



(REVIEW ARTICLE)



The role of supply chain management in enhancing industrial productivity and consumer satisfaction in the United States: The 4-Quadrant Approach

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International Journal of Science and Research Archive, 2024, 13(01), 746–753

Publication history: Received on 03 August 2024; revised on 12 September 2024; accepted on 14 September 2024

Article DOI: <https://doi.org/10.30574/ijrsra.2024.13.1.1713>

Abstract

This paper examined the role of supply chain management (SCM) in enhancing industrial productivity and consumer satisfaction in the United States. It emphasized the integration of supply chain management in the four critical quadrants of product creation. Since, no product is created of the sake of creation, but for satisfying the end-users, supply chain management amplifies customer satisfaction through strategic management of all related logistics in the production process. Raw materials deposit, industrial plant, warehousing, and consumption were identified as the critical quadrants by which supply chain processes can enhance efficiency in industrial operations, thereby leading to higher economic performance, and welfare improvement for the citizens through enhanced customer satisfaction. The study identified three challenges for the adoption of the 4-Quadrant approach, while also recommended further test of the approach by empirical analysis.

Keywords: Supply Chain Management; Industrial Productivity; Customer Satisfaction; Purchasing; Logistics.

1. Introduction

At the rudiment of the US economic greatness are four critical factors: the abundance of natural resource, immigration, institutional quality, and entrepreneurship innovations. The systematic and deliberate manipulation of these factors have shown positive impacts on the standards of living, economic growth, growing population, and improvement in transportation. At the core of these factors is manufacturing growth, which has been described by the United States Department of Commerce (1995) as the engine of growth. The relation between manufacturing growth and economic growth was expressed by Kaldor in his first law of economic growth saying, “*The faster the rate of growth of the manufacturing sector, the faster will be the rate of growth of...[GDP], not simply in a definitional sense in that manufacturing output is a large component of total output, but for fundamental economic reasons connected with induced productivity growth inside and outside the manufacturing sector.*” Any economy that is endowed with natural resources, quality population, technological innovation, and diverse transportation means will, *ceteris paribus*, maintain a steady growth of her economy.

Understanding the factors that promote manufacturing growth is crucial in planning its sustenance. Although, the literature has identified many of the factors that may promote the growth of the manufacturing sector, the role of location and localization of industries, diversified transportation channels and supply chain management cannot be overstated. While it may be empirically difficult to rank the importance of these factors in spurring manufacturing growth, it is easier for firms to compete fairly in their utilization of supply chain processes in enhancing their operations and promoting industrial productivity. Wahyuni & Sumarmi (2018) described industrial productivity in terms of the

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efficiency, and effectiveness in an industrial process that brings about the reduction in the cost per output of product. As opined by Phusavat (2013), maintaining industrial or manufacturing productivity must begin by considering the cost of the input factors, especially, raw materials, labor, and capital. While the consideration of input factors may be viewed in terms of acquisition cost, neglecting the cost associated with transportation of raw materials to the manufacturing complex, may have negative consequences on the aggregate production cost.

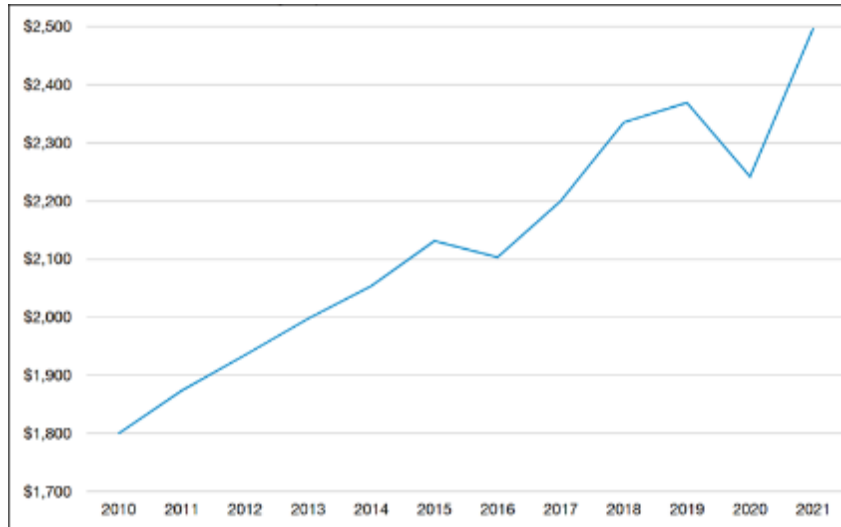


Figure 1 United States Manufacturing Output in Billion Dollars, 2010-2021

Source: Akinbolajo (2024)

The role of supply chain in adding industrial performance has not been fully dissected by scholars. In the words of Rajen (2020), “We all know that the time has come in which companies don’t compete, but indeed the great products and efficient supply chains are...!” Whilst this statement holds true, consideration must be given to all matters that can aid fair competition. Rajen (2020) further stated the channels by which supply chain can enhance industrial performance and aid competition. Specifically, he identified reduction in the purchasing cost, decrease in production cost, and a general reduction in the supply chain cost.

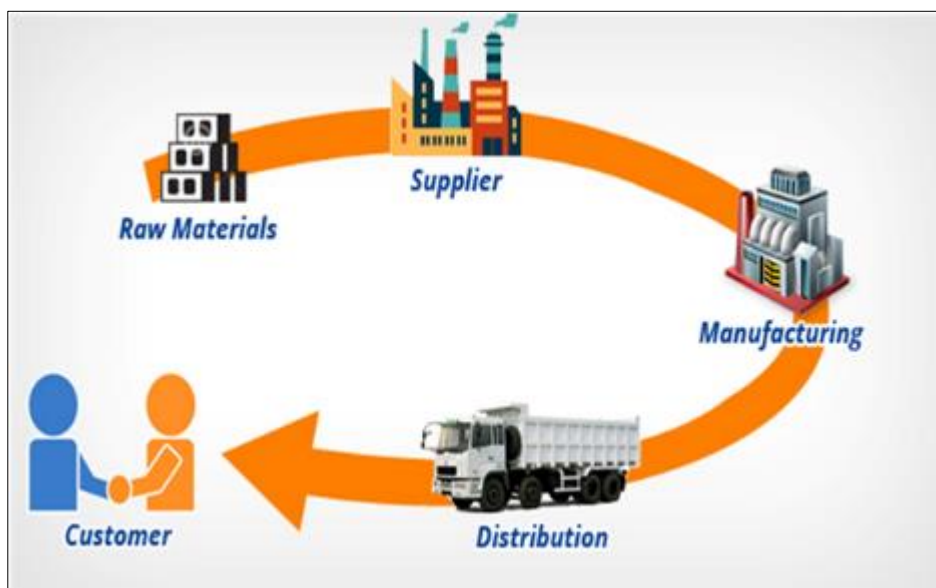


Figure 2 Supply Chain Process in Production and Distribution of Products

Source: Rajen (2020)

Cost control in every aspect of a manufacturing process is an important step in mitigating excessive production costs. Since the production of goods require transportation and logistics management from start to finish, the role of supply chain management in managing logistics costs at every stage is worth examining. The cost of logistics from raw material deposit to the manufacturing plant, the direct and indirect costs of production, and the cost of distribution of finished products across the target markets could tend towards the high end of the final price. Therefore, a strategic engagement of supply chain processes can minimize the indirect production cost relating to movement of raw materials, semi-finished products, finished products to nodes of warehouses, and to the final consumers. It is in view of this that the paper examined the role of supply chain management in enhancing industrial productivity and consumer satisfaction in the United States.

2. Literature review

The role of supply chain management in boosting industrial performance has been widely considered in the literature. While some of the studies were empirical, others were qualitative in contributing to knowledge in the area. This section considers different contributions to knowledge on the relation between industrial productivity and the role of supply chain management.

2.1. Theoretical Review on Supply Chain Management

Many theories have hypothesized the role of supply chain on industrial performance. The relevant among these theories are examined briefly.

2.1.1. Resource-Based View (RBV)

Proposed by Penrose (2009), the RBV theory may be described as a framework used by firms to plan production of goods alongside customers' satisfaction by focusing attention on the efficient use of resources. According to Utami & Alamanos (2023), RBV theory is useful in explaining and predicting the performance of a company and its competitive advantage. The theory considers access to and the efficient use of resources to hedge out competition. The role of raw materials and human resource in boosting industrial performance is the ultimate focus of the RBV theory. For the theory to be more efficient in its explanation of industrial performance through the efficient use of resources, the role of supply chain management in the adoption of the RBV theory cannot be imagined. Efficient movement of raw materials and labor is critical to the operations of an industrial complex. This role falls within the area of influence of supply chain management. Therefore, in boosting operational performance with resources, supply chain management cannot be neglected.

2.1.2. Stakeholder Theory (ST)

Stakeholder theory is a managerial theory that considers the interest of people that are directly or indirectly affected by its actions. The theory considers its core values, ethics, and morality in engaging the public. Therefore, in considering the interest of stakeholders, which are not limited to the internal parties alone, but also the consumers, suppliers, and logistics providers, the firm is taking a holistic decision that benefits all. Rather than focusing on the interest of shareholders, who are the owners of a business, the stakeholder theory concentrates on the interests of employees, suppliers, customers, shareholders, community, and society at large. The focus usually hinges on the efficiency of production, which tends to reduce wastages, makes the price competitive, and makes the product quality distinguishable in the marketplace. By considering the strategy of its competitors, an organization positions itself to better serve the stakeholder, of which the public is an integral part. Synchronizing the theory with supply chain management practice provides avenue for firms' operation to be more efficient.

2.1.3. Materials Logistics Management Theory (MLMT)

This theory is one of the most recent additions to the body of theories on strategic management. It emphasizes the control of inventory levels that facilitates operational performance for an organization. The theory deals important logistics activities such as planning, sourcing, stocking, production, and distribution of physical materials that aid the production of goods and services. The proponent of the theory understands the critical role of raw materials in a production process. More importantly, the proponents understand the need to get materials in the right quality and quantity to the right place, at the right time, and at the lowest cost possible. This underscores the relevance of supply chain management, especially in the raw materials delivery to a manufacturing plant.

2.1.4. Transaction Cost Theory (TCT)

Transaction Cost Theory (TCT) was made popular by Williamson (1981), though it originated from the idea of Coase (1937). Transaction cost theory recognizes the role of cost of transaction in the actualization or production of a product. It considers the costs inherent in a production process, especially the direct and indirect costs, envisaging these costs

provides the firm with a better understanding of how to deal with them in strategic ways. As asserted by Akinbolajo (2024), Transaction Cost theory is relevant as a fundamental background framework in supply chain management. This is because the theory emphasizes cost minimization as a way of optimizing manufacturing operations, which tends to lead to efficiency in the management of organization’s resources.

2.1.5. Production Cost Theory (PCT)

One of the earliest theories of productivity in economics is the cost of production theory. It explains the relationship between the cost of input factors relative to output. The interplay of these two functions plays a significant role in price determination, which also determines the quantity demandable of the product and the overall profit of the firm. The integration of supply chain systems in a production process can determine a firm’s productive capacity. Although, the production cost theory emphasizes two input factors, labor and capital, as the principal determinants of output, the limitation has neutral effect on the ability of supply chain management to make positive impacts on production.

2.2. Supply Chain Management Industrial Productivity in the United States

2.2.1. A Critical Overview of Industrial Productivity Measurement in the United States

Productivity is simply defined as a relation between inputs and outputs (Tangen, 2004; Cook & Zhu, 2007; Wazed & Ahmed, 2008). This view has been criticized by scholars in the recent time. Priya and Aroulmoji (2020) assert that the term productivity has been manipulated by politicians and business managers to achieve some self-serving interest in production, while agreeing to the assertion that productivity is one of the most ambiguous terms to define. Unfortunately, productivity in the United States and all over the world has been measured in terms of labor supply and economic output. If productivity is only to be measured in terms of physical productivity, what happens to economic productivity? This limitation brings about biasness in the overall evaluation of economic activities. For instance, more than labor and capital go into the production of outputs. Each input factor, raw materials, labor, relative capital consumption, and other indirect costs that go into production should be summed up as the input factor, which when compared with the price of outputs, a larger understanding of economic productivity, which is reflective of inflation, price, and profit will be a good yardstick for measuring both productivity and economic progress.

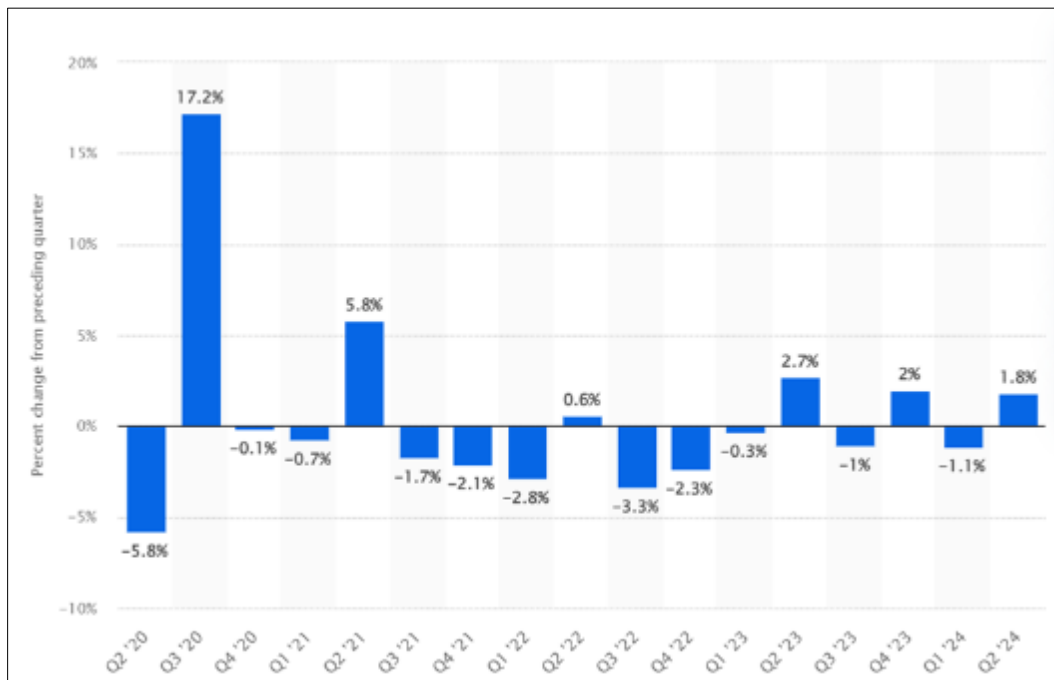


Figure 3 A Chart of Quarterly Changes in Manufacturing Productivity in the US 2022-2024

Source: Statista (2024)

The method of holding capital constant, and varying labor supply in the measurement of industrial productivity in the United States is thus questionable and calls for a wider reconsideration. Figure 3 represents the chart of quarterly changes in manufacturing productivity in the United States for 2020 – 2024.

The dwindling performance of labor, quarter-in, quarter-out, has been shown in the Figure. These performances have been affected due to many factors that are exogenous to productivity formular. As such, the need for a more robust productivity measure in terms of all input factors in relation to outputs in undeniable. Productivity measurement should encompass aggregate factors, of which the role of cost management through supply chain processes can be better understood and applied to economic decisions. As opined by Tangen (2005), and Slack (2012), productivity can be defined in terms of efficiency, effectiveness, performance and profitability.

2.2.2. *Supply Chain Management and Industrial Productivity*

Supply chain management represents a framework for connecting important points in a business network and delivering items that will facilitate production, distribution and consumption. It has been defined in different contexts, but the centrality of the definitions remains unaltered. Ghiani et al (2004) and Kozlenkova (2015) defined supply chain management as a framework in commerce that deals with purchasing of raw materials, production operations management, logistics as well as marketing or distribution management, by which raw materials are turned into finished goods and delivered to the consumers. More specifically, supply chain management was defined in terms of infrastructural support for production operations by conveying raw materials into a production plant, and the manufactured goods to the marketplace (Cornell Engineering, 2021). Singh & Sohani (2011) also defined supply chain management as a means of enhancing a firm’s competitive advantage by integrating the internal and external environments of the firm which includes suppliers, internal processes, and customers.

The role of supply chain management in industrial development has not been fully utilized yet, this is evident by the enormous and widespread coverage of supply chain in the literature. The full integration of supply chain process in industrial development can catalyze economic growth by satisfying the supply and the demand sides in an economy. In agreement with this position, Akinbolajo (2024) affirmed that supply chain can sustain the continuity of the manufacturing sector by ensuring that the supply and the demand side of an economy functions optimally. With attention on efficiency and profitability, supply chain can enhance industrial productivity in unprecedented ways.

2.2.3. *Supply Chain Management and Customer Satisfaction*

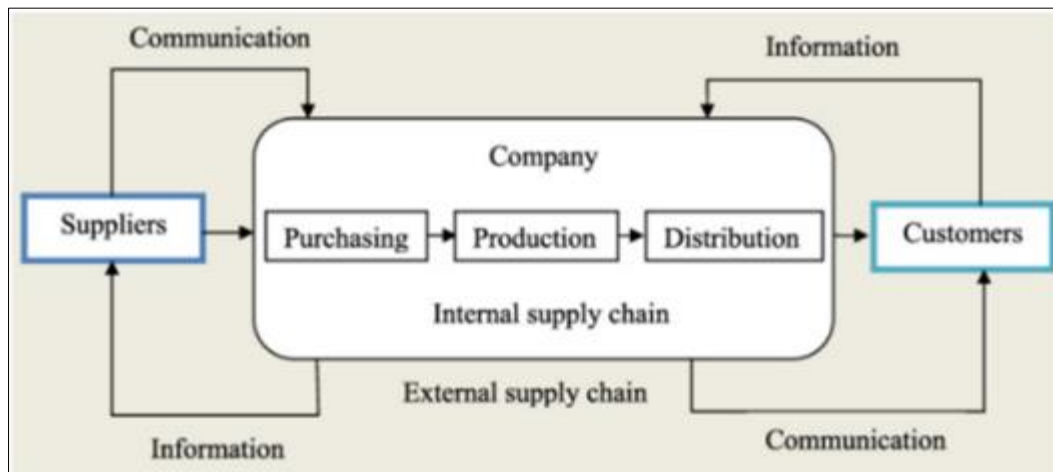


Figure 4 A Chart of Quarterly Changes in Manufacturing Productivity in the US 2022-2024

Source: Rattner (2020)

The relationship between supply chain management and customer satisfaction has received little attention in this literature. Although, many scholars may favorably anticipate a positive linear relationship between the two variables, there is need for empirical justifications of this position. Supply chain processes are as important in delivering raw materials to production plant, as much as delivering finished products to the end-users (Amazon, 2021). Customer satisfaction may be measured on one hand by the level of satisfaction a customer derives from consuming a product; on the other hand, customer satisfaction can be measured by how easily it is for customers to return impaired products. The latter is referred to as reverse logistics. The goal of supply chain management is to process forward or backward delivery of the right products, at the right time, and at the right location. Zhu (2022) examined the nexus of supply chain management and customer satisfaction on both Amazon and Emirates Airline. He concluded that when integrated into customer relationship management, supply chain management played an essential role in online shopping.

At the center of the suppliers and the consumers is a chain of activities that covers purchasing, production, and distribution. Without a proper integration of the supply chain processes, managing products to the point of consumption will be laced with many challenges.

3. Supply chain management and industrial productivity – the 4 quadrants approach

There are numerous ways of examining the relationship between supply chain management and industrial productivity. This paper addresses the relationship using the forward and backward flow of products and information within four principal quadrants. The 4-Quadrant system represents the four most critical points that connects raw materials to the production plant, the warehouse, and the end-users of a manufactured product. Within the quadrants are potentials that can speed up industrial development, economic growth, and improved welfare for all citizens. Therefore, it becomes imperative to examine the capability of the nexus of supply chain management and industrial productivity from the standpoint of the 4-Quadrant approach.

The strength of industrial production lies in the continuous access to raw materials, which, combined with labor and existing capital, are used to produce output.

Any distortion of raw materials inflow to a production plant may trigger survival threat to the plant. Therefore, any attempt to source materials under such conditions of scarcity may heighten the cost implications; hence, the likelihood of increasing the price of output. Akindipe (2014) emphasized that the availability of raw materials determines a cause for many actions in a firm, which includes enabling production activities, enhancement of operational performance and profit determination. The importance of raw materials in organizing industrial production was previously studied by Privalovskaya (1975), where he established that “a strong resource base under a favorable physical and economic conditions will give rise to integrated industrial complexes.” The importance of raw material in shaping different aspects of a firm was established by Floren, Frishammar, and Lee (2013).

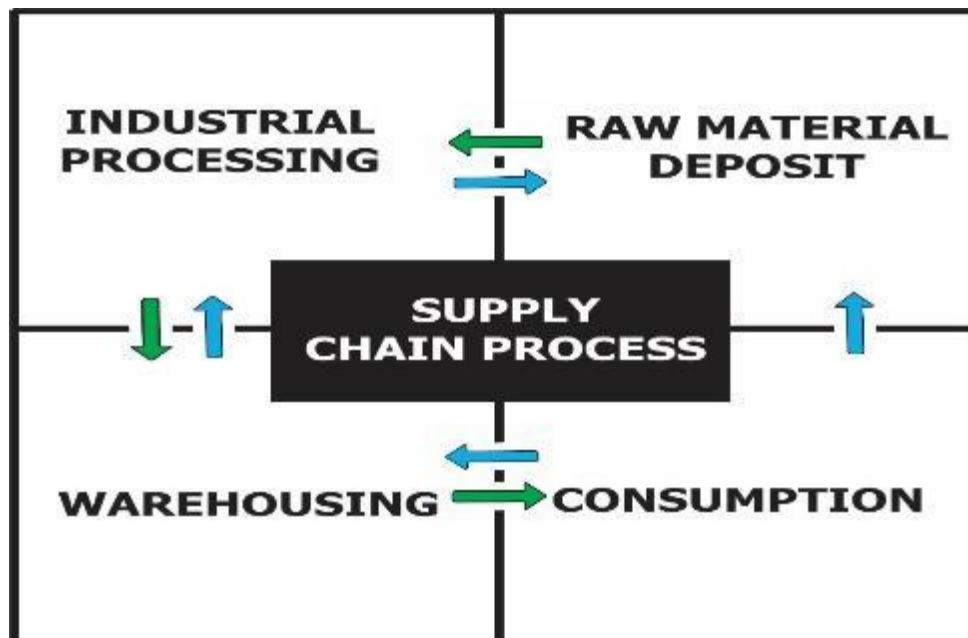


Figure 5 Supply chain process

Source: Authors' Construct (2024)

Whilst it has been established that raw materials are integral to the function of a manufacturing entity, the concern associated with movement of raw materials, at affordable costs, to production sites is the sole function of supply chain management. In deciding the location of a firm, many factors outside of access to raw materials may be considered. Supply chain management in this instance remains the framework for managing free flow of raw materials to the production plant.

In a production plant, the role of supply chain management in managing the forward and backward movement of work-in-progress among different sections of a production plant can be effectively managed within the scope of supply chain management. Many production firms have multi-level adoption of supply chain management. At one level, SCM is adopted to ensure free flow of raw materials from storage to production sites, while semi-finished goods are also moved from a location to another within the organization, then finished goods from production to packaging and then to distribution. The external supply chain takes effect from the distribution warehouse of the producer to the various nodes of warehouses that have dealership with the producer. The movement of manufactured product continues until it gets to the final consumer. There is a case of reverse logistics when goods are returned through the logistics process from either the consumer or the retailer to the producer. The process of converting raw materials to consumption goods involves a lot of movements that carry costs, which in one way or the other add up to the final price of the product.

The 4-Quadrant approach provides an opportunity for a holistic consideration of the cumulative costs associated with the activities of moving raw materials to a finished, deliverable good to the consumer. In view of maximizing consumer surplus, products must be delivered at the most efficient and competitive price.

4. The challenges of the 4-quadrant approach

There are many challenges that may be encountered in the adoption of the 4-Quadrant approach in boosting industrial productivity and consumer satisfaction in the United States. This paper identifies the following challenges.

4.1. Local and International Coordination

A major threat to the adoption of the 4-Quadrant approach in boosting industrial productivity and consumer satisfaction is coordination across firms and across regions. This problem is often compounded by the advent of globalization and the complexities associated with supply chain management at the international level.

4.2. Technological Integration

The use of technology at the industrial level is often micromanaged at the firm level. Integrating technology in the supply chain management will bring about enhanced effectiveness and efficiency in industrial productivity and customer satisfaction, the costs associated with the adoption of technology may be discouraging to many small firms in the supply chain process.

4.3. Global Shocks and Resilience Challenges

Global shocks are often unprecedented and can have profound impacts on supply chain systems, leading to significant production disruptions and reduced customer satisfaction. The COVID-19 pandemic, with its widespread restrictions both globally and domestically, caused substantial challenges that even pushed some companies into bankruptcy. Without incorporating resilience into supply chain processes, the 4-Quadrant approach is likely to fail.

Limitation of the study

The study has inspired a new approach for the consideration of the relationship between industrial productivity and customer satisfaction, and how supply chain management can enhance the interactions between the two. However, this proposal is devoid of empirical analysis. It is suggested that further studies may conduct an empirical analysis of the relationship for better understand of the relationship and for practical adoption by firms.

5. Conclusion

The role of supply chain management in industrial production and customer satisfaction is indispensable. The United States stands to benefit from improved industrial production with its capability of enhancing economic growth, full utilization of resources, and the improvement of citizens' welfare through satisfaction. The increasing population needs a proportionate increase in industrial growth. As such, by innovating with supply chain management, industrial sector may be all set to witness operational efficiency, improved response to demands, and overall improvement of customer's experience. Although, there are different challenges anticipated in the adoption of the 4-Quadrant approach, strategic implementation of the approach will improve both the industrial development and customer satisfaction.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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