Key Factors Influence the Reconfiguration of Supply Chain Design: A Review Paper

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Key Factors Influence the Reconfiguration of Supply Chain Design: A Review Paper

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Abstract. With the evolution of Industry 4.0, the most advanced technologies have been invented and due to rapid globalisation, supply chains (SC) have become vulnerable to various risks and reconfiguration of supply chain design has gained a significant consideration in recent years. This paper intends to provide a critical literature review on the current research practices and identify the key factors influencing the reconfiguration of supply chain design in the digital environment and prioritise the factors considering relative importance and develop a framework to mitigate the risk level. A systematic literature review is conducted to identify and analyse the key factors that influence the reconfiguration of supply chain design, and Analytical Hierarchy Process (AHP) method used to develop a conceptual framework. The findings of this study revealed that reconfiguration of supply chain design in digital environment sheds light on future research and focuses on the potential to enhance supply networks' efficiency and responsiveness.

Keywords. Supply Chain, Industry 4.0, Reconfiguration.

1. Introduction

In the era of Industry 4.0, digitalisation has been the basis for supply chain (SC) design and the reconfiguration; SC management is a key driver in gaining a competitive advantage [1]. Supply chain involves a series of interconnected activities connecting suppliers and customers, that includes planning, managing, and controlling the products and services. Supply chain design decision involves a wide array of decision categories, including network and product design and strategies to effectively navigate uncertainties and variations, ensuring responsiveness within the supply chain [2] .With the digital revolution, opportunities are open to reconfiguring the supply chain to provide a more collaborative value network [3].

Reconfiguration of SC is required due to various external and internal reasons for the company and the related industry. Furthermore, new competitive suppliers are entering the market with new technologies, and the existing suppliers are required to modify their products or services with the latest technologies [4]. Risk management performs a key role in operating SC effectively in a variety of uncertain circumstances. Dynamic reconfiguration of the supply chain for risk management has gained the consideration of the researchers over the last two decades due to the influence of digital technology in the SCM [5]. With the evolution of Industry 4.0, the most advanced technologies are invented, and advanced software and tools are used to reconfigure the existing design and its correlated support activities [6].It is vitally important for supply chain designers to reconfigure SC using advanced technologies and Industry 4.0. SC

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designers need to have a better understanding of the key factors that influence the reconfiguring of the SC to mitigate the risk level and improve the efficiency and responsiveness of the SC.

2. Research Methodology

2.1. Systematic Literature Review

Literature review is essential for academic research, and this research work contributes to the systematic literature review (SLR) on the key factors that influence the reconfiguration of supply chain design. According to [7] , SLR is a methodology that effectively evaluates and consolidates the existing knowledge, selects and assesses the contribution from several researchers, conducts data analysis and synthesis, and presents a comprehensive summary of the existing knowledge for further studies to identify future research problems. The SLR approach is selected for finding the key factors that influence the reconfiguration of supply chain design as its capacity to provide a clear judgment and sequence that can be traced.

2.2. AHP Software

The analytic hierarchy process (AHP) is one of the most widely used methods in the Multiple Attribute Decision-Making (MADM) problems, which was proposed in 1980 by Thomas L. Saaty [8]. By using AHP software for multi-criteria decision-making, supply chain managers can effectively evaluate and prioritise the criteria to identify the key factors that influence the reconfiguration of supply chain design.

3. Findings and Discussions

As per the systematic literature review, Figure 1 displays the developed framework to indicate the correlation between variables to understand the key factors that influence the reconfiguration of supply chain design.

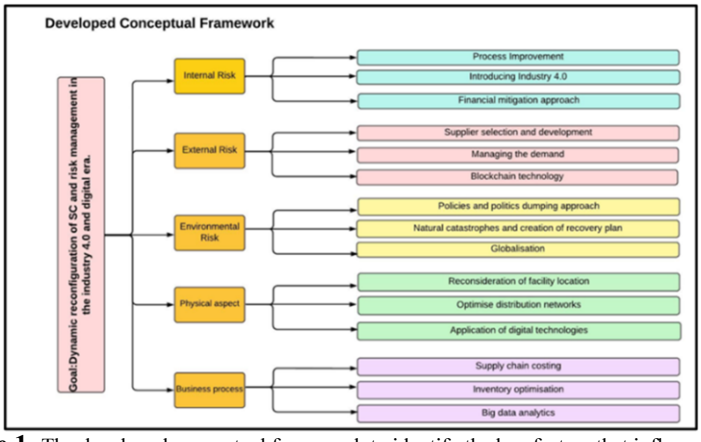

Figure 1. The developed conceptual framework to identify the key factors that influence the reconfiguration of supply chain design.

3.1. Key factors influence the reconfiguration of supply chain design.

- Internal risk

Internal risk can be defined in the literature as organisational risk as process and control risks [5]. One of the other classifications as internal risks are caused due to inefficient and unreasonable resource allocation.

Three approaches were recognised as process improvement, introducing Industry 4.0, and financial mitigation to mitigate the internal risk factors in supply chain management. Process improvement enhances operational efficiency by analysing existing processes, eliminating unnecessary costs associated with the supply chain, and improving overall performance. This leads to improved customer satisfaction, reduced response time and enhanced agility [9]. Introducing Industry 4.0 in the digital era, integrated the SC with advanced technologies such as Internet of Things (IoT), big data analytics, artificial intelligence, and cloud computing. Adaptation of digital technologies increase visibility, gives access to real-time data, and optimise the decision making. Industry 4.0 enhances supply chain transparency, operational efficiency, and enables innovative business models [10]. Financial mitigation approach involves applying strategies to mitigate the financial risks associated with the supply chain. This approach mitigates the potential disruptions by effectively managing financial aspects such as cash flow, payment terms, and financial stability. This leads to defending the financial uncertainties while increasing the profitability of the company [11].

- External risk

External risks are the risk that is outside of the focal company's control, but it is within the supply chain network. External risks are caused due to the failure to accept and respond to the sudden changes in market demand [12].

Supplier selection and development, managing the demand, and blockchain technology contribute to mitigating the external risks in the supply chain. Supplier selection and development can reduce the supplier-related issues by wisely assessing and selecting the suppliers based on criteria such as reliability, quality standards and responsiveness. Developing strong mutual relationships with suppliers leads to mitigate the risks related to quality issues, lead time and supplier failures [11]. Managing the demand and accurate forecasting of the demand ensures sufficient inventory levels are maintained to fulfil the customer's requirements. Managing the demand is essential for mitigating the external risks in the supply chain and that enables to response to the customer demand fluctuations [9]. Identification of demand patterns leads to managing the risks associated with changing market conditions, demand variability and changing customer buying behaviour [13]. Blockchain technology improved the supply chain transparency, traceability, and security and helps in mitigating the external risks [14]. Furthermore, Blockchain technology allows to create decentralised applications which enable to track, and store transactions functioned by many users and devices [15]. This enables end-to-end visibility of products, verifying authenticity and ensuring accordance with regulations [16].

- Environmental risk

Environmental risks can be defined as all the risks that happen outside of the supply chain network. For instance, governmental interventions like tariffs, tsunamis, hurricanes are considered.

Three sub-criteria were identified as policies and politics dumping approach, natural catastrophes and creation of recovery plan, and globalisation. When considering the politics and policies, government interference greatly impacts the supply chain network and any business. Policies and politics dumping approach involves executing regulations to the trade practices of dumping. The government can impose anti-dumping duties on imported goods to ensure fair competition and safeguard local businesses from harm [17]. Natural catastrophes and creation of recovery plan: Natural disasters do not happen frequently, but natural disasters like hurricanes, floods, storms, and earthquakes cause severe disruptions. In 2011 Tohoku earthquake and tsunami resulted in nearly 210 billion USD costs. Identifying natural disasters is important to manipulate the risk by creating a disaster response and recovery plan. These plans should include the diversifying sourcing locations and implementing disaster response and recovery strategies [18]. With the globalisation, new SC related concepts are used as outsourcing and offshoring, and it leads to entering the global supply chain network. Even though globalisation offers more improvements and benefits as global sourcing, it incurred a considerable level of risks. Organisations can adopt the best practices, share knowledge, and implement environment friendly technologies that can contribute to mitigating the environmental risk through the global supply chain [9].

- Physical aspect

The physical aspect is more critical as it needs the investment to construct the physical structure by considering the capacity utilisation, storage facilities and the manufacturing capacities.

Three sub-criteria were identified as reconsidering facility location, optimising distribution networks, and applying digital technologies. When reconfiguring the SC design, facility location is relocating the facilities to reduce the expenditure. Cost-effective facility locating is reduced the outbound transportation costs while decreasing the lead time, and it improves the quality of service to the customer [19]. Companies may have more alternatives when designing the distribution network and inappropriate networks can have a major negative impact on SC. Optimising distribution networks can have a great impact on the supply chain and strategical reconfiguration of network can reduce the lead time, transportation cost and improve the overall efficiency [20]. Application of digital technologies can greatly impact the supply chain and Industry 4.0 technologies such as cloud computing, blockchain, and Internet of Things (IoT) can increase the real-time visibility of inventory, transportation status and enhance the proactive decision-making and optimise the operational efficiency [21].

- Business process

In a SC, the core function is the business process, and it directly affects the performance and the profit of the focal firm. Three sub-criteria were identified as supply chain costing, inventory optimisation, and big data analytics.

Supply chain costing involves evaluating and managing all the costs related to supply chain activities. The analysis helps to identify the cost drivers and opportunities for cost reductions. Optimisation of supply chain cost, improve the profitability and enhance cost competitiveness [22]. Inventory has a major impact on a business process, and maintaining safety stocks creates a cost to the business. It is critical to keep a minimum stock in the inventory and find the right balance between inventory levels and customer demand. Organisations can reduce inventory while maintaining sufficient inventory by using techniques such as safety stock analysis, just-in-time, and demand forecasting. This

helps to reduce the carrying cost and risk of stockout while enhancing the cash flow [20]. Big data analysis facilitates the real-time data, and it provides a real-time view of SC for risk monitoring. This expedites the decision-making process by reducing the data complexity, and it leads to reducing the SC risk. Big data analytics facilitates better demand forecasting accuracy, improved inventory management, enhanced risk assessment, and more efficient supply chain planning [2].

3.2. The relative importance of the criteria and sub-criteria of the proposed framework

According to the results presented in Figure 2, it is evident that the physical aspect holds a relative importance of 27.25% compared to other criteria in the proposed framework. Additionally, the sub-criteria with the highest significance is the application of digital technologies, accounting for 9.07%. More results will be presented at the conference.

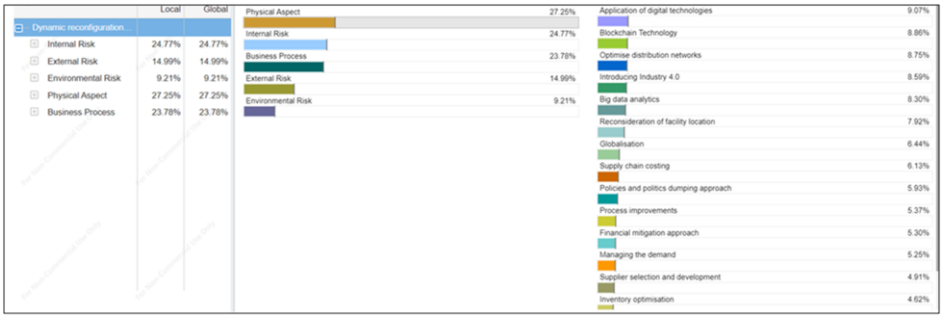

Figure 2. The relative importance of the criteria and sub-criteria of the proposed framework.

4. Conclusions and Future Research Directions

In summary, this paper has discussed the systematic literature review on the key factors that influence the reconfiguration of supply chain design and prioritise the relative importance of the factors using Analytic Hierarchy Process (AHP) software. Furthermore, this paper points out the opportunities for supply chain designers to enhance the supply chain design by identifying the key factors influencing the reconfiguration of supply chain design. Moreover, identifying the key factors for reconfiguration of supply chain design is vital for maintaining an effective supply chain and providing outstanding customer service. Future researchers can further consider the dynamic nature of these key factors and their interactions with Industry 4.0 and technological advancements. Even though, many articles identified the key factor, there has been limited focus on quantitative analysis. This gap presents an opportunity for future research, which can provide a deeper understanding of the relationships and impacts of these factors on supply chain performance.

Overall, this study highlights the potential of Industry 4.0 technologies and how key factors influence the reconfiguration of supply chain design, while also suggesting areas for future research.

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