Evaluating the Level of Information Sharing in Supply Chain Management in Vlore, Albania: a Statistical Analysis

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Abstract—Information sharing is vital for the coordination of supply chain partners. Information technologies offer numerous opportunities for information exchange between supply chain members. The aim of this study is to estimate the level of information sharing among SMEs located in Vlore city, Albania. The objectives of this research are: to identify the information technologies that are used by companies, type and frequency of information shared, to assess the level of information sharing and to identify the company characteristics like experience, number of employees, sector, role in the supply chain, use of IT tools, that impact the level of information sharing. The target population consists of all small and medium enterprises operating in Vlore city, Albania. A questionnaire was distributed to top managers and IT specialists of targeted companies during November 2015. The descriptive analysis, the chi-squared test of independence and logistic regression are used to analyze the data. It is found that the role of company as a retailer in the supply chain and the use of IT tools were positively related with the level of information sharing, whereas the local business expansion was negatively related. The results of this study are important to find out which business characteristics affect information sharing. Top managers and IT specialists of companies can be based on these results to improve the overall performance of their supply chain.

Keywords—information sharing; information technology; supply chain; chi-square test; logistic regression

I.   INFORMATION SHARING IN SCM

Many researchers have emphasized the importance of information sharing in Supply Chain Management (SCM) practice. Information sharing is considered one of the most effective ways of improving supply chain performance ([1], [2] and [3]). Supply chain partners who exchange information regularly can understand the needs of the end customer better and hence can respond to market change quicker [4]. The quantity of information shared between members it is not enough, this information should be also qualitative. Both, quantity and quality are important for the practices of SCM. Many researchers have treated information quantity and information quality independently ([5], [6]).

Also it is important to specify with whom should information be shared (manufacturer, retailers, distribution centers, etc.) and what information should be shared (order status, demand, production plan, supply capacity, etc.). In her study about determinants of information sharing in

supply chain in Albania, [7] found that information which is shared more frequently between members of supply chain was the information about order status and supply capacity and more rarely the information about production plan. Albanian companies pay attention to management of their supply chain, but they are in the first steps and must consider studies and experience of international companies in this field [8].

The objectives of this paper are: identifying the most used information technologies; identifying the type of information shared between supply chain members and identifying the relationship between business characteristics (retailers, experience, number of employees, local business, service sector, IT user) and information sharing. In the first part of this study are represented material and methods used, in the second part obtained results are presented and in the last part the conclusions derived from this study are summarized.

II.   MATERIALS AND METHODS

The target population of the study consists of all the Small and Medium-sized Enterprises (SMEs) operating in Vlore City, Albania. In total, 150 questionnaires were randomly distributed to top managers, executives and IT specialists of the targeted companies during November 2015. Only 44 questionnaires were returned and were useful for the data analysis, representing a response rate of 29.33%. The questionnaire included questions about: company profile; supply chain and supply chain management; information technology used by companies to manage their supply chain, type and frequency of information shared with supply chain members, and the level of information sharing.

This study measures the level of information sharing of SMEs with members of their supply chain(s) using the items adopted from the study of [9]. All the items were measured on a 1 to 5 Likert scale from 'strongly disagree' to 'strongly agree'. The Cronbach's alpha coefficient of internal consistency is used to determine that the items comprising the information quality variable produced a reliable scale. A higher score of Cronbach's alpha coefficient indicate a higher reliability, with a range from 0 to 1. The generally agreed upon lower limit of Cronbach's alpha is 0.7 [10]. A company was considered with high level of information sharing if the average value of information sharing items was equal or higher than the overall mean of the sample.

The descriptive analysis, correlation analysis, chi-squared test of independence and logistic regression are used to analyze the data.

The chi-square test of independence was used to test the independence of the two categorical variables (that is, there is no relationship between them) [11]. The test statistics is:

$$\chi^2 = \sum_{i=1}^{n} \sum_{j=1}^{m} \frac{(f_{ij} - p_{ij})^2}{p_{ij}} \qquad (1)$$

Where n indicates the number of columns and m the number of rows of the contingency table; f_{ij} are observed frequencies in the ij cell of the $n \ x \ m$ contingency table, whereas p_{ij} are expected frequencies in the ij cell if the null hypothesis of independence was true. The null hypothesis of independence of two variables is rejected at the level of significance α%, if p-value is lower than α% [11].

A logistic regression model with a dichotomous response of use or not use was modeled. The logistic regression equation has the following form [12]:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k \qquad (2)$$

Where p is the estimated probability that the company have high level of information sharing and $x_1, x_2... x_k$ are the independent variables of the model.

The estimated probability of the response occurring (p) divided by the probability of not occurring ($1\text{-}p$) is called the *odds ratio*. Maximum likelihood method is used to estimate the odds ratios of the model. Values of odds ratios higher than 1 indicate positive association between each independent variable and the dependent variable of the model.

STATA15 was used to perform the descriptive analysis, chi-squares test and binary logistic regression analysis.

III. RESULTS AND DISCUSSION

About 77% of the companies in the sample operate in the service sector, half of them have more than 10 employees, and only 40% of them have more than 10 years of experience. Approximately 75% of companies are retailers, 25% are producers and about 51% of them are local businesses. Around 88% of companies share information electronically with members of their supply chain.

The results of Fig. 1 indicate that more often (every day) is shared the information about order status and supply capacity, whereas the information about demand forecasting and inventory level is shared every month.
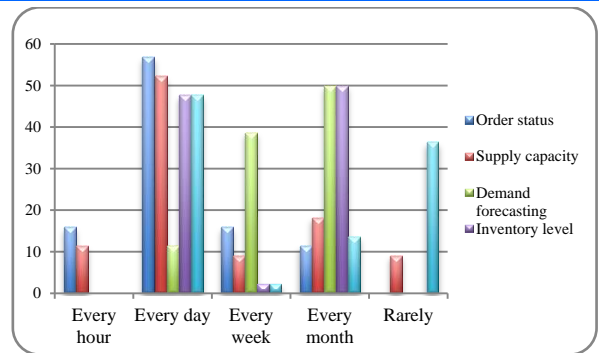

Fig. 1. Type and frequency of information shared

The Fig. 2 shows the percentage of usage of some IT tools. The results indicated that more than 80% of the companies used corporate Websites, Internet, and E-mail; more than 70% used Electronic Data Interchange and Local Area Network. Also, less than 20% of companies in the sample used Electronic bar coding systems and electronic staff input/output control systems.
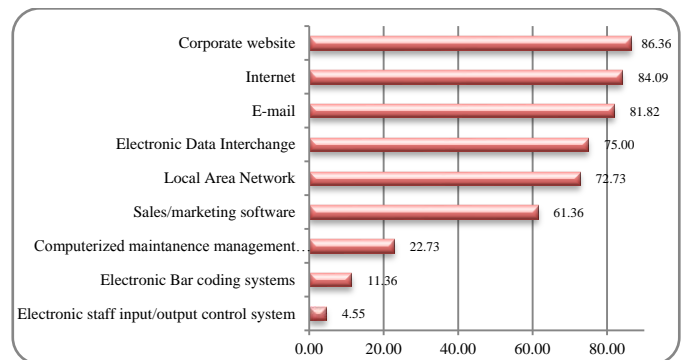

Fig. 2. Percentage of use of IT tools

More than 52% of targeted companies uses website for online ordering, about 30% take electronic complaints online and more than 18% have links or references to the enterprise social media. About 95% of companies use social media and only 14% of companies pays to advertise on internet.

The descriptive statistics, mean, standard deviation and Cronbach's alpha for all the items of information sharing are shown in table 1. The results of Table 1 indicate that all the items of the variable information sharing have an average higher than three and that the first item has the highest average of 4.64. Also, all the items have Cronbach's alpha value higher than the generally accepted lower value of 0.7.

TABLE I. LEVEL OF INFORMATION SHARING

Items	Mean	Standard deviation	Cronbach's alpha
We inform trading partners in advance of changing needs.	4.64	0.72	0.90
Our trading partners share proprietary information with us.	4.07	0.69	0.87
Our trading partners keep us fully informed about issues that affect our business.	3.68	0.90	0.85
Our trading partners share business knowledge of core business processes with us.	3.14	1.05	0.86
We and our trading partners exchange information that helps establishment of business planning.	4.07	0.92	0.85
We and our trading partners keep each other informed about events or changes that may affect the other partners.	3.48	0.87	0.85
Information sharing (all items)	3.84	0.69	0.88

The Chi-square test of independence was used to evaluate the relation between the level of information sharing and business' characteristics, the role of company in the supply chain and IT usage. A company was considered a user of IT tools when it uses all four IT tools: e-mail, internet, company website and Electronic Data Interchange.

The results of Table 2 indicate that there were significant relations between business expansion at 5% level, and between business sector and number of employees at 10% level, and the level of information sharing with members of supply chain. Experience, use of IT tools and the role of the company in their supply chain as a retailer, were not significantly related to the level of information sharing.

TABLE II.   RESULTS OF THE CHI-SQUARE TEST (BINARY VARIABLE: INFORMATION SHARING)

Variable	Chi-square value (df)	p-value
Service sector	3.12 (1)	0.077
Local business	15.24 (1)	0.000
Number of employees	3.54 (1)	0.060
Experience	0.014 (1)	0.907
Retailer	2.10 (1)	0.148
IT user	1.80 (1)	0.180

The correlation coefficients between independent variables of the logistic model were calculated to check for the problem of multicollinearity (Table 3). All the correlation coefficients were statistically significant at 5% level. The variable *Service sector* was highly correlated with the variable *Retailer* ($r = 0.939$, $p < 0.01$), whereas other correlation coefficients were lower than 0.6.

TABLE III.   THE CORRELATION MATRIX

Variable	Service sector	Local business	Number of employees	Experience	Retailer	IT user
Service sector	1.000	0.563*	- 0.217*	- 0.319*	0.939*	0.350*
Local business	0.563*	1.000	-0.303*	-0.124*	0.563*	0.066*
Number of employees	- 0.217*	-0.303*	1.000	-0.047*	-0.157*	0.140*
Experience	- 0.319*	-0.124*	-0.047*	1.000	-0.350*	0.041*
Retailer	0.939*	0.563*	-0.157*	-0.350*	1.000	0.296*
IT user	0.350*	0.066*	0.140*	0.041*	0.296*	1.000

a. Note: * $p < 0.05$

The results of binary logistic regression model 1 (Table 4) indicated that the model was statistically significant (LR chi-square (4) = 17.67, p = 0.0014). The value of Pseudo-R^2 was 31.13% and the percentage of cases correctly classified was 76.74%. The classification accuracy should be at least 25% greater than that achieved by chance [10].

TABLE IV.   RESULTS OF BINARY LOGISTIC REGRESSION (DEPENDENT VARIABLE: THE LEVEL OF INFORMATION SHARING)

Dependent variable	Model 1		Model 2	
	Coefficient	Odds ratio	Coefficient	Odds ratio
Business Expansion				
Local	-3.170	0.042*	-4.760	0.009*
National/International		1.000		1.000
Number of employees				
Ten or less		1.000	1.713	1.000
More than 10	0.675	1.964		5.545
Experience				
Ten years or less		1.000	0.477	1.000
More than ten years	0.040	1.041		1.611
Retailer				
Yes	0.651	1.917	3.03	20.74***
No		1.000		1.000
IT user				
Yes			-3.350	1.000**
No				0.035
Constant	-0.095	0.9090	-2.247	0.106
LR chi-square (df)	17.67 (4)		25.64 (5)	
% correctly classified	76.74		83.72	
Pseudo-R^2	31.13%		45.18%	

b. Note: * $p < 0.01$, ** $p < 0.05$, *** $p < 0.10$.

The odds ratios of the model 1 indicated that the level of information sharing was negatively related to the local expansion of business activity, that is, national or international business were more likely to share information at 1% level (Table 4). Other independent variables were not significant. Although non-significant, the number of employees, experience and the role of the business in the

supply chain management were positively related with the dependent variable.

The results of binary logistic regression model 2 indicated that the model was statistically significant (LR chi-square (5) = 25.64, p = 0.0001). The value of Pseudo-R^2 was 45.18% and the percentage of cases correctly classified was 83.72%. The odds ratios of the model 2 indicated that the level of information sharing was negatively related to the local expansion of business activity, meaning that the local businesses are less likely to share information with their business partners at 1% level. The companies that use IT tools were more likely to share information with business partners at 5% level. The role of company in the supply chain as a retailer was statistically significant at 10% level, whereas two other independent variables were not significant.

IV. CONCLUSIONS

The findings of this study provide useful information about SMEs in the study. The identification of the business' characteristics that statistically influence the level of information sharing in supply chain(s) can help the top managers and IT specialists to improve the overall performance of their company and their supply chain (s).

The results of descriptive analysis indicated that more than 80% of the companies in the sample used Internet, E-mail and websites. More than 70% of them used Electronic Data Interchange. The results of Chi-square test showed a significant relation between the level of information sharing and local business (business expansion), number of employees and service sector.

The binary logistic model 2 indicated that the local business are less likely to share information, whereas the role of the company in the supply chain, and the use of four IT tools (e-mail, internet, company website and Electronic Data Interchange) significantly impacted the level of information shared between partners.

In this study there are some limitations. Firstly, the study identifies some characteristics of companies and the usage of IT tools that may influence the level of information sharing. However, other factors can influence the level of information quality. Secondly, the sample was small and do not cover all the SMEs operating in Vlore City, Albania.

In the future, the research can be conducted to identify other factors that can influence the level of information sharing in supply chain(s) such as: security, trust, culture, information, etc., and also the sample size can be increased to use other multivariate statistical methods like Structural Equation Modeling.

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