

BUSINESS INTELLIGENCE AND SUPPLY CHAIN MANAGEMENT

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Abstract

The companies that apply the concept of business intelligence in their business in some of the following ways were included in this study: at the level of the entire system or specific strategic business units of companies (e.g. marketing department, research development, finance and accounting, manufacturing, commercial, procurement etc.), apply business intelligence only in certain business processes or projects, used in business from the technology and platform for data warehouse, data mining, OLAP tools, using advanced analytical techniques of simulation and visualization applications. Variables examined were categorized into four groups: business intelligence, supply chain management, information visibility and integration. Factor analysis was used to facilitate the connection of these groups of variables, i.e. reduction of number of variables. Then, we tested the correlation between the newly formed variables. There was a significant statistical correlation between business intelligence, supply chain management, information visibility and integration among the partners in the production chain. ANOVA was conducted to compare differences in the mean values of variables in relation to the activity, size and legal form. This paper will analyze the relationship between business intelligence and supply chain management.

Keywords: business intelligence, supply chain management, factor analysis, correlation, one-way analysis of variance.

1. INTRODUCTION

In the context of this research business intelligence is seen as a concept of conscious, organized, continuous, legal and legitimate gathering, analyzing and using data and information for the business. It is carried out using information technology, but also in other ways. It is aimed to collect the relevant knowledge about customers, suppliers, competitors, the industry, the technology, institutional regulations and other factors that directly or indirectly affect the company's business, and to support management in making business decisions. The purpose of this study was to capture the companies that apply the concept of business intelligence in their business. While researching on the orientation on supply chain and supply chain management, companies selected were those which have been able to confirm that they have at least one link in the supply chain in

order to be included in the sample. Also, they were supposed to be active when applying business intelligence.

2. SAMPLE SELECTION AND QUESTIONNAIRE

For the purpose of this paper the most interesting empirical statistical research involve survey sampling. The questionnaire was verified by several professors from Faculty of Economics in Split and Zagreb, Faculty of Social Sciences in Zagreb as well as practitioners of business intelligence.

Before the final definition of the survey, pilot study was conducted by the interviewer to test questions on a smaller number of respondents. The purpose of this pre-testing was confirmation of the basic assumptions of the proposed model, validation of the research instrument and remove the ambiguity. In addition to the implementation, the purpose was to determine its clarity and appropriateness for the research. The method of data collection was via internet.

321 enterprises responded to the questionnaire. Given that the intention was to investigate those companies that apply business intelligence in their work, prior to processing we exempt companies that replied to the questionnaire's last assertion of business intelligence ("In your enterprise business intelligence is not yet systematically organized"). There were 25 companies as such. In addition to these companies, the exempted were three who had not responded to this question, which means that the usable responses was 293, and the response was achieved by 29.3%. As expected response rate for online surveys is variable, in the case of 30% of companies it is considered to be acceptable.

The main instrument for the implementation to this study was a questionnaire which consisted of closed questions with the answers that involve a Likert scale with five degrees of intensity. Likert scale attitude is based on the assumption that every statement/particles on the scale has equal importance and weight in terms of how much reflects the attitude toward a particular issue or problem. The survey participants have to chose the answer from 1 = strongly disagree to 5 = strongly agree. For the purposes of this research, a measurement of the perception of respondents was employed. This was chosen for two reasons: (1) the effects of the use of business intelligence are intangible or qualitative, which are not suitable for the objective measurement, (2) most of the information by their nature confidential or strategic, is therefore not suitable for publication.

Studies have shown that managerial assessment and management estimates do not differ significantly from the objective values obtained from external sources.

3. CREATING VARIABLES RELATED TO BUSINESS INTELIENCE

Claims related to business intelligence have been grouped into five groups. Internal consistency was examined using Cronbach's alpha. The first group includes claims related to the sources and reliability of data and information. At the beginning there are total of eight variables. Cronbach's alpha was calculated to examine internal consistency and it has been concluded that one variable should be dropped. Thereafter it has been obtained a satisfactory size of Cronbach's alpha (0.715).The second group includes claims related to access to data and information. There were four claims. Cronbach's alpha was 0.77.

The third group of variables is made of claims relating to advanced analytics. There were also four claims. Cronbach's alpha was 0.778.

The fourth group includes claims related to intuition and time and consists of five claims. Cronbach's alpha was 0.765.

The fifth group consists of claims related to the organization of business intelligence and consists of five claims of which one is expelled because of internal inconsistencies. Cronbach's alpha was 0.64.

After testing the internal consistency, factor analysis was performed in order to create five latent variables to facilitate handling in the later stage of analysis. All the results were satisfactory in accordance with the requirements of factor analysis. Main indicators considered about the validity of factor analysis were: Kaiser-Meyer-Olkin measure of sampling adequacy, Bartlett's test of sphericity, Kaiser's criterion on the size of eigenvalues and the percentage of variance explained. Factor loadings were all greater than 0.5, which is very satisfactory.

4. CREATING VARIABLES RELATED TO SUPPLY CHAIN MANAGEMENT

Claims relating to the management of the supply chain are grouped into five dimensions. The first dimension is related to agility and had four claims. Cronbach's alpha was 0.894. The second dimension was related to the adaptability and had three claims. Cronbach's alpha was 0.817. The third dimension is related to the alignment and had three claims. Cronbach's alpha was 0.732. The fourth dimension is related to the proactivity and consisted of four variables. Cronbach's alpha was 0.900. The fifth dimension of supply chain management was related to the performance and consisted of six statements. Cronbach's alpha has been calculated and the result was 0.896.

After testing the internal consistency, the factor analysis was performed in order to create five latent variables in order to facilitate handling in the later stage of analysis. All the results were satisfactory in accordance with the requirements of factor analysis. The same indicators regarding validity of the factor analysis have been taken as for the creation of variables related to business intelligence.

5. CORRELATION BETWEEN BUSINESS INTELLIGENCE AND SUPPLY CHAIN MANAGEMENT

After reducing the number of variables in the business intelligence and supply chain management we have investigated the association between latent variables related to business intelligence and supply chain management. The following matrix of Pearson's correlation coefficients was obtained:

Table 1 Correlation between business intelligence and supply chain management

		SCM Agility	SCM Adaptability	SCM Alignment	SCM Proactivity	SCM Performance
BI Reliability of data and information	Pearson Correlation	0.400**	0.465**	0.321**	0.287**	0.429**
	Sig. (1-tailed)	0.000	0.000	0.000	0.000	0.000
	N	270	275	270	273	270
BI Access to data and information	Pearson Correlation	0.330**	0.330**	0.211**	0.201**	0.252**
	Sig. (1-tailed)	0.000	0.000	0.000	0.000	0.000
	N	283	289	283	285	280
BI Advanced analytics	Pearson Correlation	0.247**	0.380**	0.162**	0.397**	0.295**
	Sig. (1-tailed)	0.000	0.000	0.004	0.000	0.000
	N	274	280	274	278	273
BI Intuition and time	Pearson Correlation	0.420**	0.473**	0.313**	0.296**	0.402**
	Sig. (1-tailed)	0.000	0.000	0.000	0.000	0.000
	N	282	288	282	285	280
Organization of BI	Pearson Correlation	0.308**	0.333**	0.235**	0.242**	0.265**
	Sig. (1-tailed)	0.000	0.000	0.000	0.000	0.000
	N	276	282	275	280	275

** . Correlation is significant at the 0.01 level (1-tailed).

As can be discerned from the table above, in all cases there is a statistically significant correlation between variables that are related to business intelligence and variables related to supply chain management ($p < 0.001$). It may also be noted that the correlation coefficients are not very large.

6. ONE-WAY ANOVA OF BUSINESS INTELLIGENCE WITH RESPECT TO ACTIVITY, EMPLOYMENT AND LEGAL FORM OF THE COMPANY

It has been investigated the difference in the arithmetic means of business intelligence through one-way analysis of variance in relation to the sort of business of the company, number of employees, and legal form. Statistically significant differences in mean of business intelligence were obtained only when analyzing the activity of the company.

Table 2 Analysis of variance of business intelligence with respect to the activity of the company

Variable	Significance
Source and reliability of data and information	0.013
Access to data and information	0.080
Advanced analytics	0.061
Intuition and time	0.927
Organization of business intelligence	0.967

Companies in the field of banking and finance, telecommunications and business services sectors have significantly more developed business intelligence in relation to companies related to the industrial production, trade, tourism and construction. These differences were found in the first three groups of questions related to business intelligence and were statistically significant.

As regards the number of employees and legal form of companies, there was no statistically significant difference regarding the application of the concept of business intelligence, and thus these results are not displayed.

7. ONE-WAY ANOVA OF SUPPLY CHAIN MANAGEMENT WITH RESPECT TO ACTIVITY, EMPLOYMENT AND LEGAL FORM OF THE COMPANY

Table 3 Analysis of variance of supply chain management regarding the activity of the company

Variable	Significance
Agility	0.007
Adaptability	0.062
Alignment	0.001
Proactivity	0.394
Performance	0.002

As can be seen from the table above, all variables were statistically significant difference except proactivity. As with business intelligence, better results were achieved in companies in financial services, telecommunications and business services. As with business intelligence, there was no statistically significant difference considering number of employees and legal form of enterprise, and thus these results have not been displayed.

8. CONCLUSION

The aim of the main hypothesis was to investigate the correlation concept of business intelligence and supply chain management. Aggregate correlation coefficients show statistically significant correlation between the actual two sets of variables. Correlations dimensions that constitute the observed variables indicate some interesting elements:

- ♣ Quality of sources and reliability of data and information is effectively connected with better agility, adaptability and better performance of the companies analyzed;
- ♣ Use of intuition and time improvements based on the use of business intelligence is effectively connected with better agility, adaptability and better performance;
- ♣ Widespread use of advanced analytics is actually associated with better adaptability and greater supply chain proactivity of the companies analyzed.

With the exception of the correlation between advanced analytics and compliance which is defined as low, all other mutual correlations are strong and statistically significant, so we can conclude that there is a positive correlation between the use of business intelligence and efficient supply chain management. It can be concluded that the relationship between business intelligence and supply chain management should be strengthened in order to maximize the correlation coefficients in the practical sense.

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Supply chain management is not only a process served to generate a cost reduction in the budget or a mission to create greater operational efficiencies within an organization. While these are a part of the whole ecosystem, modern supply chain management encompasses the strategic alignment of end-to-end business processes to realize market and economic value, as well as giving a firm the competitive advantage over their business rivals. **Improve Financial Position.** Insert Profit Leverage - Businesses value supply chain managers because they help control and decrease supply chain expenditures. **Decrease Fixed Assets** - Supply chain managers decrease the use of large fixed assets such as plants, warehouses and transportation vehicles, essentially diminishing cost. Aberdeen benchmarked 149 supply chain related executives on their business intelligence initiatives in March and April 2011. Aberdeen also conducted the 5th annual Supply Chain Management summit in Chicago, March 29 and 30, 2011 where business intelligence was a key focus of several sessions. As shown in Figure 1, the top pressure that companies are facing is the growing complexity of global operations (57%), the lack of visibility at various nodes of supply chain (41%), and the need to improve top line revenue (40%). **Had a supply chain business intelligence related program in place for more than two years** - 57% of companies have identified the growing complexity of global operations as the top pressure forcing them to look at supply chain intelligence solutions. Supply Chain Management software applications provide real-time analytical systems that manage the flow of product and information throughout the supply chain network. They are designed to enhance SCM operations such as supplier sourcing, production planning, inventory planning, transportation planning, demand planning. In basic terms, supply management software manages supply chain transactions and activities, flow of data, supplier relationships and any other related activities. The software runs on the principles of the supply chain which is a very crucial area for any business. It may be **Supply Chain Agility** is important for organisations to stay competitive in today's dynamic business environment. There is increasing interest in deploying Business Intelligence (BI) in the Supply Chain Management (SCM) context to improve Supply Chain (SC) Agility. However, there is limited research exploring BI contributions to SC Agility. In this research-in-progress paper we propose a model based on a conceptual analysis of the literature showing how BI can help organisations achieve SC Agility by supporting the key areas of SCM (Plan, Source, Make, Deliver and Return).