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BUSINESS NEEDS FOR OLAP AND DATA MINING TOOLS: EVIDENCE FROM KOSOVO COMPANIES

Abstract

Background: This paper deals with topics relevant to problem of understanding how OLAP tools and DM applications integrate as well as how some information support systems can impact business processes of companies in Kosovo. It is clear that theoretical background includes various topics, such as role and impact of excellent OLAP tools and DM applications in information systems with objective to increase performance and business processes. Aim: Goal of this study is to point out needs of Kosovo companies for excellent OLAP tools and DM applications as well as information supporting systems which include mentioned tools and applications during business processes as a way to increase business performance. Method: On this study we used quantitative methods with a deductive approach. This means testing enhances theory of OLAP and DM tools, ISS and business processes by using quantitative and executive data with an adequate econometric model. Results: Results show that in Kosovo there is a low use level of adequate OLAP and DM tools and applications during business processes with p = 0.52. The coefficient p, based on results presents accuracy of conclusion that Kosovo businesses are not using adequate tools in their information systems.

Keywords: OLAP, DM, Business Process, Management Level, Information Systems

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1.   INTRODUCTION

Tools that can help managers to utilize better and more efficient business processes are on On-Line Analytical Processing (OLAP) that can be incorporated in every business information system. According to Liu and Özsu (2009), we can understand that managers have opportunity to structure hierarchically their own business data with chance to promote their views on information. This is changing relationships in order to offer more detailed insight into corporate trends influenced by the market and to identify potential issues and decisions of business processes. During finding proccess of the best method for improving business activity, managers are also discovering new knowledge about the business phenomenon; this creates a need for analyzing enormous sets of data mining and extraction. Thus Data mining (DM) tools can answer business questions that traditionally were time-consuming to be resolved. They cleanse databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations. In business processes, particularly the ones that are developed through information systems, certain enterprises should own sophisticated OLAP and DM tools for this purpose.

Olson, Dursun, Delen (2008) and W.W. Eckerson (2008) found that just 20% of OLAP and DM users apply for work methodologies CRISP and SEMMA that are part of DM application. There is also a study regarding data mining needs for Decision support system (DSS) by Rupnik and Kukar (2010), where it was found that traditional techniques of data analysis can give any solution for solving business problems. Thus, this paper studies the need for excellent OLAP and DM tools during business processes in Kosovo. The excellent OLAP and DM tools are tools which support better co-ordination between management levels during the business process.

Initial objective of this study is to show level of Information Systems IS use in business processes, the level of OLAP and DM tools as well as their application and impact on business performance. The study was conducted in Kosovo along with companies from different economic fields and was based on the following questions:

-    What are specifics of business processes according to their needs for information support systems?

-    Which areas and basic tools of OLAP and DM methods have been applied in?

-    Which DM applications are commonly used and applied in these business processes?

-    Which OLAP tools are commonly used and applied in these business processes?

-    Which are the most popular DM and OLAP techniques used in business process models within business sector of Kosovo?

- What potential fields for further research in the area are indicated by the study? Which potential fields in this area are indicated for further research on this study?

2.   BUSINESS NEEDS FOR EXCELLENT OLAP TOOLS

Name of tools for extracting knowledge from OLAP data started as an acronym (abbreviation) of "On-Line Analytical Processing." This term was created by British mathematician E.F. Codd, (E.F. & C.T., 1993) who in 1970, using basis of the so-called relational calculation, presented a relational model of data. This data model today is the most popular database of relational data.

Therefore, today it can be said that there is no important software producer who does not offer their own OLAP tools. At the end of 2002 the general turnover realized by tool market OLAP reached approximately 3.5 billion dollars, while in 2006 it reached the amount of approximately 5.7 billion dollars. The following table gives more information about specific use of OLAP tools by producers around the world.

Table 1

The participation of OLAP product by companies on the world

Producer	Participation %	Billion	Companies
Microsoft	31,6	1.806	Microsoft
Hyperion	18,9	1.077	Oracle
Cognos	12,9	735	IBM
Business Objects	7,3	416	SAP
Micro Strategy	7,3	416	Micro Strategy
SAP AG	5,7844	330	SAP
Cartesis (SAP)	3,680982	210	SAP
Applix	3,593339	205	IBM
Infor	3,488168	199	Infor
Oracle Corporation	2,787029	159	Oracle
Other	2,66433	152	
Total		5.705	

Source: OECD Report of participation in OLAP product companies 2017

OLAP tools include a wide spectrum of possibilities, from simple tracking and navigating to calculations and serious analysis through time series and complex modelling. In this manner, they can cover an entire hierarchical

chain that comprises skeleton of obtaining informed business decisions, the chain that starts with data and continues with completed information on Business Intelligence.

According to (Joint Scientific Research , 2014) (JSR-73) Expert Group, today's companies use several types of information support systems during business making process. The most popular support information systems are Management Information Systems (MIS), Group Decision Support Systems (GDSS) and Decision Support Systems (DSS).

Within information supporting systems there are elements that help users make easier and more effective decisions. One of these aspects is an OLAP tool used for advanced data analysis and decision support on business areas. OLAP tools follow what is in essence a deductive approach. The quality of this method depends on acquiring most valuable information, trends and patterns. OLAP tools can thereby help managers to better understand data adaptability during business making process.

3.   BUSINESS NEEDS FOR DATA MINING TOOLS

Before explaining data analysis it is important to say that Data Mining (DM) is used or is being used by (D. Kolich, R.L. Storch, N. Fafandjel 2016) industries and different businesses starting from production sector and continuing to service and trade sectors, respectively DM is used by all managerial levels of these certain companies.

Data exploring could be defined as discovery of data's legitimacy. Data can be organized in a database, but also can be textual, unstructured, derived from webpages or organized in time series.

This area is very young since researchers started on 20th century to deal with theoretical basis of DM (G. Kraljevic, S. Gotovac, 2010). There are multiple methodological approaches to this problem as well as preferences for their application which correspond to designated fields, depending on authors who deal with this issue (Giudici P, Figini S 2009).

Some of methods that are expressed as data exploration methods have been developed in their basic (rudimentary) forms since 1970s and 80s. In the mid 1990s there was a synthesis of data exploration (org. DATA MINING), which brings together a set of methods and actions the purpose of which is discovery of legality (collection) of data (J. H. Heinrichs and J.S. Lim. Integrating. 2003).

In the 21st century, scientists mostly focus on building data mining applications that are appropriate for the needs of enterprises, based on their respective enterprise management in different business environments which change based on market demands (G. Kraljevic, S. Gotovac, 2010). DM can be

utilized based on two approaches. First approach is through data mining software tools where data exploration is done through DM's ad hoc projects. Second approach uses a DM system or so-called Data Mining Application Access Approach (Rok Rupnik, 2007).

The first exploitation approach of DM usually operates separately from data sources by requiring an additional amount of time to export data from different sources and work through pre-processing, processing and data transfusion (Zekić-Sušac, M., Has, A., 2015). The lack of software tools for data exploration requires a large number of experts needed to collaborate in the project and deliver results to the relevant model (J. Srivastava, R. Cooley, M. Deshpande, P.N. Tan, 2000). DM's models are created and manufactured for needs of business persons. Since they are intended for businesses, DM applications should be accessible while exploring data effectively to facilitate decision support (R. Kohavi, 2015).

4.   INTEGRATION OF OLAP AND DM TOOLS INTO BUSINESS PROCESS

Depending on nature of a business activity, business process itself and its derivatives will vary. Therefore, businesses differ from each other depending on sector or scope. However, business processes have some common elements and that are to ensure efficiency and effectiveness of the company which is naturally a goal of a for-profit organization.

Information support systems provide support in partially resolving structured and unstructured business problems at all levels of companies. The fundamental properties of these systems are (Al Quhtani, 2017):

- Providing support for different methods of deciding which steps must be undertaken;

- High flexibility, interactivity and ease of use during business processes;

- Improved effectiveness (accuracy, timeliness, quality) during business processes;

- Enabling of independent development of simpler systems and one's Users, since they allow modelling and experimentation;

- Allowing access to different data in databases, different navigation and multimedia information.

5.   METHODOLOGY

In this study, we used quantitative methods based on data derived from a questionnaire. In combining our methodological approach with a theoretical

foundation, in this study deductive approach was used. Deduction was necessary because study sought to confirm existing theory of information systems and their usage as well as need of excellent tools, such as OLAP and data mining applications during business processes.

6.   RESEARCH SAMPLE

In this study interviewed managers come from 54 different enterprises. Eight of them are respondents from large enterprises and 46 from medium enterprises. Enterprises from a geographical point of view cover all 7 regions in Kosovo. The total number of respondents is 1232, selected through a random sample of population in this research.

7.   OPERATIONALIZATION OF VARIABLES

In this study research variables are quality of business process, levels of use of OLAP and DM as well as business performance. The quality of business process is dependent variable, while levels of use of OLAP and DM tools as well as business performance are independent variables. Variables were examined with the aim of testing hypothesis. High or low levels of performance process were based on use of OLAP and DM tools, as well as level of influence of OLAP and DM tools on ISS on improving and facilitating performance during business process. In order to analyse data model of linear multiplex regression equation was used. Testing model will be based on the following regression equation:

$$Yc = B0 + Bx_{performance} + Bx_{levelof\ olap\ and\ dm\ tools}$$

Analysis of the study will first start with cross-sectional analysis of variables and correlation analysis with variables and then analysis explanatory factor, as well as equation regression analysis.

According to research questions working hypotheses are:

H1: Application of OLAP and DM tools influence the quality of business processes.

H2: Adequate applications of OLAP and DM tools promote better business performance.

8.   RESULTS & DISCUSSION

Respondents were asked questions related to business policy of using OLAP and DM tools during business process and information systems used for doing interpretation during business process. Although, we hope to understand

purpose of OLAP and DM tools as elements that influence better performance of systems and decisions.

The following table displays results related to business making by managers. The next table presents results about which managerial level in companies makes strategic decisions. Result values are based on a numeric scale from 1 to 5, where 1 is very low, 2 is low, 3 is good, 4 is high and 5 is very high/always. The tables present number of respondents and average variance, standard deviation and coefficient for variables.

Table 2

Statistical variability of the ratio between level of managers and use of experience by conducting their work

Managers Level	Experience				
	Total	Me	Var	Sdev	Coeffi
L.M	664	2,38	1546,963	39,33	20,59%
M.M.	382	3,97	1532,207	39,14	10,25%
T.M	186	3,85	1555,105	24,17	0,08%
Total	1232				

Based on Table 1, results show:

Managers of all level enterprises base their work on their experience. Therefore, managers of middle level mostly perform their work and do their work based on their experience with an average of 3,97; managers of lower level perform and do their work based to their experience in value from 2,38 and ones from the highest level 3,85.

Before we start presenting results regarding level of using OLAP tools and DM applications in support of information systems at enterprises in Kosovo, we present results that have to do with how much managers use their intuition within their work performance during business processes. It is vital to know the role and use of intuition by managers within their work performance and quality of their work performance on respective business processes. Based on research group (M. Syazwan , A. Talib, A. Bakar , A. Hamid, Th. Ai Chin 2015) the use of intuition during work performance depends on information, knowledge and uncertainties of managers themselves. This implies that if there is a high level of intuition, there may be a lack of qualitative development of business processes. The following table presents results related to level of use of intuition by managers when performing their work in any business process in Kosovo enterprises.

Table 3

Statistical description based to managerial perception regarding use of their intuition during business process.

Managers Level	Using intuition during business process				
	Total	Me	Variance	Sdev	Coefficient
L.M	664	2,75	2339,750	28,45	6,15%
M.M.	382	3,24	1539,856	24,4	8,23%
T.M	186	3,54	1338,3218	20,28	13,05%
Total	1232				

Based on the above table, it can be concluded that general managers use an above-average level of intuition during business processes that are developed at enterprises. Since the high-level managers use their intuition on average from 3.54 (where values vary from 1-5), this is very high and creates doubt about quality of development and performing business processes if we refer to the research group (H. H. Tat, P. Sun Hooi, A. McGrew T. Ai Chin, R. McYus 2015). Managers of other levels also use their intuition on average at a value of 3.14 which is high. The main concern is that a high level of reliance on intuition can affect rationality of business making and can bring inefficiency into information system based on OLAP tools and DM applications. Ultimately, this gives inadequate direction to business development.

Table 4

Report between Using of Information Supporting Systems (ISS) and Managerial Levels in Kosovo MBE

Managers level	Never	Sometimes	Often	Too much	Total
LM					
%	100,0%	0,0%	0,0%	0,0%	100,0%
% of Total	5,3%	0,0%	0,0%	0,0%	5,3%
MM					
%	20,0%	20,0%	40,0%	20,0%	100,0%
% of Total	5,3%	5,3%	10,5%	5,3%	26,3%
TM					
%	33,3%	8,3%	41,7%	16,7%	100,0%
% of Total	21,1%	5,3%	26,3%	10,5%	63,2%
Total					
%	36,8%	10,5%	36,8%	15,8%	100,0%
% of Total	36,8%	10,5%	36,8%	15,8%	100,0%

Following this concern, table 3 highlights that managers use information support systems at above-average levels during business processes expressed as a total of 52%, since 15.8% are used very often and 36.8% often. We also cannot ignore the fact that 36% of managers do not use at all supporting information systems during their business processes.

9.   ANALYSES

Analyses of the study will be based on analysing and discussing results based on set hypothesis and research variables. Factorial analyses comprise our first observation (P. Newbold, W. L. Calrson, B. Thorne 2007) with an aim to find factors or variables that influence acceptance of the hypotheses. Secondly, we analyse correlations by variables extracted from factorial analyses in order to understand the connection between variables. This is important for further analysing of econometric model based on equation of multiple regression and other analyses that come out by application of this equation. The figure of factorial variables analysis follows:
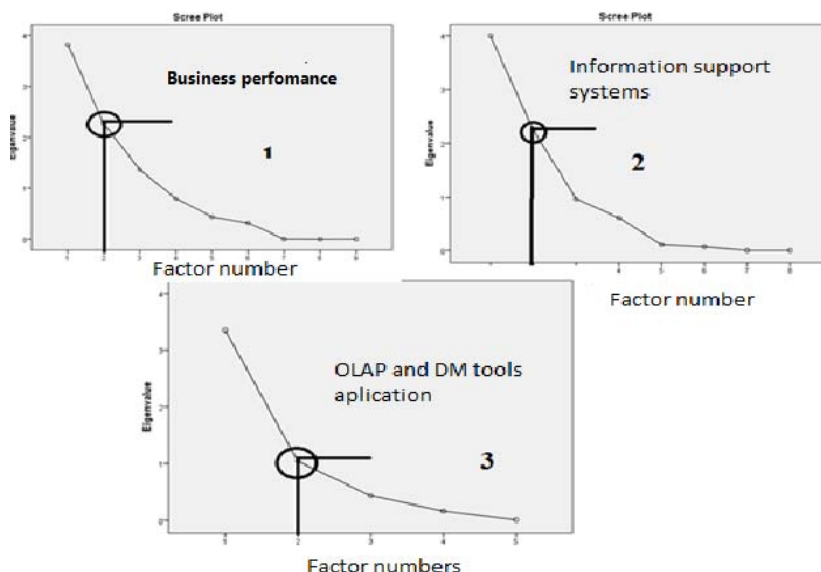

Figure 1 Factor Analyses for Variables

Based on factor analysis we can determine factors and variables. Information support systems, OLAP tools and DM application as well as business performance are primary variables that influence better business processes and performance in general. However, to determine how much and in what capacity variables affect each other, it is necessary (B. Krasniqi 2012) to make correlation analysis since this helps finding coefficients of relations between variables (P. Newbold, W. L. Carlson, B. Thorne 2007).

Table 5

Correlations between SGD, OLAP and DM tools, level of using ISS

Variables		Business performance	OLAP and DM	Level of Using ISS
Pearson Correlation	BP	1,000	,799	,945
	OLAP and DM	,799	1,000	,934
	Level of Using ISS	,945	,934	1,000
Sig. (1-tailed)	BP	.	,003	,000
	OLAP and DM	,003	.	,000
	Level of Using ISS	,000	,000	.
N – Sample Size	BP	1232	1232	1232
	OLAP and DM	1232	1232	1232
	Level of Using ISS	1232	1232	1232

Table below shows results of correlation analyses between BP, OLAP and DM performance and level of using ISS. The most reliable positive correlation is between mentioned variables. The results communicate if managers want to make correct and quality decisions for business processes they must have information support systems which consist of algorithm applications such as OLAP and DM with excellent tools.

Correlation analyses show us positive correlation between variables with high results, 945, 934, 799 and significance 000 and 003. The meaning of this positive relationship is that testing model has dependent variables that influence each other. Tables present R-value of testing regression equation model.

Table 6

Model Summary b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,972[a]	,945	,918	,30339829

a. Predictors: (Constant), OLAP and DM performance, Information Support   Systems
b. Dependent Variable: quality of business process

Based on the model we determined that R-Value Square is acceptable as demonstrated in Table 6. Based on R-value it can be concluded that ISS constructed by adequate OLAP and DM tools is part of a business process system and businesses have needs for those tools as a way to increase their performance.

Table 7

ANOVA a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,358	2	3,179	34,538	,006[b]
	Residual	,368	4	,092		
	Total	6,727	6			

a. Dependent Variable: Strategic group decision
b. Predictors: (Constant), OLAP and DM performance, Support systems during decision making

The significance of regression model is 0,006 meaning that both OLAP and DM tools, along with information support system influence business process quality. Thus our first hypothesis stating that applications of OLAP and DM tools influence quality of business processes is confirmed. We can conclude that any information support system which consists of relative OLAP and DM tools influences business process positively and brings a better quality to the process. The second hypothesis which claims that adequate applications of OLAP and DM tools promote better business performance is also confirmed but with caveats that only some applications influence business performance.

The quality of business process will depend on using adequate level of information support system. The next table presents beta value of regression equation.

Table 8

Coefficients a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	243	,152		1,605	,184
	OLAP and DM and ISS	1,193	,690	1,126	1,728	,159
	Business performance	2,204	,698	2,059	3,159	,034

a. Dependent Variable: Quality of business process

Thus constant and relied coefficient on variable quality of business process is 0,243 with a significance of 0,184 and independent variable Level of Using ISS has a beta coefficient value of 1.193 with a significance of 0.159, and OLAP and DM tools have 2.204 with a significance of 0,034. So, those variable values can be used for testing model of mentioned hypotheses.

10.   CONCLUSION

In this study we found that almost all managers use their experience and intuition during their daily work or their business process. This study also points out business needs for information support systems with adequate applications that must be based on real business demands and needs.

The study shows problems and barriers which occupy managers in business sector of Kosovo regarding continued development of OLAP tools and data mining applications. The reason for this manager concern is that companies in Kosovo use universal ISS which are not adequate or adapted for Kosovo company needs.

Actually, this study shows a great need for more flexible operative information business systems such as OLAP and DM tools which must be in line with clearly defined methodological framework of ISS applications.

An understandable development methodology is one of key parameters for successful modelling of applications which must be integrated in some business support systems. Thus OLAP and DM elements of business process system must come from business market needs. The main emphasis of this study was defining successful model for integrating OLAP and DM tools through information support systems and showing how those tools can impact business process performance.

According to H1 being confirmed, we conclude that businesses in Kosovo must incorporate and integrate OLAP and DM tools as well as applications in their processes if they want to make quality business decisions.

Since we revealed that relative and flexible operative system OLAP tools and DM applications influence the decision quality if decision process is undertaken in certain situation.

Regarding H2, we strongly recommend that business policy be oriented to applied software which must have opportunity to upgrade new tools regarding new algorithm solutions for business problems. In other words, business applied software must give an answer at all business situations in an economic policy system. For example, in Kosovo business encounters with too many loyalty barriers regarding this software must have tools that can show probability of a good decision. However, adequate software can influence business process.

In future research we recommend dealing with building of a whole system for prevention of OLAP goods and data mining tools, which are equal with business market needs in Kosovo. Data mining model tools in future according to Kosovo case must be defined and described here for detection of potential business problems and opportunities as part of business process systems.

Detection model results must be matched with defined segments of users and for each segment it is necessary to define appropriate action. This study in different complex situations must utilize best of OLAP and DM tools.

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POSLOVNE POTREBE ZA OLAP-OM I ALATIMA ZA RUDARENJE PODATAKA: PRIMJER TVRTKI NA KOSOVU

Sažetak

U ovome radu govori se o temama bitnim za razumijevanje uključivanja OLAP alata i aplikacija rudarenja podataka u poslovanje tvrtki na Kosovu, te utjecaj informacijskih sustava na te poslovne procese. Jasno je da teorijska podloga uključuje razne teme, poput uloge i utjecaja izvrsnih OLAP alata i aplikacija rudarenja podataka u informacijskim sustavima s ciljem poboljšanja izvedbe i poslovnih procesa. Cilj ovog istraživanja je istaknuti potrebe tvrtki na Kosovu za izvrsnim OLAP alatima i aplikacijama rudarenja podataka, kao i informativnim sustavima koji uključuju spomenute alate i aplikacije tijekom poslovnih procesa, kako bi se postigla bolja poslovna izvedba. U istraživanju su primijenjene kvantitativne metode s deduktivnim pristupom. Točnije, ispitivanjem se podupire teorija OLAP alata i alata rudarenja podataka, informacijskih sustava i poslovnih procesa uporabom kvantitativnih i izvršnih podataka uz odgovarajući ekonometrijski model. Rezultati su pokazali da je na Kosovu razina odgovarajućih OLAP alata i aplikacija rudarenja podataka u poslovnim procesima niska uz dobivenu statističku značajnost od p = 0.52. Koeficijent p, koji se temelji na dobivenim rezultatima potvrđuje zaključak da se poslovne tvrtke na Kosovu ne koriste odgovarajućim alatima u svojim informacijskim sustavima.

***Ključne riječi:** OLAP, rudarenje podataka, poslovni proces, razina upravljanja, informacijski sustavi.*

***JEL klasifikacija:** C88, M15, D80.*