

Enablers and Outcomes of Supply Chain Collaboration for Sustainable Growth

Suganya G¹, J Joshua Selvakumar², Sathish Pachiyappan^{2*}

¹Kumaraguru College of Liberal Arts and Science, Coimbatore, India. ²Christ University, Bengaluru, India, *Corresponding Author's Email: sathish.p@christuniversity.in

Abstract

This study explores the intricate dynamics, challenges, and potential benefits of supply chain collaboration, emphasizing its pivotal role in achieving sustainability goals. Modern Supply Chain Collaboration (SCC) projects focus on sustainability-related activities, fostering interdependence between partners and driving sustained competitive advantage. The study introduces a comprehensive framework encompassing specific enablers (e.g., Joint Decision Making, Technology Integration) and outcomes (e.g., Social, Economic, and Environmental Sustainability) of supply chain collaboration. It contributes to practical guidelines for businesses seeking to enhance collaboration strategies and delves into theoretical paradigms such as the Cooperative Advantage concept, Triple Bottom Line Theory, Resource-Based View Theory, and Network Theory. The Triple Bottom Line Theory serves as an integrated theory of sustainability, emphasizing economic advantages, environmental impact minimization, and societal benefits. The Resource-Based View Theory underscores the role of internal resources in gaining competitive advantages, aligning with sustainability goals. Network Theory explores collaborative dynamics among competing entities, emphasizing resource sharing. The study's findings offer practical implications, enabling companies to assess and improve the sustainability of their supply chain management. It advocates for the integration of supply chain collaboration into organizational missions, emphasizing the importance of trust-building through standardized guidelines. The insights gained from this study are applicable across sectors, aiding legislators in developing flexible regulations and refining collaboration processes. Additionally, the study highlights the potential cultural variations in supply chain collaboration, paving the way for future research.

Keywords: Network theory, Supply chain collaboration, Sustainable supply chain management, Triple bottom line theory, Resource-based view theory.

Introduction

Supply chains feature a large number of actors, each of whom has a unique goal. For the supply chain to be successful, it is crucial to coordinate the actions of all the actors. Companies in the supply chain face issues as a result of increased accountability because compliance with rules necessitates information from various supply chain actors. Collaboration is one of these actors, and it can be seen as a key success factor for Sustainable Supply Chain Management. The goal of the collaboration is to develop a set of strategies through which two or more independent external (firms) and internal (within the firm) actors with diverse complementary skills can achieve their shared aspirations and objectives in an atmosphere of competition (1). Modern Supply Chain Collaboration (SCC) projects specifically assess how closely SC

partners work together to carry out sustainability-related activities (2). Additionally, according to (3), sustained competitive advantage is now driven by the resources and competencies of SC members that result from SCC. Collaboration among SC partners is defined as cooperative efforts that partners make to achieve significant long-term gains (4). According to (5), SCC is characterized by participation in SC activities that are based on interdependence between SC members and the development of management strategies for such interdependencies. According to (5), SCC for sustainability depends on sustainable benefits, sustainable connections, sustainability integration, and sustainable practices. Resource-sharing solutions can be useful for maximizing material consumption and lowering emissions (6).

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For instance, resource-sharing programs that demand cooperative consolidation and deliberate allocation of shared components between SC phases might ease resource pressure (6). SCC must be supported at every phase by a common vision, set of values, and guiding principles. As a result, in order to achieve sustainability, businesses must communicate with both internal and external SC members, such as suppliers and retailers. This underlines the significance of putting SCC into action once more. SCC is a buyer-supplier business process that incorporates goal congruence, decision harmonization, and information and resource sharing. However, it can put pressure on mutually trusted relationships and lead to behavioral opportunism. Therefore, SCC can guarantee sustainability and consumer demand fulfillment through buyer-supplier collaboration, but unintentionally provide difficulties. SCC performance results are inconsistent, indicating the necessity for additional research.

The multiplicity of divisions and specialized services found in any organization has primarily increased the difficulty of collaborating. Typically, departments don't have any plans to understand about one another's capabilities, services, and experiences, and they're also not interested in working together. The majority of them are concentrated on their niche activities so that they may readily claim them as their own. This conflict has the potential to be harmful. On the other hand, poor departmental collaboration, which is the main issue faced by every industry, can lead to job disruption, and parallel work, hinder the purchase of acceptable services in the field, and make response operations ineffective. Therefore, each sector should create suitable channels for improved departmental and employee collaboration utilizing a methodical manner (7).

While the intra-organizational view focuses on the benefits acquired within companies, the inter-organizational view, also known as enterprise-to-enterprise benefits, focuses on the benefits gained due to process orientation across several enterprises. Cross-functional collaboration and inter-unit collaboration are the two main components of an organization's internal integration. Improvements to "how work is done" are essentially the focus of internal integration. Collaboration throughout the supply chain offers

a solution to issues including risk and responsibility sharing, profit sharing from shared goals, and increased administrative flexibility. Collaboration has balanced Supply and demand, enhancing profits throughout the supply chain (8). Customers are demanding more global and integrated solutions, thus businesses that can coordinate their actions and objectives across business units and regions will succeed in the marketplace (9). Collaboration becomes a crucial source of competitive advantage since business success depends on expertise that is frequently dispersed across departments (10).

The study enhances knowledge of collaborative dynamics, difficulties, and potential advantages, the study adds to the larger field of supply chain management literature by presenting a new framework and model connected to supply chain collaboration. The study contributes to the body of knowledge on sustainability and corporate social responsibility and looks at how supply chain collaboration can encourage sustainable growth in the garment industry. The study identifies specific enablers of supply chain collaboration (Joint Decision Making, Knowledge Exchange, Strategic Planning, Relationship Orientation, Technology Integration, Operational Flexibility, Organizational Trust, Sustainable Supply Chain Engagement, Relational Integration, Information Integration and Operational Integration) and outcomes (such as Social Sustainability, Economic sustainability, Environmental Sustainability and Value Chain Performance), the study contributes to practical guidelines for companies looking to improve their collaboration strategies. The study adds to existing theoretical frameworks and gives insights into value chain analysis, intra-organizational collaboration, and sustainable business practices.

Theories related to supply chain collaboration for sustainable growth in the garment value chain

The theories of Resource Dependence, Institutional, Transaction Cost Economics, Network, and Triple Bottom Line/Sustainability Accounting collectively shed light on the dynamics of supply chain collaboration for sustainable growth in the Garment Value Chain. Resource Dependence Theory suggests organizations collaborate to secure external

resources crucial for sustainability initiatives. Institutional Theory explains how collaborations align with societal norms for legitimacy. Transaction Cost Economics examines the efficiency of these collaborations in minimizing transaction costs. Network Theory analyzes the interconnected relationships between supply chain participants. The Triple Bottom Line framework ensures collaborative efforts consider economic, social, and environmental dimensions, fostering a comprehensive approach to sustainable growth in the garment industry supply chain.

Resource dependence theory

According to the theory proposed by (11), organizations rely on external resources, and participating in supply chain collaborations serves as a means to effectively manage and safeguard these resources for sustainability initiatives. Resource Dependence Theory (RDT) asserts that organizations, as outlined by (11), strategically establish connections to access vital resources like information, capital, and expertise. This strategic approach aims to reduce uncertainty and reliance on a single source. In the specific context of sustainable growth in the garment value chain through supply chain collaboration, RDT suggests that organizations collaborate to obtain resources essential for sustainable practices. This collaborative effort utilizes interdependence to improve environmental and social outcomes while minimizing risks associated with dependence on specific suppliers or processes (12).

Institutional theory

Institutional Theory explores how organizations conform to societal norms and institutional pressures. Developed by (13), the theory posits that organizations adopt structures, practices, and behaviors to fit prevailing institutional expectations, gaining legitimacy in their environment. Institutional isomorphism, the tendency for organizations to resemble others in their field, results from mimetic, coercive, and normative pressures. In practical terms, organizations within the garment industry, for example, may engage in collaborative efforts for sustainable growth to align with emerging environmental and social norms, thus gaining legitimacy and competitive advantage within their institutional context (14).

Transaction cost economics

Transaction Cost Economics (TCE), articulated by (15), examines the efficiency of economic transactions within organizations. TCE posits that firms make decisions based on minimizing transaction costs, which include the expenses of negotiating, monitoring, and enforcing contracts. The theory asserts that organizations choose between market transactions and internal coordination (hierarchy) based on the comparative costs. In the context of the garment industry, TCE would analyze whether firms collaborate in the supply chain to reduce transaction costs associated with sustainable practices, aiming for an optimal balance between market exchanges and internal coordination to enhance efficiency and profitability (14).

Network theory

Network Theory, as elucidated by sociologist (16), explores the structure and impact of social relationships in various contexts, including organizations. It emphasizes the significance of connections and social ties, examining how they influence individual and organizational behavior. In the business realm, Network Theory can be applied to understand collaborative relationships within the garment industry supply chain. The theory highlights the role of interconnections between organizations, suppliers, and stakeholders, elucidating how these networks facilitate the flow of information, resources, and support. Analyzing the garment value chain through Network Theory provides insights into the dynamics and outcomes of collaborative efforts

Triple bottom line (TBL) / sustainability accounting

The Triple Bottom Line (TBL) or Sustainability Accounting, popularized by (17), advocates for a holistic approach to evaluating business performance by considering economic, social, and environmental dimensions. TBL extends beyond traditional financial reporting, emphasizing the importance of profit, people, and the planet. In the context of the garment industry, TBL encourages organizations to assess their impact on workers, communities, and the environment. This framework underscores the interconnectedness of economic success, social responsibility, and environmental stewardship, promoting sustainable practices. TBL serves as a guide for

businesses aiming to achieve a balance between profitability, social responsibility, and environmental conservation in their operations.

Relationship between the theories

The RBV theory's emphasis on internal resources complements the TBL theory's emphasis on sustainability. Organizations that proactively invest in sustainable practices and take into account the social and environmental aspects can create distinctive resources that help them gain a competitive edge. A strong corporate social responsibility (CSR) reputation, eco-friendly technologies, or a good rapport with the community are a few examples of these resources. The concepts of cooperation and partnerships are a point of intersection between network theory and TBL theory. Working with stakeholders along the entire value chain to address social and environmental challenges is a common component of sustainable business practices. Through cooperative efforts, networks enable firms to improve their TBL performance by facilitating the exchange of knowledge, resources, and experience. According to network theory, actors in a network share resources and expertise for their mutual benefit. Businesses that follow the TBL tenets may discover chances to use their sustainable practices as resources in cooperative networks. This can improve their reputation, draw in business partners, and generate value for everyone. (18) employ a hybrid approach drawing from a Resource-Based View (RBV) and Network Theory (19) to guide their empirical investigation. RBV emphasizes that firms gain competitive advantage through the possession of rare resources, hinging on resource heterogeneity and imperfect mobility. While RBV highlights the benefits of collaborative inter-firm relationships for resource sharing, it falls short in explaining why competitors would engage in such collaborations. In contrast, Network Theory accommodates relationships between firms, even competitors, within resource networks. By combining these theories, they establish a robust foundation to explore collaborative dynamics among competitors in Supply Chain Management,

enriching our understanding of sustainability-driven competition. Exploring the dynamic relationship among TBL (Triple Bottom Line), RBT (Resource-Based Theory), and Network Theory within the context of supply chain collaboration helps to consolidate insights to reveal the strategic alignment possibilities for firms, enabling them to leverage sustainability objectives, resource-based capabilities, and network configurations to generate value and gain a competitive edge in collaborative supply chain environments.

Conceptual development

Collaboration is the creation of interfirm alliances or partnerships in which the parties collaborate and share knowledge, resources, and a certain amount of risk in order to achieve their shared goals.

In an organization, close bonds typically start to form first across functional divisions. This internal functional interdependence lays the groundwork for functional interdependence that extends into the partner firm. As a result, intra- and interfirm operations are integrated (20). Participants develop a functional interdependence and seek outcomes that are advantageous to both parties (21). Cross-organizational links are made by supply chain actors because they have an incentive to do so. According to (20), businesses "voluntarily agree to integrate human, financial, or technical resources in order to create a better business model."

Supply chain collaboration

The term "collaboration" was used by (22) to refer to the cooperation amongst independent but connected enterprises to pool resources and talents to serve the most unique demands of their clients. According to (23), supply chain collaboration is a cooperative method used when one or more businesses or business divisions cooperate to achieve mutual benefits. Previous studies frequently link supply chain collaboration to the development of information systems and inter-organizational process enhancements that enable chain participants to efficiently

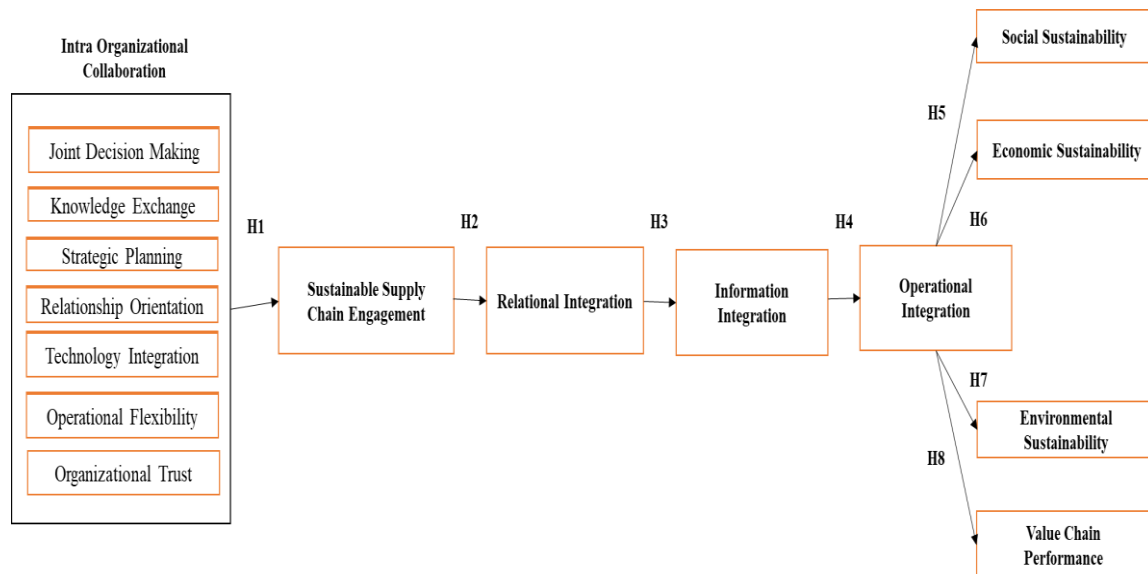


Figure 1: Conceptual model

deliver goods to customers at the lowest possible cost (24, 25) has defined supply chain collaboration as a long-term relationship created between supply chain stakeholders for mutual benefits and attaining objectives like cutting cost and risk while boosting quality and market value. Supply chain cooperation is defined by (26) as the capacity to cooperate across organizational boundaries to develop and manage unique value-added processes that better fulfill customer expectations. According to (27), supply chain collaboration is a popular approach for businesses to share information, build alliances for improved performance, and save costs and inventories. Supply chain collaboration is commonly characterized as a type of cooperation between two or more supply chain participants in terms of sharing information, making shared choices, and sharing benefits to meet the demands of end consumers, which subsequently has an influence on the profitability that may be shared (28).

Enablers of supply chain collaboration

The coordination enablers are classified into three categories in a study conducted by (29) to identify the enablers for coordination across the construction supply chain process: (i) contractual enablers including relational contracts and incentive models and (ii) procedural enablers, including multi-agent knowledge sharing systems and the last planner system along with linked databases for design coordination, design for manufacturing software platforms and automated

monitoring technologies. For speedy response and feedback procedures, it is discovered that integrating diverse operations necessitates a particular amount of stakeholder integration. However, the state-of-the-art does not sufficiently handle the integration of innovative contractual forms with digital technologies like smart contracts.

Importance of collaboration in supply chain strengthening

Collaboration in the supply chain may provide significant benefits and advantages to its partners. Collaborative relationships can aid businesses in obtaining information, sharing risks, gaining access to complementary resources, lowering product development costs, logistical costs, transaction costs, and increasing productivity, quality, technological capabilities, profit performance, and competitive advantage over time. Managing the movement of goods and information across the supply chain is unlikely to be successful without effective partnerships (30). Two or more independent enterprises working together to plan and execute supply chain operations is called supply chain collaboration. Collaboration necessitates a certain level of trust amongst supply chain participants. It also necessitates supply chain stakeholders sharing resources in order to satisfy client demands. Customer relationship management (marketing), inventory, production, and distribution management (operations management), strategic alliances (organisational management), and

electronic data interchange and radio frequency identification (information technology) are just a few of the issues that supply chain collaboration entails (31).

Sustainable development goals in business

The notion of sustainability has been integrated into the conventional tasks of supply chain management to define sustainable supply chain management (32). According to (33), sustainable development in business has progressed from individual social and environmental practices to the convergence of sustainability known as the Triple Bottom Line (TBL) (34) such as economic, environmental, and social. Firms must be accountable not just for their own financial gains but for the supply chain's environmental and social performance (35).

The purpose of Sustainable Supply Chain Management is to relate sustainability operations to business outcomes, which can be described as sustainability performance. The three TBL factors make up sustainability performance. The performance of supply chain should be economically feasible, i.e., income should surpass costs, and environmentally sustainable, i.e., the environment's value should not decline and offer an equal allocation of costs and rewards among all participants.

Elements that encourage cooperation between various stakeholders

Every supply chain or business ecosystem needs cooperation between different stakeholders to be successful and sustainable, including manufacturers, retailers, and suppliers. Several factors are essential in motivating and cultivating cooperation between these major actors. Cooperation requires open and honest communication at its core. Information on production schedules, inventory levels, and demand projections must be shared amongst stakeholders. Sharing information and experiences within a collaborative supply network helps firms better understand one another's circumstances and builds essential skills for tackling shared problems. Organizing this "collective learning" involves evaluating the situation, combining solutions, and collaborating with important parties (36). Collaboration software platforms and electronic data exchange

(EDI) are examples of technology that can be used to speed up communication and enable real-time information sharing. Reliability, communication consistency, and promise fulfillment are necessary to build trust with stakeholders. Research clearly shows the connections and interdependencies between organizational culture and strategic supply-chain links (37). According to (38), the rationalization of the supplier base, for instance, ought to lead to a strengthening of connections, emphasizing the significance of shared values like trust and collaboration between each supply-chain partner business. Collaboration is characterized by a trustworthy relationship in which participants share risks and rewards (39). Forecasting, demand planning, and inventory management are collaborative planning activities. Stakeholders can optimize processes and minimize inefficiencies by collaborating to establish plans. Stakeholder visibility and coordination can be enhanced by utilizing technology, such as enterprise resource planning (ERP) and supply chain management (SCM) systems. Collaborating on risk identification and mitigation strategies is crucial. This includes sharing information about potential disruptions, developing contingency plans, and building resilience in the supply chain. Stakeholders can be encouraged to actively participate in cooperative efforts by putting in place incentive mechanisms that reward achievement and collaboration. These incentives could take the shape of cash payouts, bonuses for performance, or split cost savings from increased productivity. Adopting a continuous improvement culture pushes stakeholders to assess and improve their joint processes on a regular basis. This entails getting input, examining performance indicators, and pinpointing areas that need to be improved in order to adjust to shifting market dynamics.

Hypotheses development

According to a study by Carnabuci (40) on the semiconductor industry, interconnected networks enabled group decision-making, problem-solving, and the exchange of various types of knowledge for new product innovation. This study looked at 232 companies across various industries. The development of a collaborative supply chain relationship helps the organization to establish an integrated approach for decision making and it

works in favour of the development of inter-organizational relationships. Close cooperation between various functional departments within the company is the basis for achieving high efficiency, high quality, low cost and on-time delivery (41). Such mutually beneficial relationships are essential for the sustainable growth of the business. Recent studies have noted that proactive management with a relationship orientation approach tends to have a competitive advantage (42). Effective knowledge collaboration across departments may result in the reinventing of existing competencies within employees as innovation is made by highly knowledgeable employees and the combination of different types of knowledge resides within them (43). According to Bowersox *et al.* (44), effective supply chain management ensures a strong collaborative strategy that facilitates business enterprises to share key information and knowledge and capitalize on market opportunities. (45) have said that organizations engage in cross-functional discussions about customers. In doing so, various departments can get deeper insights into customer value, and the organization as a whole benefits through supply chain learning. There are two aspects to supply chain integration; one deals with information sharing and the other with cooperative relationships. Both these aspects of an integrated supply chain contribute to the engagement with suppliers and customers.

Intra-organizational collaborations emerge from collaborative R&D efforts involving various departments or branches within a single organization. These collaborations can facilitate the exchange of knowledge across geographical boundaries, coinciding with the organization's expansion into different regions. A relationship between the firm and the partners is realized when trust develops, the firm is freely involved socially and joint learning occurs through communication, information and Knowledge sharing. Relational incomes are generated due to the engagement between the firm and its partners. Firms that aim for profits and risk aversion through relational integration seem to invest on relational-specific assets, knowledge accumulation, shared learning, strategic resources and governance mechanisms. Collaborative relationships yield greater synergic benefits

contrary to a firm operating individually in the market. Dyer *et al.* (42) have argued that if a company does not have the competence to achieve a competitive advantage with its existing resources, then it will be safe to combine its resources with other companies and partners. The pooling of resources by a network of companies as dyad/triad relationship provides access to valuable information and also adds to effective governance.

H1: Intra-organization collaboration enhances the relationship with sustainable supply chain engagement with partners

Sustainable supply chain engagement involves fostering transparent reporting of emissions across both the upstream and downstream segments of the supply chain (46). This helps to minimize ambiguity in environmental decision-making processes. Several large firms have resorted from a confrontational approach to a more cooperative relationship with suppliers and partners. This new strategy allows firms to consolidate their position, share information, improve performance, monitor, and control. Regular access through formal and informal channel talks and meetings between managers across firms has been crucial for inter-firm communication, information sharing and knowledge transfer. Informal contact between the employees for partnering firm have become a rich source of tacit knowledge, and such knowledge is absent in a formal organizational context. This relational cooperation which has been earned through trust has been critical in gaining access to information. This point has been reiterated by Nahapiet *et al.* (47), who have stated that high level of trust between partners enables them to access supply chain resources more efficiently and effectively. The insights from the social capital theory states that trust provides manufacturers access to broader sources of information in a timely manner, improves quality of information, reduces cost and helps to understand the barriers in the flow of information in the supply chain (47). Therefore it can be said that effective communication is one that is characterized by regular flow of information through personal contacts.

Efficiency, cost-effectiveness, and environmental impact are affected by collaboration

According to Vereecke et al. (48), supply chain partnerships help participants of a distributed network work toward achieving shared goals, enhancing relationship efficiency, and improving customer service and provision capabilities. Inter-firm collaboration can lead to various benefits such as increased sales, improved forecasts, more accurate and timely information, lower costs, reduced inventory, improved customer service, division of labor, knowledge exchanges about products and processes, cost and/or problem avoidance, and revenue enhancements, cost reductions, and operational flexibility to deal with demand uncertainties. Research suggests that supplier cooperation lowers the risks associated with procurement and helps the company establish a competitive position by guaranteeing lower transaction costs.

H₂: Sustainable Supply Chain Engagement enhances the relationship with Relational Integration

Feng et al. (49) revealed that proficiency in big data analytics enhances the favorable influence of relational integration on inter-organizational learning. Operational competencies, which arise out of accumulated knowledge from integration, are crucial for problem solving and for dealing with uncertainties in the market. This information encapsulates explicit elements such as resources, practices and processes in addition to tacit elements like industrial know-how, skill, leadership and tools to achieve the company-set goals. Wheelwright et al. (50) have stated that firms aim for operational integration not only for knowledge creation but also for the customization of operational processes. The integration between the buyer and the seller in the area of operations is bound to yield better synchronization of processes, reduce redundancies and minimize wastage. Further, operational integration between the suppliers has a direct impact on the cost, quality, delivery of products, flexibility and profitability (44). It is important for a firm today to focus not only on its own operational aspects but also on the performance of the supply chain partners. It is imperative that much importance is given to information transfer and quality of information between the exchange partners. In

short, operational integration should be able to facilitate a system to capture timely information, speed up the product design process, improve production planning, reduce inventory cost and wastages, ensure efficient manufacturing, gain market share and respond to customer demand promptly.

H₃: Relational Integration in the supply chain enhances the relationship with Information Integration

Operational integration allows for the free flow of internal and external communication, mutual understanding and cooperation among the parties involved, which is the building block for social supply chain initiatives. Organizations have started to incorporate green strategies at each level of the supply chain like maintaining healthy working conditions, looking into human right violations, fair compensation practices and cultural diversity (51). Social concern over non-compliance to the code of conduct and abiding by social standards are a priority for organizations, therefore modern supply chain practices focus on suppliers meeting ethical regulations and standards while operating in an integrated space with stakeholders. Hence different social priorities can be supported by the right supply chain practice through integration of stakeholders.

H₄: Information Integration in the supply chain enhances the relationship with Operational Integration

The adoption of sustainable supply chain management practices and integrated approaches by supply chain managers ensures economic and financial stability for the firm and proves to be profitable in the long run. Social sustainability dimension includes freight transportation planning, which reduces the negative impact of freight transportation. The organizations are able to capitalize on the benefits of operational integration which include speed of delivery, reduction in transactional cost, increase in profits and enhanced inventory turnover. Firms are also willing to integrate for operational performance which serves as a competitive capability. Several researchers have indicated that various performance capabilities such as quality, flexibility and control over cost are positively associated with supply chain integration (52). Wu et al. (53) have listed indicators such as cost, time,

quality, delivery and flexibility for measuring operational performance. Wu et al. (53) has suggested that operational indicators such as customer service, the ability to respond to the uncertainties in the market and so on should be included in the measurements of the supply chain.

H5: Operational integration enhances the relationship with social sustainable performance

The sustainable economic performance underscores the interdependence between a company's economic value and its ability to create value for society. Organizations oriented towards environmental issues are likely to encourage their partners and suppliers to adopt innovative practices, achieve efficiency through product design, waste reduction and recycling, and go for greener alternatives that save cost. Recent research has analyzed the sustainable supply chain practices leading to a green or environmentally friendly outcome, be it the purchase of raw materials or disposal of hazardous waste materials. Wu et al. (54) also has highlighted that process innovation and green product development and enhancement in environmental performance are possible only through supplier, customer and internal integration. Companies have found out methods to tap into renewable and recycled resources and they do not consume depleting resources. The integration process has given rise to environmental capabilities in the supply chain with clear policies and governance mechanisms, environmental management system, awareness and training programmes and reporting tools. Today, many organizations encourage the use of eco-friendly products and pollution-free production practices for sustainable operational performance. The push for sustainability and sustainability theory has inspired new practices such as reverse supply chain, return of products and environmentally friendly products. Researchers who have conducted studies on sustainable supply chain practices have discovered that the optimal use of energy in manufacturing would result in a decrease in carbon emissions and minimization of energy consumption.

H6: Operational integration enhances the relationship with economic sustainable performance

Operational integration refers to developing sustainable relationships with internal functional departments and supply chain partners. This integration enables the value chain to be operationally responsive to the internal and external environmental changes. Such coordination ensures seamless connectivity between the firms and suppliers by erasing the boundaries of operation. By carefully studying the value chain, it is found that several factors affect both the inbound logistics and the outbound performance (55). The value chain looks into every activity that adds value to commodities and services. The research focuses on the premise that organizations are not a mere random composition of machines, equipment, people and money, but rather when integrated into systematic activities, a cohesive unit would generate value for the customers. So, a complex highly integrated supply logistics activity connected with the firm's inbound and outbound performances emerges. The supply chain is able to take advantage by offering products at a lower price or by improving customer experiences at the same level of cost.

H7: Operational integration enhances the relationship with environmental sustainable performance

Operational integration is a strategic approach that optimizes the coordination and alignment of various processes within a company's value chain. By seamlessly connecting activities such as procurement, production, distribution, and customer service, operational integration enhances the overall efficiency and effectiveness of the value chain. This, in turn, positively impacts value chain performance (56). When operations are harmonized and synchronized, it leads to cost reductions, shorter lead times, improved quality, and greater customer satisfaction. Ultimately, this synergy between operational integration and value chain performance enables organizations to gain a competitive edge in the market, foster customer loyalty, and achieve sustainable success.

H8: Operational integration enhances the relationship with value chain performance

Chain Performance is achieved by promoting seamless coordination and collaboration across an organization's numerous functional divisions.

According to a recent study by Robertstone et al. (57), integrated operational procedures significantly contribute to better efficiency and effectiveness across the value chain. When several departments, such as manufacturing, logistics, and marketing, collaborate, it results in improved processes, decreased bottlenecks, and faster response times to market changes. Organisations can use this integration to optimise resource utilisation, reduce costs, and ultimately improve overall value chain performance. Operational integration fosters better communication and information sharing, allowing for a more holistic understanding of the entire value chain, which is critical for strategic decision-making and achieving a competitive advantage in today's dynamic business environment.

Sustainability is measured and assessed while taking social and environmental factors into account

Sustainability measurement and assessment involve evaluating the impact of activities, processes, and organizations on both the environment and society. The goal is to ensure that economic, social, and environmental considerations are integrated into decision-making processes. Measuring sustainability involves a combination of qualitative and quantitative indicators to assess performance. The economic, social, and environmental factors that need to be incorporated into the performance goals of supply chain management as a whole are often referred to as the triple bottom line (TBL). For this reason, the SC's management of social and environmental issues, or SSCM, has received a lot more attention lately (58). The effects of corporate activities on economic systems are covered within the economic line of TBL. The organization's capacity to add economic value to the domestic or global economy is the key focus, as this helps ensure that future generations can continue to expand economically and survive financially. The ability of an organization to perform fair business practices for labor, human capital, and the community is referred to as the social line. To put it simply, it refers to "giving back" to the community by actions like raising wages and offering health insurance. The third TBL line, environmental, speaks about how successful organizations are in ensuring that access to environmental resources for future

generations is not jeopardized. It speaks about using energy sustainably and efficiently, cutting emissions, and minimizing the carbon footprint. Supply chain performance was formerly measured primarily in terms of costs, time, and accuracy using financial metrics. Firms are compelled to adhere to environmental and social responsibility due to heightened scrutiny from stakeholders and customers.

Real-World examples:

The Better Cotton Initiative (BCI):

- Cooperation Overview: The Better Cotton Initiative is a global partnership involving stakeholders from the entire cotton supply chain. It aims to promote more sustainable cotton farming practices, focusing on environmental, social, and economic aspects.
- Critical Success Elements:
 - Multi-Stakeholder Collaboration: Involvement of farmers, manufacturers, retailers, and NGOs ensures a holistic approach.
 - Standards and Certification: Establishing and adhering to standards for sustainable practices and providing certification adds credibility.
- Obstacles:
 - Adoption Challenges: Convincing all actors in the supply chain to adopt sustainable practices can be challenging.
 - Monitoring and Compliance: Ensuring that the agreed-upon standards are consistently met across the supply chain requires robust monitoring mechanisms (bettercotton.org).
 - Nike's Sustainable Materials Coalition:
- Cooperation Overview: Nike collaborates with suppliers, manufacturers, and other industry stakeholders through the Sustainable Apparel Coalition. This coalition focuses on improving sustainability in materials used in apparel and footwear.
- Critical Success Elements:
 - Innovation and Research: Investing in research for sustainable materials and manufacturing processes.
 - Transparency and Communication: Openly sharing information about sustainability efforts helps build trust.

- **Obstacles:**
 - **Cost Implications:** Sustainable materials and processes can initially be more expensive.
 - **Supply Chain Complexity:** Managing sustainability across a global supply chain with various partners requires coordination (59).

In general, the textiles industry has seen several examples of supply chain cooperation leading to sustainable growth. One notable case involves the Sustainable Apparel Coalition (SAC), a collaborative effort among brands, retailers, manufacturers, and NGOs in the apparel and footwear industry. The SAC has developed the Higg Index, a suite of tools that enables organizations to measure and score the sustainability performance of their products and facilities. This initiative emphasizes transparency and cooperation across the supply chain, encouraging companies to work together to address environmental and social issues.

Critical success elements and obstacles in the textiles industry

1. Critical Success Elements:

- **Collaborative Innovation:** Encourage joint research and development efforts to create and adopt sustainable materials and technologies.
- **Transparency and Traceability:** Implement systems to trace the origin of materials, providing transparency and accountability (60).
- **Education and Training:** Invest in educating all stakeholders on the benefits of sustainable practices and how to implement them effectively.
- **Transparency and Information Sharing:** Successful supply chain cooperation in the textiles industry often requires a high level of transparency and information sharing among stakeholders. This includes sharing data on production processes, materials sourcing, and environmental impact.
- **Standardization of Sustainability Metrics:** The development and adoption of standardized metrics, such as the Higg Index in the case of SAC, provide a common language for industry players to assess and communicate their

sustainability efforts. This standardization helps in benchmarking and setting shared goals.

- **Supplier Engagement:** Engaging with suppliers is crucial for promoting sustainability throughout the supply chain. Companies need to work closely with their suppliers to ensure compliance with sustainable practices and to encourage continuous improvement.

2. Obstacles

- **Cost Pressures:** The textiles industry often faces tight profit margins, making it challenging to invest in sustainable practices without increasing product costs.
- **Regulatory Compliance:** Adhering to various international and local regulations related to sustainability can be complex and costly.
- **Resistance to Change:** Some stakeholders may resist adopting new, sustainable practices due to a reluctance to change or lack of awareness.
- **Cost Considerations:** Implementing sustainable practices can sometimes come with additional costs. Companies may face resistance if they perceive these practices as a financial burden. Finding ways to make sustainability financially viable is a common challenge.
- **Lack of Industry-wide Standards:** While standardization is a critical success element, the lack of universally accepted sustainability standards in the textiles industry can hinder collaboration. Different companies may have different criteria for what constitutes sustainable practices.
- **Complex Supply Chains:** The textiles industry often has complex and globalized supply chains, making it challenging to trace and monitor every step of the production process. Achieving transparency in such intricate supply chains can be a significant obstacle.
- **Short-term Focus:** Some companies may prioritize short-term profits over long-term sustainability goals. This can create tensions within the supply chain, particularly when different stakeholders have different time horizons for return on investment.

These critical success elements and obstacles highlight the complexity of achieving sustainable growth through supply chain cooperation in the

textiles industry. Successful cases often involve a commitment to long-term goals, collaboration, and a recognition of the interconnectedness of various industry players.

Methodology

Instrument Development

A structured questionnaire was used for data collection to give a comprehensive approach to the research. The instrument to measure the independent variables Joint Decision Making, Knowledge Exchange, Strategic Planning, Collaborative Commitment, Relationship Orientation, Goal Congruence, Internal Integration, Technology Integration, Operational Flexibility, Sustainable Supply Chain Engagement, Organizational Trust, Collaborative Culture, Information Integration, Operational Integration, Relational Integration were adopted from existing studies. Whereas scales to measure dependent variables Social Sustainability, Economic Sustainability, Environmental sustainability and Value Chain Performance were adopted with minor changes. The research instrument was prepared in the English language and converted to the native Tamil language in order to facilitate better understanding for the respondents.

Sample

The primary data were collected from apparel manufacturing firms, fabric manufacturers, ginning factories, knitting and weaving units registered under Indian Texpreneurs Federation (ITF). The research considered all the 448 garment manufacturing companies and allied industries registered with the ITF, out of which only 402 responded. The sampling frame includes 48 Ginning Mill, 149 Spinning Mill, 67 Weaving Unit, 54 Knitting Unit, 56 Fabric Manufacturers and 28 Garment Manufacturing Units which totals to 402.

Following the purification of the constructs, a post hoc calculation is performed to determine the sample's net power.

F tests - Multiple Regression: Omnibus (R^2 deviation from zero)

Analysis: Post hoc: Compute achieved power

Input: Effect size f^2

= 0.15

α err prob

= 0.05

Total sample size

= 402

Number of predictors

= 6

Output: Non-centrality parameter λ

= 60.300000

Critical F

= 2.121538

Numerator df

= 6

Denominator df

= 395

Power (1- β err prob)

= 0.999998

The effect size shows the precision of the sample size for the research. Since the research is in the area of social science, the effect size is fixed at 0.15 which is a medium level. Pertaining to the research although the medium effect size is observable to the naked eye the level of collaboration within the supply chain partners are unknown. Going by the golden rule by Cohen's guidelines the above effect size has been fixed at 0.15. The value describes the significance level and is at 5% level of significance. Using the combination of responses from 402 respondents and 6 independent constructs, the power of the test is obtained to be 0.99. This clearly indicates that the theory would be true 99% of the time and the sample size of 402 respondents is sufficient to prove this theory.

Reliability of constructs and instrument purification

The reliability value for certain constructs is found to be low and these constructs are removed. Despite having low-reliability scores, the constructs of Joint Decision Making and Knowledge exchange are significant. As a result, both constructs are retained due to their importance in prior research, because supply chain research is practice-based research and each firm applies its own strategies and so Cronbach's alpha values tend to be lower than behavioral research.

A wide range of different qualitative descriptors was used to interpret alpha values calculated. These descriptors are reported with the range representing the highest and lowest values labelled that way in articles surveyed. So, alpha

values were described as excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust (0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70–0.77), slightly low (0.68), reasonable (0.67–0.87),

adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55) and low (0.11) (Keith et al., 2018).

Table 1: Reliability of constructs and instrument purification

Construct Name	Reliability of Constructs (before purification)	Reliability of Constructs (after purification)
Joint Decision Making	0.419	0.45
Knowledge exchange	0.470	0.49
Strategic Planning	0.666	0.69
Relationship orientation	0.857	0.86
Internal integration	0.769	0.77
Operational flexibility	0.683	0.68
Sustainable supply chain engagement	0.701	0.70
Organizational Trust	0.486	0.65
Collaborative culture	0.590	0.62
Information integration	0.744	0.74
Relational Integration	0.738	0.74
Social sustainability	0.720	0.72
Economic Sustainability	0.846	0.85
Environmental Sustainability	0.633	0.71
Value chain Performance	0.615	0.62

Results and Discussion

Multiple regression analysis is carried out using Warp PLS and the result after testing the conceptual model has been displayed in Figure 2, which displays the effect of the collective interaction of the independent latent variables such as Intra-organization collaboration, sustainable supply chain engagement, relational integration, information integration, operational integration on social sustainable performance, economic sustainability, environmental sustainability and value chain performance.

H₁: Intra-organization collaboration enhances the relationship with sustainable supply chain engagement with partners

While analysing the influence of intra-organization collaboration on sustainable supply chain engagement, the output of the analysis shows a $p < 0.01$ and a $\beta = 0.28$. The relationship is significant, therefore hypothesis 1 is accepted and there exists a significant positive influence between intra-organization collaboration and sustainable supply chain engagement.

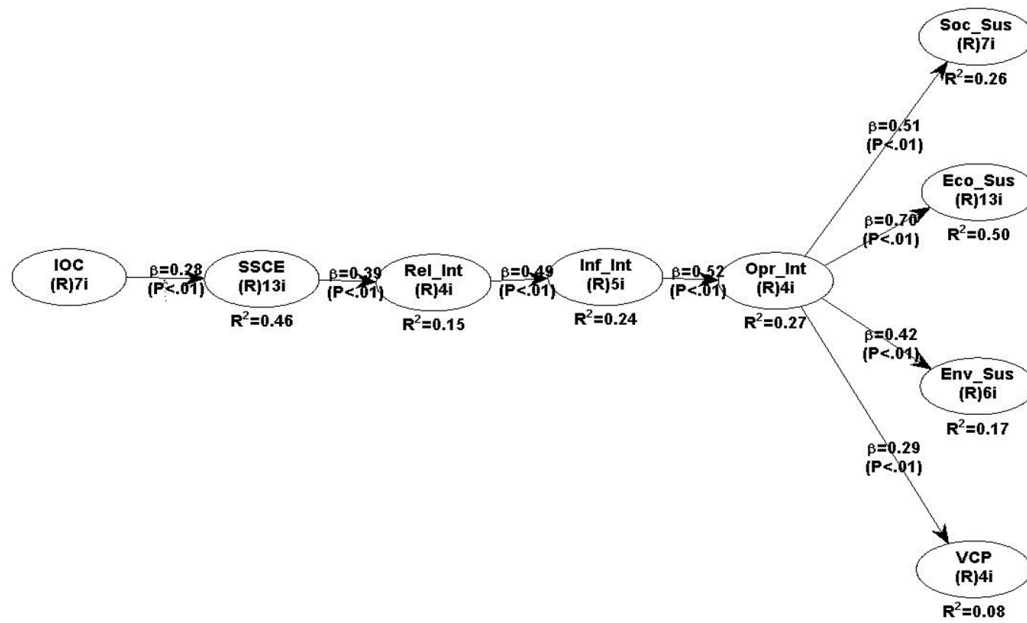


Figure 2: Hypotheses test of latent variables

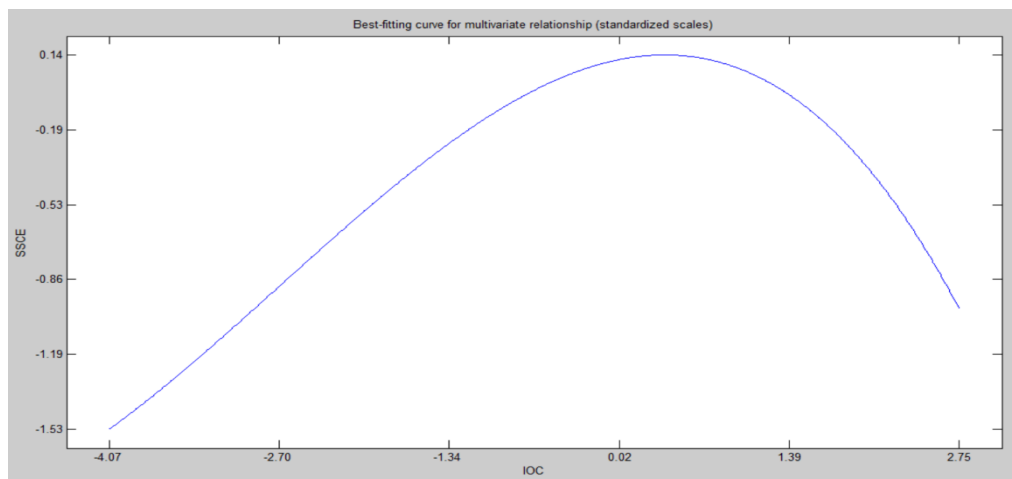


Figure 3: Best fit curve for the relationship between intra-organizational collaboration and sustainable supply chain engagement

From the Figure 3, it can be seen that the increase in the intra-organizational collaboration leads to the increase in sustainable supply chain engagement. The intra-organizational collaboration reaches the average point and the curve seems to decline proving that in the long run intra-organizational collaboration requires another variable to trigger an increase in sustainable supply chain engagement.

H₂: Sustainable supply chain engagement enhances the relationship with relational integration

While analysing the influence of sustainable supply chain engagement on relational integration from Figure 4, $p < 0.01$ and are

observed $\beta = 0.39$. The relationship is significant, therefore hypothesis 3 is accepted proving that there exist significant positive influence between sustainable supply chain engagement and relational integration. The regression co-efficient $R^2 = 0.15$ shows that the sustainable supply chain engagement impacts relational integration by about 15%.

The figure 4 reveals that the increase in sustainable supply chain engagement would improve relational integration, but that engagement has to be sustainable at the long run.

H₃: Relational integration in the supply chain enhances the relationship with information integration

On analysing the influence of relational integration on information integration it can be observed that the output of the analysis shows a $p < 0.01$ and a $\beta = 0.49$. The relationship is significant, therefore hypothesis 3 is accepted ensuring that there exist significant positive

influence between relational integration and information integration. The regression coefficient $R^2 = 0.24$ shows that relational integration influences information integration by about 24%.

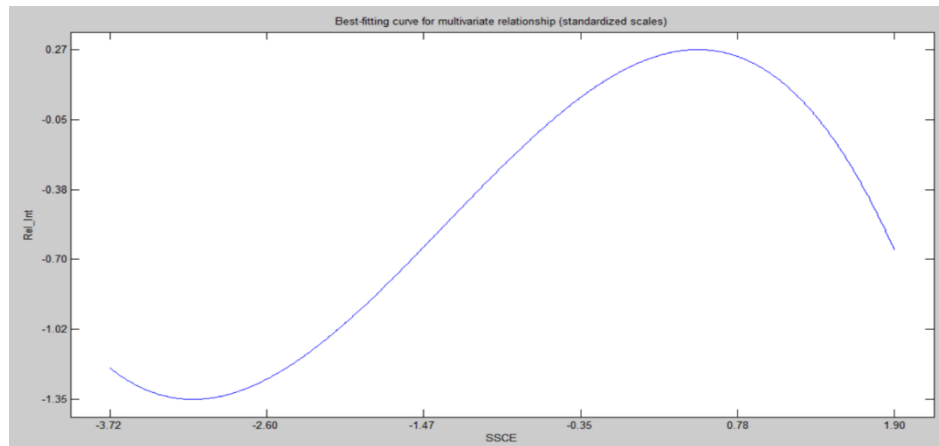


Figure 4: Best fit curve for the relationship between sustainable supply chain engagement and relational integrating

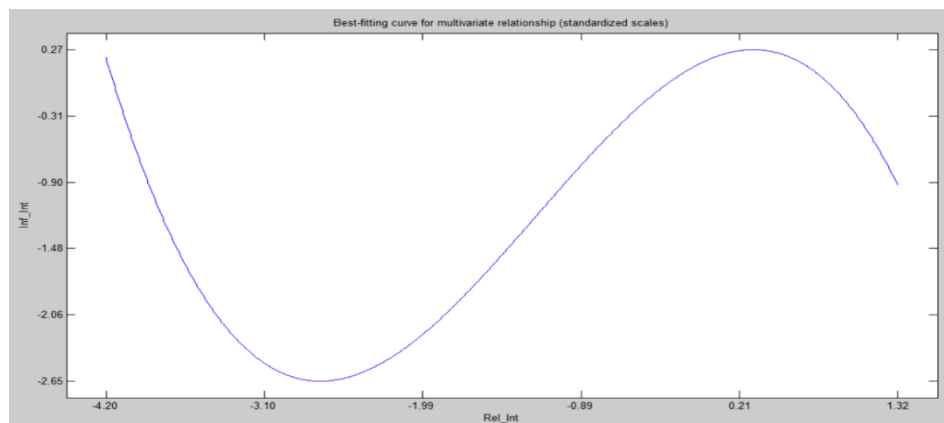


Figure 5: Best fit curve for relationship between relational integrating and information integration

The above figure shows the relationship between relational integration and information integration. The curve seems to show a cyclical flow. This shows that though there is high information integration in the supply chain for information to flow regarding certain key and critical matters, the relationship has to be built extensively as revealed by the increase in the relational integration and the subsequent increase in information integration.

H₄: Information integration in the supply chain enhances the relationship with operational integration

On analysing the influence of information integration on operational integration, it can be observed that $p < 0.01$ and a $\beta = 0.52$. The relationship is significant, therefore hypothesis 4 is accepted and there exists significant positive influence between information integration and operational integration. The regression coefficient $R^2 = 0.27$ shows that the information integration influences operational integration by about 27%.

There appears to be a high operational integration between the supply chain partners, but at the long run, it tends to decline and with the efforts taken

for streamlining information flow and creating centralized information databases and new technology to capture data, information integration improves which, in turn, once again improves operational integration within the supply chain.

H₅: Operational integration enhances the relationship with social sustainable performance

On analysing the influence of operational integration on social sustainable performance from figure 7, it can be observed that $p < 0.01$ and $\beta = 0.51$. As the relationship is significant, hypothesis 5 is accepted ensuring that there exist significant positive influence between operational integration and social sustainable performance. The regression co-efficient $R^2 = 0.26$ which shows that the operational integration influences social sustainable performance about 26%.

From the above diagram it can be seen that the increase in the operational integration leads to the increase in social sustainable performance.

H₆: Operational integration enhances the relationship with economic sustainable performance

On analysing the influence of operational integration on economic sustainable performance from figure 8, it can be observed that $p < 0.01$ and $\beta = 0.70$. The relationship is significant, therefore hypothesis 6 is accepted ensuring that there exists significant positive influence between operational integration and economic sustainable performance. The regression co-efficient $R^2 = 0.50$ which shows that the operational integration influences the economic sustainable performance by 50%.

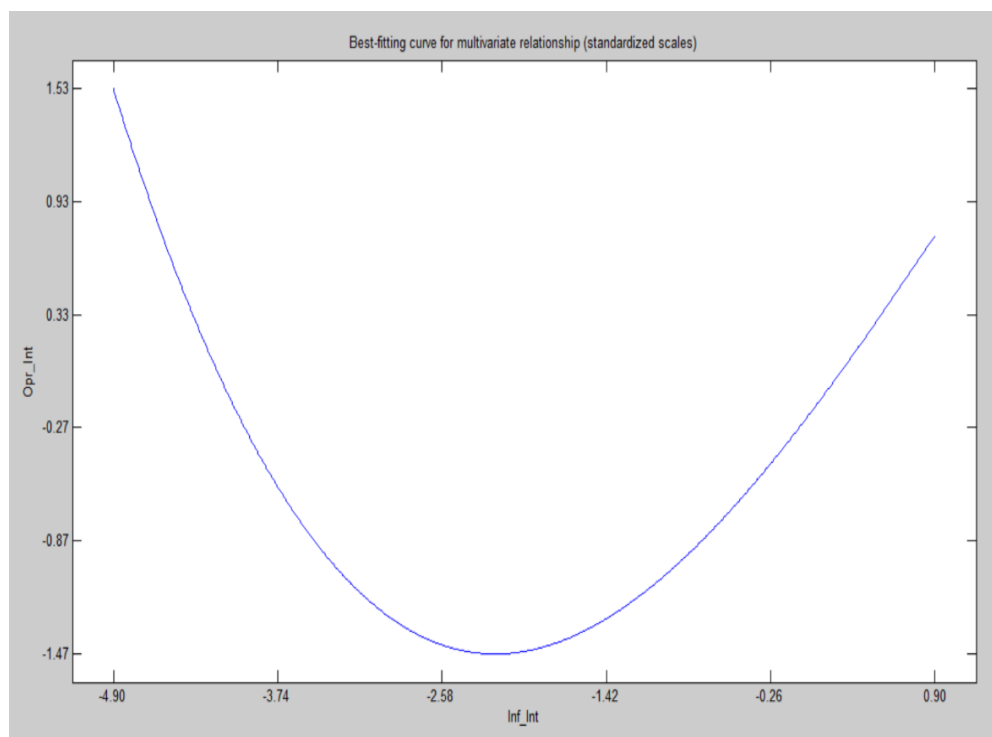


Figure 6: Best fit curve for relationship between information integrating and operational integration

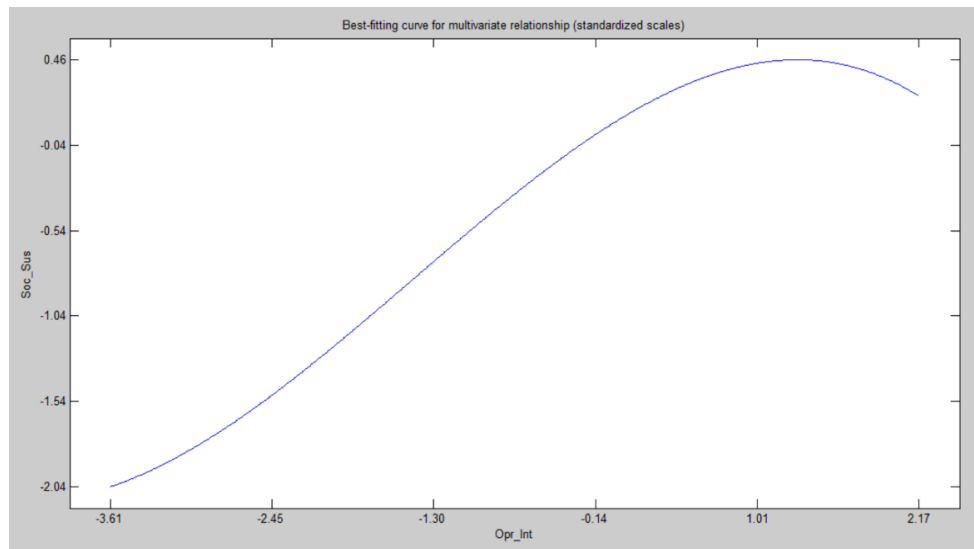


Figure 7: Best fit curve for the relationship between operational integration and social sustainable performance

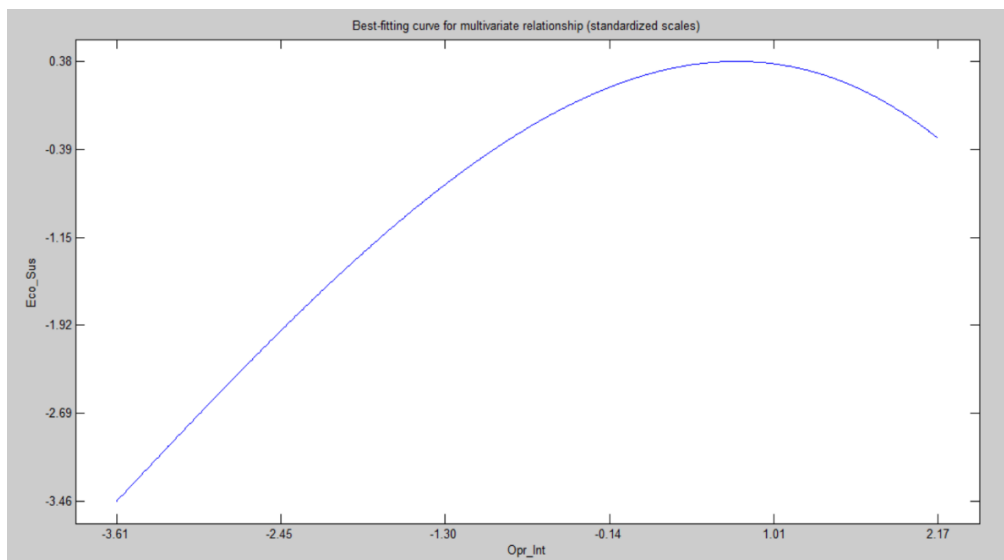


Figure 8: Best fit curve for relationship between operational integration and economic sustainable performance

From the above figure, it can be seen that the increase in operational integration leads to the increase in economic sustainable performance.

H7: Operational integration enhances the relationship with environmental sustainable performance

Figure 9 represents the influence of operational integration on environmental sustainable performance $p < 0.01$ and a path coefficient $\beta = 0.42$.

The relationship is significant, therefore hypothesis 7 is accepted and there exists a significant positive influence between operational integration and environmental sustainable performance. The regression coefficient $R^2 = 0.17$ shows that the operational integration influences the environmental sustainable performance by 17%.

From the figure 9, it can be seen that consciousness towards environment, pollution and wastage seems to decline over time, but careful operational integration ensures better environmental sustainability in the supply chain.

H₈: Operational integration enhances the relationship with value chain performance

On analysing the influence of operational integration on the performance of value chain from Figure 10, it can be observed that $p < 0.01$ and the path coefficient $\beta = 0.29$. Thus the

relationship is significant, therefore hypothesis 8 is accepted and there exists significant positive influence between operational integration and value chain performance. The regression coefficient $R^2 = 0.08$ shows that the operational integration influences the environmental sustainable performance by 8%.

The above figure shows that when there is greater integration in terms of operational capability, resources and database, there seems to be a constant increase in the value chain performance.

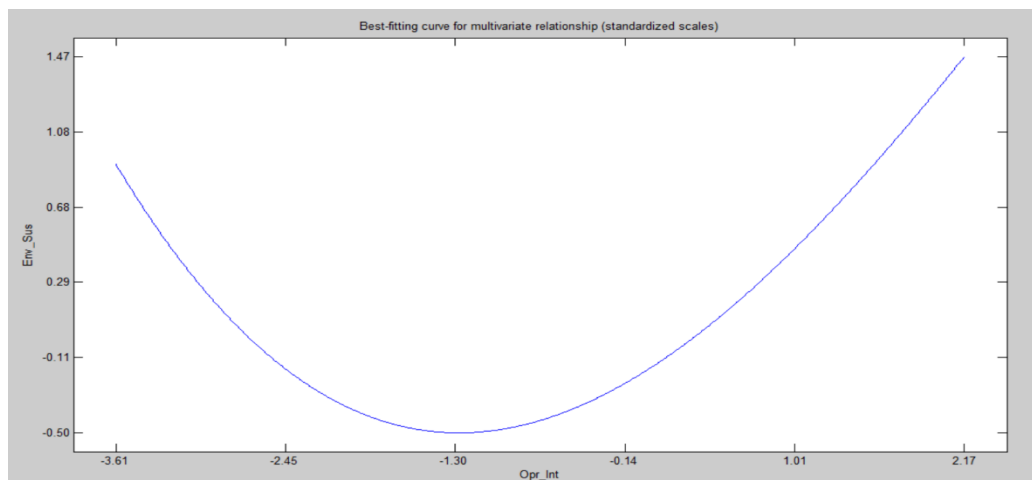


Figure 9: 4Best fit curve for relationship between operational integration and environmental sustainable performance

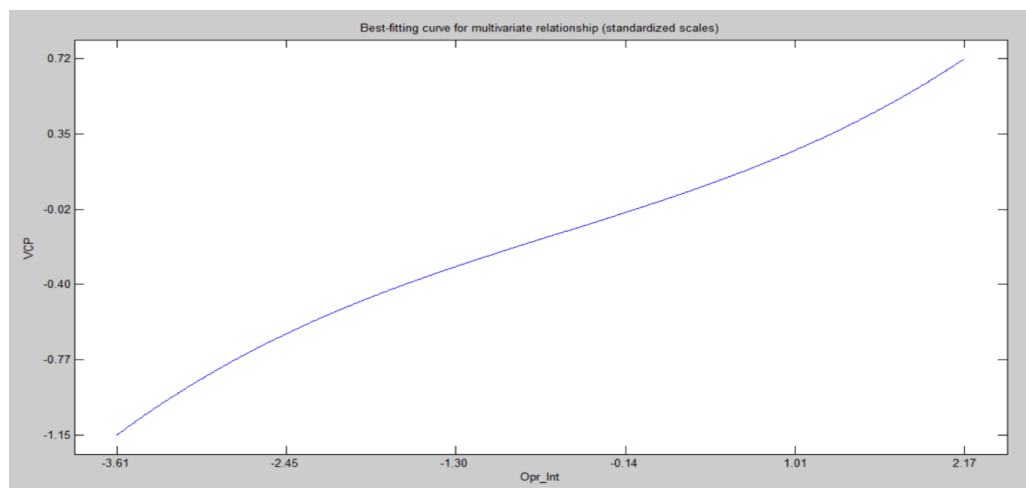


Figure 10: 1Best fit curve for relationship between operational integration and environmental sustainable performance

Implications

Companies can fit this model in their distribution channel and check for the degree of sustainability of their supply chain management. Weak links in

collaborative spheres can be identified and dealt with. Organizations need to understand the importance of supply chain collaboration and

include it into their company's mission and vision as well as their corporate culture. Firms, in order to develop trust between partners, need to focus on setting down standard guidelines and protocols to be followed by all the players in a supply chain. This would reduce the chances of error and accusations as the system defines the responsibility areas of each supply chain player clearly, which inculcates responsible behaviour. This helps in building trust and further encourages supply chain partners in adapting effective collaboration.

The current study includes all the players prevailing in a garment supply chain from the start to the end. Thus, the results of the study, which aims to measure the impact of collaborative integration within a supply chain leading sustainable supply chain management dynamics, can be used by all the players in order to reduce bottlenecks and further strengthen their relationship with their dealers, agents, suppliers and third party supply chain agents irrespective of their position in the supply chain. The insights gained from the study would come handy to the management of any organization in the framing and implementation of their strategic policy decisions as they emphasize the organizational benefits that arise out of sustainable supply chain engagement through effective collaboration. The study can aid legislators and government regulatory agencies in developing laws to loosen stringent procedures by illustrating the critical nature of supply chain integration during times of economic turmoil. The same dimensions of the study can be applied across other sectors in addition to the garment and spinning sector in order to measure the current practices in existence and to refine the collaboration process in order to create and set up sustainable supply chain management practices. The study also can be made in the context of the northern regions of India and attempt to record and explain the cultural differences arising in the results.

Limitations and scope for further study

The study has measured effectiveness only in the cloth manufacturing industry. The same model has to be subjected to further scrutiny when generalized across other sectors. The sample population elements have been drawn

from the register of International Textpreneurs Federation (ITF) of Tamil Nadu. While the sample is fairly descriptive of the population belonging to the garment and textile businesses in Tamil Nadu, it restricts itself only to the region of Tamil Nadu. Opinions of players from the other states could have been considered. External factors that contribute to collaboration and integration within a supply chain have not been focused, upon rather the focus is the intra-organizational practices that assist in collaboration. While this study looks into vertical collaboration between layers in the garment supply chain, it fails to consider the effects arising from horizontal collaboration between each independent layer of the supply chain.

Since there is a considerable focus on the forward supply chain in this study, further research can be conducted on backward supply chain processes and the influence of collaborative culture on backward supply chain. There is a huge market of secondary supply chain that awaits a similar study. Intra-Organizational collaboration that could evolve as a result of forward and backward integration in an organization's supply chain could be hypothesized. Optimum velocity of the flow of material, money and information that arises out of effective collaboration can further be focused on. The vast scope of collaboration between the vendors and the logistic partners who are important facilitators of supply chain performance could be researched upon.

Conclusion

Despite the abundance of literature on supply chain collaboration, there is still a need for deeper knowledge of the topic and examination of its numerous dimensions and results in a variety of scenarios. In the context of the garment business, the present research has demonstrated that building collaborative relationships not only helps both buyers and suppliers but also results in more sustainable industry practices. In terms of intra-organizational collaboration, management in garment manufacturing organisations places a premium on collaborative decision making. The sharing of knowledge among enterprises in the supply chain network has been demonstrated to be credible. Further, collaboration has resulted in improvements to products, processes and operational capabilities. The comprehensive

model proposed and tested demonstrates that intra-organizational collaboration contributes positively to relational integration, information integration and operational integration, all of which serve as the building blocks for the sustainable growth and performance of value chain.

Abbreviations

Nil

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Author contributions

Each author's contribution to the manuscript is as follows: Dr. Suganya G has significantly contributed the introduction, theoretical framework and literature review for the research. Questionnaire preparation, research survey and research design conducted by Dr. Joshua Selvakumar. Further, analysis, results and discussion was done by Dr. Sathish Pachiyappan. All authors have read and approved the final version of the manuscript.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. We confirm that the research was conducted with utmost integrity and without any undue influence.

Ethics approval

This research adhered to ethical guidelines and prepared the manuscript as per the journal requirements.

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