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Developing a resilient supply chain

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Abstract

In today's global economy, the fierce competition among companies makes them to operate in uncertainties whereby high risks are faced. Should in case these risks become reality, they will absolutely have a negative impact on the supply chain of these organizations, resulting in deformations that could lead to a drop in profitability and competitive advantages. Creating a resilient supply chain could be the answer; however, this is a new area of study that still needs to be properly investigated. Although, "resilience" could be defined as the ability of a substance to get back to its original state after deformation, there is still no concrete definition of a "resilient supply chain" or "supply chain resilience". This paper therefore analyses the supply chain and the risks it faces, investigates the resilience of the supply chain, and gives appropriate strategies and tools that would help avoid these risks, and as a result, an organization would be able to bounce back after any deformation along its supply chain.

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1. Introduction

Many research programs have shown that modern supply chains are at greater risks than their supply chain managers recognize. "In today's uncertain and turbulent markets, supply chain vulnerability has become an issue of significance for many companies and appropriate researches on resilient supply chain are yet to be conducted" (Christopher & Peck, 2004), and as "the numbers and types of threats that can undermine a supply chain are now greater, organizations are facing greater challenges in managing risks than ever" (Sheffi, 2005). These risks including natural disasters, terrorism, cyber attacks, credit crunch and many more could yield to a drastic loss in

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productivity, revenue, competitive advantage, profitability etc, if not managed appropriately, and that is why a resilient supply chain is of great importance. Although “resilience” could be defined as the ability of a substance to get back to its original state or form after deformation, the Supply Chain Resilience is still a new area of management to be explored. Moreover, as the possibility of it returning back to its original form after deformation is still “theoretical”, “many organizations still lack the awareness that it is necessary to take into consideration a resilient supply chain as part of their strategy when developing their risk and business continuity management” (Christopher & Peck, 2004). This paper therefore discusses appropriate approaches in order to develop a more resilient supply chain strategy to help organizations bounce back after disruptions that may affect the upper and lower streams of the supply chain. The *research methods* are mainly qualitative, exploiting various scientific publications, relevant literatures, journals as well as the authors’ professional lecturing experiences in the field of management and modeling and simulation. Alternatively, quantitative secondary resources were also exploited to show the degree of the loss of productivity due to supply chain incidents. The *objectives* of the research is to develop a supply chain resilient strategy to “govern” the upper stream and lower stream of the supply chain including the supply chain partners in order to help organizations bounce back after deformation along the supply chain. This article is divided into four parts namely, the supply chain, the supply chain management, the supply chain risks and the supply chain resilience. The first part which is the supply chain, analyses the supply chain in which the authors have integrated the stages of the supply chain with the flow of materials, information and money into a diagram to illustrate how dynamic the supply chain is. The next section, which is the supply chain management, discusses the importance of the supply chain management where the flow of materials etc, needs to be effectively and efficiently managed by various business functions. These business functions include research and development, operations, finance department, distribution, customer service etc from the upper to the lower levels of the supply chain. The supply chain risks section portrays the risk involved in managing the supply chain, and emphasizes the vulnerability of the supply chain whereby risk is still a concern and should not be neglected in today’s uncertain and turbulent markets. The last section, the supply chain resilience, recommends appropriate strategies that could be used to “combat” risks and deformities along the supply chain so that organizations will be able to bounce back after any deformation along the upper stream and or lower stream of the supply chain.

2. The supply chain

Before reflecting on the “supply chain resilience” it is necessary to grasp a better understanding of the supply chain itself. Several authors have come up with different definitions that tend to overlap in many cases with the supply chain being defined, for example, as “a group of inter-connected participating companies that add value to a stream of transformed inputs from their source of origin to the end products or services that are demanded by the designated end-customers” (Lu, 2011), or “a general description of the process integration involving organizations to transform raw materials into finished goods and to transport them to the end-user” (Pienaar, 2009) etc. According to the authors of this paper, “supply chain is a sequenced network of business partners involved in production processes that convert raw materials into finished goods or services in order to satisfy the consumers’ demand” (Mensah & Merkurjev, 2012). Hence the supply chain is dynamic and has many stages. A simple supply chain includes raw materials suppliers’ suppliers, raw material suppliers, manufactures, distributors, retailers and customers as shown in Figure 1 below.

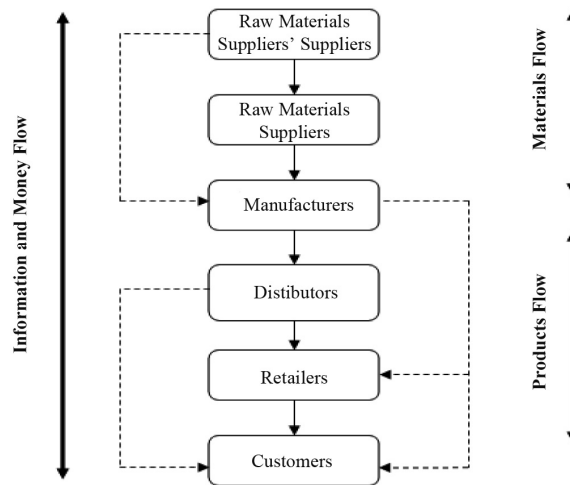


Fig. 1. Simple supply chain stages (prepared by authors)

With reference to Figure 1, in the upper level of the supply chain, the manufacturers receive their raw materials from their raw materials suppliers or the raw materials suppliers' suppliers. Value is then added to the materials which are converted into goods to be exploited in the lower level of the supply chain. This is made possible by the manufactures passing on the value added products onto the distributors that distribute the products to the appropriate retailers that can easily reach the target customers. On the other hand, some manufacturers can reach their target customers directly through their websites and therefore bypassing distributors and retailers. Hence, all the stages in figure 1 are not always necessary.

From another perspective, taking the retail sector into consideration, for example, the Rimi Supermarket in Latvia, the supply chain begins when a customer is interested in and places an order, and ends after the customer's needs have been satisfied. The next stage is for the customer to obtain his/her desired products at the Rimi Supermarket which can only be executed after receiving supplies from its warehouse, distributors and or manufacturers if applicable. The distributors, in most cases are manufacturers' representatives that receive their goods through agreements from manufactures in order to supply their retailers whereas the manufacturers, after receiving raw materials from suppliers, manufacture the necessary goods. In some companies like DELL, the customer can purchase directly from its website, bypassing retailers and distributors, and can even build his/her computer online by simply ticking boxes according to his/her preferences. All of these stages involve the "flow of materials, information and money through a business network, all the way from the suppliers to the customers" (Crocker, 2003) and vice visa. Hence, as the supply chain is dynamic, it therefore needs proper management and this is where the supply chain management plays a vital role which is considered next.

3. The supply chain management

The "supply chain management is aimed at examining and managing supply chain networks" (Janvier-James, 2012), thus the stages discussed in the former chapter if not managed accordingly, organizations would find themselves underperforming that can lead to a loss in competitive advantages and profitability. Just like the supply chain, the supply chain management consists of various definitions. Recently, the Council of Supply Chain Management Professionals states that "supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers" (CSCMP, 2013). Consequently, from figure 1, taking the manufacturers into

consideration, various business functions including research and development, operations, etc should be capable enough in order to effectively manage the materials, products, money and information flow between the upper and lower levels of the supply chain. Moreover, these business functions have to be cross-functional in order to operate successfully in today's competitive world. Furthermore, supply management and purchasing professionals should play the leading role in operations between the upper and lower levels of the supply chain as they would be able to manage and monitor cost. It should also be made clear that some of these stages are run by different companies making the flow of information vital.

3.1. Managing the Supply Chain

According to the authors, three factors namely, decision making, strategy and tactics (DMST) are essential when managing the supply chain. These factors are illustrated in Figure 2 below.

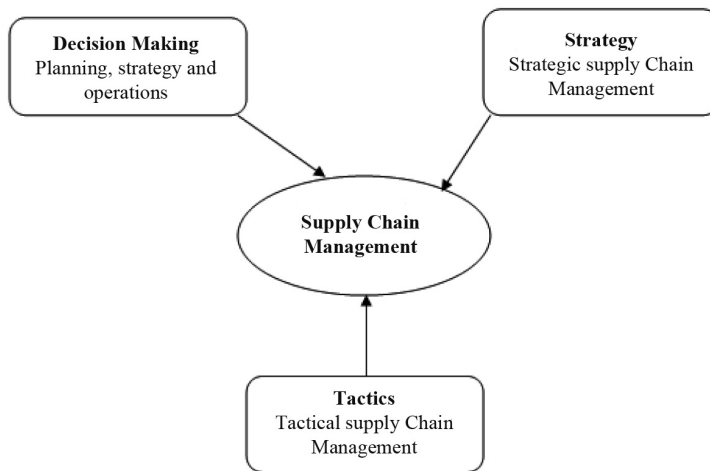


Fig. 2. Managing the Supply Chain - DMST (prepared by authors).

Decision making:

The decision making involves planning, strategy and operations (Mensah & Merkurjev, 2013) which are given below;

Planning:

What is to be done and how it should be done are questions if answered to correctly; then the organization is on the right path. As a matter of fact, planning consists of defining the organization's goals, establishing a strategy to achieve the necessary goals, and on the other hand integrating and coordinating activities through proper arrangements. All of these lead to the development of an appropriate strategy for the supply chain.

The strategic decision making:

After planning, the supply chain has to be designed, crafted and developed for the production of particular goods or services. As top managers are responsible for decision making about the mission and direction of the organization, and establishing policies that affect all organizational members, they will have to take the responsibilities of crafting

the appropriate cost effective supply chain that is responsive to customers' demand, whilst facilitating product development, manufacturing and logistics.

Operations:

The application of the transformation process where organizations add value by converting inputs into outputs along the supply chain is known as operations. From a general perspective point of view, it is organized by determining what tasks to be done and by whom; how the tasks are to be grouped; who reports to whom and where decisions are to be made.

The other two features of the supply chain management, which are the strategic supply chain management and tactical supply chain management, are also vital to create an integrated supply chain management where all the parties involved are well informed about the processes, developments and changes.

The strategic supply chain management:

The strategic supply chain management is essential as it has to achieve its main goal which is most probably the customer's satisfaction. In order to achieve this goal, the organization should have the necessary competencies and skills to select and link reliable suppliers so that value is added on materials, products and services along the supply chain that would lead to profitability and competitive advantages.

Tactical supply chain management:

Simultaneously, as the supply chain is dynamic, a tactical supply chain management should be enforced to meet with any changes along the supply chain in today's competitive world, if not, organizations might fail to reach their goals. The tactical supply chain management involves the continuous monitoring of activities along the supply chain using appropriate IT software while sharing information as well as being engaged in continuous planning and making necessary changes.

Although effective strategies have been introduced to govern the supply chain, it is still vulnerable to disruptions in which some of the risks involved are unavoidable. The next sections deals with the supply chain risks.

4. Supply chain risks

Managing the supply chain is quite a challenging task as supply chains are more complex today. Although the operational efficiency of well structured supply chain is high, the risk involved is still a concern and should not be neglected, as "in today's uncertain and turbulent markets, supply chain vulnerability has become an issue of significance for many companies" (Christopher and Peck, 2004). "There are many risks to be analysed in the supply chain from high profile risks such as disasters like earthquake, terrorism, tsunami, SARS etc, to the more common risks which are mainly operational" (Tang, 2006). These common risks include demand, supply, materials and information flow. The authors are only taking the operational risks into consideration in this section.

With reference to figure 1, if there is a delay in the flow of materials and information in the upper level, it would yield to a problem of visibility where confidence in the supply chain is weakened as "the time it takes for materials to move from one end of the supply chain to the order is long" (Martin and Lee, 2004) and the information flow along the supply chain is not accurate enough. As a result, this would cause a delay in production and supply which could "ridicule" some of the business functions especially the marketing and sales department as they would lack adequate knowledge to respond to customers' demand.

According to the survey done by the Independent Risk Consulting Company, Protivity, about Understanding Supply Chain Risk Areas, Solutions, and Plans (Protivity, 2013), the risks in operational supply chain are many and they include the following:

- A variety of supply interruption risks
- Demand and supply planning and integration risks
- Purchase price risks
- Inventory and obsolescence risks
- Regulatory and compliance risks

- Information privacy and security risks
- Customer satisfaction and service risks
- Contract compliance and legal risks
- Process inefficiency risks
- Employee and third-party fraud risks
- Product introduction and cycle time risks
- Human resource skills and qualifications risks
- Project management risks
- Corporate culture and change management risks
- Information integrity and availability risks

The probability of dealing with or managing all the above risks especially in a small organisation is quite low, and as a matter of fact, the authors have considered a few according to their importance, namely:

- Demand and supply planning and integration risks
- Inventory risks
- Customer satisfaction and service risks
- Information integrity and availability risks

It is very easy for companies to make significant errors when forecasting the demand of their customers. Such mistakes will affect the whole supply chain from the upper level to the lower level. For instance, if there is a forecast of a 20% increase in demand whilst in reality there is no increase, this would lead to more materials flowing down from the upper level of the supply chain, yielding to a 20% increase in production and a 20 % buffer of the production. The buffer here means that 20 % of the products will remain unsold. There is no doubt here that there is an increase in cost and inventory and obviously an incredible loss to the organization. Customers' preferences are dynamic and changes most of the time which makes it difficult to have a sustainable customer satisfaction. In addition, as the competition among rivalry companies is fierce, it is quite easy for customers to switch. To avoid these, organizations should have a constant feedback from their current customers and react accordingly whilst trying to gain new customers. Moreover, as discussed earlier in this section, there should be an accurate flow of information, materials, and product along the supply chain as this would ensure visibility, integrity and transparency. All of these are a stepping stone in developing a supply chain resilient strategy which is discussed in the next section.

5. The supply chain resilience

The dictionary definition of “resilience” states that it is the ability of a substance to return to its original shape after it has been bent, stretched or pressed (Oxford Advanced Learners Dictionary, 2013). Although “resilience” could be defined as the ability of a substance to get back to its original state after deformation, there is still no concrete definition of a “resilient supply chain” or “supply chain resilience”. Other definitions which are close in meaning to the dictionary definition, states that “resilience is the ability of a system to return to its original or desired state after being disturbed” (Cranfield School of Management, 2003) or “the ability to bounce back from large-scale disruptions” (Sheffi, 2008). The disruptions discussed here are major and high profiled, and if occurred, the results could be catastrophic for organizations and they might end up in bankruptcy or terrible loss in profits. Additionally, “in today’s uncertain and turbulent markets, supply chain vulnerability has become an issue of significance for many companies and appropriate research on resilient supply chain are yet to be conducted” (Christopher and Peck, 2004). Actually some of the researches have only just begun, for example, according to the 3rd annual survey of the Business Continuity Institute where more than 550 organizations from over 60 countries were surveyed, “supply chain incidents led to a loss of productivity for almost half of businesses along with increased cost of working (38%) and loss of revenue (32%). The disruptions include, adverse weather

(windstorm/tornado, flooding, snow etc), unplanned outage of IT or telecommunication systems, transport network disruption Earthquake/tsunami, failure in service provision by an outsourcer, loss of talent/skills, product quality incident volcanic ash cloud, insolvency, civil unrest/conflict, industrial dispute, fire and cyber attack” (Business Continuity Institute, 2011). Furthermore, “cyber risk stood out as the most pressing non-traditional risk within a supply chain context, and perhaps the only issue where a seemingly small failure could cause rapid and widespread disruption” (World Economic Forum, 2012).

As IT is now playing a vital role in the information, materials and financial flow in the supply chain, there is no doubt that it is vulnerable to cyber attacks and IT failures as shown in Figure 3.

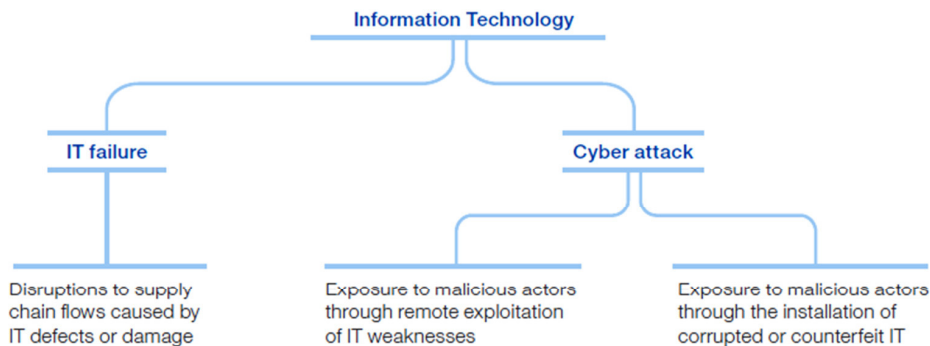


Fig. 3. Cyber risks to global supply chains (World Economic Forum, 2013).

Any hardware or software defect or damage on the IT system will result to an IT failure that would cause disruption in the whole of the supply chain. Cyber attack is another serious issue where weaknesses in the IT system is vulnerable to hackers, or organizations might assume they have had a good deal enabling them to cut costs not knowing that they have just installed a fake or counterfeit IT system that is easily attacked by hackers. Organizations should therefore always be alert just in case any of the deformities discussed above or the risks in the previous section occur. Therefore, the only way to bounce back after these disruptions is by developing and implementing a supply chain resilience strategy.

5.1. Developing a Resilient Supply Chain

Historically, immediate solutions to disrupted supply chains like the outbreak of the SARS or the Hurricane Sandy that affected 24 states in the USA in October last year, was not possible and might not be possible in the future if organizations lack proper planning (Mensah & Merkurjev, 2013). Nevertheless, disruptions could be combated by organizations with better planning, strategies and operations even in the short run. After conducting a thorough research, the authors propose that a resilient supply chain could be developed by organizations, through planning and implementing lean production, six sigma practices, flexibility and a strong corporate culture. As a result, these organizations would have the capabilities to speed up the process of bouncing back after deformation on any part along the supply chain. The authors have tabularised these strategies in Table 1 with their advantages and disadvantages.

Table 1. Resilient strategies (prepared by authors).

Strategy	Advantages	Disadvantages	Examples
Lean production with JIT delivery and low inventory	Minimise waste and inefficiency. Continuous improvement in quality, productivity and responsiveness. Tight control over production process. Shortening product development cycles.	Necessitates rapid and frequent flow of goods and information Entails close relationship with suppliers	Toyota Kellogg's
Six sigma supply chain	3.4 defects per million activities or opportunities. Stops and prevents problems from happening. Management will be able to solve problems effectively as they have a solid grasp of the problems of their organization. Pay off in the long run.	High cost in investing both time and money into training employees in order to utilize the sigma tools effectively. A long-term method.	Ford General Electric Motorola Allied Signal
Increasing SC flexibility	Better respond to a change in demand Capabilities in reallocating resources when needed Developing good relationship with suppliers	Basically no disadvantages except for the fact that employees have to be trained which is an increase in costs	Intel
Developing a strong corporate culture	Employees well informed about the organization activities through continuous communication. Empowering employees to make quick decisions. Quick recovery after disruptions.	Might create dysfunctional conflict among employees if they are not well informed.	Toyota Apple

All of the strategies in Table 1 are significant and could be adopted and practiced in organizations depending on their capabilities. Due to the limitation of this paper, the authors will be focusing on the theoretical analysis of Lean production.

5.2. Lean Production

The Japanese automobile industry, with Toyota as the main player, actually developed lean production after the 2nd world war in order to rebuild the Japanese economy by reducing waste whilst improving quality in all the business functions as well as stages of the supply chain. In fact, the Toyota Production System (TPS) and lean manufacturing are commonly used as synonyms to lean production. There are many definitions today defining lean production, “the definition of lean production is highly elusive” (Pettersen, 2012). One of the definitions that the authors of this article prefer, states that, “lean production is ‘lean’ because it uses less of everything compared to mass production, half the human effort in the factory, half the manufacturing space, half the investment in tools, half

the engineering hours to develop a new product in half the time. Also, it requires keeping far less than half the needed inventory on site, results in fewer defects, and produces a greater and ever growing variety of products” (Womack, Jones & Roos, 1990). It is quite clear from the definition that waste is avoided in all the functions of the organization. Furthermore, lean production consists of four major parts namely awareness, quality assurance, level production and just in time (Toyota Productive System, 1996) as portrayed in Figure 4 below:

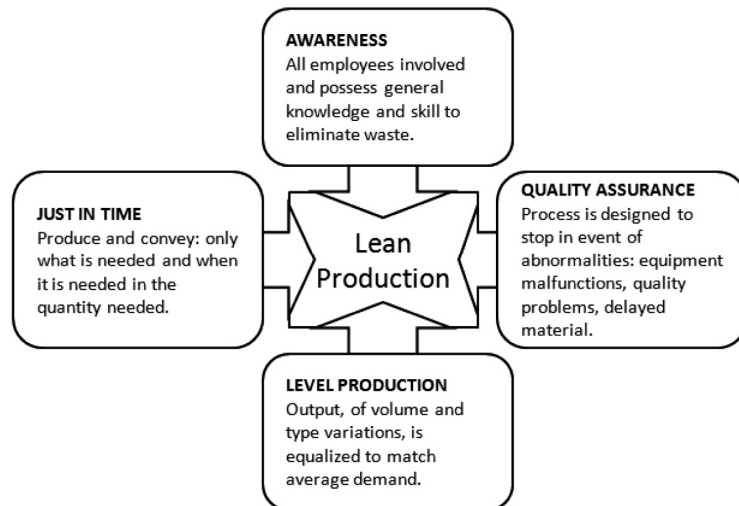


Fig. 4. Toyota productive systems

Awareness:

The Toyota Company ensures that all their employees have adequate knowledge and are actively involved in eliminating wastes. Through awareness, employees are performance focused, practice continuous improvement or “Kaizen” and are empowered to make decisions and manage on site when necessary.

Quality Assurance:

The quality assurance ensures that all machines and equipment should stop and raise an alarm when there is a defect so that the machines would not be damaged; this is known as the “Poka Yoke”. Likewise, employees working on the conveyor belt or operating a machine should stop the machine if there is a defect or problem. Hence, quality is checked at each stage.

Level Production:

The level of production is driven by customers’ demand in order to avoid overproduction or underproduction.

Just in Time:

The necessary materials arrive when they are needed in the right quantity resulting in a smooth flow of the materials.

Additionally, by applying “the 5 principles of Lean, that consists of value, the value stream, flow, pull and perfection” (Womack, Jones & Roses 1990) along the supply chain, it will not only lead to better flow of information, material, products and money, but will also create transparency and trust among the different supply chain partners which is crucial in helping an organization to bounce back after any deformation along its supply chain. By implementing the 5 principles of lean, a lean supply chain allows the customers to define the *value* of a product or service whereby the products or services will be transformed according to the customers’ preferences. Next, a sequential process creates value along the supply chain from the raw materials to the customers and this process is known as *the value stream*. This has to be integrated with the *flow* that helps to add value quickly by

eliminating the waiting time of work in progress, maximizing value added content and minimizing wastes along the supply chain. The *value, value stream and flow* cannot be effective if there is a mismatch with the *pull*, which is the actual customers' demand that drives the supply chain in which the suppliers in the upstream can only supply after receiving information about the customers' demand. All of these lead to *perfection* where continuous improvement or the "kaizen" is practiced.

5.3. Recommendation

Although implementing lean production backed up by the six sigma strategy, flexibility and a strong corporate culture at the same time yields to a very "resilient" strategy, it is very expensive and complicating to implement. Therefore, the authors propose lean production as the main recommendation with the six sigma strategy as an alternative. Both strategies could be backed up with flexibility and or a strong corporate culture depending on the organization's capabilities. The advantages and disadvantages of these strategies are given in table 1. In implementing the strategies, organizations should hire experienced supply chain managers, with adequate knowledge of the given strategies, and purchasing professionals to lead the supply management and purchasing professionals teams respectively, so that operations between the upper and lower levels of the supply chain is well monitored with a transparent flow of information, materials and money to build trust and visibility whilst minimising wastes and costs.

Finally, in case any of the disruptions and or risks discussed earlier occurs resulting in a disruption of the supply chain, organizations practising the recommended strategies will find themselves in a position where they are always well prepared as they have the necessary capabilities, competencies and flexibilities to bounce back and resume operations in the shortest possible time. This will eventually lead to sustainability, an increase in profitability and competitive advantages over their rivals who are less resilient.

6. Conclusion

The authors have investigated the vulnerability of the supply chain to disruptions and risks in a qualitative research method as well as quantitative secondary resources where scientific publications, relevant literatures, journals as well as the authors' professional lecturing experiences in the field of management and modelling and simulation were exploited. It was discovered that these disruptions and risks including natural disasters, terrorism, cyber attacks, credit crunch and many more could yield to a drastic loss in productivity, revenue, competitive advantage, profitability and even bankruptcy if not managed appropriately. The supply chain was well analysed and illustrated in a diagram portraying the various stages of the supply chain, and the flow of materials, products, information and money. However, it still needs proper management, and therefore the authors developed the DMST factors so that it could be exploited by supply chain managers when managing the supply chain. After thorough research, the authors proposed four strategies namely; lean production, the six sigma strategy, flexibility and a strong corporate culture, that would make organizations more resilient so that they could resume operations in the shortest possible time after any form of disruptions or damages along the supply chain. The authors also recommended that implementing all of the strategies where expensive and complicating and therefore organizations should implement lean production as the main recommendation with the six sigma strategy as an alternative and that both strategies could be backed up with flexibility and or a strong corporate culture depending on the organization's capabilities as these will make organizations resilient and flexible enough to withstand any form of disruptions.

Although, the lean production strategy was analysed, it was mainly theoretical and still needs to be applied in an organization so that it could be tested. A simulation model can also be developed and run to observe the disruptions in a non resilient organisation compared to a more resilient organisation practicing the given strategies, and the length of time it will take the organization to bounce back and resume operations.

References

- Building Resilience in Supply Chains (2013). World Economic Forum. Retrieved October 1, 2013, from http://www3.weforum.org/docs/WEF_RRN_MO_BuildingResilienceSupplyChains_Report_2013.pdf.
- Christopher, M., & Peck, H. (2004). Building the Resilient Supply Chain. *International Journal of Logistics Management*, 15, 1–13. <http://dx.doi.org/10.1108/09574090410700275>
- Creating Resilient Supply Chains: A Practical Guide. (2003). Cranfield University. Retrieved October 1, 2013, from http://www.som.cranfield.ac.uk/som/dinamic-content/research/lscm/downloads/57081_Report_AW.pdf.
- Crocker, J. (2003). The Supply Chain: Increasing Value through Process Improvement. Retrieved October 10, 2013, from <http://www.clermiston.com.au/Documents/Supply%20Chain%20Increasing%20Value%20Process%20Imp%20JRC%20Handout%20x.pdf>
- Definition of resilience noun (2013). Oxford Advanced Learners Dictionary. Retrieved October 1, 2013, from <http://oald8.oxfordlearnersdictionaries.com/dictionary/resilience>.
- Janvier-James, A. M. (2012) A New Introduction to Supply Chains and Supply Chain Management: Definitions and Theories Perspective. *International Business Research*, 5 (1), 194–207. <http://dx.doi.org/10.5539/ibr.v5n1p194>
- Logistic (2013). Council of Supply Chain Management Professionals. Retrieved October 10, 2013, from http://www.cscmp.se/CLMSite/CLM_logistik.htm
- Lu, D. (2011). Fundamentals of Supply Chain. Dr. Dawei Lu and Ventus Publishing ApS.
- Martin, C., & Lee, H. (2004) Mitigating Supply Chain Risk Through Improved Confidence. *International Journal of Physical Distribution & Logistics Management*, 34 (5), 388–396. <http://dx.doi.org/10.1108/09600030410545436>
- Mensah, P., & Merkurjev, Y. (2013). The role of ICT in the supply chain resilience, International Conference on Applied Information and Communication Technologies (*AICT2013*). Jelgava, Latvia.
- Pettersen, J. (2012). *Defining Lean Production: Some conceptual and practical issues*. Sweden: Linköping University.
- Pienaar, W. (2009). *Introduction to Business Logistics*. Southern Africa: Oxford University.
- Sheffi, Y. (2005). Building a resilient SC. *Supply chain strategy*, 8 (1), 1–14.
- Sheffi, Y. (2008). Resilience – What is it and how to achieve it. Retrieved October 1, 2013, from http://web.mit.edu/screponse/repository/Sheffi_Congressional_Testimony.pdf.
- Supply Chain Resilience 2011 (3rd Annual Survey). (2011). Business Continuity Institute, 1–47.
- Tang, C., S. (2006). Perspectives in supply chain risk management, *Int. J. Production Economics*, 103, 451–488. <http://dx.doi.org/10.1016/j.ijpe.2005.12.006>
- Understanding supply chain risk areas, Solutions, and plans (Five part series) (2013). Protiviti, 1–36. Retrieved October 1, 2013, from <http://www.protiviti.com/en-US/Documents/Surveys/SupplyChainRiskAreas.pdf>.
- Womack, J. P., & Jones, D. ffT. (1996). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Simon & Schuster.
- Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world*. New York: Harper-Collins.