A Conceptual Framework for Sustainable Supply Chain Practices for the Pharmaceutical Industry

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Abstract - Sustainability is an important global subject, considering the current dynamic and ever-changing business environment and need to develop a sustainable supply chain framework, it is imperative to develop a contemporary sustainable framework for the Indian pharmaceutical supply chain, which caters to the needs of developing nations such as India considering indigenous economic, environmental, social, and cultural factors. This chapter aims to propose a conceptual model to investigate how pharma companies create supply chain models for system-level transformation towards sustainability. It focuses on exploring the association between supply chain functions and the three dimensions of the supply chain, i.e., economic, social, and environmental issues. Further, aims to build a framework that would be beneficial for pharma companies in building a sustainable supply chain.

Keywords: Sustainability, Supply chain, Framework, Pharmaceuticals

I. INTRODUCTION

To build this framework, content analysis, research approaches were used. An integrative literature review was carried out to develop insights from existing SSCM frameworks. The proposed framework bridges the gap in terms of sustainability and supply chain. Specifically, the main business functions i.e, strategic, innovation, procurement and operations are covered in this framework.

Carter and Rogers (Carter & Rogers, 2008) focused on the investigation of non-economic issues to include SSCM and presented a conceptual framework, it referred to SCM as "the strategic, transparent integration and achievements of organizations social, environmental and economic goals in the systematic coordination of key inter-organizational business processes for improving the long term economic performance of the company and its supply chain". Sustainable models consider ecological, finance and social concerns embedded into business activities and connected to all parties to implement activities (Bocken, Short, Rana, & Evans, 2014).

Environment – key metrics

- Water reduction and water stewardship compliance
- Waste reduction and circularity
- API emissions reduction
- Adoption of biodiversity action plans
- Measurement of carbon etc.

Societal – key metrics

- Welfare of communities
- Welfare of employees
- Worklife balance
- Improved supplier relations
- Ethical business practices
- Align with government and legal policies

Economic – key metrics

- Improved cost performance
- Improved productivity
- Improve market share
- Increase profits
- Competitive advantage
- Improved customer and brand loyalty

FRAMEWORK TO ACHIEVE SUSTAINABILITY ACROSS SUPPLY CHAIN

Despite some research on sustainable practices across the supply chain, scientific studies on the pharma industry in India are scant on SSCM. SSCM includes concerns about product design, production, storage, distribution, and disposal (Sarkis, 2003). Zhu and Sarkis (Zhu, 2007) conceptualize GSCM as the integration of environmental thinking with operations management in the SC, starting with the product design, selection of raw materials, manufacturing processes, transportation and delivery, and the final consumer arriving at the destination after use.

DESCRIPTIVE INFORMATION

Seuring and Müller (Seuring S. M., 2008) state that the first publications related to GSCM date from 1994. However, the main publications appear at the beginning of the 21st century and become significant from 2010 (Fahimnia, Sarkis, & Davarzani, 2015) the year of the beginning of the analysis.

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The descriptive analysis contributes to the identification of the models, the dimensions, and the categories of analysis of sustainable practices (Soni & Kodali, 2013). Journals consider for building framework are journal of cleaner production; International Journal of operations and procurement management; resources, conservation, and recycling; sustainability journal; and others.

II. MODELS/ FRAMEWORKS IN SSCM

The identified models for the evaluation of SSCM practices in the supply chain are presented below,

Srivastava's Framework (2007)

Srivastava studies the literature on Green SCM (nearly 1500 volumes, over 227 sources). The researcher employed a tree-like structure, namely a top term (GSCM), 14 categories and 3 dimensions, related to a set of green/sustainable practices. As an initial framework, this has a certain amount of imbalance, which is the green design, got the support from two practices. Therefore, the author distributes the scope of Green SCM into three main categories of analysis: environmental importance, eco-design, and green operations. The below table illustrates the organization of the dimensions and categories proposed by the author.

Table: Dimensions and criteria

Indicator	Practices
Green Design	Lifecycle assessment analysis (LCA) Environmentally conscious design (ECD)
Green Operations	Discarding Source reduction Collecting Location and distribution Reducing pollution Pre-processing Collecting and Inspection Production planning and scheduling Inventory management Remanufacturing Recycling and reducing

Source: (Srivastava, 2007)

Seuring and Muller Framework (2008)

The authors examine 191 articles, which supported the proposal of a sustainable theoretical framework and a set of green practices for GSCM (Seuring & Müller, 2008). As per the view of the researcher, the principle (focal) companies are responsible for the environmental and social performance of the business partners with whom they are associated, promoting the adoption and implementation of environmentally friendly practices. The researcher also extended the analysis of GSCM beyond environmental management and also proposed it should include economic and social aspects.

The authors identified three main dimensions for SSCM: pressures, incentives, and barriers; green supplier management; and green product management. Below table summarizes the main points that support pressures, barriers, and incentives.

Table: Pressures and Incentives

Indicator	Practices
Pressures and Incentives	Legal demand Consumer demand Response to stakeholders Competitive dimension Demands on social aspects from groups Demand on environment aspects from groups Company image
Barriers	Implementation costs Complexity in coordination and information sharing Lack of communication in SC

Source: (Seuring S. M., 2008)

Zhu, Saekis, Cordeiro, and Lai's Framework (2008)

The researcher proposed a framework that constructs green practices into five blocks: green purchasing, internal environmental management, cooperation with clients, investment recovery and eco-design (Zhu, Sarkis, Cordeiro, & Lai, 2008). The researcher recognize that the variables have significant correlations with Green SCM. The framework that the authors proposed with a measurement scale to evaluate the implementation of SSCM practices are presented in the below table. The framework was tested for its validity and reliability in the Chinese industry.

Table: Structure of the green practice measurement for SSCM

Indicator	Practices
Internal environmental management	Commitment of managers Implementation support Corporation Total quality Audit program Implementation of ISO 14001 Environmental management system
Green purchasing	Eco production certification Cooperation with suppliers Environmental Audit ISO14001 suppliers Environment-friendly practices in second-tier suppliers
Cooperation with clients	Eco friendly design Clean production and operations Green package practices
Eco-friendly design	Design products for the reduction of resources including material, energy usage and other factors of production Ensure products for reuse, recycling, and recovery of materials Design products in a way that produce less environmental wastage
Investment recovery	investment recovery Sale of disposed material Dispose/ sale of surplus equipment

Source: (Zhu, Sarkis, & Cordeiro, Firm-level correlates of emergent green supply chain management practices in the Chinese context, 2008)

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Testa And Iraldo Framework (2010)

The authors analyse the determinants and motivators of green practice adoption and environmental and organizational performance. The study applied to 4000 organizations from different sectors in seven countries and tested whether GSCM positively influences environmental performance and the reputation of firms. The study classified the determinants into external and internal factors, related respectively to the pressures of the stakeholders and the company's business strategies (Testa & Iraldo, 2010).

Regarding external factors, the authors verify that three institutional mechanisms influence environmental decisions: normative, coercive, and mimetic. Normative pressures occur when clients ask to align firm strategy with customer demands and regulatory pressure. Coercive pressure occurs when stakeholders influence the dissemination of environmental reports. Mimetic pressure results when the development of environmental practices in specific sectors or competitive arenas becomes so significant that it induces their adoption by followers.

Regarding internal factors, the three most observed motivations for the adoption of GSCM practices are reputation, which involves environmental performance, lifecycle analysis, green logistics practices, and cooperation with partners; efficiency, which involves the reduction of raw materials and energy; and innovation, typically led by a focal company.

Azevedo, Carvalho, and Cruz Machado Framework (2011)

The researcher identified the association between sustainable practices and SC performance. The study covered to five Portuguese automotive supply chains, retrieve data from the literature a set of green practices analysed at three levels: upstream of the focal company, developed by and depending exclusively on the focal company, and downstream of the focal company (Azevedo, Carvalho, & Machado, 2011). Below table transcends the evaluation of practices at the focal company level but also considers suppliers and consumers.

Table II:1 The impact of green practices on the supply chain performance- A theoretical framework

Upstream	Focal Firm	Downstream
Environment-friendly practices in purchasing	Minimising waste	Environmental collaboration with customers
Environmental collaboration with suppliers	ISO 14001 certification	Environment-friendly packaging
working with designers and suppliers to reduce and eliminate products' environmental impact	Decreased consumption of hazardous and toxic material	working with customers to change product specifications
-	-	reverse logistics

Source: (Azevedo, Carvalho, & Machado, 2011)

Sellitto Framework (2018)

Sellitto (Sellitto, 2018) unified previous research. Sellitto et al. (Sellitto M. B., 2015) recommended a green management practice model applied to the automotive chain of Brazil. The study tested and refined a model to evaluate the effectiveness of GSCM implementation. Sellitto and Hermann (Sellitto M. H., 2016) improved the model by adding a fuzzy-based decision method and implemented it in the agro-food industry. Based on those studies, the application was extended to other industries [37]. The model adopts a tree-like structure, formed by an overall concept (GSCM), supported by three constructs (Strategy, Innovation, Operation), that is also supported by 16 green practices. The model details are presented in the below table.

Table II:2 the theoretical framework of green practices in supply chain

Indicator	Practices
Strategy	Green strategy development Measurement system and Monitor of performance Collaboration with partners and adoption Risk management and Communication Barriers Growth drivers
Innovation	Green process eco-design Green products Greenmarkets
Operation	Green purchasing Green manufacturing Green distribution Reverse logistics Disposal Pollution mitigation

Source: (Sellitto M. , 2018)

PSR framework

Several national and international organisations have found that the PSR framework is renowned as useful method to develop indicators and for environment reporting. It has proved valuable in highlighting the cause-and-effect relationships between environment, social conditions, and human activities. As such it helps decisions makers and the public see that environmental, economic, and social issues are interconnected, and helps policymakers to design policies that address the key problems at the appropriate level. It, therefore, provides a means of selecting and organising indicators in a way that is useful for decision-makers and the public. It also has the following advantages.

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- Frameworks support easy to understand and usage
- This framework is neutral, focuses on where linkages exist instead of focusing on negative or positive effects
- Identified as a flexible model which provides greater details, certain features and is widely recognised
- Ensures by analysing issues should not be overlooked any important issues in a reliable way

III. SUMMARY OF SSCM MODELS

To integrate the analysis, it is necessary to integrate the retrieved categories and concepts into a single model as simple as possible. To do so, it is important to summarize the main results retrieved from the studies and to propose a framework. A paired analysis of the dimensions and categories exposed by the models, it is found similarities in the category levels and dimensions.

CONCEPTUAL FRAMEWORK AND SUSTAINABLE PRACTICES

Frameworks have an important role in organising data and guiding in the selection of indicators needed to answer certain questions. By systematically considering issues, they ensure that important considerations have not been overlooked. an indicators framework or model provides an overview for considering sustainable development problems and associated interconnections between them. Although, frameworks and models are essential tools for developing and selecting indicators they have their limitations[1].

The information provided by the articles helped to define the framework categories. The systematic review of the literature provided information and data and grounded the construction of the conceptual framework. Categories were organized considering their relationship with the dimensions (economic, social, environmental) and their relations and interactions within the supply chain.

A Conceptual Framework for Pharma companies

Dimension	SC indicators/categories	Sustainable Practices
STRATEGIC	Sustainable strategy & Performance measures	-Environmental plans and goals -EMS -Environment risk management -ISO 14001 -Welfare of local community -Culture change to eco friendly -Welfare of employees - competitive strategy -Audits -Benchmarking -Information sharing among stakeholders -Cost-saving
INNOVATION	Sustainable technologies	-Sustainability tools -R&D -Design capabilities -Increased use of IT
	Product design, development, packaging, recycling etc	-Green products -Reusable, recycled and recoverable products and parts Product definition -Product characteristics -Decreased usage of hazardous and toxic material -Green packaging -Design for resource efficiency -Design for resource efficiency -Process designs to efficiency
PROCUREMENT	Procurement / supplier participation	-Supplier awareness programs -Joint ventures -Specifications for suppliers -Supplier audits -Evaluation of suppliers at different tiers -Improved supplier relationships
OPERATIONS	Manufacturing & Operations	-Cleaner production -Green energy and conservation -Decreased usage of hazardous and toxic material -Waste management -Eco-friendly plants -Green warehousing -Internal sustainable plans -increase productivity
	Distribution & Marketing	-Green distribution -Green marketing & Brand image -Green packaging and documentation -Eco-friendly programs -Conservative marketing -Green advertisement -Eco services -Customer awareness on green products
	Waste Management & Reverse logistics	-Recycling and reuse -Carbon management -Plans to reduce greenhouse gases -Goals to reduce solid wastage -waste and disposal costs -Inspections -Eco-friendly disposal processes

Table / Figure: A conceptual framework for sustainable practices

IV. CONCLUSION

The framework developed for the pharma industry has mainly 4 dimensions strategic, innovation, procurement and operations. Each of these dimensions is further subdivided into indicators that plays important role in a company's supply chain. The sustainable supply chain practices are listed for each indicator. This conceptual framework is hopefully helpful for Pharma companies in transforming their current supply chain into a more sustainable one.

BIBLIOGRAPHY

[1] Azevedo, S., Carvalho, H., & Machado, V. (2011). The influence of green practices on supply chain performance: A case study approach. Transp. Res. Part E Logist. Transp. Rev., 850-871.

[1] OECD environmental indicators: http://documentacion.ideam.gov.co/openbiblio/bvirtual/017931/DocumentosIndicadores/Temasvarios/Docum26.pdf

 DOI : 10.35291/2454-9150.2022.0115

[2] Bocken, N., Short, S., Rana, P., & Evans, S. (2014). A Literature and Practice Review to Develop Sustainable Business Model Archetypes. J. Clean. Prod., 42-56.

[3] Carter, C., & Rogers, D. (2008). A framework of sustainable supply chain management: Moving toward new theory. Int. J. Phys. Distrib. Logist. Manag., 360–387.

[4] Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. Int. J. Prod. Econ., 101-114.

[5] Kassarjian, H. (n.d.). Content analysis in consumer research. J. Consum. Res., 8-18.

[6] Sarkis, J. (2003). A strategic decision framework for green supply chain management. J. Clean. Prod., 397-409.

[7] Sellitto, M. (2018). Assessment of the effectiveness of green practices in the management of two supply chains. Bus. Process. Manag. J., 23-48.

[8] Sellitto, M. (2018). Assessment of the effectiveness of green practices in the management of two supply chains. Bus. Process. Manag. J., 23-48.

[9] Sellitto, M. B. (2015). Evaluating the implementation of GSCM in industrial supply chains: Two cases in the automotive industry. Chem. Eng. Trans, 1315-1320.

[10] Sellitto, M. H. (2016). Prioritization of green practices in GSCM: Case study with companies of the peach industry. Gest.Prod.

[11] Seuring, S. M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production, 1699-1710.

[12] Seuring, S. M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. J. Clean.Prod.

[13] Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. J. Clean. Prod., 101-114.

[14] Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. J. Clean.Prod., 1699-1710.

[15] Soni, G., & Kodali, R. (2013). A critical review of supply chain management frameworks: Proposed framework. Benchmarking Int. J., 263-298.

[16] Srivastava, S. (2007). Green supply-chain management: A state-of-the-art literature review. Int. J. Manag. Rev., 53-80.

[17] Testa, F., & Iraldo, F. (2010). Shadows and lights of GSCM (Green Supply Chain Management): Determinants and effects of these practices based on a multi-national study. J. Clean. Prod., 958-962.

[18] Zhu, J. S. (2007). "Green supply chain management: pressures, practices and performance within the Chinese automobile industry,". Journal of Cleaner Production, 041-1052.

[19] Zhu, Q., Sarkis, J., & Cordeiro, J. (2008). Firm-level correlates of emergent green supply chain management practices in the Chinese context. Omega, 577–591.

[20] Zhu, Q., Sarkis, J., Cordeiro, J., & Lai, K.-H. (2008). Firm-level correlates of emergent green supply chain management practices in the Chinese context. Omega, 577-591.

 DOI : 10.35291/2454-9150.2022.0115