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Sundus Chishti, Salma Ahmed

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# Managing a green supply chain: role of communication, collaboration, learning and trust

Sundus Chishti* and Salma Ahmed

Department of Business Administration,
Faculty of Management Studies and Research,
Aligarh Muslim University,
Aligarh, India
Email: sunduschishti@gmail.com
Email: salmaahmed6@rediffmail.com
*Corresponding author

**Abstract:** The study reveals that how the interplay of human dimensions – communication, collaboration, learning and trust, helps in managing a green supply chain. The study is based on primary data as well as secondary data. Primary data was collected by interviewing supply chain experts in academia and industry. Secondary data has been collected from various case studies and surveys. The study revealed the importance of communication, collaboration, learning, and trust in managing a green supply chain. Communication coupled with collaboration imparts learning, skill development among supply chain members. Frequent communication among supply chain members and collaborative initiatives fosters the inter-organisational relationships which impart trust in the relationships. When the various firms trust each other, they work together towards a common goal that creates positive outcomes. Supply chain managers need to develop a long-term relationship with other stakeholders to manage a green supply chain.

**Keywords:** green supply chain management; GSCM; communication; collaboration; learning; trust; sustainability.

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**Biographical notes:** Sundus Chishti is currently a PhD student at Department of Business Administration, Faculty of Management Studies and Research, Aligarh Muslim University (AMU), Aligarh. She is pursuing research in the area of supply chain management. Her research interests include supply chain management, human resource management, green supply chain management and organisational behaviour. She obtained her Masters of Business Administration from Aligarh Muslim University. She obtained her Bachelors in Psychology (Hons.) from AMU.

Salma Ahmed is currently a Professor at Department of Business Administration, Aligarh Muslim University, Aligarh. She has received her PhD and MBA. Her area of interests includes supply chain management, knowledge management and information systems. She has published over 60 papers and attended and presented papers in more than 40 conferences both at national and international platform. She has also authored a book entitled *How to Write and Analyse Cases* which was formally released in New Delhi in 2011. She has also conducted faculty development program on case writing and analysis.

## 1 Introduction

Sustainable development has become an issue of focal importance in governance of countries (Ghafourian and Shirouyehzad, 2019). Due to growing industrialisation, management of environment has become a concern for businesses, governments and consumers as well (Kurian et al., 2018). There is an increased demand for energy consumption due to modernisation (Ali et al., 2018). The fact that the resources are limited and the demands of humankind are unlimited draws the attention of people towards sustainable development. There is a risk of not only diminishing resources but also destruction of earth's natural system. Green supply chain management (GSCM), which has started attracting the attention of organisations is seen as a possible solution to tackle this issue (Ali et al., 2018). GSCM has been defined as 'monitoring and improving environmental performance of the supply chain' (H'Mida and Lakhal, 2007). Inclusion of green practices in the supply chain and paying closer attention to environmental concerns has become an increasingly important topic in industry and academia (Asif et al., 2020). There are numerous reasons of implementation of GSCM practices by manufacturing firms such as pressure from government regulations, customer requirements, genuine concern for environment be concerned about the environment and opportunity for cost saving from GSCM practices (Liu et al., 2020).

Researches done in field of green supply chains have emphasised on the adoption of green technology. Some of the work done include product life extension (Linton and Jayaram, 2005), developing processes having low carbon production (Seo et al., 2015; Shi et al., 2011), developing green practices to create less pollutants in shipping industry (Lai et al., 2011), development of waste treatment technology (Lee et al., 2012; Yuan et al., 2011), developing methods of recycling (Coelho et al., 2011; Hsu et al., 2012; Steuer et al., 2017). Researches have also focused on development of green products. Environmental principles are considered in the design and manufacturing of such products. Recycling strategies are incorporated into the design phase of the products, products are often produced with recycled materials and that use fewer toxic materials (Chen and Chai, 2010). Some studies focused on designing products for disassembly at the end of its life cycle (Khor and Udin, 2013) and development of sensor embedded products (Ilgin and Gupta, 2011). Other researchers employed eco-design tools and eco-cycle principles (Martinho et al., 2015) to design a green product. Zhang et al. (2018) discussed energy efficiency and Peng et al. (2018) focused on the energy-related $CO_2$ emissions.

An organisation alone cannot manage its entire supply chain. It needs to work with other supply chain members. Researches have focused on the technical aspects of the supply chain. Studies have emphasised on the adoption of new technology that has a less environmental impact. The literature on sustainable development lacks the role of the human dimension in carrying a shift from supply chain management to GSCM. This study fills the research gap by highlighting the importance of the human dimensions in the integration of sustainability into supply chain management. The human dimensions considered for the study includes communication, collaboration, learning and trust. The study reveals that how the interplay of these four dimensions help in managing green supply chains.

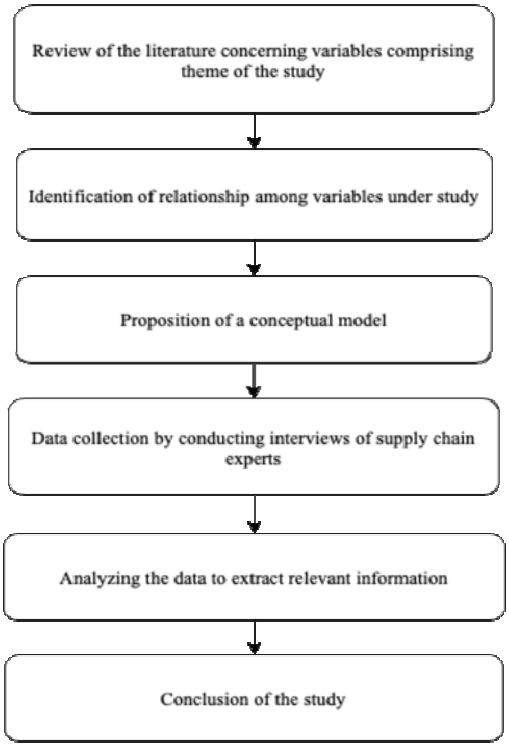
## 2 Research methodology

The objective of the study is to study the role of human dimensions in GSCM. This is broken into sub objectives which are listed below:

- to study the role of communication in GSCM
- to study the role of collaboration in GSCM
- to study the role of learning in GSCM
- to study the role of trust in GSCM.

The methodology suggested by Vivaldini and Pires (2016) has been adopted for the study. The research has been organised as follows:

**Figure 1** Flowchart showing organisation of research




The study is based on review of the literature concerning variables comprising theme of the study. Based on the review, relationships among the study variables have been identified and a conceptual model has been proposed. Further, a survey was conducted to supplement the findings from the review. Study is exploratory in nature based on primary and secondary data. Secondary data was collected by analysing past studies involving surveys and case studies. Multiple case studies and surveys were analysed as they provide a deeper a deeper understanding of the phenomenon (Huberman and Miles, 1994; Yin, 1994). Analysis of case studies facilitates the development of a rich theoretical

framework (Ellram, 1996). Primary data was collected by interviewing supply chain experts in academia and industry. The interview method helps in incorporating the expert opinion in the analysis to supplement the findings from other sources 13 experts were selected for the interview on the basis of convenience sampling. Out of 13 experts, and seven were associated with academia and six were associated it industry. The interview was based on structured open-ended questionnaire. The interview was recorded and analysed later to extract relevant information pertaining to research objectives.

The scope of the study is defined in terms of respondents, sector, geography and variables. The study confines itself to supply chain managers in industry and academicians in management institutes. The study is limited to India but carried on a pan India basis. Its scope is limited to four variables only they being communication, collaboration, learning and trust as elements of human dimension.

The study is not conducted in a specific sector. Instead, case studies and surveys from diverse sectors have been selected. The study has been limited to the environmental aspect of sustainability.

## 3 Development of conceptual model

### *3.1 Role of communication in GSCM*

Lack of communication across a supply chain acts as a barrier in the implementation of green practices (Lamming and Hampson, 1996). Projects related to green practices fail because the goals of the project are not communicated properly to all the stakeholders across a supply chain (Carter and Dresner, 2001). Projects concerning green practices that have been successful were characterised by frequent communication among its stakeholders across the supply chain. Such initiatives require inputs from various functional areas as well as various stakeholders which is possible through effective communication across various functional areas as well as across a supply chain (Handfield et al., 1997). There is a need to make improvements in the process of communication among all the stakeholders in a supply chain. Multi-directional communication should be encouraged. The stakeholders need to be educated about the principles and implications of sustainability. Mechanisms need to be developed that support communication among various stakeholders which would help in relationship development among the stakeholders. Communication is important for supporting green projects such as product stewardship because all the members need to their role clearly for the success of the project (Seuring et al., 2008). Universitat Auto' noma de Barcelona (UAB) started a promotional campaign to communicate the importance of green office material which included stationery items to its suppliers. It distributed posters promoting green office materials to its buyers (Bala et al., 2008). IKEA successfully integrated sustainability principles into its supply chain management practices. IKEA's way of doing business sustainably is termed as IWAY. The entire way of doing business sustainably as part of IWAY was communicated to all the workers, suppliers as well as the sub-suppliers to ensure compliance from them (Laurin and Fantazy, 2017). In a study of sustainable supply chain management practices in Canadian firms, corporate experts interviewed revealed that it is not possible to integrate sustainability principles unless all the stakeholders in a supply chain understand what it is. Communication is important for educating them about the best practices and sustainability principles (Morali and Searcy,

2013). Efficient communication strengthens buyer and supplier relationships, increase the flow of supply chain capital and mitigate uncertainty for implementation of green practices (Lu et al., 2018). Communication about the environmental concerns and 'greener' requirements of the final product is essential. Cooperation with suppliers, providing design specifications and sharing and informing suppliers about benefits of cleaner production will help in designing products with biodegradable material and will lead to environmental improvement of supply chains (Ali et al., 2018).

**Table 1** Studies showing relationship between communication and GSCM

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Carter and Dresner (2001) | 'Purchasing's role in environmental management: cross-functional development of grounded theory' | 'Lack of communication is a barrier in green projects' |
| Handfield et al. (1997) | 'Green value chain practices in the furniture industry' | 'Successful green projects are characterised by frequent communication' |
| Seuring et al. (2008) | 'Sustainability and supply chain management–an introduction to the special issue' | 'Communication is important for supporting green projects' |
| Laurin and Fantazy (2017) | 'Sustainable supply chain management: a case study at IKEA' | 'Communication to workers regarding sustainability is important to ensure compliance from them' |
| Paulraj et al. (2008) | 'Inter-organisational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer–supplier relationships' | 'Communication across a supply chain contributes to learning' |
| Bala et al. (2008) | 'Experiences with greening suppliers. The universitat autonoma de Barcelona' | 'Communication is important for promoting importance of green materials' |
| Morali and Searcy (2013) | 'A review of sustainable supply chain management practices in Canada' | 'Communication is important for educating people about sustainability principles' |
| Lu et al. (2018) | 'Exploring sustainable supply chain management: a social network perspective' | 'Communication mitigates uncertainty for SCM implementation' |
| Ali et al. (2018) | 'An assessment of green supply chain framework in Indian automobile industry using interpretive structural modelling and its validation using MICMAC analysis' | 'Communication about environmental concerns and greener requirements will lead to environmental improvement of supply chain' |

## *3.2 Role of collaboration in GSCM*

Collaboration includes creating platforms where various stakeholders can share information as well as best practices for better decision making and business performance (Morali and Searcy, 2013). Collaboration is important for collective problem-solving. It enables complex problem solving that a firm cannot solve alone (van Hoof and Thiell, 2014). Collaboration is important in a supply chain as the system in which you are

working is too complicated. It requires various types of skills and expertise which is possible when various stakeholders work with each other (Prokesch, 2010). Collaboration with suppliers enables achieving improvements in environmental performance while maintaining product quality and cost goals (Geffen and Rothenberg, 2000). Esquel, the world's leading cotton shirt firm collaborated with its supplier farmers to integrate sustainability into its business. They introduced the farmers to new farming techniques such as drip irrigation that saves water. They established natural disease and pest control programs to reduce the use of pesticides. Esquel also partnered with the banks to provide microfinancing to their suppliers to enable them to invest in new technology. Thus, collaboration in a supply chain led to the production of cotton in an environment-friendly manner (Lee, 2010). UAB collaborated with its suppliers to start campaigns related to environmental issues, provide them with rebates, grants, premiums, providing free samples of green products to encourage 'green behaviour' among its suppliers as well as customers (Bala et al., 2008). Posco collaborated with its supplier Siemens VAI and came up with a sustainable technology: Finex steelmaking process. It helped in reducing carbon emissions, producing fewer greenhouse gases and other pollutants (Lee, 2010). Collaboration between organisations and their suppliers is critical to effective implementation of green practices along the supply chain as they can monitor the performance of their suppliers. Collaborations among the various entities of supply chain will lead to development of common goal of process improvement (Asif et al., 2020). Environmental collaboration with the supplier has a direct impact on improvement of environmental performance (Li et al., 2020)

**Table 2** Studies showing relationship between collaboration and GSCM

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Morali and Searcy (2013) | 'A review of sustainable supply chain management practices in Canada' | 'Collaboration improves business performance' |
| van Hoof and Thiell (2014) | 'Collaboration capacity for sustainable supply chain management: small and medium-sized enterprises in Mexico' | 'Collaboration helps in complex problem solving' |
| Grant (1996) | 'Prospering in dynamically-competitive environments: organisational capability as knowledge integration' | 'Firms across a supply chain collaborate which results in learning' |
| Prokesch (2010) | 'The sustainable supply chain' | 'Collaboration is important when the system is complicated' |
| Geffen and Rothenberg (2000) | 'Suppliers and environmental innovation: the automotive paint process' | 'Collaboration with suppliers enables achieving improvements in environmental performance' |
| Lee (2010) | 'Don't tweak your supply chain – rethink it end to end' | 'Collaboration helped Esquel in the production of cotton in environmentally friendly manner' |
| Lee (2010) | 'Don't tweak your supply chain–rethink it end to end' | 'Posco collaborated with Siemens and came up with sustainable technology' |

**Table 2** Studies showing relationship between collaboration and GSCM (continued)

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Bala et al. (2008) | 'Experiences with greening suppliers. The universitat autonoma de Barcelona' | 'UAB collaborated with its suppliers to start campaigns related to environmental issues' |
| Asif et al. (2020) | 'Adoption of green supply chain management practices through collaboration approach in developing countries – from literature review to conceptual framework' | 'Collaborations between organisations and their suppliers is critical to effective implementation of green practices along the supply chain' |
| Li et al. (2020) | 'Realising the environmental benefits of proactive environmental strategy: the roles of green supply chain integration and relational capability' | 'Environmental collaboration with the supplier has a direct impact on improvement of environmental performance' |

**Table 3** Studies showing relationship between communication, collaboration and learning in GSCM

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Paulraj et al. (2008) | 'Inter-organisational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer–supplier relationships' | 'Communication contributes to knowledge development' |
| Min et al. (2018) | 'Inter-organisational learning in the context of third-party logistics services' | 'Communication enables relevant information flows across supply chain facilitating learning' |
| Viana and Filho (2017) | 'Supply chain management in traditional industries in Brazil: a relational view' | 'Communication helps in learning of expertise leading to innovative practices' |
| Vachon and Klassen (2008) | 'Environmental management and manufacturing performance: the role of collaboration in the supply chain' | 'Collaboration with key suppliers and customers helps in supply chain learning' |
| Lee (2010) | 'Don't tweak your supply chain – rethink it end to end' | 'Organisations such as Walmart and Nike collaborated with their supply chain partners to provide platforms for training and learning of their suppliers' |
| Gao et al. (2019) | 'The mechanism of inter-organisational collaboration network on innovation performance: evidences from east coastal enterprises in China' | 'Collaborative interaction channels among various members helps to promote enterprise's exploitative learning and exploratory learning' |

### *3.3 Role of communication and collaboration on learning in GSCM*

Supply chain learning has been defined as: "Multiple supply chain partners engaged in interaction where learning occurs and is focused on supply chain issues and solutions" (Flint et al., 2008) Communication across various firms in a supply chain contribute to knowledge development by means of effective learning (Zaheer and Bell, 2005; Paulraj et al., 2008). A study done in the context of third-party logistics provider revealed that

communication enables relevant information flow across supply chain facilitating learning and creating knowledge (Min et al., 2018). A study conducted in the context of textile and footwear industries revealed that information exchange across a supply chain enables learning of expertise by firms leading to development of innovative practices (Viana and Sousa-Filho, 2017). Firms across a supply chain collaborate which results in sharing and learning of tacit as well as critical knowledge (Kogut and Zander, 1992; Grant, 1996). Collaboration with key suppliers and customers helps in supply chain learning which positively affects supply chain performance (Vachon and Klassen, 2008). Organisations such as Walmart and Nike collaborated with their supply chain partners to provide platforms for training for their suppliers as a step towards greener supply chains (Lee, 2010). Esquel, the world's leading cotton shirt firm collaborated with its supplier farmers to integrate sustainability into its business. They introduced the farmers to new farming techniques such as drip irrigation that saves water performance (Lee, 2010). Collaborative interaction channels among various members helps to promote enterprise's exploitative learning and exploratory learning, which positively affects innovation performance (Gao et al., 2019).

### *3.4 Role of learning in GSCM*

Organisations need to learn to survive in the fierce competition (Hult et al., 2000). Environment-friendly techniques of production have been regarded as cleaner production programs and learning is an important aspect of a cleaner production program (van Hoof, 2014). According to Ivarsson and Alvstam (2009), implementing green practices in a supply chain requires the dissemination of knowledge, innovative ideas and learning throughout the supply chain. They provided a case in which an organisation worked with its suppliers to disseminate ideas related to quality management and GSCM practices with all its sub-tier suppliers which benefitted the entire supply chain. Learning of environmental issues between buyer and supplier provide a competitive advantage to supply chain (Carter and Rogers, 2008). A survey of the Korean logistics company revealed that organisations oriented towards learning were more capable of adopting environmental practices that created a sustainable competitive advantage (Kim and Han, 2012). Van Hoof (2014) linked organisational learning theory to the adoption of cleaner production projects. He argued that organisational learning is critical for the implementation of cleaner production projects. Projects launched by the Mexican sustainable supply program were surveyed that aimed at disseminating knowledge about cleaner production among small-sized suppliers of large companies. Suppliers were invited to participate in training projects on cleaner production led by MNCs. They were being supervised by a focal company. It was found that the learning of suppliers was conducive to the implementation of cleaner production projects. Findings of Gosling et al. (2016) are also in line with the fact that learning is important for having a green supply chain. Employees should be trained in environmental issues to empower their skills. This type of training has been regarded as green training (Paillé et al., 2014; Muduli et al., 2013). Green training encourages the learning and adoption of green technology by the firms (Teixeira et al., 2016). Green training was found to be associated with the adoption of green technology by firms in Spain (Sarkis et al., 2010). Both supplier and customer learning is beneficial for proactive green innovation in products and production processes in a supply chain. It facilitates focal firms to obtain resources, information, key know-hows, and essential capabilities to develop products and processes

with energy saving, pollution prevention, waste recycling, and non-toxic materials (Lisi et al., 2020). Organisational learning has been found to be critical issue in implementation of a green project. When learning takes place, knowledge base of processes and procedures of a green project is created, stored and transferred within a supply chain (Mohanty and Prakash, 2017).

**Table 4** Studies showing relationship between learning and GSCM

| *Author name* | *Title* | *Key finding* |
|---|---|---|
| van Hoof (2014) | 'Organisational learning in cleaner production among Mexican supply networks.' | 'Learning is an important aspect of a cleaner production program' |
| Ivarsson and Alvstam (2009) | 'Learning for foreign TNCs: a study of technology upgrading by local suppliers to AB Volvo in Asia and Latin America.' | 'Implementing green practices in a supply chain requires the dissemination of knowledge, innovative ideas and learning throughout the supply chain' |
| Carter and Rogers (2008) | 'A framework of sustainable supply chain management: moving toward new theory' | 'Learning of environmental issues between buyer and supplier provide a competitive advantage to supply chain' |
| Vachon and Klassen (2008) | 'Environmental management and manufacturing performance: the role of collaboration in the supply chain' | 'Collaboration with key suppliers and customers helps in supply chain learning which positively affects supply chain performance' |
| Kim and Han (2012) | 'The role of organisational learning in the adoption of environmental logistics practices: empirical evidence from Korea.' | 'Organisations oriented towards learning are capable of adopting environmental practices' |
| Gosling et al. (2016) | 'The role of supply chain leadership in the learning of sustainable practice: toward an integrated framework.' | 'Learning is important for having a green supply chain' |
| Teixeira et al. (2016) | 'Green training and green supply chain management: evidence from Brazilian firms.' | 'Green training encourages the learning and adoption of green technology by the firms' |
| Sarkis (1995) | 'Supply chain management and environmentally conscious design and manufacturing.' | 'Green training was found to be associated with the adoption of green technology by firms' |
| Lisi et al. (2020) | 'Embracing green innovation via green supply chain learning: The moderating role of green technology turbulence' | 'Learning is beneficial for proactive green innovation in products and production processes in a supply chain' |
| Mohanty and Prakash (2017) | 'Searching for definitions and boundaries in sustainable production system' | 'Learning facilitates implementation of a green project by creating a knowledge base' |

### *3.5 Role of communication and collaboration on trust in GSCM*

In the context of the supply chain, trust refers to the belief in the honesty and integrity of a partner that leads to positive outcomes (Anderson and Narus, 1990; Morgan and Hunt, 1994). Trust is imparted through effective communication and collaboration among

members of the supply chain (Cheng et al., 2008). By fostering transparent communication, organisation can create among employees a positive, fulfilling work-related state of mind (i.e., employee engagement) characterised by positive affect toward their employers and a strong sense of empowerment to accomplish their tasks. Such positive psychological capital ultimately leads to higher trust among employees toward the organisation (Jiang and Luo, 2018). If there is effective communication regarding implementation of a project, for e.g., green project, a focal firm may gain the trust of various supply chain members (Vosse and Aliyu, 2018). Open communication can narrow down the information gaps across a supply chain, diminish change-related misinformation and rumours, and reduce employees' anxiety and stress. Employees upon sensing organisations' sincere interest in looping them in the change plan will be more likely to trust organisations' intention and capability in implementing any change (Yue et al., 2019). A case study conducted on Wal-Mart found that Wal-Mart collaborated with its suppliers by investing in training, co-developed delivery processes that would cut suppliers' costs and their own. They gained the trust of their suppliers who then joined them in becoming environmentally responsible (Lee, 2010). If collaborative framework is not implemented successfully across a supply chain, trust deficit occurs among supply chain members (Onyango, 2019).

**Table 5** Studies showing relationship between communication, collaboration and trust in GSCM

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Cheng et al. (2008) | 'Trust and knowledge sharing in green supply chains' | 'Trust is imparted through effective communication and collaboration among members of the supply chain' |
| Jiang and Luo (2018) | 'Crafting employee trust: from authenticity, transparency to engagement' | 'By fostering transparent communication, organisations create among employees a positive, fulfilling, work-related state of mind leading to higher trust' |
| Vosse and Aliyu (2018) | 'Determinants of employee trust during organisational change in higher institutions' | 'Focal firm gain the trust of various supply chain members through communication regarding green projects' |
| Yue et al. (2019) | 'Bridging transformational leadership, transparent communication, and employee openness to change: the mediating role of trust' | 'Open communication can narrow down the information gaps across a supply chain diminishing change related misinformation' |
| Lee (2010) | 'Don't tweak your supply chain–rethink it end to end' | 'Collaborating with suppliers by providing training platforms helps in gaining their trust and support in becoming environmentally sustainable' |
| Onyango (2019) | 'Organisational trust and accountability reforms in public management: Analysis of inter-agency implementation relations in Kenya' | 'Difficulties in collaborative-implementation framework across a supply chain leads to problems of trust' |

### *3.6 Role of trust in GSCM*

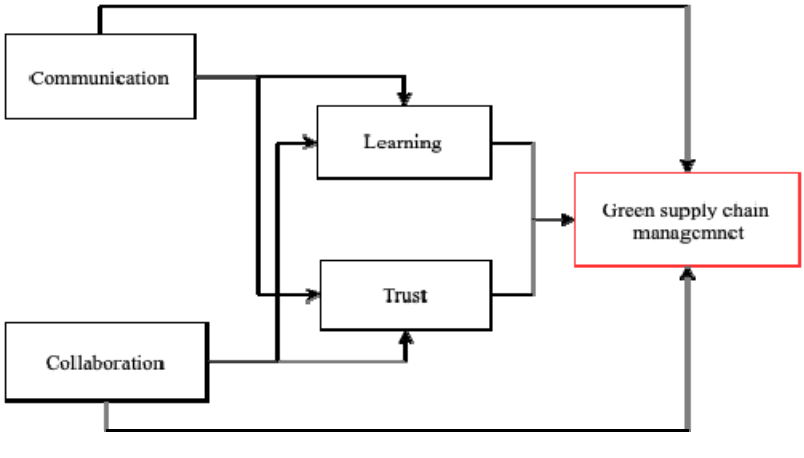
In the context of the supply chain, trust refers to the belief in the honesty and integrity of a partner that leads to positive outcomes (Anderson and Narus, 1990; Morgan and Hunt, 1994; Cheng et al., 2008). When trust is there in buyer-supplier relationships, it facilitates having a common vision and goal and helps in tackling various complex issues that arise in the management of the supply chain (Sahay, 2003). Studies have found a lack of trust among supply chain members as a barrier to the implementation of green supply chain practices (Wood and Gray, 1991). Trust in a buyer-supplier relationship acts as an enabler in implementing the green practices in a supply chain (Gimenez and Tachizawa, 2012). Trust is essential for managing supply chains (Halldorsson et al., 2007) and fosters inter-organisational relationships (Dwyer et al., 1987; Anderson and Weitz, 1989). Lack of trust leads to a reluctance by firms to use sustainable technology as they fear being exploited by buyer or supplier firms across a supply chain (Lee, 2010). Trust is important in maintaining relationship and trust-based relationships encourage suppliers to improve their environmental performance (Wycherley, 1999). A study done in the context of buyer-supplier relationships in the UK firms highlighted the importance of trust in building a green supply chain. The study considered two components of trust: credibility and benevolence. It was found that benevolence and credibility are important for implementing green practices provided, there is support from top management. When there is a feeling of credibility and benevolence in buyer-supplier relationships, it convinces top management to invest in green initiatives as it would result in mutual gains for both parties. One respondent who participated in the study said that the supplier brings environmental issues to them because they have a relationship of trust and friendship (Hoejmose et al., 2012). In order to become environmentally responsible, Wal-Mart mobilised its supplier network, set aggressive goals for them to reduce energy consumption and the negative environmental impacts of their production processes. The suppliers due to fear of exploitation did not take part actively in the initiative. Wal-Mart collaborated with its suppliers by investing in training, co-developed delivery processes that would cut suppliers' costs and their own. They gained the trust of their suppliers who then joined them in becoming environmentally responsible (Lee, 2010). A case study of a biochemical industry revealed the importance of trust among supply chain members to implement the green practices in a supply chain. The study involved various supply chain actors and multiple supply chain tiers were included. Data were collected by conducting semi-structured interviews with supply chain actors. The study revealed that trust was there among supply chain members, so they were more engaged in green initiatives. Suppliers took part in implementing the green initiative although there were no economic benefits for them to indulge in the green initiative (Meqdadi et al., 2017). Deficit of trust in buyer supplier relationships causes fear and resistance towards sustainable competitiveness and innovation, and thus becomes a barrier in implementation of green practices (Nazam et al., 2020).

**Table 6** Studies showing relationship between trust and GSCM

| *Author name* | *Title* | *Key findings* |
|---|---|---|
| Sahay (2003) | 'Understanding trust in supply chain relationships' | Trust helps in having a common vision and helps in tackling complex issues in supply chain |
| Gimenez and Tachizawa (2012) | 'Extending sustainability to suppliers: a systematic literature review' | Trust in a buyer-supplier relationship acts as an enabler in implementing the green practices in a supply chain |
| Halldorsson (2007) | 'Complementary theories to supply chain management' | Trust is essential for managing supply chains |
| Lee (2010) | 'Don't tweak your supply chain – rethink it end to end' | Lack of trust leads to a reluctance by firms to use sustainable technology |
| Hoejmose et al. (2012) | 'Green supply chain management: The role of trust and top management in B2B and B2C markets' | Components of trust – benevolence and credibility, are important for implementing green practices provided, there is support from top management. |
| Meqdadi et al. (2017) | 'The role of power and trust in spreading sustainability initiatives across supply networks: a case study in the bio-chemical industry' | Suppliers took part in implementing the green initiative because of trust among members although there were no economic benefits |
| Nazam et al. (2020) | 'Categorising the barriers in adopting sustainable supply chain initiatives: a way-forward towards business excellence' | 'Deficit of trust in buyer supplier relationships becomes a barrier in implementation of green practices' |

After reviewing the extant literature following model has been proposed showing relationship among the variables under study:

**Figure 2** Proposed conceptual model (see online version for colours)



## 4 Result

Similarity of opinion has been found between academic and industry experts regarding importance of communication, collaboration, Learning and trust in managing green supply chains. Lack of communication is a major barrier in the implementation of sustainability. Projects related to green practices fail because the goals of the project are not communicated properly to all the stakeholders. Successful sustainability projects involved frequent communication among its stakeholders across the supply chain. Communication enables the flow of creative ideas. Knowledge transfer and transfer of quality management practices for strong suppliers to weak suppliers. It helps weak suppliers to solve a complex problem. Communication is important for new product development. The stakeholders need to be educated about the principles and implications of sustainability. Mechanisms need to be developed that support communication among various stakeholders which would help in relationship development among the stakeholders. Communication helps in reduction of lead time thereby reducing inventory and prevention wastage. Communication across supply chain also improves quality of the product.

**Table 7** Key excerpts from interview of academic experts

| |
|---|
| 'Communication is like having a 'see-through' or visibility in partners working' |
| 'Communication may lead to the flow of new and more creative ideas for product development' |
| 'Communication leads to transfer of quality management practices particularly from stronger players to a weaker supplier' |
| 'Communication facilitates collaboration among members which allows harnessing the synergistic potential among one another. This improves the sustainable performance of the system' |
| 'Collaboration builds the relationship as it builds commitment among supply chain members' |
| 'Collaboration paves the way for learning new methods, procedures which facilitate in developing trust between firms' |
| 'Collaboration can be concerning joint product development or logistic integration which leads to benefits like cost reduction, risk-sharing' |
| 'Collaboration leads to trust and vice versa' |
| 'Collaboration strengthens relationships across a supply chain and builds trust' |
| 'Collaboration enables complex problem solving that a firm cannot solve alone which is essential for green supply chain management' |
| 'Learning among supply chain members plays an important role in the implementation of green projects as it enables them to understand the concept of sustainability and work with new technology' |
| 'The learning of environmental issues among buyers and suppliers provides a competitive advantage to the supply chain' |
| 'It is much easier to build a green supply chain if a trust is there' |
| 'Communication is one of the factors that build trust' |
| 'Lack of trust among supply chain members is a major barrier to the implementation of green practices' |
| 'Trust improves the quality of partnerships among firms which helps in the successful implementation of green projects' |

**Table 8** Key excerpts from interview of industry experts

| |
|---|
| 'Without communication, Green SCM practices cannot work. when supply chain members ensure proper communication, the desired result is attained on time' |
| 'With frequent communication and collaboration platforms, more knowledge will be created' |
| 'If communication gap is there, lead time will increase. It will lead to piling of inventory and expiry of product which will ultimately increase wastage' |
| 'By collaborating with our partners, we have developed technology to reduce wastage, emissions' |
| 'Collaboration with partners will lead to optimal use of resources' |
| 'We need to educate our partners about sustainability initiatives through communication and collaborate with them if they are not able to achieve these goals on their own' |
| 'Communication and collaboration provide learning opportunities for all supply chain partners and helps in their growth' |
| 'Learning is important for all supply chain partners to know about sustainability norms and comply to it' |
| 'Learning is important to know what practices we can use so that they do not harm the environment' |
| 'Learning is important to know what practices we can use so that they do not harm the environment' |
| 'If we are helping our suppliers by communicating and collaborating with them, they will trust us which will help in implementation of green practices' |
| 'If new technology, idea is there all members will use only if they trust each other' |
| 'If trust is not there, firms will be reluctant to share any innovation with their partners' |
| 'To develop trust most important is that there is healthy relationship with supplier which can be achieved through communication and collaboration' |
| 'Trust plays key role in achieving sustainability. No trust means no result' |

Collaboration with suppliers is important for achieving improvements in environmental performance while maintaining product quality and cost goals. Collaboration helps to harness the synergistic potential of one other. It helps in overcoming the shortcomings of firms. It facilitates technological transfers which make supply chain members more competitive. It enables joint product development or logistic integration which leads to benefits like cost reduction, risk-sharing, etc. It leads to the learning of supply chain members regarding green practices. It strengthens relationships across a supply chain and builds trust. It enables complex problem solving that a firm cannot solve alone which is essential for GSCM.

Learning has been found to play a key role in managing a green supply chain. Supply chain members need to learn about sustainable products, sustainable procedures, and code of conduct. Implementing green practices requires the dissemination of knowledge throughout the supply chain. For achieving the objective of sustainability like minimisation of carbon emissions or good reverse logistics program, supply chain members need to learn. Awareness regarding sustainability is less, so learning will build awareness. They need to learn how to manage their waste, learn new technology. Communication contributes to knowledge development. Collaboration results in the sharing and learning of tacit as well as critical knowledge. Implementing green practices in a supply chain requires the dissemination of knowledge, innovative ideas and learning throughout the supply chain. The learning of environmental issues among buyers and

suppliers provides a competitive advantage to the supply chain. Organisations oriented towards learning were found to be more capable of adopting environmental practices that created a sustainable competitive advantage.

Communication is one of the factors that build trust. It helps in building shared values that build trust among supply chain members. Lack of trust among supply chain members is a major barrier to the implementation of green practices. Trust improves the quality of partnerships among firms which helps in the successful implementation of sustainability projects. When there is a common set of goals and objectives between firms, it will build trust among them. Trust is imparted through effective communication and collaboration among members of the supply chain. When trust is there in buyer-supplier relationships, it facilitates having a common vision and goal and helps in tackling various complex issues that arise in the management of green supply chain. Lack of trust leads to a reluctance by firms to use green technology as they fear being exploited by buyer or supplier firms. Trust-based relationships encourage suppliers to improve their environmental performance.

## 5 Discussion

Communication plays a key role in making stakeholders aware of the importance of sustainability as well as the criteria to follow to encourage sustainability. The supply chain experts interviewed regard communication as indispensable for GSCM. Communication is important for new product development. Communication leads to knowledge transfer and transfer of quality management practices particularly from stronger players to weaker suppliers. It helps a weak supplier when he confronts a complex problem which is beyond its capacity to handle. There should be two-way communication which means constructive feedback should be ensured. One expert quoted, “When information is shared, it is a roadway for building relationships. It is like having a ‘see-through’ or visibility in partners working”. One expert quoted “Communication may lead to the flow of new and more creative ideas for product development.” “Effective relationships are based on proper dissemination of information among channel members.” All the experts agreed to the fact that communication is important for building relationships and learning of supply chain members.

Collaboration is important for managing a green supply chain by creating platforms for various stakeholders to come together for the successful implementation of sustainability practices which may include platforms for training, promotional campaigns, financial assistance to list a few.

Experts are of the view that collaboration plays an important role in building relationships between various firms in a supply chain. Communication facilitates collaboration among members which allows harnessing the synergistic potential among one another. This improves the sustainable performance of the system. One expert quoted, “It builds the relationship as it builds commitment among supply chain members”. Through collaboration, various firms can overcome their shortcomings. Collaboration paves the way for learning new methods, procedures which facilitate in developing trust between firms. Collaboration facilitates technological transfers which make supply chain members more competitive. According to experts, collaboration can be with respect to joint product development or logistic integration which leads to benefits like cost reduction and risk-sharing One expert quoted, “Collaboration leads to

trust and vice versa". This improves the sustainable performance of the system. Firms should identify key suppliers and customers for effective business relationships and they should agree to common goals that are mutually beneficial to their relationship and organisation. One expert told that "collaboration would help in the learning of supply chain members when there is a commitment from top management".

Communication and collaboration lead to the transfer of knowledge and skills to their supply chain partners thus fostering learning among various members. Learning among supply chain members play an important role in the implementation of green projects as it enables them to understand the concept of sustainability and work with new technology. Supply chain experts regarded learning as indispensable for managing a green supply chain. Communication between firms help in the learning of supply chain members. They learn new techniques, procedures from each other to be more competitive in the market. Members need to learn about sustainable products, sustainable procedures and code of conduct. Further learning about new possibilities and opportunities make members efficient which in turn makes a supply chain sustainable. Progression from the supply chain to a green supply chain is a change process. Clarity should be there. Thus, learning is important as members should know what to do and how to do. One expert quoted, "Learning is the basis of any physical phenomenon and its impact. It is important for building a green supply chain." For achieving the objective of sustainability like minimisation of carbon emissions or good reverse logistics program, supply chain members need to learn the process. Another expert quoted, "If members don't communicate, you won't know what tools people are using. It is difficult to work in isolation. So many changes are taking place. If you don't communicate and learn, you would be left behind." Another expert quoted, "One firm may not be able to do everything. Different people have different skills, competencies. If you collaborate there is nothing better, you will work as a team". Another expert told that "Awareness regarding sustainability is less, so learning will build awareness. People need to develop a consciousness that environmental norms are not being implemented, resources are getting depleted. They need to learn how to manage their waste, learn new technology."

Moving towards greener supply chains require a shift which may need financial investment and also change in way of managing the various operation. Thus, it involves an element of risk. Trust among supply chain members is necessary to remain committed towards the goal of 'green supply chain'. Frequent interaction among the members and collaboration to promote green supply chains, imparting of training, providing financial assistance all go a long way to develop trust among supply chain members and which ultimately results in positive outcomes.

According to the experts, trust improves the quality of partnerships among firms which help in the successful implementation of green projects. Communication is one of the factors that build trust. Trust is important and for building a green supply chain, it takes some strategies and tactical actions. One of them is communication and creation of a conducive environment. When there is a common set of goals and objectives between firms, it will build trust among them. The supply chain members would work as a team for problem-solving. When you work together, you get to know each other closely. It is not possible to work without collaborating to fulfil common goals. One expert quoted, "It is much easier to build a green supply chain if trust is there. Because of trust, quality, delivery and everything else gets affected. When trust is there, you can rely on each other. A firm cannot work alone to build sustainability." Communication removes the possibility of any mistrust or bias among the firms. It helps in building shared values

which builds trust among supply chain members One expert said expert quoted, “When you communicate, you share critical information and the company would do so only when it trusts the supplier. So, it leads to building trust among supply chain members.”

## 6 Conclusions

The study involved analysing the approach towards green supply chains in various industries. The focus of the study was the environmental aspect of sustainability. The study revealed the importance of communication, collaboration, learning, and trust in managing a green supply chain. Communication leads to the flow of innovative ideas across the supply chain. It would aid in developing new plans, products, and strategies. Collaboration helps in creating platforms so that various supply chain members can come together. Collaboration would help in collective problem-solving. It would help in overcoming the shortcomings of various firms. Implementing green practices requires dissemination and understanding of knowledge throughout the supply chain. Communication coupled with collaboration imparts learning and skill development among supply chain members. Frequent communication among supply chain members and collaborative initiatives foster the inter-organisational relationships which impart trust in the relationships. When the various firms trust each other, they work together towards a common goal that creates positive outcomes. Thus, when the issue of communication and collaboration is addressed, it will lead to learning and trust in a supply chain and it will organise the entire supply chain system in such a way that all its elements will have same interest.

### *6.1 Unique contribution*

The unique contributions of the study include the focus on the importance of ‘people’ factor in the management of green supply chain. Proper implementation of green projects is not possible unless a healthy relationship is developed between various partners in supply chain through frequent communication, collaboration, providing learning opportunities and developing trust in a supply chain.

### *6.2 Theoretical and managerial implications*

The study provides inputs regarding various factors that are of immense importance in managing a green supply chain. Supply chain managers need to elevate the nature of the transactional relationship with their suppliers to more of a long-term and transformational relationship. They should develop mechanisms for frequent communication among various members of a supply chain. More collaborative projects should be introduced that benefit everyone. Communication and collaboration should provide learning opportunities for the supply chain members. Also, it would aid in developing a shared vision for the entire supply chain that would work together to create positive outcomes.

### *6.3 Limitations and future research directions*

The study is exploratory. Future work could focus on conducting a descriptive study and the proposed model can be validated statistically. The study is limited to the

environmental aspect of sustainability. Future work could focus on studying the social as well as economic aspects of sustainability. Studies can be conducted on specific sectors identifying specific green practices of a particular sector and the role of communication, collaboration, learning and trust in achieving them.

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