

SELECTED ASPECTS OF THE DISRUPTIONS RISK IN THE IMPLEMENTATION OF SINGLE SOURCING

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Abstract

In the paper will be presented the way performing the studies, particularly the selection and characterization of the survey sample and the analytical scheme of research. The results of this study will enable to answer the following questions: whether the use of SS (single sourcing) increases the likelihood and consequences of disruption and whether SS has been applied in an appropriate way. The main objective of the conducted research was an assessment of the relationship between the use of selected management instrument - SS and the risk of disruptions in the supply chain. While the scientific aim is to enrich the knowledge of the issues on the risk of disruptions to supply chain management.

Keywords: Disruption risk, single sourcing, supply chain

1. INTRODUCTION

In modern enterprises searching for a competitive advantage, undertakes to cooperate in the supply chain and an integration of suppliers with buyers, which is expressed in the use of appropriate instruments for managing supply chains. These instruments include among others single sourcing (SS). The risk of disruptions, which has been present for a very long time, is currently becoming more meaningful in the context of integration within supply chain defined as “the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer” [1]. Not without significance is the fact that supply activities take place on a global scale – in various legal, political and social environments. The literature on the subject stresses the fact that in the last decade there have been several factors which increased the vulnerability of supply chains [2, 3]. These include: natural disasters as an earthquake in Nepal, terrorist attacks, highly unusual weather patterns across the world, months-long strikes and delays at major U.S. ports, streams of refugees and migrants crossing Europe on foot, the rapidly changing and unpredictable demand, shorter product life cycles, a reduction in the number of basic products components, reduced supplier bases, a reduction of buffers, e.g. in store levels and in delivery terms, more integrated and intertwined processes ongoing amongst businesses, more demand for JIT supplies, in shorter time windows, technological changes, cost pressure, the necessity to increase leanness and agility, increased use of outsourcing and off-shoring, dependence on suppliers. This is just a small selection of issues from last years. Our world is full of risk, and at any time we should expect the unexpected. Supply chains are crucial for all organizations - and the more global, the more complex. A disruption in a single node of the supply chain can have wide-ranging implications.

2. RESEARCH PROBLEM

Some authors believe that higher vulnerability of supply chains defined as “exposure to serious disruptions resulting from the risk within the supply chain as well as from internal risks for supply chains” is a consequence of the application of lean supply chains strategies that has been taking place in recent years. In particular, it has become a general practice to keep inventories at extremely low levels which prevents buffering the breaks in the supply flow and causes disruptions. The above is stressed by Handfield, Blackhurst, Elkins and

Craighead [4] who notice a conflict between the need to decrease the frequency and minimize the effects of disruptions in supply chains as well as a strive for cost reduction by implementing global economy strategies. The above results from the fact that on one hand the integration of supply chains and the use of lean management tools brings obvious profits, but on the other it affects such elements of supply chains which are believed to increase the risk of disruptions.

Handfield and McCormack [5] define disruptions as major delays in the production, distribution links of supply chain, which have implications for the activities of the other entities of the supply chain. Disruptions are usually a bottleneck in one of the links, which, in effect, spreads throughout its supply chain. Any single event such as fire, quality problems, machine failures, delayed customer orders can cause significant disruption throughout the supply chain.

Considering the fact that the evaluation of risk level is based on two elements, i.e. the probability of its occurrence and its effect, following the analysis of literature on supply chain strategies, one conclusion seems to be obvious: perhaps the strategies of SS - have a positive effect on the probability of disruption, however, if and when it happens, the effects of such disruption might be much more unfavorable than in the situation when the single sourcing is not applied. To justify the need to take up research into the disruption risk of supply chain instruments an assumption was made that there is a relation between the level of risk and the applied SS in the supply chain.

This manner of formulating the research problem leads to the following thesis that the use of such supply chain management instrument as SS affects the risk of disruption and 2 hypotheses. H1. The application of SS increases the probability of occurrence of disruptions; H2. The application of SS increases the negative effects of disruptions. This research aims to enrich the knowledge of the issues on the risk of disruptions to supply chain management. In the theoretical aspect, the research aim involves defining the notion of "disruption risk" especially in the contexts of its synonyms such as interruption, delay, deviation. Furthermore there is a need to identify the characteristics of disruptions in supply chains. Another theoretical aim includes defining the fundamental determinants of the selected supply chain strategies. The research calls for providing answers to the following questions which are relevant to the management of supply chains and the development of knowledge on the subject: Does the use of SS increase the likelihood and consequences of disruption? Has SS been applied appropriately?

3. METHODOLOGICAL BASES AND LITERATURE REVIEW

The methodological aim includes operationalization of variables used in the analytical scheme and defining the method of measurement of the variables related to the disruption risk in supply chains. The finally aim is to verify hypotheses formulated based on a constructed simulation model and the performed simulations to research methods with which achieved the answers for this questions and verification of hypotheses, include: literature studies, empirical research with the use of statistical methods. The source data for statistical analysis was obtained from questionnaires as it is impossible to use exclusively the data from secondary sources. The sample consisted of 195 enterprises, the use of SS was declared by 55 companies.

The risk of disruptions is a particularly meaningful and frequently stressed category of risk in supply chains. The literature on supply disruptions has been growing during the past decade [6]. The issues of risk of disruptions are discussed by Polish authors. Świerczek [7] pointed to the transmission of disruptions, i.e. the expansion of the negative effects of risk to a higher number of supply chain participants in the contexts of becoming mutually dependent on the companies which act within supply chains. Kramarz [8] built a model of strengthening resilience of supply chains from the point of view of material division within the supply chain of steel products. A very recent article [9] summarizes this literature by organizing it into six categories: evaluating disruptions; strategic decisions; sourcing decisions; contracts and incentives; inventory; and facility location. Closer cooperation within a single supplier, while reducing the level of buffer stock and flow times, causes

more frequent occurrence of disruptions. Sinha et al. [10] - the need to control the effects of disruption in the process of planning, controlling and monitoring the relationship between the organization and its partners. Handfield and McCormack [5] saw a conflict between the need to take action to reduce the frequency and impact of disruptions in supply chains and the aspirations to reduce costs by the strategies of the global economy. Hendricks and Singhal [11] - an increase in the number of large and costly supply chain disruptions resulting from the introduction of lean management. Moreover, there is no publication that contains an analysis of the just in time in view of the risk of disruption.

Secondary research carried out in economic environments points to the fact that the managers approach the eventuality of supply chain disruptions as one of the most important threats for businesses. [12] The main trends in risks in supply chains are: piracy, cargo theft, currency volatility, earthquakes, war and terrorism, IT and telecommunication failures, port congestion, cyber-attack, supplier trouble, severe weather, hurricanes, geopolitical disruption [13].

Based on a literature review the concept of disruption in the supply chain was defined as unplanned event leading to a break in the normal flow of goods and information, which has a negative impact on the supply chain. The most general notion is a disruption in the supply chain. Considering the problem of disruption from the perspective of the company and not the entire supply chain, we are talking about disruption of supplies. On the other hand, when we estimate the probability of occurrence of an identified potential disruption and its possible effects, then we can talk about the risk of disruption.

4. THE ASSESSMENT OF THE IMPACT OF SS ON THE PROBABILITY AND EFFECTS OF SUPPLY CHAIN DISRUPTIONS

SS impact on the likelihood and consequences of disruptions, rated on the basis of the results of quantitative analyzes responses given to the question:... "Do you think that the use of a SS, as opposed to the situation that this instrument is not used, causes: [...],". The answers are presented in **Table 1**.

Respondent could agree with them or not. By checking in accordance with their feelings - on a scale of 1-5: 1 - "definitely not" 2 - "probably not", 3 - "neither, nor so", 4 - "rather yes", 5 - "definitely yes". Given the questions, which used a five-point Likert scale, benefited from higher statistics measurement. The mean, standard deviation, and median.

When analyzing the SS instrument and considering a question whether the probability of a supply disruption is greater when SS is applied, one cannot see any prevalence of either - "yes" or "no" answers.). There were respondents who rated this indicator to 1 - strongly disagreed that the use of SS increased the probability of disruptions (17 respondents) and 5 - strongly agreed with this statement (11 respondents). When assessing the increase in potential impact of disruptions, it may occasionally be seen - when analyzing the median - that half of the respondents did not perceive either a negative or positive relationship between the probability of disruption and the supply of one supplier. Thus, respondents do not agree with statement that the use of SS increase the likelihood of disruption.

Based on this question, it should be borne in mind that both SS and those who did not have supplies from one supplier in the organization were respondents.

The results for increasing the potential effects of the disruption, when used or not using the SS, were similar in degree of mediocrity. Most of the cited results, according to the respondents, would neither increase nor decrease in the case of the SS, as compared to the situation in which the SS did not apply. The average for all variables relating to potential negative effects when using SS oscillate around 3.0 (with a standard deviation of approximately 1.0). In each case, there were people who were determined to be so or determined.

Although this is not statistically significant, and you can not draw conclusions on the whole population on this basis, you can compare the number of indications to 1 - "definitely not" and 5 - "definitely yes" for individual

variables. Using the SS, compared to the situation in which this instrument would not be used, definitely makes: if there is a supply disruption, the lost output will be higher, according to 32 respondents (16.67%), 11 (5.73%) strongly disagree with this statement; if there is a disruption in deliveries, the lost sales will be higher - 28 people (14.58%) in opposition to 12 (6.25%), which marked 1; if there is a disruption in deliveries, its duration will be longer (the disruption will be over longer) - so 31 (16.5%) respondents strongly oppose this statement 22 (11.46%); if the source of risk was external (eg natural disaster) and would affect our supplier, it would be more difficult for us to cope with its effects - with this variable, also 31 (16.5%) respondents strongly agreed with this statement and strongly opposed This statement 22 (11.46%); the disruption that would occur in our supplier would have affected us faster, with 29 (15.1%) respondents strongly agreeing, 11 (5.73%) definitely disagreed.

According to 34 respondents (17.71%), the use of SS definitely did not cause the disruption to affect more links in the supply chain, a slightly smaller group - 23 people (11.98%) - This will cause the interference to affect more than one chain in the supply chain.

With a statistical estimate of the increase in potential disruptive effect in the case of SS, only with reference to the variable - "if the supply disruption occurs, the lost sales will be higher," can be seen - by analyzing the median - that half of the respondents agreed with this statement.

Table 1 Statistics for the question „Do you think that the use of a SS increase the probability of disruption risk and causes pointed effects?

Do you think that the use of a SS, as opposed to the situation that this instrument is not used, causes: [...]	Average	Median	Standard deviation
a higher likelihood of a supply disruption	2.93	3.00	1.06
a situation when a disruption that occurs at our supplier's end would affect us sooner	3.25	3.00	1.14
a situation that if the source of risk was external (e.g. a natural disaster) and it affected our supplier, it would be more difficult for us to deal with its consequences	3.19	3.00	1.24
a situation that end consumers of our product/service could find out sooner about our problems	3.03	3.00	1.19
the disruption would affect a greater number of cells in our supply chain	2.94	3.00	1.25
it would be more difficult to for the flows of information to return to their state from before the disruption	2.86	3.00	1.26
it would be more difficult to return the flows of goods to their state from before the disruption	2.95	3.00	1.21
if there was a supply disruption, its duration would be longer (it would be quite time consuming to overcome the fault)	3.16	3.00	1.25
if there were a supply disruption, the amount of losses (financial) will be greater	3.19	3.00	1.14
if there were a supply disruption, the sale losses would increase	3.33	4.00	1.14
if there were a supply disruption, the lost production volume would increase	3.27	3.00	1.15

5. IDENTIFICATION AND EVALUATION OF USE OF SS CONDITIONS IN THE CONTEXT OF DISRUPTIONS

In the test sample, 55 organizations declared the use of SS. A set of reviews for this instrument was prepared and the respondents were requested to express their approval - by selecting the answer "definitely yes" or "rather yes" or their disapproval - by checking "definitely not", "probably not,.". They could also choose a neutral reply by selecting a „neither yes nor no" answer. The answers are presented in **Table 2**.

Table 2 The answers for the question: Why did you decide to implement the SS in your organization?

Why did you decide to implement the SS in your organization?	Average	Median	Standard deviation
Our competitors enforced the implementation of SS on us	3.31	4.00	1.13
SS was imposed upon us by our client (we did not want to lose them)	3.28	3.00	1.03
The use of SS was our idea, we imposed certain conditions for the good of both parties	3.37	4.00	1.12
We would not have implemented the SS, if there had been no trust between us with respect to information sharing	2.98	3.00	1.16
We would not have implemented SS without the support of integrated IT systems	3.30	3.00	0.94
We have successfully implemented the SS because the supplier fulfills their quality management duties	3.72	4.00	1.02
Long term financial profits from using the SS are higher than possible losses that might be caused by disruptions	3.43	4.00	1.11
Before we implemented the SS deliveries we had considered the threat of increased risk of disruptions	3.23	3.00	1.08
We had protected ourselves against the effects of disruptions within the SS by introducing penalties for failing to meet the terms of deliveries	3.41	4.00	1.32
Thanks to the application of SS we cope much better than our competitors with external disruptions	3.63	4.00	0.98
Since the time we have been relying on the supplier within the SS, the disruptions in their deliveries occur less frequently	3.54	4.00	1.01
We apply the SS but we simultaneously monitor our supplier and support them in case external disruptions occurred	3.56	4.00	0.87
SS is used only for the goods in regular and continually controlled demand	2.98	3.00	1.14
We use the SS if the scale of flow from the supplier is substantial enough	3.12	3.00	1.20
We have not decided to use the SS without standardization	3.07	3.00	1.18
Within the SS we plan the purchase of product ranges with no guarantee of their quality	3.38	4.00	1.14
We would not be using the SS if we could not be sure that we could eliminate the possible disruptions	3.67	4.00	1.01
In order to ensure the demand we have set up a warehouse in the vicinity of our recipient so that we could meet their SS requirements	2.60	3.00	1.08
Whenever there were disruptions within the SS deliveries, it caused substantial financial losses to our organization	2.70	3.00	1.11
If we use the SS deliveries, it is only for the standard components for which replacements may easily be found	3.30	4.00	1.13

Perhaps the value of granted answers here, seen in the context of statistical inference is not great, but from the qualitative analysis, the results of an opinion on the instruments used in the context of the conditions of their implementation and the possible effects on the risk of disruptions, they seem to be valuable. For each query the averages also oscillated around the "3", with a tolerance of "1". The analysis of the median points to the fact that half of the respondents „rather agree" with most of proposed statements. This are - *inter alia*: our competitors enforced the implementation of SS on us, the use of SS was our idea, we imposed certain conditions for the good of both parties, we have successfully implemented the SS because the supplier fulfills their quality management duties etc.

6. CONCLUSION

It is convinced that the quality of delivered items/services, such as supplier's commitment to quality management are the basic issues to get advantage from SS implementation. Although the SS is being used as a factor to increase the sensitivity of the supply chain, respondents using this instrument argue that it is better to deal with disruptions better than the competition. Deliveries from a single supplier are less frequent, and companies using SS simultaneously monitor and support a supplier when external sources of disruptions occur. The motives for SS implementation vary, with half of the respondents saying they were pushed out by the competition and the other half that it was their own initiative. However, the deviations from these values are large enough (about 1.0), thus a conclusion that the use of SS increases the negative effects of potential disruptions would be an overstatement. The present studies show that the use of SS which is one of the basic tools of lean management does not increase the risk of disruptions in the supply chain. The analysis of the median suggests that a representative sample might prove that the use of this instrument increases the negative effects, yet it does not affect the increase in the likelihood of disruptions. The analysis should be based on conditions of the application of lean tools as well as on the correctness of their implementation. Therefore, it is suggested that risk analysis should constitute the starting point for the implementation of lean tools.

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