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Assessing Supply Chain Risk Management Practices in Manufacturing Industries in Malaysia

(Penilaian Risiko Pengurusan Rantaian Bekalan dalam Industri Pembuatan di Malaysia)

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ABSTRACT

Effective supply chain management (SCM) is essential to drive an organisation's performance through increased productivity. This paper aims to identify the various risk sources that cause supply chain risks to occur in the Malaysian manufacturing industry. In addition, the type and frequency of supply chain risks and discussing the best approach to reduce these risks in the context of the manufacturing industry. A survey method was adopted using a questionnaire to collect the necessary information in order to achieve the aim and objectives of this study. Information was collected from several manufacturing sectors in Malaysia, namely; the automotive, electronics and food sectors. The respondents were people having practical knowledge of risk management, including supply chain managers and supervisors. The survey results were analysed using Statistical Package for the Social Sciences (SPSS) software. The analysis of the results indicated that the primary source that led to the occurrence of supply chain risks was mainly due to the delay in responding to the risks. The associated risks that often occur in the manufacturing industry were also identified, namely, changes in customer demand and increasing raw material prices. In addressing these risks, it was found that communication and the exchange of information were the most important practices and initiatives to help reduce the occurrence of supply chain risks. Accordingly, this study is considered as a pilot study given the small number of respondents. Thus, it can be used as a preliminary guideline for future research work.

Keywords: Risk management; Supply chain; Manufacturing industry; Malaysia.

ABSTRAK

Pengurusan rantaian bekalan yang berkesan adalah penting untuk memacu prestasi organisasi melalui peningkatan produktiviti organisasi. Dalam kajian ini, kami mengenal pasti faktor-faktor yang menyebabkan risiko rantaian bekalan dalam industri pembuatan di Malaysia. Selain itu, jenis dan kekerapan risiko rantaian bekalan yang berlaku juga dikenal pasti. Akhir sekali, kami mengkaji cara terbaik bagi mengurangkan risiko rantaian bekalan dalam industri pembuatan di Malaysia. Kaedah kaji selidik telah digunakan untuk mengumpul maklumat yang diperlukan bagi mencapai objektif kajian ini. Maklumat yang dikumpul telah diperolehi daripada beberapa sektor pembuatan di Malaysia, yang terdiri daripada sektor automotif, elektronik dan makanan. Responden terdiri daripada mereka yang mempunyai pengetahuan dalam pengurusan risiko, seperti pengurus rantaian bekalan dan penyelia. Keputusan kaji selidik dianalisis dengan menggunakan perisian SPSS. Analisis keputusan menunjukkan bahawa faktor utama yang menyebabkan risiko rantaian bekalan ialah kelewatan dalam menangani risiko yang berlaku. Risiko yang sering berlaku dalam industri pembuatan juga telah dikenal pasti, iaitu perubahan permintaan pelanggan dan peningkatan harga bahan mentah. Dalam menangani risiko-risiko ini, kajian menunjukkan bahawa komunikasi dan pertukaran maklumat sebagai amalan dan inisiatif yang paling penting untuk mengurangkan risiko daripada berlaku. Kajian ini dianggap sebagai satu kajian perintis memandangkan jumlah responden yang kecil, justeru itu, ia boleh digunakan sebagai garis panduan untuk penyelidikan pada masa hadapan.

Kata kunci: Pengurusan risiko; Rantaian bekalan; Industri pembuatan; Malaysia.

INTRODUCTION

Supply chain risks are not foreign nowadays and are often recognised across many sectors including the manufacturing, automotive, maritime, food and the electronics sector. Supply chains do not only involve small industries but involve large industries globally. In 2012, Toyota suffered a loss of USD 5 billion due to the disruption in the supply of gas pedals and floor mats for vehicles (Kayis & Karningsih 2011). Likewise, supplier performance has also been recognised as a significant risk in the supply chain as it can affect the performance of a company dramatically.

Globalisation has also helped to provide a favourable impression of supply chains given they can help reduce costs, penetrate new markets, facilitate communication and networking opportunities supported by innovative technologies. However, there are also several factors that cause supply chain disruptions and exposure to certain risks. For instance, supplier bankruptcy, political instability, natural disasters, and machine/equipment breakdown will make supply chains more susceptible and vulnerable to risks. Based on a study by Diabat et al. (2012), supply chain risks are divided into five categories, namely; product or service management risks, macro-level risks, demand management risks, supplier management risks, and information management risks. According to Juttner et al. (2003), the consequences of risks can multiply and often overlap (*e.g.* operational risks, human resource risks and customer and service level risks), hence, often becoming significant events.

The impact of supply chain disruptions on company performance has increased over recent times (Kern et al. 2012). Consequently, supply chain risk management (SCRM) is important to assess given the impact of risks but also given the significant negative effect on companies and consumers. Given the rapid development of many industries (including the technology industry) over the last few years, it has attracted the interests of many researchers to focus more on supply chain performance measurement (Balfaqih et al. 2016). Nevertheless, this is primarily due to supply chain risks increasing in parallel with the advancements and progress within the various manufacturing industries. As mentioned, this impacts company performance, creating an adverse effect such as excessive costs (including overheads) and expenses. For example, in the automotive industry, the risk of production disruption will cause a loss of more than USD 100 million per day (Kirilmaz & Erol 2016).

Increasing disruptions within supply chains have led companies to place greater emphasis on SCRM in order to deal with the problems that arise as a result, (i.e. maintaining performance). In manufacturing industries, SCRM is increasingly widespread as it is used to detect, predict, and reduce the impact of supply chain disruption risks, such as the disruption of suppliers, inaccurate demand forecasting and machine downtime (Blome & Schoenherr 2011). The manufacturing environment and different activities within the industry will also influence different types of supply chain risks (Kayis & Karningsih 2011). Kersten et al. (2007) mentioned that potential damage to the supply chain and adopting a risk-based approach, (i.e. risk bearing, risk transfer and risk-avoidance) needs to be considered and planned. The study was based on a survey of 50 manufacturing plants and 39 logistics service providers. Similarly, in a study by Thun and Hoenig (2011), they analysed supply chain risks and the impacts based on a survey of 67 manufacturing plants in the automotive sector in Germany. Their study highlights two distinct approaches: (1) reactive and (2) preventive, each giving different impacts such as bullwhip reduction and flexible safety stocks respectively. Accordingly, Blos and Miyagi (2015) identify the disruption of interdependent supply chains and introduce a model that incorporates nodes (transitions and places) that allow decision-makers to appropriately respond based on the type and nature of the risk.

Recently, Salleh Hudin et al. (2017) revealed the external and internal risks associated with the supply chain. Accordingly, the study aimed to clarify the main risks of three selected automotive companies in Malaysia. The main problems that occur were mainly due to the quality of raw materials, late delivery of imported components and insufficient skills of employees. Employees also play an important role to lead the success of the company. In view of this, Satar and Md Deros (2008) implement Quality Control Circle (QCC) at a production company in Malaysia. As a result, the top management play crucial roles in the development of workers capabilities, otherwise it might lead to a gloomy environment and contribute to the downfall of the company. Previous studies have also been conducted by researchers on risk mitigating strategies, such as in the areas of communication and the exchange of information, reduction and rationalisation of suppliers, helping suppliers towards improving their performance, the accuracy of demand forecasts, and reward schemes in the presence of little to no risk in the industry (Lavastre et al. 2011).

The facilities that are provided nowadays, such as transportation and technology, have further improved the industries in Malaysia, especially towards logistics management. However, the advancements also make the industry more vulnerable and susceptible to supply chain risks and disruptions. Disruptions can occur due to transportation problems, poor product quality, and delivery time. Accordingly, these disruption risks will negatively impact the efficiency and robustness of supply chain operations. Therefore, our study aims to assess the key factors, the frequency and mitigating strategies related to supply chain risks in the manufacturing industry in Malaysia.

This paper is organised into a number of sections. Section 2 will present the methodology used in the study. Section 3 will discuss the analysis and results obtained which is followed lastly, by Section 4 summarising the paper with a conclusion and suggestions for future work.

METHODOLOGY

As part of the study, a questionnaire was developed to identify the current risks associated with supply chains in the context of the Malaysian manufacturing sector and the frequency and strategies adopted to mitigate the risks. Using previous literature, several references were adapted to obtain information regarding existing supply chain risk sources and mitigating strategies (Diabet et al. 2012; Thun et al. 2011; Lavastre et al. 2011). The information from these references were integrated and modified to develop the questionnaire that suits the scope of our study.

The questionnaire was distributed between January and March 2017 involving a number of manufacturing companies from various sectors in Malaysia, namely; the automotive, electronics, and food sectors. The questionnaire was distributed to respondents with supply chain knowledge, such as managers, supervisors, and engineers. This was to ensure that the respondents understood the questions and could provide the required information concerning supply chain risks.

The questionnaire consisted of two sections with four main questions; the type of risk, the frequency of occurrence, consequences of the risks and risk mitigation techniques. The Likert scale was used, where weights of 1, 2, 3, 4, and 5 were assigned to represent "Strongly Agree", "Disagree", "Neutral", "Agree" and "Strongly agree".

A total of 220 questionnaires were distributed through various channels, including email and by hand to the respondents in order to collect the required information. However, only 32 completed questionnaires were received which represents a response rate for this study of only 14.6%.

Based on the 32 questionnaires that were returned, an analysis of the results was then carried out using SPSS 19. The analysis was performed to show the frequency of each question, in addition to the mean and mode for the questions. Presentation of the results and discussion of the outcome are discussed in the following sections.

RESULTS

GENERAL INFORMATION RELATED TO RESPONDENTS

As mentioned in the previous section, a total of 32 questionnaires were received and used in this study. Ten questionnaires were completed by engineers for their respective company, followed by managers (8 people) and supervisors (6 people). A total of 28.1% of respondents were within the automotive sector, and 25.0% represented the electronics and other sectors.

The analysis indicated that more than 85% of respondents surveyed said that their companies consider SCRM as high priority. Also, 90% of respondents agreed that the management of supply chains is important in a company. Next, 84.4% of respondents agreed that employee involvement is essential to overcome supply chain risks in the industry. Therefore, it can be concluded from the results that most employees are aware that SCRM is an important aspect of their organisation, besides the involvement of each individual in helping to mitigate supply chain risk issues.

RISK SOURCES

The analysis in Figure 1 showed that only 1 out of 7 risk sources had a mean of more than 4.00, which became a significant source in driving the occurrence of supply chain risk, notably; "delays in responding to risks that occur". Another source causing supply chain risk is poor information flow within the industry which is influenced by factors such as errors in predicting customer demand, disruption in information sharing and the failure of IT systems (Diabat et al. 2012).

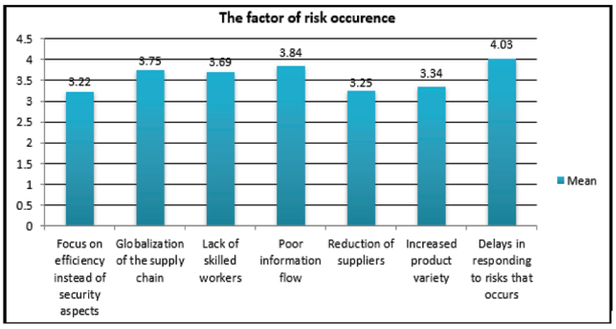

FIGURE 1. The factor of risk occurrence

Most of the respondents indicated that the emphasis on efficiency rather than safety is not a strong source that contributes to supply chain risk. Furthermore, the Safety Act that was introduced in Malaysia makes most of the industry comply with the act in order to maintain the safety of workers and improve the company's image and reputation. Therefore, this source is seen as the lowest contributor to the occurrence of risk in the supply chain.

TYPE OF RISKS THAT FREQUENTLY OCCUR

As discussed previously, several types of risks can occur in the industry. Among the 13 risks that were listed, "changes in customer demand" was one of the most common risks identified having the highest mean at 3.4688. Other risks that often occur in the industry included risk of increased [excess] raw materials and supplier quality problems.

The risk of import and export restrictions and the risk of accidents were cited as less frequent risks in the industry. These risks had a low mean, therefore, indicating that these risks rarely occur in the manufacturing industry in Malaysia. The lack of involvement with foreign countries and the high level of safety in the industry today may also attribute towards these two risks rarely occurring in Malaysia.

THE IMPLICATION OF SUPPLY CHAIN RISKS

The survey results also indicated that quality problems from suppliers are a key risk that can contribute towards having a significant impact in the manufacturing industry; 25 respondents agreed with this risk. This can be referred to in Figure 2. Damage to the raw material that is supplied directly will also affect the operations of the company as it can disrupt production processes. Machine breakdowns [downtime] and increased raw material prices were also identified as risks with an average of 3.8438 and 3.8125 respectively.

Furthermore, increasing customs [excise] duties and the impact of the global oil crisis contributed to the lowest effect compared to other risks represented with a mean of 2.8438 and 2.5938 respectively. Although these risks were recognised

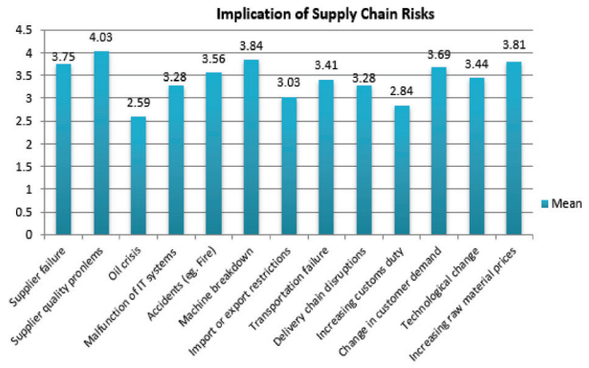

FIGURE 2. Implication of supply chain risks

in the manufacturing industry, the impression given by the results indicates that these risks might not significantly affect performance within the manufacturing industry.

RISK-MITIGATING STRATEGIES

As seen in Figure 3, the method most frequently adopted to overcome supply chain risk is through communication and information exchange. Accordingly, this approach can help increase the agility of the supply chain, thereby enhancing the company's performance. In addition to communication and information exchange, industries also use other techniques such as helping suppliers improve their performance in dealing with supply chain risks.

FIGURE 3. Supply chain risk mitigating strategies

Another method that is often used is the accuracy in predicting customer demand which is a suitable method to avoid excess or shortage of inventory.

The study has also shown that not all methods from the data collected in the questionnaire are used in the industry. This can be seen from two of the 12 methods attributed with low mean values indicating that the respondents did not agree with the methods. In this case, the method is the introduction of a reward in the absence of misconduct and reducing the number of suppliers.

DISCUSSION

THE RELATIONSHIP BETWEEN FREQUENCY AND RISK MANAGEMENT TECHNIQUES

Changes in customer demand was identified as one of the risks faced by the industry given the level of global uncertainty that currently exists in the market. Changes in customer preferences and competition between companies have led to changes in demand that have previously been forecasted. The results of this study also showed that change in customer demand is one of the most common risks in the industry.

Previous studies have proved that communication and the exchange of information with partners is the best way to manage supply chain risks (Lavastre et al. 2012). In an uncertain market situation, agility in the supply chain is important so that the company can respond quickly to changes. Agility in the supply chain can be improved by learning and sharing information with and between external partners.

Concerning external learning, companies can receive and acquire new knowledge from other organisations. Past studies have shown that external learning can improve a company's innovation performance (Laursen & Salter 2005; Bao et al. 2012). In the context of supply chain management, learning from experts who specialise in SCM can help organisations to be sufficiently prepared with the latest knowledge in systems, procedures, and technologies to respond to market changes quickly and efficiently (Ngai et al. 2011).

From the results of this study, communication and the exchange of information were the main initiatives that were identified by most companies. Looking at the relationship between the frequency of risk occurrence and the strategies used by the company to address supply chain risks, it can be seen that communication and information exchange are the most effective methods to reduce risk (i.e. risk of changes in customer demand). For example, one of the companies in the automotive sector uses a special online system that was built as a platform for communication with their main customers. The platform enables quick and easy communication when needed, particularly during times when there are changes in order quantity or product specifications. Production problems such as machine breakdowns or supply disruption may also be conveyed through this system, hence, reducing the possibility of shortages, delays or mismatch of product demand. Thus, the results are considered to be in line with that of previous studies, where real-time communication and quick exchange of information were used to address market uncertainty. Further, it can also be said that this method has been practised by many companies to mitigate risks associated with changes in customer demand.

Besides the risk of demand management, supply management risks can also occur in the manufacturing industry. The analysis shows that the most common risks that

occur are related to supplier quality problems. This is due to the occurrence of defects in the supply of raw materials, the difference in material characteristics and properties and so forth.

To overcome this risk, one of the initiatives adopted by the manufacturing industry is to assist suppliers in improving their performance. Interestingly, this relationship was chosen by most of the respondents in the survey as the most common risks in terms of supplier quality problems and techniques to help suppliers. Previous studies also state that introducing a performance improvement program for suppliers can often help to guarantee more secure supply regarding delays, quantities, and quality of materials (Lavastre et al. 2012). Therefore, establishing good relationships with suppliers and providing assistance are good techniques in dealing with the raw material quality problems in the manufacturing industry.

THE RELATIONSHIP BETWEEN RISK SOURCE AND THE FREQUENCY OF OCCURRENCE

Information risk is one of the risk categories that frequently occur in supply chains. From the results of this study, poor or inadequate flow of information was identified as one of the primary supply chain risk factors in the manufacturing industry. Information management risk in the supply chain can be caused by errors in forecasting product demand, distortions in information sharing and the failure of IT systems (Diabat et al. 2012). In this study, poor or insufficient flow of information was found to lead towards supply quality problems. Confusion of a purchase order or an unexpected order change at short notice will cause problems in the supply of materials such as different grades or types, differences in quantities, price and so forth.

The manufacturing industry of today is still putting safety first to avoid issues and supply disruption problems. This can be further supported by the results of this study in which it shows that most respondents did not agree that the focus should be on efficiency rather than the security of supply as a source of risk regarding supply chains. This means that companies still prioritise and acknowledge safety in their work environment. The study also showed that the risk of accidents occurring is among the lowest risk factors and the occurrence is rare in the Malaysian manufacturing industry. Looking at the relationship between these two aspects, it can be deduced that the practice and awareness of safety have reduced the risk of accidents in companies. In fact, it clearly shows that companies do not compromise safety to achieve a reasonable level of efficiency.

CONCLUSION

An assessment of SCRM was conducted in this study, where the factors, types and frequency of supply chain risks in the manufacturing industry in Malaysia were identified and examined. The study also looked at the main methods practised in the manufacturing industry to reduce supply chain risks. The analysis of the results indicated that the main source of risk is caused by the delay in recognising and responding to risks that occur. Whereas, neglecting the security aspects in achieving efficiency in the industry was seen as a weak source in this category. Nonetheless, changes in customer demand were the most common form of supply chain risk, however, this risk was less significant compared to supplier quality problems showing a higher response than the risk associated with changes in customer demand. Accordingly, this may be due to the communication and information exchange methods used by the industry to address these risks. This study can be considered as a pilot study due to the small number of survey respondents and therefore, the results obtained in this study can be used as a guideline for future work. There are several directions for future study that should be conducted. Investigating the disruption risk impact on a green supply chain setting would be an interesting topic to pursue (Jamian et al. 2014). In addition, a study on the risks associated with the remanufacturing industry is a worthwhile extension and is currently under way.

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REFERENCES

Balfaqih, H., Nopiah, Z.M., Saibani, N. & Al-Nory, M.T. 2016. Review of supply chain performance measurement systems: 1998-2015. *Computers in Industry* 82: 135-150.

Bao, Y.C., Chen, X.Y. & Zhou, K.Z. 2012. External learning, market dynamics, and radical innovation: Evidence from China's high-tech firms. *Journal of Business Research* 1226-1233.

Blome, C. & Schoenherr, T. 2011. Supply chain risk management in financial crises – A multiple case-study approach. *International Journal of Production Economics* 134(1): 43-57.

Blos, M.F. & Miyagi, P.E. 2015. Modeling the supply chain disruptions: A study based on the supply chain interdependencies. *IFAC-PapersOnLine* 28(3): 2053-2058.

Diabat, A., Govindan, K. & Panicker, V.V. 2012. Supply chain risk management and its mitigation in a food industry. *International Journal of Production Research* 50(11): 3039-3050.

Hudin, N.S., Hamid, A.B.A., Chin, T.A. & Fadly, N. 2017. Exploring Supply Chain Risks Among Malaysian Automotive SMEs. *Proceedings of INTCESS (4th International Conference on Education and Social Sciences 6 August 2017.*

Jamian, R., Rahman, M.N.A., Deros, B.M., Ibrahim, M.Z. & Ismail, N.Z.N. 2014. Relationship between 5S implementation and green performance of Malaysian manufacturing SMEs: A conceptual model. *Jurnal Kejuruteraan* 26: 1-14.

Juttner, U., Peck, H. & Christopher, M. 2003. Supply chain risk management: Outlining an agenda for future research. *International Journal of Logistics Research and Applications* 6(4): 197-210.

Kayis, B. & Karningsih, P.D. 2012. SCRIS: A knowledge-based system tool for assisting manufacturing organisations in identifying supply chain risks. *Journal of Manufacturing Technology Management* 23(7): 834-852.

Kern, D., Moser, R., Hartmann, E., Moder, M., Kern, D. & Moser, R. 2012. Supply risk management: model development and empirical analysis. *International Journal of Physical Distribution & Logistics Management* 42(1): 60-82.

Kersten, W., Hohrath, P. & Böger, M. 2007. An empirical approach to supply chain risk management: Development of a strategic framework. *Proceeding POMS Conference 2007* 1-20.

Kirilmaz, O. & Erol, S. 2015. A proactive approach to supply chain risk management: Shifting orders among suppliers to mitigate the supply side risks. *Journal of Purchasing and Supply Management* 23(1): 54-65.

Laursen, K. & Salter, A. 2006. Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal* 131-150.

Lavastre, O., Gunasekaran, A. & Spalanzani, A. 2012. Supply chain risk management in French companies. *Decision Support Systems* 52(4): 828-838.

Ngai, E.W.T., Chau, D.C.K. & Chan, T.L.A. 2011. Information technology, operational, and management competencies for supply chain agility. *Journal of Strategic Information Systems* 232-249.

Satar, N. & Deros, B.M. 2008. A case study on the implementation of quality control circle in the production line of a manufacturing company. *Jurnal Kejuruteraan* 20: 1-10.

Thun, J.H. & Hoenig, D. 2011. An empirical analysis of supply chain risk management in the german automotive industry. *International Journal of Production Economics* 131(1): 242-49.

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