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AN OVERVIEW OF THE FACTORS INFLUENCING THE FLEXIBILITY OF THE SUPPLY CHAIN IN MANUFACTURING ENTERPRISES

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ABSTRACT

The flexibility of the supply chain plays a crucial role in enabling enterprises to respond promptly to market fluctuations, providing a competitive advantage over rivals. The objective of this study is to elucidate the essence of supply chain flexibility. The research also conducts an overview of the factors influencing supply chain flexibility in manufacturing enterprises. Six groups of factors that commonly affect supply chain flexibility are mentioned, including: commitment of top leadership, supply chain strategy, IT system information sharing capability, supplier relationships, flexible staff, and production/logistics machinery and infrastructure. Based on the overview results, several conclusions and discussions are presented.

Keywords: Supply Chain Flexibility, Manufacturing Enterprises, Influencing Factors.

INTRODUCTION

Nowadays, in the face of market fluctuations, the global Covid-19 pandemic, and increasing uncertainty from both customers and suppliers, businesses are compelled to focus on developing more flexible supply chains (Kazancoglu et al., 2022). The flexibility of the

supply chain plays a vital role in enabling companies to respond promptly to market dynamics, providing a competitive edge over their competitors. Supply chain flexibility, from a management perspective, involves the ability of each member in the system to adapt and pivot in response to environmental uncertainties through various aspects of flexibility, such as organizational flexibility, product flexibility, production capacity, supplier flexibility, production flexibility, and delivery and distribution flexibility (Enrique et al., 2022a).

From a managerial standpoint, supply chain flexibility allows for better customer satisfaction. The rapid response from distributors, wholesalers, retailers, agents, stores, as well as information sharing and collaboration among suppliers and logistics companies, has enabled manufacturing businesses to become more agile in understanding market trends, developing new products, and ensuring timely product distribution, meeting both quantity and quality requirements. The ultimate aim of this flexibility is to optimize time and cost across the entire system while still meeting customer demands (Bai and Sarkis, 2020). These are critical criteria for evaluating a company's ability to supply products and services in a volatile market.

Globalization and outsourcing trends have increased the interdependence of all parties involved, leading to greater risks and the potential for supply chain disruptions. Heightened competition, trade wars, ethnic conflicts, or disease outbreaks have recently had a significant impact on the business operations of companies in general and manufacturing enterprises in particular (Enrique et al., 2022a). Any disruption at any point can affect manufacturing and business activities across the entire chain and, on a larger scale, impact the economies of nations. Trade tensions like the U.S.-China trade war, the Covid-19 pandemic, military campaigns like Russia-Ukraine, energy price fluctuations—these events have underscored the extent of dependence and vulnerability of modern supply chains, as disruptions can cascade between industries and nations. If businesses assess the situation strategically within the supply chain scope, cooperation and adaptability adjustments to the supply chain will enable proactive and agile manufacturing and business operations. To achieve these goals, manufacturing companies need to efficiently utilize available resources, including human resources, physical resources, and internal and external relationships. Only then can they enhance forecasting capabilities, rapidly adjust product characteristics, production volumes, product structures, shorten market response times, and promote flexibility, operational efficiency, and a competitive advantage over their competitors.

From the above analysis, supply chain management in the future will not solely revolve around performance and cost management but will be based on safety, flexibility, and the adaptability of the supply chain in both the short and long term. A flexible supply chain will enable companies to respond faster and smarter to unpredictable market changes. However, what exactly is supply chain flexibility, what factors can influence it, and whether supply chain flexibility has an impact on business operational performance or not, remains a top concern for many managers and scholars today. Therefore, the objective of this research is to provide an overview of studies on the factors influencing supply chain flexibility in manufacturing enterprises.

OVERVIEW OF SUPPLY CHAIN FLEXIBILITY IN MANUFACTURING ENTERPRISES

A supply chain is defined as a system of organizations, people, resources, information, and activities related to the movement of products or services from suppliers or manufacturers to

consumers (Christopher, 2022). The supply chain not only includes manufacturers, suppliers, and distributors but also extends to logistics companies, financial services, and customers. Each finished product goes through multiple processes before reaching the hands of consumers, such as supplier assessment and selection, raw material procurement, production, product manufacturing, packaging, and product transportation to distributors, agents, stores, and all these processes are part of the supply chain. Therefore, the supply chain plays a critical role in delivering products and services to consumers and significantly impacts the operations and business activities of the entities involved in the chain.

Supply chain flexibility is also referred to as Supply Chain Flexibility (SCF) or Flexible Supply Chain. By using keywords such as "supply chain flexibility," "manufacturing flexibility," "flexible supply chain," "supply chain" AND "flexibility," "systematic literature review," "supply chain agility," the authors conducted an overview of research on supply chain flexibility based on databases from reputable and major global publishers such as Elsevier, Springer, Emerald, Wiley, Taylor & Francis. The literature review results show that supply chain flexibility is multidimensional, not only considering production aspects or within the scope of a single organization but also relating to other components within the supply chain. Studies related to SCF can be divided into three stages:

- ***Stage 1 (early 1990s and earlier)***: Flexibility was broadly defined as the effective response capability of individual businesses to uncertainties or disruptions from the business environment. During this period, with the strong development of the manufacturing sector to meet market demands, flexibility was primarily examined within manufacturing companies.
- ***Stage 2 (late 1990s to 2010)***: Researchers delved deeper into understanding the essence of flexibility and expanded its scope beyond manufacturing businesses to encompass the entire supply chain. The approach to flexibility was also examined across the entire supply chain, covering all fundamental business processes like supply, production, and distribution, rather than just focusing on manufacturing as in the previous stage.
- ***Stage 3 (from 2010 to the present)***: Scholars often build upon previous research results to support experimental studies that verify the relationship between supply chain flexibility and other factors such as operational performance, supply chain agility, and influencing factors on SCF. During this stage, numerous literature reviews of SCF aim to classify and categorize SCF into different levels (from resource-level flexibility, departmental or functional flexibility to strategic-level flexibility within organizations). Various models used in research include conceptual, empirical, simulation, and mathematical models. Especially from 2020 onwards, the world has experienced many upheavals, exemplified by the Covid-19 pandemic, leading to global supply chain disruptions. The level of uncertainty in supply and demand is increasing, product lifecycles are becoming shorter, and the inherent issues of market globalization and the growing use of partners in distribution, production, and logistics activities have all contributed to an immensely complex international network (Skipper and Hanna, 2009). In this context, scholars tend to explore SCF more deeply under the influence of digital transformation, smart technologies, and smart factories.

  SCF comprises three dimensions: (1) Supply Flexibility, (2) Manufacturing

Flexibility, and (3) Delivery Flexibility (Enrique et al., 2022b). Thus, each member company within the supply chain must not only operate and efficiently utilize resources to flexibly produce but also expand cooperative relationships with external partners such as suppliers and logistics companies to ensure supply and delivery flexibility in all situations. Table 1 summarizes recent studies on supply chain flexibility.

Table 1

Summary of Recent Studies on Supply Chain Flexibility

No	Authors	Supply Flexibility (SFL)	Manufacturing Flexibility (MFL)	Delivery Flexibility (DFL)
1	Kamel et al. (2009)	√		√
2	Malhotra and Mackelprang (2012)		√	
3	Syed and Fantazy (2014)	√		√
4	Jin et al. (2014),	√	√	√
5	Pérez et al. (2016)		√	
6	Sreedevi and Saranga (2017)	√	√	√
7	Singh et al. (2017)	√	√	√
8	Liu et al. (2019)	√	√	√
9	Chandak et al. (2019)			√
10	Delic and Eyers (2020)	√		√
11	Burin et al. (2020)	√		√
12	Khalayleh et al. (2022)			√
13	Enrique et al. (2022b)	√	√	√

Overview of Factors Influencing Supply Chain Flexibility

The research used keywords such as "Supply chain enablers," "Drivers of supply chain," "Models in supply chain flexibility," "Sources of supply chain flexibility," "Factors influencing supply chain flexibility" to search for articles and research papers published in journals indexed in WoS, Scopus, Emerald, Springer, Science Direct, Elsevier, Sage, Taylor and Francis. The overview results indicate that there are six groups of factors commonly mentioned as influencing SCF, including: commitment of top leadership, supply chain strategy, IT system information sharing capability, supplier relationships, flexible staff, and production/logistics machinery and infrastructure. Table 2 presents a summary of the factors influencing SCF.

Table 2

Summary of Research on Factors Influencing SCF (2001-2022)

No.	Years	Authors	TMC	SCS	IT IS	SUR	EMP	MLF
1	2001	Pérez and Sánchez			√	√		
2	2002	Kara et al.	√					
3	2002	Van Der Vorst and Beulens			√			√
4	2003	Lummus et al.			√			
5	2004	Koste et al.	√					√

6	2004	Anand and Ward		√					
7	2005	Slack	√		√				
8	2005	Sánchez and Pérez			√	√			
9	2007	Mendonça Tachizawa et al.				√			
10	2007	Fawcett et al.			√				
11	2008	Swafford et al.			√				
12	2009	Aissa Fantazy et al.		√					
13	2009	Skipper and Hanna		√	√	√			
14	2012	Moon et al.			√			√	
15	2014	Jin et al.			√	√			
16	2017	Singh et al.	√	√	√	√			
17	2017	Um		√		√			
18	2018	Goyal et al.	√			√			
19	2019	Chandak et al.		√	√				
20	2020	Shukor et al.						√	
21	2020	Burin et al.			√				
22	2022	Khalayleh et al.	√		√		√	√	
23	2022b	Enrique et al.			√				

CONCLUSION AND DISCUSSION

The research has provided an overview of domestic and international studies on supply chain flexibility from 2001 to 2022. The study results indicate that supply chain flexibility for manufacturing enterprises encompasses not only production flexibility but also the entire supply chain (supply flexibility, distribution flexibility, and delivery flexibility). Six groups of factors commonly mentioned as influencing supply chain flexibility include: top leadership commitment, supply chain strategy, IT system information sharing capability, supplier relationships, flexible staff, and production/logistics machinery and infrastructure.

The literature review results show that most studies tend to focus on understanding the impact of discrete factors such as supplier relationships, information technology, and information sharing, digital transformation, on supply chain flexibility. A few other studies examine supply chain flexibility in relation to operational performance, business competitiveness, or supply chain agility. Very few research works fully combine both aspects of the model with the intermediary role of SCF. There is no study that empirically examines the influence of integrating core resource factors of enterprises such as human resources, infrastructure, machinery and equipment, strategy, information sharing capability, and supplier relationships on SCF, with a predominant focus on studying these factors separately.

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