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Sustainability Initiative towards Supply Chain Inventory Management

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Abstract

Almost every industrial supply chain operation has an environmental impact, ranging from pollution caused by industrial processes to waste generated by overproduction. The increased emission of greenhouse gases leads to global warming, demanding the use of sustainability initiatives in industrial supply chain models to reduce the emissions produced by their operations. The objective of this research study is to give a complete overview of integrating sustainability criteria into inventory management models to help researchers and practitioners make market-specific decisions. This study investigates simple and complex supply chain structures, as well as the incorporation of various green initiatives to improve the resiliency of supply chain models. The literature review highlights the sustainability constraints in inventory models by considering the industry's environmental and societal consequences. Finally, through a detailed analysis of the existing literature and related limitations, this paper provides potential research insights for future research directions in the domain.

Keywords: Sustainable inventory models, Sustainability, carbon emission, societal and environmental factors, corporate social responsibility.

1. Introduction

The purpose of supply chain management is that it helps industries to enhance the customer value and achieve organizational success. Various supply chain components support multiple business tasks and procedures that are essentially considered for logistics management. Currently, different factors are shaping the supply chain's new normal, including a seemingly never-ending pandemic, congestion challenges, increasing transit cost, shortage of raw materials, shifting consumer demands, and cyber-attacks. Supply chain resilience [1] has inevitably become the demand of the hour, by becoming more prioritized than supply chain

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efficiency. The solution for this demand is developing a good inventory management and control procedures, redesigned inventory management approaches, and technological revolution.

1.1 Inventory Management

Inventory refers to the items or materials that a company expects to sell to clients for a revenue. The term inventory management is the process of tracking the inventory from suppliers / manufacturers to warehouses and from these places to the customer as shown in Figure 1. This remains as a vital component of a supply chain. Inventory management [2] deals with having the appropriate items in the right location and at the right time. This necessitates inventory tracking and management, which includes knowing when to order along with its quantity and storage place. Moreover, inventory management is the point at which all aspects of the supply chain combine. This helps to develop an independent supply chain process.

Figure 1. Inventory Management

1.2 Role of Inventory in Supply Chain

Inventory plays three major roles in supply chain [3], they are:

Purchase Inventory: Purchase of components or raw materials and getting them delivered to the warehouse is purchase inventory.

Storage Inventory: Storage of goods/materials until it is needed is storage inventory. Raw materials are transported to manufacturing facilities to be transformed into final products and returned to warehouse until ready for shipment.

Profit/Gain Inventory: Controlling the number of final products that are available for sale is profit inventory. Orders are filled by utilizing the finished products. The final products will then be shipped to the consumers.

These roles of inventory help to mitigate the primary supply chain challenges such as understocking, liquidation, obsolescence, and holding in situations when the demand exceeds the available amount and when the available amount exceeds the demand.

2. Need for Sustainable Supply Chain Inventory Management

The process based economic growth has begun with the onset of industrial revolution. The industrial revolution has not just resulted in expanding the scientific, technological, and economic growth but also increased the consumption of natural resources for unprecedented economic development. Environmental deterioration remains as the major reason for the global warming effect. The globalized industrialization has led to increased emission of CO_2 into the environment. Researchers have recently reported that the primary environmental challenges that occur in the supply chain environment is due to the transportation and prolonged storage of goods [4].

Sustainable inventory management is an innovative approach to make right decisions on the utilization of inventories, warehouse, and goods by reducing its environmental and societal impact without compromising the profitability. Modelling and analysing the location and transportation constraints might lead to more sustainable supply chain practices. The recent research initiatives have emphasized the necessity to incorporate sustainability/green elements other than standard inventory models into the design of sustainable inventory systems by including environmental impact factors such as waste reduction, cost and energy reduction, and economic growth into the conventional Economic Order Quantity model [5].

3. Literature Review

From the research literature, it is observed that only a limited number of research ideas have been proposed in the domain of sustainable supply chain inventory management.

In [6], the researchers have discovered the impact of unsold inventories, emission of greenhouse gases, carbon costs, and environmental quality control. This exploration will assist the supply chain decision-makers to consider the societal and environmental factors for

sustainable development. In [7], authors have analysed the routing challenges that arise due to the integration of sustainability factors. As a continuation of the review work, Becerra et al., [8] have classified the sustainability challenges in supply chain inventory management in terms of supply chain structure, type of decision, information sharing, green/circular economy, software tools and application. As [9] considered only the application context, Chan et al., have classified the mathematical challenges in incorporating the sustainable supply chain management practices by considering three main areas: inventory management, supply chain network design, and production and distribution planning. A more extensive research review on sustainable supply chain inventory management has been proposed by Yadav et al. [10], which identified the advantages of considering the waste management, equipment setup and preservation factors with cross price demand while designing a supply chain model.

4. Green Initiatives in Supply Chain Structures

The successful implementation of Industry 4.0 demands for the introduction of carbon emission reduction approach by reducing the waste production. The sustainable supply chain management has been increasingly anticipated by many countries across the globe to develop supply chain inventory management approaches to increase the revenue and at the same time reduce the waste and energy consumption cost [11].

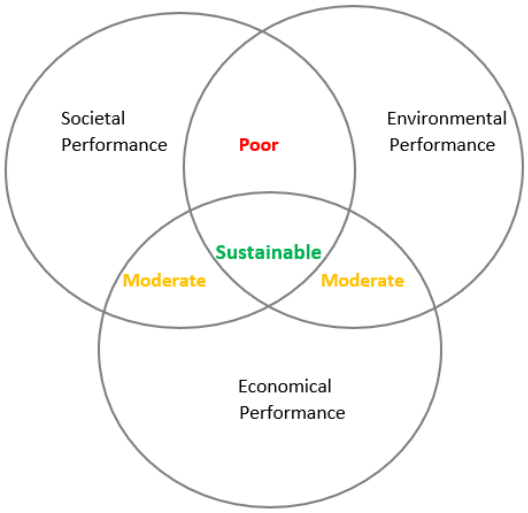

Figure 2. Sustainable Supply Chain Management

There is an increasing need for developing innovative models to combine all the interlinked factors such as inventories, manufacturing, storage, and transportation to complete

the goods distribution or collection process. Combating the location and transportation challenges, can provide an opportunity to incorporate sustainable inventory management practices in supply chain; for example, defining the warehouse operation cost, and wastage and production wastage estimation. The sustainable supply chain management helps to balance the societal, economic, and environmental performance as shown in figure [2].

4.1 Towards a Sustainable Supply Chain Industry:

For moving towards the development of sustainable supply chain industry [12], the following factors should be considered.

- Involvement of each supply chain parameter
- Manufacturing, production, and supply wastage must be reduced and recycled
- Companies should highlight the awareness on carbon emissions and climatic change
- Encourage the usage of natural resources instead of harmful/environment degrading substances

Table 1 illustrates the strategic plan prepared for implementing sustainable supply chain inventory management practices in different industries.

Table 1. Sustainable Supply Chain Inventory Management Practices in different industries

Type of Industry	Aspect	Technique Used	Developed By	Advantages	Applications
Financial Services	Environmental	Supply chain operations with net zero carbon	HSBC [13]	A healthier and more sustainable future	Build a robust low-carbon economy
Apparels	Environmental	Transparent supply chain operations with	Nike [14]	Reduces 14,000 truck transportations annually	Utilizes 100% renewable energy

		water-based transport			
Supermarket Chain	Environmental & Economical	Solar panels to power some stores and reverse supply chain for composting waste	Aldi [15]	Reduces food wastage	Waste food re-processing
Vehicles	Environmental & Economical	Blockchain technology and supply chain carbon footprint assessment	Jaguar Land Rover [16]	Greater transparency and compliance	Transparently trace raw materials from origin to supplier
Tobacco	Societal	Concentrating on workforce and framework to predict climatic shocks	Philip Morris International [17]	Supports tobacco-farming communities	Reports child labour
Food Delivery	Environmental & Societal	Environmentally responsible and sustainable sourcing model	Asda [18]	Increased use of recycled product, supports communities	Refuses to buy cotton from Uzbekistan due to the use of forced child labour, buying recycled polyester

E-Commerce	Environmental	Reduce non-degradable packaging materials; multi-carrier services	ShipHawk [19]	Reduces landfills and transportation cost	Multi-carrier based efficient transportation, Eco-friendly packaging
Retail	Environmental & Economical	Product recycling, sourcing sustainable raw materials	IKEA [20]	Supports local farmers, and reduces product wastage	Natural cotton sourcing, Reforest damaged areas
Consumer Goods Corporation	Environmental & Economical	Sustainability of the world's forest resource	Procter & Gamble [21]	Ending deforestation, supporting local farmers	Minimizing unwanted sources of wood and maintaining independent third-party verification systems
Beverage	Environmental	Sustainable goods and bio-degradable raw materials	Suntory [22]	Promotes activities considering the global environment	Moved from plastic to bio-degradable paper straws

5. Roadmap to Sustainable Future

The organisational insights of the proposed roadmap are intended to serve as a conceptual model to assist researchers in formulating new strategies and practices that develop and implement sustainable supply chain inventory management models [3], such as fixing and reshaping faulty goods in local stores to increase profitability in a global supply chain market.

As represented in Fig. 3, the promising ways to enhance the sustainability trend in supply chain inventory management is described below.

5.1 Environmental Perspective

As mentioned in Sections 3 and 4, most of the research works have focused on reducing the carbon footprints, greenhouse gas emissions, and waste production. In the near future, more research works can be initiated to integrate government regulated eco-friendly guidelines and more research initiatives should be encouraged towards social sustainability.

5.2 Inventory Management Perspective

Currently, some of the primary challenges in inventory management remains unexplored. A more focused research work should be dedicated towards considering the warehouse location, storage facility, and make smart decisions regarding transportation routing.

5.3 Architectural Perspective

From Table 1, it is evident that the current research trend is more focused on introducing sustainability enabling architectures like reverse supply chain and closed loop authenticated models into traditional supply chain structures. In future, this should be extended towards introducing sustainability aspects in complex and large-scale supply chain networks.

5.4 Modelling & Application Perspective

The currently existing mathematical model-based sustainability enabling technique works with a common objective but when the complexity level increases, it necessitates the need to work with multiple objectives. In future, multi-objective supply chain modelling

techniques and algorithms can be developed to deal different sustainability aspects such as social, economic, and environmental aspects.

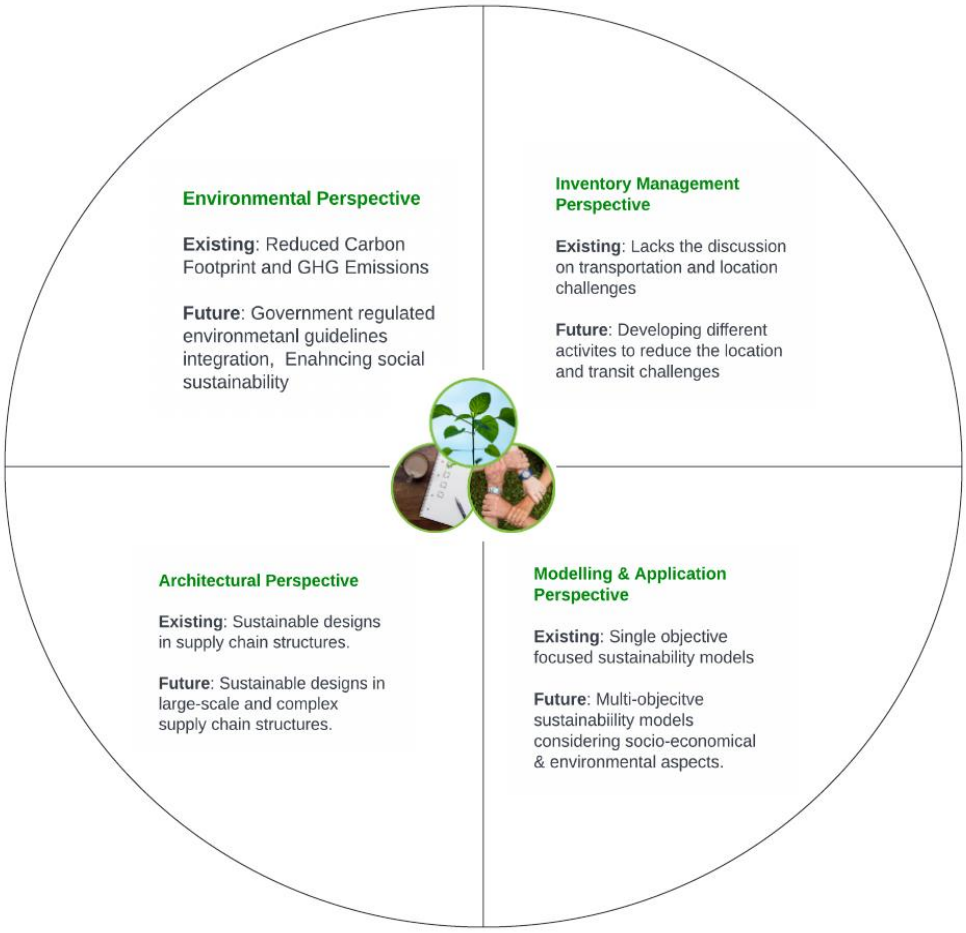

Figure 3. Roadmap to Sustainable Future

6. Conclusion

This research study summarizes the integration of sustainable inventory management practices in supply chain environment. The study has been initially geared towards analysing and addressing how efficiently supply chains can manage sustainability using the inventory management methods. Here, three different aspects such as social, economic, and environmental aspects are considered. From the review, the recent green initiatives reveal that almost two-third of the industrial sectors have introduced sustainability criterion into their designs by incorporating different techniques as mentioned in table 1. It is also noted that the environmental sustainability has given more focus in the reviewed real-time applications. Therefore, the uncertainty and societal considerations should also be given equal importance

in all the industrial sectors. The review results obtained from this study has finally proposed a roadmap stating the current trends in sustainable supply chain inventory management by discussing about the recent research trends and future research possibilities based on four different perspectives: architectural, environmental, inventory management, modelling, and application. To conclude, the forthcoming research works should build a sustainable inventory management by considering the green and sustainability objectives. The described conceptual architecture can be applied to optimize the supply chain inventory management models to real-time applications of different industries.

References:

[1] Tukamuhabwa, Benjamin R., Mark Stevenson, Jerry Busby, and Marta Zorzini. "Supply chain resilience: definition, review and theoretical foundations for further study." *International Journal of Production Research* 53, no. 18 (2015): 5592-5623.

[2] Teerasoponpong, Siravat, and Apichat Sopadang. "Decision support system for adaptive sourcing and inventory management in small-and medium-sized enterprises." *Robotics and Computer-Integrated Manufacturing* 73 (2022): 102226.

[3] Becerra, Pablo, Josefa Mula, and Raquel Sanchis. "Sustainable Inventory Management in Supply Chains: Trends and Further Research." *Sustainability* 14, no. 5 (2022): 2613.

[4] Shekarian, Ehsan, Behrang Ijadi, Amirreza Zare, and Jukka Majava. "Sustainable Supply Chain Management: A Comprehensive Systematic Review of Industrial Practices." *Sustainability* 14, no. 13 (2022): 7892.

[5] Shaikh, Ali Akbar, Leopoldo Eduardo Cárdenas-Barrón, and Asoke Kumar Bhunia. "An EOQ model for a deteriorating item under permissible delay in a vendor managed inventory system." *International Journal of Applied Management Science* 14, no. 3 (2022): 183-204.

[6] Pattnaik, Suchitra, Mitali Madhusmita Nayak, Stefano Abbate, and Piera Centobelli. "Recent trends in sustainable inventory models: A literature review." *Sustainability* 13, no. 21 (2021): 11756.

[7] Malladi, Krishna Teja, and Taraneh Sowlati. "Sustainability aspects in Inventory Routing Problem: A review of new trends in the literature." *Journal of Cleaner Production* 197 (2018): 804-814.

[8] Becerra, Pablo, Josefa Mula, and Raquel Sanchis. "Green supply chain quantitative models for sustainable inventory management: A review." *Journal of Cleaner Production* 328 (2021): 129544.

[9] Chan, Felix TS, Nan Li, Sai Ho Chung, and Mozafar Saadat. "Management of sustainable manufacturing systems-a review on mathematical problems." *International Journal of Production Research* 55, no. 4 (2017): 1210-1225.

[10] Yadav, Dharmendra, Rachna Kumari, Narendra Kumar, and Biswajit Sarkar. "Reduction of waste and carbon emission through the selection of items with cross-price elasticity of demand to form a sustainable supply chain with preservation technology." *Journal of Cleaner Production* 297 (2021): 126298.

[11] Shetty, Sunil Kumar, and K. Subrahmanya Bhat. "Green supply chain management practices implementation and sustainability–A review." *Materials Today: Proceedings* 52 (2022): 735-740.

[12] Amjad, Ahmad, Kashif Abbass, Yasir Hussain, Farina Khan, and Shahzad Sadiq. "Effects of the green supply chain management practices on firm performance and sustainable development." *Environmental Science and Pollution Research* (2022): 1-18.

[13] https://www.gbm.hsbc.com/insights/growth/the-journey-towards-sustainable-supply-chains

[14] https://futurevvorld.com/footwear/nike-supply-chain-2022-distribution-centers-cobots-artificial-intelligence-recycled-packaging-shipping-sustainability/

[15] https://cr.aldisouthgroup.com/en/responsibility/our-work-action/supply-chain

[16] https://www.jaguar.in/news/jlr-trials-world-first-digital-supply-chain-for-leather-using-blockchain-technology.html

[17] https://www.pmi.com/sustainability/fundamentals/manage-our-supply-chain-sustainably

[18] https://www.asda.com/creating-change-for-better/better-lives/supporting-supply-chain-communities/responsible-sourcing

[19] https://blog.shiphawk.com/supply-chain-sustainability

[20] https://about.ikea.com/en/sustainability/building-a-better-business-with-iway

[21] https://us.pg.com/ethics-and-corporate-responsibility/supply-chain/

[22] https://www.suntory.com/softdrink/company/sustainability/rawmaterials.html

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Aysha Bathool has two years of teaching experience at National First Grade College and at Almighty PU & Degree College as Principal for 16 years, Bengaluru. She has 4 years of experience in Maldives teaching 'O' and 'A' level. She started her career as a teacher. She is pursuing a Ph.D. She is a research scholar in the Department of Management, at the University of Mysore. Her extensive research and her specialty is leadership and entrepreneurship. In total, she has published one research paper in the fields of Women Empowerment at National conference, she has attended many conferences and FDP's.