

Reconfiguration of Supply Chains in Today's Digital Era: A Review Paper

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Abstract. This paper is intended to provide a critical literature review on the current research practices and the existing progress research published in the fields related to supply chain design and supply chain digitalisation. The study aims to reveal the adaptability of digital technologies to supply chain design and further explain the issues and requirements for dynamic reconfiguration of the supply chain in the digital era. The review study comprises articles appearing in the major journals related to the topic, and detailed analysis as to the approaches and findings of these works. The contribution of this study lies in the taxonomy study, and findings are revealed that digitalisation of supply chain design followed and shedding light on future research. Further need for research is identified regarding framework development, and reconfiguration of supply chain design in the digital era is more important to mitigate the risk level and improve the efficiency and responsiveness of the supply chain.

Keywords. Reconfigurable supply chain, Supply Chain Design, Digital era.

1. Introduction

The last 20 years have seen the emergence of the supply chain as a critical competitive force in today's increasingly uncertain marketplace. Supply Chain Management (SCM) plays a vital role in achieving a competitive advantage. As we enter a digital era, the term Industry 4.0 that has been the basis for the SC design and the reconfiguration.

Büyükoçkan & Göçer, [6] described the Supply chains as a series of interconnected activities between suppliers and customers that includes managing, planning, and controlling the products and services. The rationale behind the SCM is to manage the SC network by reducing the excessive costs and meet and exceed customer satisfaction by giving a better service. Designing a supply chain is correlated to an excessive range of decisions. It can be categorised into three groups as decisions of network design, product design, and decisions that allow the SC to be responsive to uncertainty and variability. With the digital revolution, opportunities are open to reconfiguring the supply chain to provide a more collaborative value network [23].

Reconfiguration of SC is required due to various external and internal reasons for the company and the related industry. Customer behaviours are changing rapidly, and manufacturers need to adapt to this behaviour to survive in the market. Furthermore, new competitive suppliers are entering the market with new technologies, and the existing suppliers are required to modify their product or service with the latest technologies.

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Risk management performs a key role to operate 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.

In the digital era, the usage of new technologies and processes contributes to reducing the size of the supplier base by narrowing the supply network. Rapidly growing technologies are opening doors to automation, and Industry 4.0 plays a key role in the SCM. The scope of this research is the reconfiguration of SC design and its integration with SC risk management.

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. More narrowly, Industry 4.0 concerns the execution of cyber-physical systems, resulting in the digitalisation. The firm's operational limitations such as productivity, efficiency, transparency, costs, and flexibility are improved with the new technologies. Digital technologies such as big data analytics (BDA), advanced manufacturing technologies with sensors, advanced robotics, and tracking and tracing technologies facilitate the development of digital supply chains and smart operations [15].

According to the literature review, there are plenty of research articles and books that are discussed regarding this field but, less research has been done on reconfiguration of SC design to mitigate risk using advanced digital technologies.

However, in the current competitive market, supply chain design becomes more challenging due to various risk factors. Thus, it is vitally important for supply chain designers to reconfigure SC using advanced technologies and industry 4.0. SC designers need to have a better understanding of what technologies are required to reconfigure the SC to mitigate the risk level and improve the efficiency and responsiveness of the SC.

2. Review Methodology

The main aim of doing a literature review is to evaluate the existing knowledge and identify future research problems. One of the best methods for studying the emerging fields is Systematic Literature Network Analysis (SLNA) [3]. The systematic literature review methodology was adapted as a literature methodology. To gather the existing literature, keywords and topics are considered and collecting the relevant journals and articles. The Rational for the Systematic Literature Review Approach for Supply Chain Reconfiguration (SCR) in the digital era is the more benefits as it ensures the clear judgment and sequence that can be traced. Once after finding the relevant articles and papers, the searching process is repeated to study and select the most relevant papers [3]. This paper presents the summary of data gathered from the research and descriptive analysis of the literature review.

3. Literature Review Analysis

SCM is the coordination and management of a complicated network of activities engaged in delivering a finished product to the end-user or customer [9]. The concept of SC resilience by design leads to justify that supply chains not only to optimise operational procedures but also achieving resilience. Companies should have the ability to develop and implement the most effective risk management tools for their supply chains.

Reconfiguration of the supply chain is required to mitigate the consequences and aid in recovery from disasters [19].

Designing a supply chain is correlated to an excessive range of decisions. It can be categorised into three groups as decisions of network design, product design, and decisions that allow the SC to be responsive to uncertainty and variability [14]. The design of the SC network has a significant role in today's competitive environment, and it inspires the competitive position of the firm [10].

A firm's ability to survive in an unstable business environment is enhanced by agile SC systems. Unstable and volatile markets are driving the competitiveness and competition and changes in the global economy impose further insecurity. Agility and flexibility are critical in the challenging business environment, and it comprises volatile and unpredictable demand [16]. Once the SC network becomes uncertain with a risk condition, SC designers reconfigure the network with a potential to sustain in similar conditions [2].

Supply chain reconfiguration can be defined simply as changing the existing SC design to construct a new supply chain structure to enhance the supply chain performance level while reducing the SC risk level. Considering many reasons, the existing design is reconfigured consistently to gain superior performance. Supply chains are reconfigured time to time due to the short product life cycle. SC in the modern era with the digital revolution, opportunities are open to reconfiguring the supply chain to provide a more collaborative value network [23].

4. Discussion and Findings

Bressanelli et al, [5] observed that SC reconfiguration is entitled to various challenges. It makes complex of the redesigning process and SC designers are concerned about each aspect and doing a viability analysis before applying the redesigned structure to the firm. In the digital era, the usage of new technologies and processes contributes to reducing the size of the supplier base by narrowing the supply network. Technologies are playing a vital role in SC management; they received considerable attention from various technologies [7]. According to Menon & Shah, [17] rapidly growing technologies are opening doors to automation, and Industry 4.0 plays a key role in the SCM.

Supply chain design improves the sustainable performance of the organisation and customer service by adapting innovative technologies [1]. The digital transformation of a SC enhances the company's performance by improving the customer experience and creating new business models [21]. Evolving technologies are required to adopt by organisations to their business process and for the effective management of next-generation Digital Supply Chain, data flows are needed to increase in their value chain [13]. The fourth industrial revolution, named Industry 4.0 inspires to maintain the factories without human involvement, and it encourages firms to connect worldwide through the SC networks [15].

4.1. Digital Technologies supporting Reconfiguration of SC

Digital technologies such as Addictive manufacturing (AM) are used to survive with fluctuations in demand and cost structures as the business environment evolves, the supply chain design must be dynamically reconfigured. Production demand and the production cost at each plant vary as economic factors change over time [22].

Oztemel & Gursev, [18] defined the IoT (Internet of Things) enable to inter-networking of physical devices, vehicles, buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity and collection and exchange of data. Considerable changes happen when transferring from industry 3.0 to industry 4.0 and one of the elements is triggering the IoT. These technologies facilitate the machine to machine (M2M) communication and it leads to human-free development. IoT technologies such as Radio-frequency identification (RFID) is performing a key role in many of the supply chain industrial applications like warehousing, tracking, and retailing. It includes single or multiple readers which are corresponded with multiple tags by inquiring about their identification. Mainly this technology is implemented in the SC systems to streamline the information flow by tracking the status like arrival and departure of an objective. This technology improves digital traceability and provides real-time data, leading to reconfigure the SC by identifying the risk involved in the existing SC [8].

Nowadays, the adoption of cloud computing has become regular due to the attractive IT acquisition options for many organisations. Many companies are looking to acquire cloud computing due to the opportunity of higher flexibility and cost-effectivity [20]. Contrasting to traditional SC, cloud computing provides an opportunity to access the on-demand inventory data as well as massive scalability in service.

Generally, Simulation techniques are used to build or evaluate the complicated supply chains by considering the supply chain design to upgrade the decision-making process. Good simulation models can be visualised end to end SC and it is easy to identify the inefficiencies, required improvements, potential risk situations without reconfiguring the SC. Without time and cost consuming, different supply chain designs can be manufactured and verified using a trial-and-error approach with less cost [4]. The blockchain can be identified as another application layer that runs on top of internet protocols and facilitates economic transactions between relevant partners. Moreover, Blockchain technology allows to create of decentralised applications that enable to track and store transactions functioned by many users and devices [11].

Big data playing a vital role in improving supply chain management. Supply chain risk management can mostly benefit from big data technologies and analytic methods for collecting, analysing, and monitoring both supply chain internal data and external data.

The enormous usage of digital technologies has headed to the emergence of big data business analytics (BDBA), which provides a better means to gather data to gain a strong competitive advantage. There are some considerable challenges in the SC which are resulted from the inefficiencies and wastages, like delayed shipments, rising fuel costs, and unreliable suppliers. Firms are highly passionate to invest in BDA in the SC operations to improve the visibility, flexibility, and integration of global supply chains and logistics processes [12].

The key target of SC visibility is to show current activities and involvement along a supply chain, and it leads to collecting the right information for the decision-makers. Existing SC data and business transactions are evaluated and analysed to gather external data and analyse the SC network. Then the analytics findings are contrasted with existing data to update the information. Furthermore, existing data related to handling unplanned interruptions are available for upcoming situations. Big data analysis facilitates real-time data and provides a real-time view of SC for risk monitoring. Tableau Software and Power BI are the most common software used for data analytics.

When reconfiguring the SC, decision-makers should consider the financial and non-financial situation, trade-offs among the financial and non-financial factors, and the

uncertainties that could affect the desirability of the substitutes. SC reconfiguration is important to a firm to enhance its performance and innovate the operational process. Rigid SC structures are effectively replaced the flexible and reconfigurable SC structures. It will change the existing logistic channels. To construct a new SC design and analyses the impact of changes on the SC performance setting a standard and rules are desired.

5. Conclusions and Future Research Works

Overall, this paper has discussed the systematic literature review on the relationship of digital technologies and supply chain design to manage the supply chain risk. Furthermore, this paper identified the gaps in the SC reconfiguration that leads to future research avenues and provided a detailed review of the literature's background to better understand the current research. The study demonstrated that, in the current competitive market, supply chain design becomes more challenging due to various risk factors. It is also observed that digital technologies are enhancing the supply chain design and is vitally important for supply chain designers to reconfigure SC using advanced technologies and industry 4.0. SC designers need to have a better understanding of what technologies are required to reconfigure the SC to mitigate the risk level and improve the efficiency and responsiveness of the SC.

The paper revealed that dynamic reconfiguration of the supply chain is still an effective research area for future research, and the above gaps can be fulfilled by proposing a conceptual framework to identify the impact of industry 4.0 for reconfiguring the SC design for risk management. Due to the space limitation, developed path for the future research will be presented at the conference.

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