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Environmental Management Practices and Supply Chain Integration's Effects On the Performance of Technological Innovation

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Peer Review Information	Abstract
<i>Submission: 17 Feb 2024</i> <i>Revision: 21 March 2024</i> <i>Acceptance: 23 April 2024</i> Keywords <i>Environment, Supply Chain Integration, Technological Innovation, Performance, Resource Efficiency, Waste Reduction, Collaboration, Sustainability</i>	This investigation examines the relationship among environmental management practises, supply chain integration, and technological innovation performance. The goal is to understand how environmental management practises along with supply chain integration can favorably impact the creative effectiveness of technology-focused organizations. The paper implements a systematic literature review methodology to collect pertinent studies and analyses the results to provide insights into the topic. The results indicate that effective environmental management practises and strong supply chain integration could boost the efficiency of innovation by increasing resource efficiency, decreasing waste, and fostering collaboration and knowledge sharing. The review additionally points out several challenges and barriers to achieving successful integration and emphasizes the need for an integrated approach to environmental management and supply chain management. This study's findings have practical ramifications for organizations seeking to improve innovation performance and contribute to sustainable development.

INTRODUCTION

The development of new technologies is absolutely necessary for both the acceleration of economic growth and the solution of environmental problems. In order to maintain a competitive edge in the global market, businesses across a wide range of sectors are continuously looking for new methods to improve their capacity for innovation. In the same vein, the ever-increasing need for sustainable development has brought increased attention to the significance of environmentally responsible management practices. These practices have the dual goals of reducing damaging effects on ecosystems as well as the most efficient use of resources. On the other side, supply chain integration is primarily interested in the creation of fluid coordination and cooperation among the many stakeholders operating within the supply chain network [1]. It is necessary for businesses that want to achieve sustainable and innovative results to have a solid recognition of the connection among environmental management practices, supply chain

integration, and technology innovation. It is possible for greater innovation performance, increased resource efficiency, and a decrease in waste to result from the incorporation of environmental sustainability worries regarding procedures of supply chain management. Nevertheless, the mechanics of this connection and the variables that influence it are complicated, and greater work is required to fully understand them. This research study aims to give insights into how environmental management practises along with supply chain integration may influence the development of new technologies and bridge the knowledge gap that currently exists between the two fields [2].

OBJECTIVE

The study sought to achieve the following goals:

- Study regarding environmental management practices
- Explain about the Supply chain integration
- Study about the technological innovation
- Elaborate about linkages between environmental management practices, supply chain integration, and technological innovation
- Examine regarding the implications and recommendations

METHODOLOGY

The study covers environmental management, supply chain integration, and technological innovation performance. Environmental management along with supply chain integration may improve technology-focused organizations' innovation performance. The study uses a systematic literature review to gather relevant papers and analyses the findings to get an understanding. Effective environmental management and strong supply chain integration may improve innovation performance by enhancing resource efficiency, lowering waste, and promoting cooperation and information transfer. The analysis also highlights many obstacles to integration and stresses the necessity for environmental and supply chain management integration. This study's conclusions may help organizations boost innovation and sustainability.

Environmental Management Practices:

Definition and Frameworks:

Environmental management practises are the tactics, regulations, and operations that organizations adopt to reduce their ecological impact. effects on the environment and to encourage more sustainable ways of doing things. These methods include not only the avoidance of pollution but also the management of waste, the saving of energy, the development of sustainable sourcing practices, and the creation of environmentally friendly products. Organizations may get assistance to assist them in the implementation of efficient environmental management practices by using frameworks such as ISO 14001 and the Triple Bottom Line approach [3].

Advantages and Challenges:

Organizations stand to gain a great deal from the successful implementation of environmentally responsible management practices. To begin, it may lead to greater resource efficiency by optimizing the use of energy, water, and raw materials. This can be a significant advantage. This not only lowers expenses but also lessens the toll that it takes on the environment. The second benefit of environmental management practices is that they help reduce waste by encouraging recycling and the use of appropriate disposal techniques. Thirdly, businesses that place an emphasis on sustainability may improve their corporate image and reputation, which in turn draws in consumers and stakeholders that are environmentally conscientious. Fourthly, ensuring legal and regulatory compliance through complying with environmental norms and standards is an absolute need. In conclusion, the implementation of environmental management practices may provide organizations with the opportunity to gain access to new markets and consumers that place an emphasis on environmentally friendly goods and procedures [4]. However, there are also problems that come along with the process of putting environmental management practices into place. These problems include budgetary restrictions, reluctance to change, a lack of knowledge or experience, and the difficulty in incorporating sustainability concerns into current operations.

Additionally, there is a lack of awareness or competence. Conquering these obstacles calls for dedication, the allocation of resources, and a preventative strategy toward achieving sustainability.

Supply Chain Integration:

Concepts and Types:

Integration of the supply chain requires coordination and cooperation among the numerous stakeholders within the network of the supply chain in order to improve the efficiency of operations, exchange information, and generate value. It includes integration on both the internal and exterior levels of an organization, including with customers, suppliers, and other partners. There are several formats for supply chain integration to choose from. The concept of vertical integration refers to the process of combining distinct segments of a supply chain, such as retail, wholesale distribution, and manufacturing. Its goal is to cut out the middlemen in order to enhance efficiency and simplify business processes. On the other hand, horizontal integration refers to the process of working together amongst organizations that are located at the same level of the supply chain [5]. These organizations may be rivals or businesses operating in industries that are closely tied to one another. This kind of integration looks to create economies of scale, improve market presence, and combine resources in order to accomplish its goals. Partner organizations in a supply chain engage in collaborative integration when they make decisions together, share information with one another, and pool resources. The integration in question encourages collaboration and confidence among the many parties.

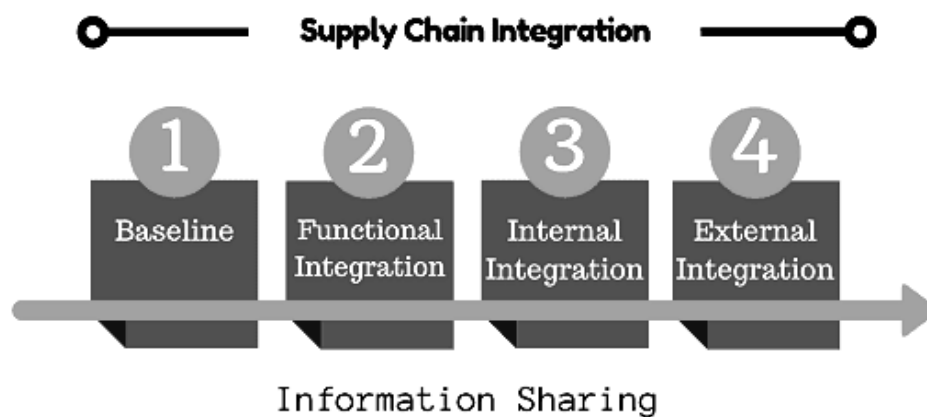


Figure 1: Supply Chain Integration

Factors and Benefits:

There are several different factors that urge companies to integrate their supply chains. To begin, the requirement for organizations to increase their efficiency and lower their costs is the primary driver behind the streamlining of their supply chain operations. Integration of supply chains provides greater coordination and communication among stakeholders, which ultimately results in optimized operations and decreased inefficiencies [6]. Second, the need for increased levels of customer satisfaction compels businesses to work together with their vendors and business partners to better the quality of their service and their responsiveness to customers' needs. Integration of the supply chain makes greater coordination of operations possible, which in turn leads to increased levels of customer service and satisfaction. Thirdly, businesses strive to improve their adaptability and reactivity to shifting situations in the market. Integration of supply chain operations allows for a more rapid response from businesses to shifting needs in the market as well as preferences expressed by customers. Lastly, businesses are becoming more aware of the potential advantages that might result from sharing risks and resources with other partners in the supply chain [7]. Organizations have the opportunity to create economies of scale, decrease costs, and share information and skills if they collaborate and integrate their processes.

Technological Innovation:

Definition and Types:

The term "technological innovation" relates Innovation refers to the invention, acceptance, and execution of fresh innovations, procedures, or goods resulting in significant advancements. major improvements in either the efficiency or effectiveness of a business as well as its ability to gain a competitive edge. It includes the production of new goods as well as the improvement of processes, organizational structures, and business models that are already in existence. There are several categories into which one may place technological advancement. Product innovation is the method of creating new or improved products or offerings with the objective of meeting customer needs of target customers while also providing a market advantage. The improvement of operational processes via the use of process innovation might result in increased efficiency, decreased costs, or improved quality [8]. The term "organizational innovation" refers to the process of enhancing an organization's performance by the introduction of novel management practices, structures, or systems. The process of innovating a business model entails rethinking and rebuilding the manner in which an organization generates value, delivers that value, and then retains it.

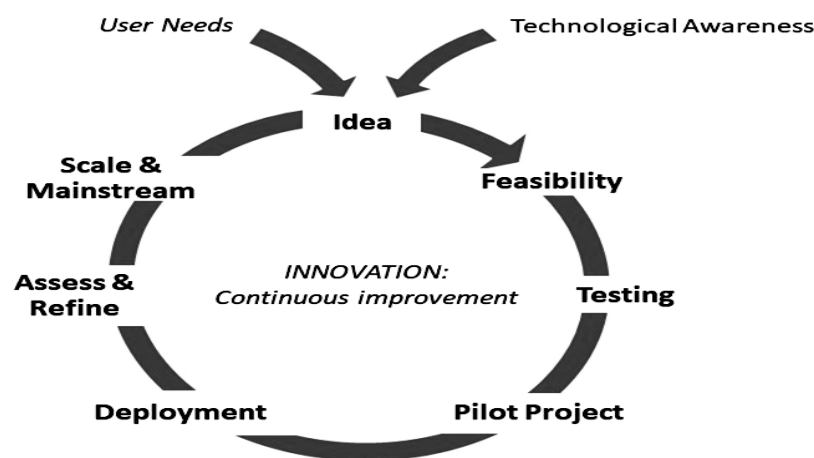


Figure 2: Technological Innovation Cycle

Performance Measures:

It is essential to measure the performance of technical innovations in order to assess the efficacy and impact of these innovations. When measuring the success of a company, it is feasible to use various financial or non-financial indicators technological innovation. The rise of revenues and profits, as well as returns on investments and cost reductions brought about by innovations, may all be considered financial indicators. Market share, customer happiness, brand equity, quality improvements, and time-to-market are examples of non-financial metrics. In addition, sustainability-related performance measurements may be used to evaluate the effects of technological innovation on the environment and society. These indicators include the decrease of a company's carbon footprint, savings in energy and waste, and the use of environmentally friendly technology.

Linkages between Environmental Management Practices, Supply Chain Integration, and Technological Innovation:

Resource Efficiency and Waste Reduction:

Integration of environmental management practices and supply chain contribute in tandem to increased resource efficiency and decreased waste in technological innovation. Organizations are able to maximize their use of resources, cut down on the amount of waste they generate, and lessen their overall effect on the environment when they put sustainable sourcing practices into action. Integration of supply chains makes cooperation and information exchange easier, which in turn enables businesses to develop novel approaches to problems such as minimizing waste and maximizing the use of available resources. Partners in the supply chain may increase innovation performance by streamlining processes, removing inefficiencies, and adopting environmentally

Environmental Management Practices and Supply Chain Integration's Effects On the Performance of Technological Innovation friendly practices if they collaborate and work together to do so. This will result in less consumption of resources and more creation of trash [9].

Collaboration and Information Sharing:

Integration of environmental management practices and supply chains both place an emphasis on the importance of stakeholder cooperation and the exchange of information. Collaboration in the supply chain promotes the sharing of ideas, areas of expertise, and successful business procedures, which in turn encourages the creation of innovative and environmentally friendly solutions. Effective environmental management practices enable organizations to participate in partnerships, research collaborations, and knowledge networks to foster learning and innovation. These types of relationships may be beneficial for both parties involved. The incorporation of environmental sustainability issues into the processes of supply chain operations improves cooperation and the exchange of information, so establishing an atmosphere that is favorable to the development of technical innovation that tackles environmental problems. The exchange of information about environmental issues, methods for achieving sustainability, and creative solutions helps to promote the development and implementation of environmentally friendly technology and practices [10].

Obstacles and Challenges to Integration:

Integration of environmental management practices, supply chain integration, and technology innovation is fraught with obstacles and difficulties, despite the fact that doing so might result in positive outcomes. These obstacles include the following:

- **Inadequate awareness and comprehension:** Some organizations may be unaware of the significance of sustainability, or they may not completely comprehend the potential advantages of incorporating environmental factors into innovative processes. This may make them less eager to invest in sustainable practices and stymie integration attempts.
- **Budgetary constraints:** Environmental management practices and supply chain integration projects sometimes need large financial expenditures. Limited financial resources may make adopting and executing these strategies difficult for organizations, especially small and medium-sized firms (SMEs).
- **Change resistance:** Change resistance is a typical impediment to incorporating sustainability into innovative processes. Employees and stakeholders may be resistant to new practices because they see them as extra costs or interruptions to present operations. To overcome opposition, effective change management practices and a clear explanation of the advantages and purpose of integration are required.
- **Problems with coordination and collaboration:** Integrating environmental management practices and supply chain operations necessitates coordination and cooperation among several internal and external stakeholders. Goal misalignment, power dynamics, and information exchange may all create hurdles to successful cooperation and stymie integration attempts.
- **Scalability and complexity:** In order to include sustainability concerns in innovation processes, organizations must manage complicated environmental legislation, standards, and guidelines. Furthermore, owing to disparities in organizational cultures, competencies, and resources, scaling up sustainable practices throughout the supply chain may be difficult.

Addressing these impediments and difficulties will need a comprehensive strategy that includes leadership commitment, stakeholder involvement, capacity building, supporting laws and regulations, and the formation of collaborative networks. It is critical for organizations to overcome these hurdles in order to fully realize the potential advantages of combining environmental management practices, supply chain integration, and technology innovation.

Implications and Recommendations:

Implications for Practice:

This study paper's results and discussions have various implications for practitioners working in the fields of environmental management, supply chain management, and technological innovation, including the following:

- Companies need to be aware of the links that exist between environmental management practices, supply chain integration, and technology innovation. Implementing any of these tactics separately may result in a reduction of their potential advantages. As a result, businesses have to move towards adopting an integrated strategy that takes into account the impact that various procedures have in conjunction with one another.
- When it comes to innovation, companies should put an emphasis on maximizing their resource efficiency and cutting down on waste. Organizations are able to lessen their impact on the environment by lowering their consumption of resources, minimizing the amount of waste they produce, and improving the operations of their supply chains if they design their products with sustainability in mind and use sustainable manufacturing practices.
- It is important to stimulate collaboration and information exchange among the participants in the supply chain. Across the supply chain, organizations can do their bit to encourage innovation and sustainability by cultivating a culture of collaboration, forming partnerships, and making it easier for people to share knowledge. Working together to solve problems, create common objectives, and identify and implement effective solutions are all outcomes that may result from collaborative efforts.
- In order to overcome integration's obstacles and difficulties, strong leadership commitment, effective change management tactics, and clear communication are required. It is important for businesses to make investments in employee training and capacity development so that their staff members have a better awareness of sustainability principles and the advantages of integration. In addition, businesses should coordinate their goals, rules, and incentives to encourage integration and innovation for the sake of sustainability in their operations [11].

Recommendations for Future Research:

- While this research article has looked at the connections between environmental management practices, supply chain integration, and technological innovation, there is still a need for further research. Future studies should consider the following recommendations:
- Further study is required to understand the processes through which environmental management practices and supply chain integration impact technological innovation performance. Extensive case studies and empirical research may illuminate the precise methods, processes, and practices that contribute to effective integration and innovation results.
- Longitudinal research may provide light on the long-term effects of environmental management practices, supply chain integration, and technological innovation. Understanding the dynamics and development of these interactions over time may help organizations and policymakers better understand the long-term viability and resilience of integrated systems.
- Research may look at the function of digital technologies like blockchain, IoT, and AI in improving the integration of environmental management practices, supply chain processes, and technological innovation. Investigating the potential of these technologies to allow real-time monitoring, data sharing, and collaboration may lead to the discovery of new paths for long-term innovation.
- Comparative research across sectors and geographies may give a thorough knowledge of the contextual elements that impact the efficacy of combining environmental management practices, supply chain integration, and technology innovation. This may help shape customized plans and policies for certain industries and areas.

Future studies that address these research gaps can contribute to a better understanding of the relationships between environmental management practices, supply chain integration, and technological innovation, as well as provide actionable insights for organizations and policymakers seeking to promote sustainable innovation.

CONCLUSION

The structure that has been defined above offers a thorough structure for resolving the interaction that exists between environmental management practices, integration of supply chain operations, and the performance of technological innovation. The report will give a critical analysis of the available literature, identify gaps in the knowledge base, as well as offer suggestions for more study. The goal is to contribute to a better understanding of how organizations may successfully combine environmental sustainability and supply chain management in order to improve their performance in the area of technological innovation and promote sustainable development.

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