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Prioritizing Supply Chain Resilience Practices based on the Sustainability Goals

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Prioritizing Supply Chain Resilience Practices based on the Sustainability Goals	
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Abstract	In present scenario Supply chain is operating under turbulent and uncertain times which has developed an immense need for adopting supply chain resilience. However, while maintaining operations in the short term, the sustainability of the supply chain could be compromised. This phenomenon has created a challenge for managers to maintain operations in uncertainty while retaining the same level of sustainability. This developmental paper aims to propose supply chain resilience practices which also work towards preserving sustainability in the supply chain. A multi-criteria decision-making method shall be used to cluster and prioritize the practices by their sustainability. Suggested practices will contribute towards achieving sustainable supply chain resilience. <106>
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1. Introduction

Resilience in the supply chain is the ability to adapt to recover after a disruptive event. It ensures quick recovery of operations while minimizing the impact of disruptions on the business. (Ponomarov and Holcomb, 2009) In case of uncertain events, it can be very useful, as the traditional risk management strategy cannot deal with unforeseen events. (Pettit et al., 2010). It deals with uncertainty and also prepares supply chain proactively to face any disruptions in the future. (Hohenstein et al., 2015)

While preparing for uncertain events, it is possible that we take certain decisions which would impact the social and environmental surroundings of the supply chain. For example, if managers plan to keep redundant capacity in the supply chain as a resilient practice, then it could have an impact on the environment by producing more waste and pollution and will also consume more natural resources. These social and environmental impacts are signs of lower sustainability of a supply chain as sustainability in a supply chain refers to the reduction of the negative impacts of supply chain operations on society and the environment. (Seuring and Müller, 2008). The above scenario gives rise to challenges in implementing supply chain resilience strategy while maintaining the sustainability of the supply chain.

In our paper, we try to address these challenges by identifying the Resilient supply chain practices, which are also not harming the sustainability of the supply chain. We have used the three dimensions of sustainability that are economic, social, and the environment as criteria to measure the sustainability of each resilient practice. The results of the study will give a set of practices that will help organizations to achieve resilience without compromising on the sustainability of the supply chain, in other words, they will be one step closer to sustain the supply chain operations in uncertain times.

2. Literature review

2.1. Supply Chain Resilience

Resilience is a risk management strategy which ensures the quick recovery of the business after getting hit by an adversary. There can be two types of risks in a supply chain, operational risk, and disruption risk. Operational risks are those who have less impact and are high in frequency, but disruption risks are low in frequency but high in impact. The resilience specifically helps to deal with the disruption risks (Goh et al., 2007). It facilitates businesses by making them adaptive by continuously predicting the risks and evolving to a better state (Hamel and Välikangas, 2003).

In the context of a supply chain, the resilience is the ability to reconsider the present state of the supply chain and move to a better operating state once exposed to a disruption (Christopher and Peck, 2004). The definition of the supply chain resilience used in this study is as follows:

“The adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function” (Ponomarov and Holcomb, 2009)

For the study, we have listed the major supply chain resilience enablers through various sources of literature. Total of seven enablers of supply chain resilience was found out from the literature

(See Table 1). Following is the meaning of each enabler and how they enable resilience in the supply chain:

- i. **Agility:** It refers to the alertness of the supply chain towards internal and external changes. It helps to enhance the capability of the supply chain to respond in a timely and flexible manner. (Li et al., 2009).
- ii. **Collaboration:** When two or more companies come together and do common planning, management, execution, and performance measurement, it is referred to as collaboration. (Anthony, 2000) It is considered as a binding force which brings companies together at the time of crisis and helps each other to recover from it. (Autry and Glenn Richey, 2009)
- iii. **Flexibility:** It refers to the degree to which a firm can adjust its supply chain speed, destinations, and volumes as per the requirement of the market. (Lummus et al., 2005)
- iv. **Risk management culture:** Its objective is to identify and eliminate the sources of risk through mitigation strategies among supply chain managers. (Manuj and Mentzer, 2008).
- v. **Visibility:** When supply chain partners have access to or share critical information, which helps them to take business decisions, it tends to increase the visibility in the supply chain. (Barratt, 2004).
- vi. **Redundancy:** It can be achieved by keeping resources more than required so that in case of any contingency, firms can use additional resources to overcome the situation. In a supply chain, we can keep safety stock, maintain multiple suppliers, and run operations at a low capacity utilization rate to create redundancy. (Blackhurst* et al., 2005).
- vii. **Anticipation Capability:** It refers to the ability of a firm to accurately forecast future events of change so that it can prepare itself for the adverse conditions. This capability of the organization is an important part of a proactive strategy for resilience. (Wieland and Marcus Wallenburg, 2013).

Insert Table 1 about here

2.2. Sustainability

To achieve overall sustainability, organizations cannot move ahead without including their suppliers in the strategy of adopting sustainability. In today's market, focal companies are often held responsible for the activities of their suppliers and distributors, which makes it important for them to influence the complete supply chain to adopt sustainability (Seuring and Müller, 2008). Measuring the performance of a supply chain based on the triple bottom line framework will help managers to integrate sustainability in the supply chain (Clift, 2003; Foran, Lenzen, Dey, & Bilek, 2005; Pagell & Wu, 2009; Seuring & Müller, 2008). TBL in supply chain suggests that the focal company and its suppliers take responsibility for carrying out business operations while ensuring economic, social, and environmental performance (Govindan et al., 2013). Three goals of the triple bottom line are important pillars of sustainability and required to keep in balance with each other (Wittstruck and Teuteberg, 2012).

2.3. Research gap

Resilience and sustainability are two distinct strategies which share contradictory and complementary relationships at different intersections (Derissen et al., 2011; McLellan et al., 2012; Milman and Short, 2008). Authors have also highlighted the importance of adopting both strategies simultaneously as both of them serve distinct but crucial functions in the supply chain (Anderies et al., 2013; Derissen, 2014; Redman, 2014). Due to the nature of relationships of these two strategies, there can be some tradeoffs at the time of operationalization. Hence, It becomes the responsibility of the supply chain manager to identify the practices in such a way that it fulfills the goals of both the strategies without any compromise (Karutz et al., 2018). Keeping in mind the requirement of fulfilling the goals of both the strategy we intend to identify those resilient practices which will achieve supply chain resilience goals without compromising on sustainability goals. In literature, we couldn't find any study which would recommend practices that are complementing both the strategies. We see this as a major research gap and propose the research objective of the study to cluster the supply chain resilience practices in high medium and low sustainable practices and then prioritize the high sustainable practices based on their ability to achieve sustainability goals.

3. Methodology

Understanding the research objective of clustering and prioritizing the supply chain resilience practices, we will conduct the study in the following steps.

3.1. Identifying Supply Chain Resilience Practices (SCRP)

Referring to all seven enablers, we have identified the practices for each in the literature. (See Table 2 and 3). The seven enablers are not independent of each other. These enablers share overlapping relationships with each other. Due to these overlaps, the practices are not unique in some cases. We observed that some of the practices are common under different enablers. We removed redundant practices to get a clear set of supply chain resilient practices (SCRP). After removal of redundant practices, we obtain a final list of SCRPs in Table 3.

Insert Table 2 about here

Insert Table 3 about here

3.2. Identify the sustainability criteria to assess SCRPs

To prioritize the practices as per their ability to fulfill sustainability goals, we need to identify criteria under three dimensions of sustainability that are economic, social, and environment.

Economic Performance: Resource Management Efficiency

The variables that indicate the flow of money are used to measure the economic performance of a company (Gutowski, 2013). It is a traditional criterion of performance which gives importance to

the financial outcomes of the business process. (John Elkington, 1997) There can be two ways to increase economic performance, either by increasing the revenue or by decreasing the associated cost to any product. The major cost in any product includes procuring, managing, and operating the resources in a supply chain. Raw material, final product, semi-finished product, machinery, packaging material, and human resource are some of the examples of the resources. (Zhou et al., 2000) If the supply chain strategy can manage the resources more efficiently, then it will directly reduce the costs and will result in financial benefits for the overall supply chain. (Harmon and Cowan, 2009; Zailani et al., 2012) Hence, resource management efficiency is an important criterion for measuring economic performance in a supply chain.

Social Performance: Relationship with community Stakeholders

The social performance deals with the people front of the 3Ps as suggested by Elkington (1997), which means that the firms must be working towards the development of their stakeholders for better social performance. In a supply chain, there can be three types of stakeholders internal, inter-firm, and external. (Klassen and Vereecke, 2012) Under risk management activities, it is important to study the stakeholders and manage them to maximize their positive influence and reduce their negative influence as they have a significant impact over the business (Walker et al., 2008). Local communities have been an important influencer as external stakeholders and one of the most difficult stakeholders to manage. (Stephen Tsang et al., 2009; Walker et al., 2008). Handling the challenges of managing the local community will result in a better relationship between the firm and the community. Hence, it is an important criterion for assessing the social performance of the firm.

Environmental Performance: Energy Consumption

Firms which can reduce the impact of their operations on the surrounding natural environment are considered environmentally sustainable companies (Eltayeb et al., 2011). In case of a supply chain, the environment is affected by the carbon footprint as the operations are dependant on the energy produced from fossil fuels. (THUERMER, 2008) To reduce the impact on the environment, firms need to either reduce energy consumption or to look for alternative sustainable sources of energy other than fossil fuels. (Carter and Rogers, 2008). In the context of logistics and supply chain, energy efficiency is usually neglected, but at the same time, it has a significant impact on the environment. Hence to improve the environmental performance in the supply chain, there is a need to look for options to reduce the consumption of energy. (Kovács and Halldórsson, 2010) We will use reduced energy consumption as the criterion for environmental performance.

3.3. Identify Clustering and Prioritizing Techniques

We intend to use the sustainability goals of a supply chain as criteria to cluster and prioritize the supply chain resilient practices. First of all, we plan to calculate the weights of the economic, social, and environmental criteria by running Analytical Hierarchal Process (AHP). It allows us to compare the decision elements with one another and assign weights to them based on the experts' knowledge of decision variables (Gaudenzi and Borghesi, 2006). After running AHP, we will get importance weights for each of the criteria.

Next, we would run a grey clustering algorithm to categorize the SCRP based on the impact of each practice on the given sustainability criteria. It helps in categorizing data based on relatively unsure or judgmental data and results in the classes of importance for effective prioritization (Rajesh, 2018).

Once we have the categorization of practices in high, medium, and low importance categories for sustainability, then the prioritization of high importance SCRP will be done using the TODIM method. This method incorporates the psychological factors of a decision maker while deciding on a multi-attribute problem. This study evaluates results based on the responses from the industry experts for three criteria and twenty-eight alternatives. Hence we use TODIM to take care of the psychological factors of the respondents (Zhou et al., 2018).

3.4. Designing a Questionnaire

A survey questionnaire is designed to collect data from supply chain experts. The questionnaire has three sections; in section 1, there are questions related to the department, experience, and industry. In section 2, there is a pairwise comparison between three sustainability goals that are improved resource management efficiency, an enhanced relationship with community stakeholders and reduced energy consumption. This comparison is made on a scale from 1 to 9. In section 3, we used a 9 point scale varying from extremely low to extremely high to measure the impact of each supply chain resilience practice (SCRP) on the three dimensions of sustainability.

3.5. Data Collection

The respondents to the survey will be supply chain managers that have at least five years of experience in the field of the supply chain. We are planning to consider multiple experts in our study to reduce biases. We will be taking an average of the results of AHP and taking the median of the linguistic responses by the experts, which will ensure that there are no biases in our study.

3.6. Analysis of Data

Analysis of data will be done on MS Excel using the algorithm of the techniques mentioned above.

4. Way ahead

This paper is still in its developmental stage and intended to cluster and prioritize supply chain resilient practices by criteria of sustainability. The data collection is under process. The data will be analyzed once the collection process is done. After the completion of the analysis, we will be able to cluster the supply chain practices in categories of high, medium, and low importance for sustainability categories. After that, we will target practices of only high importance category to prioritization. We will rank the practices by their sustainability nature. High sustainable practices would be higher in rank. The results would help supply chain managers to decide for sustaining the performance of supply chain system in a turbulent and disruptive environment.

References

- Anderies, J.M., Folke, C., Walker, B., Ostrom, E., 2013. Aligning Key Concepts for Global Change Policy: Robustness, Resilience, and Sustainability. *Ecology and Society* 18. <https://doi.org/10.5751/ES-05178-180208>

- Anthony, T., 2000. Supply chain collaboration: success in the new internet economy. *Achieving supply chain excellence through technology* 2, 41–44.
- Autry, C.W., Glenn Richey, R., 2009. Assessing interfirm collaboration/technology investment tradeoffs: The effects of technological readiness and organizational learning. *Int Jnl Logistics Management* 20, 30–56. <https://doi.org/10.1108/09574090910954837>
- Barratt, M., 2004. Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal* 9, 30–42. <https://doi.org/10.1108/13598540410517566>
- Barroso, A.P., Machado, V.H., Barros, A.R., Cruz Machado, V., 2010. Toward a resilient Supply Chain with supply disturbances, in: 2010 IEEE International Conference on Industrial Engineering and Engineering Management. Presented at the EM), IEEE, Macao, China, pp. 245–249. <https://doi.org/10.1109/IEEM.2010.5674462>
- Bhamra, R., Dani, S., Burnard, K., 2011. Resilience: the concept, a literature review and future directions. *International Journal of Production Research* 49, 5375–5393. <https://doi.org/10.1080/00207543.2011.563826>
- Blackhurst*, J., Craighead, C.W., Elkins, D., Handfield, R.B., 2005. An empirically derived agenda of critical research issues for managing supply-chain disruptions. *International journal of production research* 43, 4067–4081.
- Carter, C.R., Rogers, D.S., 2008. A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management* 38, 360–387. <https://doi.org/10.1108/09600030810882816>
- Chopra, S., Sodhi, M.S., 2004. Supply-chain breakdown. *MIT Sloan management review* 46, 53–61.
- Christopher, M., Peck, H., 2004. Building the Resilient Supply Chain. *The International Journal of Logistics Management* 15, 1–14. <https://doi.org/10.1108/09574090410700275>
- Clift, R., 2003. Metrics for supply chain sustainability. *Clean Technologies and Environmental Policy* 5, 240–247. <https://doi.org/10.1007/s10098-003-0220-0>
- Day, G.S., 1994. The Capabilities of Market-Driven Organizations. *Journal of Marketing* 58, 37–52. <https://doi.org/10.2307/1251915>
- Derissen, S., 2014. Managing ecological-economic systems under uncertainty [WWW Document]. URL <https://d-nb.info/1072072645/34#page=61> (accessed 7.24.18).
- Derissen, S., Quaas, M.F., Baumgärtner, S., 2011. The relationship between resilience and sustainability of ecological-economic systems. *Ecological Economics* 70, 1121–1128. <https://doi.org/10.1016/j.ecolecon.2011.01.003>
- Eltayeb, T.K., Zailani, S., Ramayah, T., 2011. Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling* 55, 495–506. <https://doi.org/10.1016/j.resconrec.2010.09.003>
- Falasca, M., Zobel, C.W., Cook, D., 2008. A decision support framework to assess supply chain resilience, in: *Proceedings of the 5th International ISCRAM Conference*. pp. 596–605.
- Flint, D.J., Blocker, C.P., Boutin, P.J., 2011. Customer value anticipation, customer satisfaction and loyalty: An empirical examination. *Industrial Marketing Management, Special issue on Service-Dominant Logic in Business Markets* 40, 219–230. <https://doi.org/10.1016/j.indmarman.2010.06.034>
- Foran, B., Lenzen, M., Dey, C., Bilek, M., 2005. Integrating sustainable chain management with triple bottom line accounting. *Ecological Economics* 52, 143–157. <https://doi.org/10.1016/j.ecolecon.2004.06.024>
- Gaudenzi, B., Borghesi, A., 2006. Managing risks in the supply chain using the AHP method. *The International Journal of Logistics Management* 17, 114–136. <https://doi.org/10.1108/09574090610663464>
- Goh, M., Lim, J.Y.S., Meng, F., 2007. A stochastic model for risk management in global supply chain networks. *European Journal of Operational Research* 182, 164–173. <https://doi.org/10.1016/j.ejor.2006.08.028>

- Govindan, K., Khodaverdi, R., Jafarian, A., 2013. A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production* 47, 345–354. <https://doi.org/10.1016/j.jclepro.2012.04.014>
- Gutowski, T., 2013. The Triple Bottom Line: What Is It and How Does It Work? 9.
- Hamel, G., Välikangas, L., 2003. The Quest for Resilience. (cover story). *Harvard Business Review* 81, 52–63.
- Harmon, R.R., Cowan, K.R., 2009. A multiple perspectives view of the market case for green energy. *Technological Forecasting and Social Change* 76, 204–213. <https://doi.org/10.1016/j.techfore.2008.03.026>
- Hohenstein, N.-O., Feisel, E., Hartmann, E., Giunipero, L., 2015. Research on the phenomenon of supply chain resilience: A systematic review and paths for further investigation. *International Journal of Physical Distribution & Logistics Management* 45, 90–117. <https://doi.org/10.1108/IJPDLM-05-2013-0128>
- Holcomb, M.C., Ponomarov, S.Y., 2009. Understanding the concept of supply chain resilience. *Int Jnl Logistics Management* 20, 124–143. <https://doi.org/10.1108/09574090910954873>
- James B. Rice Jr Yossi Sheffi, 2005. A Supply Chain View of the Resilient Enterprise. *MIT Sloan Management Review*; Cambridge 47, 41–48.
- John Elkington, 1997. Cannibals with forks: the triple bottom line of 21st century business [WWW Document]. URL <https://search.proquest.com/openview/804cc9d98196ef6e26d88748e89f8db0/1?cbl=35934&pq-origsite=gscholar> (accessed 4.3.19).
- Jüttner, U., Maklan, S., 2011. Supply chain resilience in the global financial crisis: an empirical study. *Supply Chain Management: An International Journal* 16, 246–259. <https://doi.org/10.1108/13598541111139062>
- Jüttner, U., Peck, H., Christopher, M., 2003. Supply chain risk management: outlining an agenda for future research. *International Journal of Logistics Research and Applications* 6, 197–210. <https://doi.org/10.1080/13675560310001627016>
- Karutz, R., Riedner, L., Vega, L.R., Stumpf, L., Damert, M., 2018. Compromise or complement? Exploring the interactions between sustainable and resilient supply chain management. *International Journal of Supply Chain and Operations Resilience* 3, 117. <https://doi.org/10.1504/IJSCOR.2018.090768>
- Klassen, R.D., Vereecke, A., 2012. Social issues in supply chains: Capabilities link responsibility, risk (opportunity), and performance. *International Journal of Production Economics, Sustainable Development of Manufacturing and Services* 140, 103–115. <https://doi.org/10.1016/j.ijpe.2012.01.021>
- Kovács, G., Halldórsson, Á., 2010. The sustainable agenda and energy efficiency: Logistics solutions and supply chains in times of climate change. *Int Jnl Phys Dist & Log Manage* 40, 5–13. <https://doi.org/10.1108/09600031011018019>
- Li, X., Goldsby, T.J., Holsapple, C.W., 2009. Supply chain agility: scale development. *The International Journal of Logistics Management* 20, 408–424. <https://doi.org/10.1108/09574090911002841>
- Lummus *, R.R., Vokurka, R.J., Duclos, L.K., 2005. Delphi study on supply chain flexibility. *International Journal of Production Research* 43, 2687–2708. <https://doi.org/10.1080/00207540500056102>
- Manuj, I., Mentzer, J.T., 2008. Global supply chain risk management strategies. *International Journal of Physical Distribution & Logistics Management* 38, 192–223.
- McLellan, B., Zhang, Q., Farzaneh, H., Utama, N.A., Ishihara, K.N., 2012. Resilience, Sustainability and Risk Management: A Focus on Energy. *Challenges* 3, 153–182. <https://doi.org/10.3390/challe3020153>
- Milman, A., Short, A., 2008. Incorporating resilience into sustainability indicators: An example for the urban water sector. *Global Environmental Change, Local evidence on vulnerabilities and*

- adaptations to global environmental change 18, 758–767.
<https://doi.org/10.1016/j.gloenvcha.2008.08.002>
- Min, S., Roath, A.S., Daugherty, P.J., Genchev, S.E., Chen, H., Arndt, A.D., Glenn Richey, R., 2005. Supply chain collaboration: what's happening? *The International Journal of Logistics Management* 16, 237–256. <https://doi.org/10.1108/09574090510634539>
- Movahedi, B., Lavassani, K.M., Kumar, V., 2008. How Can B2B E-Marketplaces (EM) Enhance the Quality of Supply Chain?, in: Xu, L.D., Tjoa, A.M., Chaudhry, S.S. (Eds.), *Research and Practical Issues of Enterprise Information Systems II*. Springer US, Boston, MA, pp. 857–867. https://doi.org/10.1007/978-0-387-76312-5_8
- Pagell, M., Wu, Z., 2009. BUILDING A MORE COMPLETE THEORY OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT USING CASE STUDIES OF 10 EXEMPLARS. *Journal of Supply Chain Management* 45, 37–56. <https://doi.org/10.1111/j.1745-493X.2009.03162.x>
- Pettit, T.J., Fiksel, J., Croxton, K.L., 2010. ENSURING SUPPLY CHAIN RESILIENCE: DEVELOPMENT OF A CONCEPTUAL FRAMEWORK. *Journal of Business Logistics* 31, 1–21. <https://doi.org/10.1002/j.2158-1592.2010.tb00125.x>
- Ponomarov, S.Y., Holcomb, M.C., 2009. Understanding the concept of supply chain resilience. *The International Journal of Logistics Management* 20, 124–143. <https://doi.org/10.1108/09574090910954873>
- Rajesh, R., 2018. Measuring the barriers to resilience in manufacturing supply chains using Grey Clustering and VIKOR approaches. *Measurement* 126, 259–273. <https://doi.org/10.1016/j.measurement.2018.05.043>
- Redman, C., 2014. Should sustainability and resilience be combined or remain distinct pursuits? *Ecology and Society* 19. <https://doi.org/10.5751/ES-06390-190237>
- Sangari, M.S., Dashtpeyma, M., 2018. An integrated framework of supply chain resilience enablers: a hybrid ISM-FANP approach 28.
- Schmitt, A.J., Singh, M., 2012. A quantitative analysis of disruption risk in a multi-echelon supply chain. *International Journal of Production Economics, Supply Chain Risk Management* 139, 22–32. <https://doi.org/10.1016/j.ijpe.2012.01.004>
- Scholten, K., Sharkey Scott, P., Fynes, B., 2014. Mitigation processes—antecedents for building supply chain resilience. *Supply Chain Management: An International Journal* 19, 211–228.
- Seuring, S., Müller, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* 16, 1699–1710. <https://doi.org/10.1016/j.jclepro.2008.04.020>
- Soni, U., Jain, V., Kumar, S., 2014. Measuring supply chain resilience using a deterministic modeling approach. *Computers & Industrial Engineering* 74, 11–25. <https://doi.org/10.1016/j.cie.2014.04.019>
- Stephen Tsang, Richard Welford, Michelle Brown, 2009. Reporting on Community Investment. *Corporate Social Responsibility and Environmental Management*.
- Swafford, P.M., Ghosh, S., Murthy, N., 2008. Achieving supply chain agility through IT integration and flexibility. *International Journal of Production Economics* 116, 288–297. <https://doi.org/10.1016/j.ijpe.2008.09.002>
- THUERMER, K.E., 2008. Air cargo braces for a slowdown. *Logistics Management* 47.
- Walker, D.H.T., Bourne, L., Rowlinson, S., 2008. Stakeholders and the supply chain 32.
- Weiss, H.J., Rosenthal, E.C., 1992. Optimal ordering policies when anticipating a disruption in supply or demand. *European Journal of Operational Research* 59, 370–382. [https://doi.org/10.1016/0377-2217\(92\)90194-E](https://doi.org/10.1016/0377-2217(92)90194-E)
- Wieland, A., Marcus Wallenburg, C., 2013. The influence of relational competencies on supply chain resilience: a relational view. *International Journal of Physical Distribution & Logistics Management* 43, 300–320.

- Wittstruck, D., Teuteberg, F., 2012. Understanding the success factors of sustainable supply chain management: empirical evidence from the electronics and electronics industry. *Corporate Social Responsibility and Environmental Management* 19, 141–158.
- Zailani, S., Jeyaraman, K., Vengadasan, G., Premkumar, R., 2012. Sustainable supply chain management (SSCM) in Malaysia: A survey. *International Journal of Production Economics* 140, 330–340. <https://doi.org/10.1016/j.ijpe.2012.02.008>
- Zhou, Z., Cheng, S., Hua, B., 2000. Supply chain optimization of continuous process industries with sustainability considerations. *Computers & Chemical Engineering* 24, 1151–1158. [https://doi.org/10.1016/S0098-1354\(00\)00496-8](https://doi.org/10.1016/S0098-1354(00)00496-8)
- Zhou, Z., Dou, Y., Liao, T., Tan, Y., 2018. A Preference Model for Supplier Selection Based on Hesitant Fuzzy Sets. *Sustainability* 10, 659. <https://doi.org/10.3390/su10030659>

Appendix A: List of Tables

Table 1: List of top Enablers and References

Enabler	References
1. Agility	(Barroso et al., 2010; Christopher and Peck, 2004; Hohenstein et al., 2015; Li et al., 2009; Movahedi et al., 2008; Ponomarov and Holcomb, 2009; Scholten et al., 2014; Soni et al., 2014; Wieland and Marcus Wallenburg, 2013)
2. Collaboration	(Barroso et al., 2010; Bhamra et al., 2011; Christopher and Peck, 2004; Hohenstein et al., 2015; Holcomb and Ponomarov, 2009; Jüttner and Maklan, 2011; Movahedi et al., 2008; Pettit et al., 2010; Sangari and Dashtpeyma, 2018; Soni et al., 2014)
3. Flexibility	(Christopher and Peck, 2004; Hohenstein et al., 2015; Holcomb and Ponomarov, 2009; James B. Rice Jr Yossi Sheffi, 2005; Jüttner and Maklan, 2011; Movahedi et al., 2008; Pettit et al., 2010; Sangari and Dashtpeyma, 2018; Schmitt and Singh, 2012)
4. Risk Management Culture	(Barroso et al., 2010; Christopher and Peck, 2004; Hohenstein et al., 2015; James B. Rice Jr Yossi Sheffi, 2005; Movahedi et al., 2008; Pettit et al., 2010; Soni et al., 2014)
5. Visibility	(Bhamra et al., 2011; Christopher and Peck, 2004; Hohenstein et al., 2015; Jüttner and Maklan, 2011; Pettit et al., 2010; Sangari and Dashtpeyma, 2018; Scholten et al., 2014; Soni et al., 2014; Wieland and Marcus Wallenburg, 2013)

6. Redundancy	(Barroso et al., 2010; Falasca et al., 2008; Hohenstein et al., 2015; Holcomb and Ponomarov, 2009; James B. Rice Jr Yossi Sheffi, 2005; Movahedi et al., 2008; Sangari and Dashtpeyma, 2018; Schmitt and Singh, 2012; Scholten et al., 2014)
7. Anticipation capability	(Pettit et al., 2010; Sangari and Dashtpeyma, 2018; Wieland and Marcus Wallenburg, 2013)

Table 2: List of Resilient Supply Chain Practices

	Enablers	Practices	Authors
1	Agility	<ul style="list-style-type: none"> a. Reduction of manufacturing lead time b. Reduction of development cycle time c. Increase frequencies of new product introductions d. Increase levels of product customization e. Adjust delivery capability f. Improve customer service g. Improve delivery reliability h. Improve responsiveness to changing market need 	(Swafford et al., 2008)
2	Collaboration	<ul style="list-style-type: none"> a. Information Sharing b. Joint Planning c. Joint Problem Solving d. Joint performance Measurement e. Leveraging resources and skills 	(Min et al., 2005)
3	Flexibility	<ul style="list-style-type: none"> a. Ability to change the quantity of a supplier's order b. Ability to change delivery times of the supplier's order c. Ability to alter delivery schedules to meet customer requirement d. Ability to change production volume capacity e. Ability to accommodate changes in the production mix f. Ability to reduce manufacturing throughput times to satisfy customer delivery g. Ability to reduced development cycle times 	(Swafford et al., 2008)
4	Risk Management Culture	<ul style="list-style-type: none"> a. Avoiding Risk b. Using vertical integration, stockpiling, excess capacity and contracts to control risk c. Joint efforts in continuity plans share information and increasing visibility. 	(Jüttner et al., 2003)

		d. Adopting Product postponement e. Developing multiple and local sourcing	
5	Visibility	a. Developing the ability to sense information about external sensed events and changes in the supply chain b. Developing the ability to learn and gain new information and knowledge from its supply chain partners c. Developing the ability to obtain complete information to support decision making in for managing different kinds of dependency in supply chain relationships d. Developing the ability to share the information among supply chain partners to arrive collaborative goals and build up a collective identity for a supply chain	(Chopra and Sodhi, 2004; James B. Rice Jr Yossi Sheffi, 2005)
6	Redundancy	a. Maintaining Safety stock b. Using multiple suppliers c. Developing Backup Sites d. Maintaining Excess Capacity	(Chopra and Sodhi, 2004; James B. Rice Jr Yossi Sheffi, 2005)
7	Anticipation capability	a. Anticipate Customers b. Anticipate competitors c. Anticipate disruptions on supplier side.	(Day, 1994; Flint et al., 2011; Weiss and Rosenthal, 1992)

Table 3: List of Resilient Supply Chain Practices after removing redundancies

S. No.	Practices
SCRP 1	Reduction of manufacturing lead time
SCRP 2	Reduction of development cycle time
SCRP 3	Increase frequencies of new product introductions
SCRP 4	Increase levels of product customization
SCRP 5	Improve delivery capability
SCRP 6	Improve customer service
SCRP 7	Improve delivery reliability
SCRP 8	Improve responsiveness to changing market need
SCRP 9	Promote Joint Planning
SCRP 10	Adopt Joint Problem Solving
SCRP 11	Adopt Joint Performance Measurement

SCRP 12	Leverage on resources and skills of partners
SCRP 13	Increase the ability to change the quantity of the supplier's order
SCRP 14	Reduce delivery times of supplier's order
SCRP 15	Increase ability to alter delivery schedules to meet customer requirement
SCRP 16	Increase ability to change production volume capacity
SCRP 17	Accommodate changes in production mix
SCRP 18	Avoiding Risk
SCRP 19	Using vertical integration
SCRP 20	Stockpiling
SCRP 21	Using Contracts
SCRP 22	Joint efforts in continuity plans share information and increasing visibility.
SCRP 23	Develop multiple and local sourcing
SCRP 24	Maintaining safety stock
SCRP 25	Develop Backup Sites
SCRP 26	Maintain Excess Capacity
SCRP 27	Develop the ability to sense information about external sensed events and changes in the supply chain
SCRP 28	Develop the ability to obtain complete information to support decision making in for managing different kinds of dependency in supply chain relationships