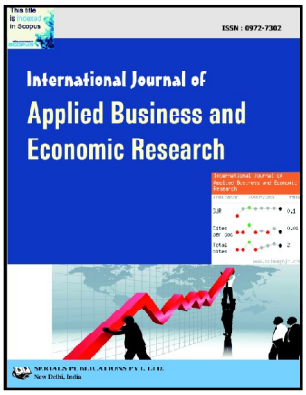

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Study of Impacts the Quality of Information Systems have on Measures used to Increase Supply Chain Flexibility in Slovak Tourism Industry

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Abstract: The purpose of this paper is to analyze the utilization of various measures and approaches designed to increase flexibility of supply chains in tourism industry, specifically the impact quality of information system has on application of selected measures. The main focus is on assessing the reality of tourism enterprises located in Slovak republic. In order to achieve this aim we use data provided by Slovak enterprises via a survey. Thirty-five measures to increase flexibility in supply chains were assessed. A list of these measures was created based on literature review of current and significant studies on the topic of supply chain flexibility and quality of information systems. Five hypotheses were formulated and tested. Applied methods were consequently divided into three categories according to the extent of their application by Slovak tourism enterprises. Based on these findings a list of methods to increase flexibility of supply chain which are not used by Slovak enterprises was created. Moreover, correlation coefficients were calculated to discover and measure significant relationships between applied methods and various factors including the quality of information systems. Our findings provide a better understanding of how various methods can function when applied in combination and moreover, how would they behave in terms of companies' characterizations.

Keywords: Supply chain, Flexibility, Quality of information systems, Tourism enterprises.

1. INTRODUCTION

Supply chain management is a relatively newly developed field of study; however it has been given a significant attention recently (Bozorgmehr & Tavakoli, 2015; Choi & Messinger, 2016; Gandhi & Sheorey, 2017; Grover & Malhotra, 2003; Malhotra & Grover, 1998; Véronneau *et al.*, 2015; Wang & Wei, 2007; Wiengarten *et al.*, 2016; Zhang *et al.*, 2009). It is highly necessary to focus on development of supply chains in current conditions. Nowadays, corporate processes are continuously evolving and their operations are

more demanding in terms of precision. Based on this new reality and given current market conditions, resources are becoming closely monitored and harder to obtain. This situation naturally leads to higher pressures on businesses from their competitors. The essential question is how fast can resources be delivered and how quickly can final product or service be offered to its customer. Therefore, a close cooperation among suppliers and customers is essential. In today's globalized business environment, competition has gone beyond the boundaries of single organization and extended across the full supply chain spectrum. Each member of supply chain is essential to achieve desirable results for all businesses involved. The quick responsiveness to ever-changing demands has clearly become a distinguishing mark between desirable partner and disruptive chain link. Market dynamics forces all supply chains to pay close attention to their strategies and turn their focus towards flexibility. Only such performance enables all members of supply chain to thrive. On the other hand, if an enterprise is unable to successfully apply measures to achieve and consequently support flexibility, it is quickly replaced (Aksin *et al.*, 2015; Baboli *et al.*, 2013; Brinkhoff *et al.*, 2014; Christ, 2014; Gong, 2008; Malhotra & Grover, 1998; Moon *et al.*, 2012; Sodhi & Tang, 2012; Sodhi *et al.*, 2011).

Overall supply chains are becoming both more complex and structured in more detailed ways (Cheng *et al.*, 2014; Cohen & Mallik, 2009; Gligor & Holcomb, 2012; Kleindorfer & Saad, 2009; Mackelprang *et al.*, 2014; Malhotra & Mackelprang, 2012; Singh & Duggal, 2017; Sodhi *et al.*, 2011; Wang *et al.*, 2015) which only increase the importance of their ability to provide quick response to stimuli and consequently to adapt in constantly changing environments (Gligor, 2013; Liao *et al.*, 2010).

From the view of supply chain management, a number of strategic measures can be utilized to increase performance and flexibility of supply chain (Koste & Malhotra, 1999; Lockström *et al.*, 2010; Nair *et al.*, 2011; Papke-Shields *et al.*, 2006; Wang & Wei, 2007). Among such measures are those that focus on development of information systems throughout supply chain (GrudzieñAuthor Vitae & Hamrol, 2016; Maiga *et al.*, 2015; Srima *et al.*, 2015; Wang *et al.*, 2016).

Although research on flexibility is considerable, the majority of it is focused on implementation of corporate strategies in individual organizations and the value of supply chain is underestimated (Beach *et al.*, 2000; Budeanu, 2009; Cai *et al.*, 2009; Chung *et al.*, 2014; De Toni & Tonchia, 1998; Koste *et al.* 2004; Mackelprang & Malhotra, 2015; Malhotra *et al.*, 2014; Mandal, 2015; Omar *et al.*, 2012; Stevenson & Spring, 2007; Zhang & Murphy, 2009).

Flexibility studies from the supply chain perspective in tourism industry, however, have thus far been limited. Several empirical studies and analyses were conducted in order to assess business reality of supply chain managements (Brandenburg, 2016; Caniëls *et al.*, 2013; DeGroote & Marx, 2013; Luthra *et al.*, 2016; Mandal, 2015; Samuel *et al.*, 2011; Shin & Eksioglu, 2015; Sluis & De Giovanni, 2016; Thun & Hoenig, 2011; Youn *et al.*, 2014). However, none of these studies are focused on measures' applications in whole nation tourism environment regardless of enterprises' orientation. Moreover, there is no research examining the relationship between quality of information systems and application of measures to increase supply chain flexibility in terms of this specific sector of economy.

Over the years researchers have focused their efforts to identify ways to make supply chains more responsive to changes and to successfully deal with uncertainties resulting in development of various types of flexibility measures. The most complex lists of measures can be found several studies (Akyuz & Erkan,

2010; Balasubramaniam & Somu, 2015; Brinkhoff *et al.*, 2014; Chopra & Mohan, 2004; Chung *et al.*, 2014; Georgiadis & Athanasiou, 2013; Gualandris *et al.*, 2015; Lummus *et al.*, 2005; Seuring, 2010; Sodhi & Tang, 2012; Závadsky & Hiadlovsky, 2014; Závadský & Závadská, 2014). These authors each provide a new perspective and outlook on measures designed to increase supply chain flexibility. However, there is a research gap which lies in the lack of more complex look into business reality on national level especially in tourism sector, especially through the lens of information system quality. We set out to explore how these measures are used in Slovak tourism enterprises using a representative sample of enterprises operating in tourism industry of selected country and how their application is influenced by various aspects of information system quality.

A closer look into tourism industry business reality on national level can therefore provide significant information which can not only serve as a baseline for further research into methods used in practice, but can also serve as guidelines for enterprises. An extensive review of applied measures in supply chain development is a natural extensions of studies mentioned above. Given these problems, we undertook an empirical study among tourism enterprises in Slovakia to determine which measures are most commonly used in practice and what is the nature of relationship between quality of information system and measures applied to increase supply chain flexibility, since this issue has not yet been studied. Research results on the topic are presented in an attempt to gain a better understanding of the various methods used in order to achieve flexibility of supply chains on the level of an important sector of national economy.

2. METHODOLOGY

The main aim of this empirical research is to analyze the utilization of various measures and approaches designed to increase flexibility of supply chains in tourism industry through the lens of information system quality. Data provided by Slovak tourism enterprises via a survey was used to achieve this aim. Survey was conducted in the period between June 2016 and December 2016. Our research sample file was created as a representative sample of the base file. We took into account the criterion of enterprise's size. We focused our research on all tourism enterprises, since we assume larger enterprises have a higher extent of flexibility measures applications. The decisive criterion was set according to the European Standard No. 2003/361/EC. We considered the representativeness of our sample file in accordance with the structure of base file provided by the Slovak Statistical Office at the time of our research.

During the research period, 326 questionnaires returned completed, out of which 12 were discarded due to inconsistent data. The final sample file used in this study consists of 314 tourism enterprises. Our sample file consists of 295 small enterprises (93.95 %), 17 medium sized enterprises (5.41 %) and of 2 large sized enterprises (0.64 %).

Using the statistical testing method, the level of representation of the sample file of enterprises was confirmed by the application of Pearson´s chi-squared test (÷2 - test), which is also known as the 'goodness-of-fit' test. According to results of this performed test, our file is a representative sample of the base file.

Five hypotheses were formulated in order to further explore the extent of utilization of various measures to increase supply chain flexibility in Slovak tourism enterprises and to achieve statistically valuable results:

H_1: The most commonly used measure to increase flexibility of supply chain in Slovak tourism enterprises is flexible promotion.

H_2: The implementation of quality system standards in enterprise is used to increase supply chain flexibility by less than 30% of Slovak tourism enterprises.

H_3: At least three of identified main components of information system quality are among the most commonly used methods to increase flexibility of supply chain by Slovak tourism enterprises.

H_4: Application of information system model to increase supply chain flexibility in Slovak tourism enterprises is dependable on number of enterprise's suppliers.

H_5: Application of all identified main components of information system quality has a direct influence on application of other measures to increase supply chain flexibility in Slovak tourism enterprises.

Based on research studies in tourism industry (Zhang *et al.*, 2009; Zhang & Murphy, 2009) promotion is important for all enterprises. Therefore the first hypothesis assumes that this measure is applied also to increase flexibility of supply chain operations. On the other hand, Závadský & Závadská (2014) proved that implementation of quality system standards has very little effect on enterprise's performance. Therefore, we assume the same results in terms of supply chain flexibility. According to studies (GrudzieñAuthor Vitae & Hamrol, 2016; Maiga *et al.*, 2015; Srima *et al.*, 2015; Wang *et al.*, 2016) we divided quality of information systems into its five main components: information collection throughout supply chain, information processing and analysis, dissemination of information, data quality (precision and usefulness) and information system model. Since we strive to examine the impact of quality of information system on measures used to increase supply chain flexibility in Slovak tourism industry, we assume that this impact is significant and therefore, at least three of identified main aspects of quality of information system are among the most commonly used methods to increase supply chain flexibility in Slovak tourism industry. Application of modeling methods has been proved highly useful in increasing supply chain flexibility (Akyuz & Erkan, 2010; 3; Gong, 2008; Kim *et al.*, 2017; Wang *et al.*, 2015). Therefore, we assume that more supplies enterprise has more beneficial information systems model can be for flexibility. Hypothesis H_5 test the assumption that the quality of information system influences application of measures to increase flexibility of supply chains which is the main topic of this research study and as such a innovative issue that has not yet been tested.

These hypotheses were verified using program SPSS Statistics. Binomial test was used to test hypotheses H_1, H_2 and H_3. Pearson correlation test was used to test hypotheses H_4 and H_5 and multivariate regression analysis was used to test H_5.

3. RESULTS AND DISCUSSION

In this part of the paper, we present the results of a survey conducted in order to evaluate the current state of utilization of measures to increase supply chain flexibility and the impact of quality of information system on their applications. We asked enterprises to select measures they apply to achieve flexibility. A list of 35 options was presented to them. We created this list of methods based on literature review. In order to properly evaluate their selections, we correlated these results with information provided about the number of enterprise's suppliers and number of their returning customers. Our goal was to provide a detailed analysis of integration of flexibility measures into supply chain management in terms of information system quality. Ten most commonly used measures by tourism enterprises are displayed in Table 1 and Table 2. The numbers represent percentages of all enterprises in sample file.

Table 1
The most commonly used methods structured by the number of suppliers

No. of suppliers Measuresin %	*1 – 20*	*21 – 50*	*51 – 75*	*76 – 100*	*101 – 200*	*201 – 500*	*over 501*	*Overall*
selection of suppliers based on predefined criteria	13.69	4.46	2.55	10.19	3.82	0.96	2.87	38.54
creation of stocks of finished products for special orders	5.73	8.28	2.87	4.78	1.27	0.96	0.96	24.84
possibilities for redeployment of human and material resources between process and/ or facilities	14.33	4.46	1.59	1.91	2.55	0.96	0.32	26.11
implementation of quality system standards (ISO, TQM, etc.)	9.55	8.60	4.14	3.18	2.87	2.55	1.27	32.17
insurance against the risk of adverse events	17.20	5.10	3.18	2.55	2.87	0.96	1.27	33.12
customer orientation as a main strategic concept of enterprise	9.87	10.19	9.87	1.27	2.23	1.91	2.23	37.58
continuous improvement, learning organization	22.61	6.05	8.60	3.18	3.82	3.18	2.55	50.00
frequent adjustments in pricing policies	7.64	5.41	1.91	0.00	2.23	1.27	1.59	20.06
information collection throughout supply chain	7.32	5.41	2.87	0.64	1.59	0.64	0.64	19.11

The most commonly used measure in Slovak tourism industry is flexible promotion. Over 58.28% of all enterprises apply this tool in their supply chain management. The second most commonly used measure is continuous improvement, applying the concept of learning organization (50% of all enterprises). Table 1 also provides information about the number of suppliers of these enterprises. We can observe downward trend in these numbers. Therefore, we can state that majority of enterprises in our sample file procures their resources from less than 20 suppliers.

The majority of Slovak tourism enterprises in our sample file has between 76 to 100 customers who used the services of enterprise more than once. Interesting finding is that over 19.13% those enterprises that use flexible promotion have between 6 to 10 returning customers, which is the highest number of enterprises using the same measure within the same interval of customer's number. Another interesting finding is that the most commonly used measure by enterprises with over 501 returning customers is application of concepts of continuous improvement and learning organization (20.39%). The most commonly used measure by enterprises with 5 and less returning customers is the selection of suppliers based on predefined criteria (13.41%).

The extent of methods application in practice was also examined. According to data provide by tourism enterprises in sample file, we divided measures into three categories. The first category consists of most commonly used measures. These are the measures which are used by more than 20 % of enterprises in our file. The next category consists of measures used by at least one of the enterprises. Lastly also we provide information about measures which are not used in Slovak tourism environment. This category consists of 5 measures: customers' expectations forecasts, reverse logistics utilization, mathematical programming utilization in SC management, application of game theory methods in parameters settings of production factors and information system modeling.

Table 2
The most commonly used methods structured by the number of returning customers

No. of returning customers / *Measuresin %*	*1 – 5*	*6 – 10*	*11 – 20*	*21 – 50*	*51 – 75*	*76 – 100*	*101 – 200*	*201 – 500*	*over 501*
flexible promotion	3.18	11.15	4.14	4.14	6.37	9.55	3.50	7.96	8.28
selection of suppliers based on predefined criteria	3.50	4.78	2.55	3.50	3.18	6.69	1.91	10.19	2.23
creation of stocks of finished products for special orders	2.23	4.46	1.59	1.91	1.59	8.60	1.91	1.27	1.27
possibilities for redeployment of human and material resources between process and / or facilities	2.23	2.87	2.87	3.50	3.50	2.87	1.59	1.27	5.41
implementation of quality system standards (ISO, TQM, etc.)	2.55	3.50	3.18	1.91	1.59	9.24	1.27	4.14	4.78
insurance against the risk of adverse events	2.23	3.82	2.23	2.87	4.78	2.55	2.55	5.73	6.37
customer orientation as a main strategic concept of enterprise	2.87	4.46	1.59	2.55	4.14	7.64	3.18	5.10	6.05
continuous improvement, learning organization	3.18	10.19	2.23	4.46	6.37	4.14	3.82	5.73	9.87
frequent adjustments in pricing policies	3.18	1.27	1.91	1.27	1.27	7.96	1.27	0.96	0.96
information collection throughout supply chain	0.96	1.91	0.64	1.91	2.23	3.82	1.59	2.87	3.18

Furthermore, we explored relations between applied measures and various factors. Correlation coefficient was used to evaluate these relations and to discover significant dependences between factors. Particular correlation coefficients presented in Table 3.

Table 3
Dependences between applied measures and enterprises' characterizations

Correlation coefficients	*No. of suppliers*	*No. of returning customers*	*Enterprise size*	*Provided services*
FXP	0.271	0.637	0.128	0.107
SSC	0.741	0.186	0.322	- 0.151
HMR	- 0.205	- 0.091	- 0.440	0.018
IQS	0.228	0.153	0.177	- 0.196
INC	0.703	0.168	0.055	0.164
COC	0.348	0.696	0.206	- 0.102
ILO	0.301	0.221	0.651	- 0.024

These results indicate that there is no significant dependence between any of examined measures and business sector in which enterprise operates, i.e. the types of tourism services it provides. However, the size of enterprise proofs to be different. There is a medium-strong direct dependence between size and application of measure concerning the selection of suppliers based on predefined criteria. This result indicates that larger Slovak tourism enterprises are more likely to use this approach when selecting a new supply chain partner. Furthermore, according to the data provided there is a significant indirect dependence

between enterprise's size and redeployment of human and material resources between process and / or facilities. This means that smaller enterprises are more likely to adopt this approach. An interesting finding is the fact that implementation of quality system standards is not dependable neither with size of enterprise not its business sector.

Moreover, a few strong dependences were marked. One of them was between number of suppliers and their selection based on predefined criteria (0.741). This result is not surprising since there is clearly a relationship between these observed factors. Similar dependence is between customer orientation as a main strategic concept of enterprise and number of returning customers.

What can be considered interesting is the finding that there is a strong positive correlation between using insurance against the risk of adverse events and number of enterprise's suppliers. However, application of this measure is not significantly dependable with number of enterprise's returning customers.

Table 4
Dependences among applied measures

correlation coefficients	*FXP*	*SSC*	*HMR*	*INC*	*COC*	*ILO*
FXP	-	- 0.158	- 0.090	0.153	0.202	-0.715
SSC	- 0.158	-	0.203	- 0.139	- 0.076	0.298
HMR	- 0.090	0.203	-	-0.744	0.063	0.798
INC	0.153	- 0.139	-0.744	-	0.301	0.066
COC	0.202	- 0.076	0.063	0.301	-	- 0.137
ILO	-0.715	0.298	0.798	0.066	- 0.137	-

Based on these findings we can conclude that the factor of orientation of enterprise's provided services does not have any correlation effects on applied measures to increase supply chain flexibility. However, the results are different when considering the size of enterprise. Based on correlation coefficients provided in Table 4, six significant relationships were discovered. R1 represents the positive correlation between selection of suppliers based on predefined criteria and number of enterprise's suppliers. Relationship R2 is between information collection throughout supply chain and number of enterprise's suppliers. The positive dependence between number of enterprise's returning customers and utilization of flexible promotion is marked as R3. Relationship R4 represents the dependence between customer orientation as a main strategic concept of enterprise and number of its returning customers. Dependence between enterprise's size and utilization of redeployment of human and material resources between process and / or facilities is marked R5. The last identified significant relationship R6 is between application of continuous improvement, learning organization and enterprise's size. In order to further explore these dependences we examined particular relationships among applied measures.

Results indicate that even though there is dependence between flexible promotion utilization and number of company's returning customers (R3) and between customer orientation as a main strategic concept of enterprise and number of its customers (R4), there is no significant dependence between these two measures themselves. Correlation coefficient for the relationship of flexible promotion utilization and customer orientation as a main strategic concept of enterprise is only 0.202. Therefore, this dependence

cannot be considered relevant. The findings are similar when considering the relationship of information collection throughout supply chain and selection of suppliers based on predefined criteria. Both these measures have significant correlation with number of enterprise's suppliers (R1 and R2). However, the calculated corresponding correlation coefficient for these measures is only - 0.139. Moreover, the relationship between measures from dependences R5 and R6 was also examined. It was discovered that there is a positive dependence between utilization of redeployment of human and material resources between process and / or facilities and application of continuous improvement, learning organization. Their correlation coefficient was at level 0.798, which indicates a significant positive dependence.

Two other significant relationships between measures that had previously not been identified were discovered. Firstly, it is the negative dependence between utilization of redeployment of human and material resources between process and / or facilities and information collection throughout supply chain (-0.744). The second relationship is between flexible promotion utilization and application of continuous improvement, learning organization. Once again the dependence is negative (-0.715).

In order to further explore the extent of utilization of various measures to increase supply chain flexibility in Slovak medium and large sized enterprises and to achieve statistically valuable results five hypotheses were formulated and tested. In the first hypothesis we assumed that the most commonly used measure to increase flexibility of supply chain in Slovak tourism enterprises is flexible promotion. A binomial test indicated that the level utilization of this measure was higher than utilization level of any other measures. Therefore, this hypothesis can be confirmed. The second formulated hypothesis stated that the implementation of quality system standards in enterprise is used to increase supply chain flexibility by less than 30 % of Slovak tourism enterprises. This hypothesis was not confirmed. A binomial test indicated that level utilization of this measure of 0.32 was higher than the expected 0.30. Hypothesis H_3 focused on identified main aspects of information system quality. The assumption was that at least three of them are among the most commonly used methods by Slovak tourism enterprises. This hypothesis has rejected since only information collection throughout supply chain passes the criteria to belong to this category. Furthermore, performed binomial tests indicated that level of utilization of remaining three measures is lowered, therefore, they cannot be categorized as most commonly used measures. Hypothesis H_4 assumes that application of information system model to increase supply chain flexibility in Slovak tourism enterprises is dependable on number of enterprise's suppliers. Despite the importance of this aspect of information system quality, no Slovak tourism enterprise applies this measure to increase their supply chain flexibility. Therefore, this hypothesis was automatically rejected. The fifth hypothesis tested the assumption that application of all identified main aspects of information system quality has a direct influence on application of other measures to increase supply chain flexibility in Slovak tourism enterprises. Extent of application of every identified component of information system quality was paired with every other flexibility measure and every pair was individually tested for correlative relationship. In order to achieve more valuable results we also used the multivariable regression analyses to test this hypothesis which allow us to assess the impact of multiple variables on the response variable. Confidence interval was set at 95 % level. Both these tests aided us in discovery of significant new relationships in addition to two previously discovered relationships. The first new dependence is between information collection throughout supply chain and periodical analysis of market conditions and product life cycle. Application of this measure is also related to information processing and analysis. Consequently this component of information system quality also

relates to application of frequent product innovations. Both the dissemination of information and data quality (precision and usefulness) have a relationship with measure which focuses on creating partnerships among members of supply chain. There was no relationship identified between information system model and any of applied flexibility methods. However, this fact is due to lack of application of information system models in Slovak tourism enterprises. Based on this information we have to reject the hypothesis H_5.

4. CONCLUSIONS

The main aim of this research was to analyze the utilization of various measures and approaches designed to increase flexibility of supply chains in tourism industry, specifically the impact quality of information system has on application of selected measures. Our main focus was on assessing the extent of such applications in tourism enterprises located in Slovak republic. The data was gathered by questionnaire. We provided 35 possible measures used in practice in order to increase flexibility of supply chains and to develop the quality of information systems. Our findings describe how these measures are utilized in Slovak business practice and what the relationships between applications of these measures are. Our research also identified the measures which are currently not used.

We discovered that the most commonly used measures are flexible promotion (58.28%), continuous improvement, learning organization (50%) and selection of suppliers based on predefined criteria (38.53%). The potential for improvement lies mainly in the area of measures evaluated as "unused measures". In total 6 measures belong to this category according to the level of their application in Slovak tourism enterprises.

By discovering significant dependences not only between measures and enterprises' characterization, but also among methods themselves we managed to provide some guidelines for enterprises striving to improve their supply chain flexibility. When deciding which methods to choose in order to achieve flexibility, enterprises can select combination of methods which can function as a co-dependent system. Our findings also provide a better understanding of how various methods can function when applied in combination and moreover, how would they behave in terms of enterprises' characterizations. Therefore, one of the possible extensions of this research is through multivariate regression analysis. This method may provide further evidence to all achieved results in terms of achieving flexibility. We applied multivariate regression analysis to evaluate relationship between quality of information system and application of flexibility measures. The discovered dependences can be used to draw conclusions about the nature and strength of impact of information system quality on measures used to increase flexibility of supply chains. As an example we used a representative sample file of Slovak tourism enterprises. Identified dependences prove that the quality of information system has a significant impact on selection of measures applied. Our study examined the application of which measures is based on various components of information system quality; however, we did not examined the consequences of such relationships, which would serve as a foundation for further research.

This study provides ideas for the next step of research into this topic and may provide a source of information for other authors looking for enrichment of discussion concerning methods used to increase supply chain flexibility and their dependences with components of information system quality. Since study into this relationship does not exist we are currently unable to compare our results with those achieved by

other authors. Particular set of measures used in this research is not a complex one. However, it provides a suitable foundation for exploring this topic in terms of Slovak tourism environment with special focus on conditions in tourism industry.

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