d2	(d2-d1)/d2	((xij-x(i-1))/x(i-1)) , i=2,3,4		j= N of rows	Total N of publ.
		1970-1979	1920-1929	1990-1999	2000-2009	2010-2013	2000-2003	2010-13 compared to 2000-03	1920-1929 compared to 1970-79	1990-99 compared to 1980-89	2000-09 compared to 1990-99	1970-2013
"decision support"	DS	710	12300	72600	877000	168000	168000	0%	1632%	490%	1108%	1130610
"decision support systems"	DSS	353	7840	16400	15900	15900	16300	-2%	2121%	109%	-3%	56393
"computer based decision support"	CBDSS	8	311	1210	2650	1100	842	31%	3788%	289%	119%	5279
"decision support tools"	DSS tool	25	532	5830	16300	16400	7980	105%	2028%	996%	180%	39087
"decision support methods"	DSS method	2	37	392	2030	1470	523	181%	1750%	959%	418%	3931
"decision support techniques"	DSS technique	2	104	972	2400	1500	605	131%	5100%	835%	155%	5133
"decision support technologies"	DSS techno	0	29	333	1150	842	297	184%	2800%	1048%	245%	2354
"decision support technologies"+"technique"	DSS tech&tech	0	13	132	421	311	103	202%	1300%	915%	219%	877
"business intelligence"	BI	81	273	1620	16300	24400	5990	307%	237%	493%	1091%	45674
"decision support+"business intelligence"	DSS+BI	4	31	405	13700	14200	1460	873%	675%	1206%	3283%	28340
"business intelligence tools"	BI tools	1	2	40	1580	1760	307	473%	100%	1900%	3800%	3363
"business intelligence tools"+"data mining"	BI tools+DM	0	0	20	793	854	161	430%	0%	2000%	3865%	1667
"business intelligence tools"+"olap"	BI tools+OLAP	0	0	17	572	546	137	299%	0%	1700%	3265%	1135
"business intelligence tools"+"data mining"+"olap"	BI tools+DM +OLAP	0	0	16	509	428	114	275%	0%	1600%	3081%	953
"on-line analytical processing"	OLAP	3	7	775	6150	2970	1820	63%	133%	10971%	694%	9905
"data mining"	DM	695	2030	18500	613000	159000	76600	107%	1099%	789%	3214%	793275
"text mining"	TM	271	203	492	21000	20200	3670	422%	-25%	142%	4168%	42168
"web mining"	WM	0	195	354	15600	11900	2990	298%	19500%	82%	4307%	28049
"web mining"+"text mining"	WM+TM	0	4	31	3340	2760	521	430%	400%	675%	10574%	6135
"data management"	Data mngm	5660	16600	51200	515000	128000	71300	80%	193%	208%	906%	716460
"business analytics"	BA	9	4	25	1400	4080	121	3272%	-56%	525%	5500%	5518
"corporate performance management"OR"business performance management"	CPM OR BPM	1	8	117	3250	2840	409	594%	700%	1363%	2678%	6216
"knowledge management"	KM	503	1330	13400	355000	117000	74400	57%	164%	908%	2549%	487293
"decision support"+"knowledge management"	DSS+KM	7	216	2340	18300	18200	5550	228%	2988%	983%	682%	39063

Area	Abbreviation	k1	k2	k3	k4	d1	d2	(d2-d1)/d2	((xij-x(i-1))/x(i-1)), i=2,3,4			j=N of row	Total N of pubbl.
		1970-1979	1980-1989	1990-1999	2000-2009	2010-2013	2000-2003	2010-13 compared to 2000-03	1980-1989 compared to 1970-79	1990-99 compared to 1980-89	2000-09 compared to 1990-99		1970-2013
"customer relationship management"	CRM	27	58	713	24900	25500	11600	120%	115%	1129%	3392%	51198	
"customer satisfaction"	CS	924	3150	24800	84300	62900	38600	62%	241%	687%	240%	176074	
"business excellence"	BE	15	37	1100	10300	11100	2140	419%	147%	2873%	836%	22652	
"performance excellence"	PE	16	90	542	4470	3400	986	245%	463%	502%	725%	8518	
"six sigma"	SS	66	184	1970	16300	16400	4030	307%	109%	916%	772%	36842	
"six sigma tools"	SS tools	3	1	15	1020	854	150	476%	-67%	1400%	6700%	1903	
"total quality management"	TQM	33	497	22000	44500	37400	21300	76%	1406%	4327%	102%	104430	
"enterprise resource planning"	ERP	54	89	1690	26600	17700	9500	86%	65%	1796%	1474%	46133	
"balanced scorecard"	BSC	40	43	2980	23700	16600	9660	92%	8%	6830%	695%	45363	
"key performance indicators"	KPI	18	134	1310	17000	18000	3850	368%	644%	876%	1198%	36462	
"quality management"	QM	3200	6150	83800	345000	101000	97200	4%	92%	1283%	312%	539150	
"supply chain management"	SCM	181	490	6510	96100	32900	22700	45%	171%	1229%	1376%	136181	
"data warehouse"OR"data warehousing"	DW	115	149	6840	15000	15900	15300	4%	30%	4356%	126%	37804	
"business process reengineering	BPR	7	25	5220	16900	8630	6070	42%	257%	20780%	224%	30782	
"knowledge discovery"	KD	53	115	8130	129000	43000	23300	85%	117%	6970%	1487%	180298	

The concepts with the highest correlation (r>0,98, p<0,01,n=34)

	DM	data_mngm	KM
ds	,988	,982	,981

	CS	PE	BE	SCM	BPM/CPM	BI+OLAP
dss	,988	,988	,984	,984	,981	,981

	BSC	ERP	SS
dss tools	,986	,981	,980

	QM	dss technologies
dss techniques	,984	,981

	QM
dss technologies	,983

	KPI	DSS+KM	BI tool	BI+DM	BE	BI+OLAP	dss+bi
BI	**,993**	,989	,988	,986	,986	,985	,981

	DSS+KM
dss+bi	,988

	BI+DM	KPI	BE	BI+OLAP	BI+DM+ OLAP	PE	SCM
BI tool	**,994**	**,993**	,989	,987		,982	
BI+DM	**,995**	**,995**	**,994**	**,990**	,982		,981

	BI+DM+ OLAP	SCM	PE	BE	KPI	CS	CRM	DW	ERP	BSC
BI+OLAP	**,999**	**,990**	,989	,989	,985	,985	,984	,983	,982	,981

	SCM	PE	CRM	CS	BE	BSC	DW	ERP	SS
BI+DM+OLAP	**,991**	,989	,985	,985	,984	,984	,984	,984	,981

Appendix 2

	KM	KD						
DM	**,996**	,988						
	SCM	SS	PE	DSS+KM	ERP	BSC	CS	
BPM OR CPM	**,992**	**,990**	,987	,986	,986	,983	,980	
	KD							
KM	,987							
	ERP	SS	SCM	DW	BSC			
DSS+KM	**,996**	,988	,986	,983	,980			
	BSC	SCM	PE	ERP	DW	CS	SS	
CRM	**,996**	**,994**	**,990**	,988	,986	,985	,985	
	PE	SCM	DW	BSC	QM	ERP	BE	SS
CS	**,995**	**,993**	,988	,988	,985	,984	,982	,981
	KPI	PE	SCM					
BE	**,996**	,986	,983					
	SCM	BSC	SS	DW	ERP			
PE	**,996**	**,991**	,983	,982	,981			
	SCM	ERP	BSC					
SS	**,992**	**,992**	,989					
	SCM	BSC	DW					
ERP	**,993**	**,991**	,989					
	SCM	DW	QM					
BSC	**,995**	**,989**	,980					
	DW							
SCM	,987							

Sabrina Šuman[1]
Maja Gligora Marković[2]
Berta Jadro[3]

Prethodno priopćenje
UDK 65.012.123

POTPORA ODLUČIVANJU I POSLOVNA INTELIGENCIJA – ŠTO JE POTREBNO ZNATI?[4]

SAŽETAK

Brojna su područja koja danas donositelji odluka moraju poznavati kako bi kontinuirano donosili kvalitetne odluke. Razvoj računalnih tehnologija i specifičnih alata za potporu odlučivanju u posljednjih deset godina sve je brži, a menadžeri na svim razinama moraju pratiti taj razvoj, raspolažući u svakom trenutku odgovarajućom vrstom i količinom znanja za optimalno upravljanje. Domena potrebnog znanja šira je na višim menadžerskim pozicijama, dok je na nižim pozicijama sužena, te se traži detaljnije i dublje znanje o nekom području. Dakle, potrebno je znati koja osnovna znanja trebaju posjedovati zaposlenici na različitim poslovnim razinama. Cilj ovog rada je dati pregled pojmova iz područja sustava za potporu u odlučivanju koje autorice drže nužnim za razumijevanje važnosti i svrhe korištenja takvih sustava. Promatrani su sljedeći pojmovi: strateške metode, metode orijentirane na izvedbu, mjerenja, skupovi tehnika i specifični alati. Pojmovi su izdvojeni zbog svoje dokazane važnosti u područjima vezanim uz potporu odlučivanju, a na temelju proučene literature iz tog područja. U radu je iznesena argumentacija odabira pojmova kao i njihova povezanost. Također je analizirana i dinamika pojavnosti tih pojmova kroz posljednja dva desetljeća. Analizom korelacije pokazano je koja su se područja razvijala sličnom dinamikom. Ovakav pregled trebao bi biti vodič za daljnje proučavanje predložene domene pojmova područja sustava za potporu odlučivanju, kao i svima onima koji žele dobiti cjelovit pogled na šire područje povezano s potporom odlučivanju, od studenata do menadžera.

***Ključne riječi**: potpora odlučivanju, poslovna inteligencija, poslovna izvrsnost, potpuna kvaliteta, upravljanje znanjem*

[1] Mag. edu. math. et inf., predavač, Veleučilište u Rijeci, Vukovarska 58, Rijeka, Hrvatska. *E-mail:* ssuman@veleri.hr
[2] Mr. sc., viši predavač, Veleučilište u Rijeci, Vukovarska 58, Rijeka, Hrvatska. *E-mail:* mgligoram@veleri.hr
[3] Bacc. informatike, student, Veleučilište u Rijeci, Vukovarska 58, Rijeka, Hrvatska. *E-mail:* bjadro@veleri.hr
[4] Datum primitka rada: 20. 2. 2014.; datum prihvaćanja rada: 5. 5. 2014.