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## Development of levels of buyer-supplier collaboration: a Delphi study

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**Abstract:** The world is witnessing a stupendous increase in collaborative buyer-supplier practices in sustainable supply chains due to large-scale globalisation and mounting stakeholder pressure. There is an increasing need for classifying collaborative parameters into stages and levels of progression. With various already existing indicators of buyer supplier collaboration, classifying these collaborative parameters into stages and levels of progression is required to understand the development of these practices. This paper attempts to identify various significant indicators of such collaborations in Indian markets and to establish the different levels of collaborative spectrum Indian buyer's and supplier's perspective. This study uses a Delphi method to identify, rank and categorise the significant factors in levels of buyer-supplier collaboration using multi stakeholder viewpoints. A total of 66 experts comprising of academicians, NGOs and representatives of buyers and suppliers were selected to participate in the three rounds of the Delphi study. The study establishes seven levels of buyer-supplier collaboration that represent consensus-based indicators and display stages of locally accepted assessment of sustainable supply chain collaboration.

**Keywords:** buyer supplier collaboration; supply chain; sustainable; sustainable supply chain.

**Reference** to this paper should be made as follows: Kashyap, A. and Lakhanpal, P. (2022) 'Development of levels of buyer-supplier collaboration: a Delphi study', *Int. J. Business Performance and Supply Chain Modelling*, Vol. 13, No. 1, pp.27–52.

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## **1 Introduction**

A new era is dawning upon the organisations all around the world, as their significant stakeholders are increasingly becoming aware about the importance of sustainability practices. The organisations cannot handle this ever-growing concern for upholding sustainable practices without the constant support and cooperation from their supply chain partners (Klassen and Vachon, 2003; Pagell et al., 2010). Collaboration is even more essential when the supply chains aim at achieving economic, environmental and social performances collectively, during a product's total life-cycle (Gold et al., 2010). Hence, organisations are perpetually trying to engage with suppliers by collaborating in supply chain to achieve sustainability goals (Beske et al., 2014; Lokesh et al., 2017). Buyer supplier collaboration requires organisations to willingly contribute towards common sustainability commitments (Blome et al., 2014; Pakdeechoho and Sukhotu, 2018; Paulraj et al., 2014) and understand each other's responsibilities and capabilities (Vachon and Klassen, 2008). The existing literature demonstrates the importance of collaboration in sustainable supply chain by empirically proving its positive impact on the firm performance (Blome et al., 2014; Vachon and Klassen, 2008). The literature supports these findings majorly based on buyer/ focal firm's perspective with very few studies taking supplier's perspective into consideration.

The past studies have explored indicators, drivers and barriers of adopting sustainable practices in the supply chain. However, greater understanding is required for embedding sustainability practices in a collaborative paradigm (Paulraj, 2011; Touboullic and Walker, 2015a; Wong et al., 2012) specifically in an emerging economy like India. Many studies show that the buyer supplier collaboration may be influenced by the type of suppliers involved (Silva and Moreira, 2018; 2020; Zimmermann et al., 2019). Small and medium suppliers involved with the large buyer companies can provide specialisation and environmental adaptability but can also hamper the collaborative relationship due to limitation of resources (Lee et al., 2010). Silva and Moiera, 2020 studied that early supplier collaboration in a new product development can help large companies to differentiate their products and assist smaller supplier firms to increase their efficiency. Collaboration between organisations can be influenced by size of the firms, objectives of collaborative alignment, technological intensity of the industry, innovation (Silva and Moiera, 2020), trust, commitment (Dania et al., 2018; Hingley et al., 2015; Silva and Moiera, 2021), collaboration value, coordination and stability (Dania et al., 2018). The literature review has identified few significant buyer supplier collaboration measures such as information and knowledge sharing (Large and Thomsen, 2011, Seuring and Müller, 2008b; Manthou et al., 2004; goal congruence (Angeles and Nath, 2001), relationship management (Cheng, 2011; Cox et al., 2003), incentive alignment (Simatupang and Sridharan, 2005), decision synchronisation, joint planning, joint efforts, sharing of activities (Dania et al., 2018; Zhu et al., 2008), collaborative communication

(Vachon and Klassen, 2006), shared problem solving (Heide and Miner, 1992) and flexibility to make decisions (Heide and Miner, 1992). Kang and Hwang in 2017 analysed the interdependency of the collaborative indicators on the environmental aspects of sustainable supply chain. Though buyer-supplier collaboration for the purpose of sustainability is gaining significance, most of the researches focus only on economic and environmental aspects of sustainability thereby neglecting the social dimensions (Chen et al., 2017; Nakamba et al., 2017). Therefore, this study focuses on taking the research one step forward by developing the levels of buyer supplier collaboration after considering economic, environmental and social aspects of sustainable supply chain. From the existing compendium of indicators and measures of buyer supplier collaboration, the study aims to develop stages of buyer supplier collaboration.

Most of the studies based on sustainability and collaboration in supply chain are based on resource-based view (RBV) and resource dependence theory (RDT) (Bowen et al., 2001; Carter and Rogers, 2008; Svensson, 2007). However, Sarkis et al. (2011), linked the different theoretical aspects of sustainable supply chain viz. complexity theory, ecological modernisation theory, information theory, institutional theory, social network theory, stakeholder theory, and transaction cost economics (Morali and Searcy, 2013). This study draws its theoretical support from RBV and RDT, which emphasises that competitive advantage emanates from utilising the core capabilities uniquely through valuable and non-substitutable resources (Barney, 1991; Hart, 1995). Many authors have taken this theory as the basis to show that sustainable collaboration helps firms to generate sustainable competitive advantage (Touboulic and Walker, 2015a). Manufacturers in India have higher potential for competitive advantage but the suppliers, who are mainly small and medium enterprises, play a crucial role in the same. In order to respond to the global competition faced by the supply chain in an emerging economy, there is a need not only to understand the significance of collaboration indicators but also to recognise the pattern of their progression in collaborative paradigm. The literature review highlights that the buyer and supplier perspectives on collaboration are different (Ambrose et al., 2010; Nyaga et al., 2010) and scanty research analyses the collaborative practices from the supplier's perspective (Lee et al., 2018). This paper seeks to fill this gap and determine the levels of collaboration not only by considering buyer's dominant position but also by systematically interpreting it from the relatively smaller sized supplier's perspective.

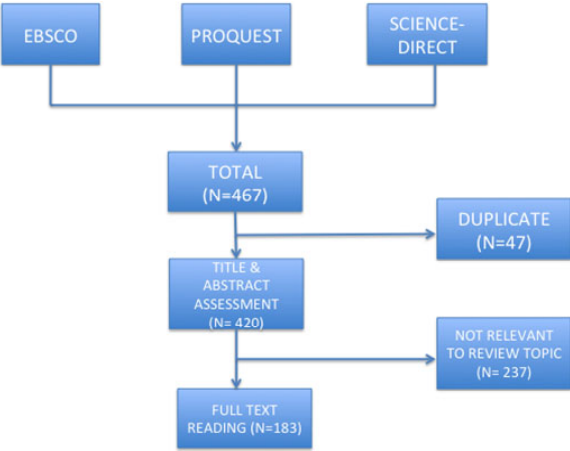
The major research questions that this study aims to address are:

- a What are the significant factors in collaborative sustainable supply chain?
- b Can these factors and indicators be grouped into different levels of buyer supplier collaboration?
- c If yes, what are these levels of buyer supplier collaboration?

This paper focuses on using expert report identifying and classifying the buyer-supplier collaboration indicators.

The next section of this paper focuses on the review of literature on collaboration with suppliers and sustainability in supply chain. It is then followed by the methodology section explaining the entire Delphi procedure adopted. The last sections of the paper focus on the findings and outlining the future research.

**Figure 1**    Selection process for review of literature (see online version for colours)



**Figure 2**    Indexing of articles (see online version for colours)

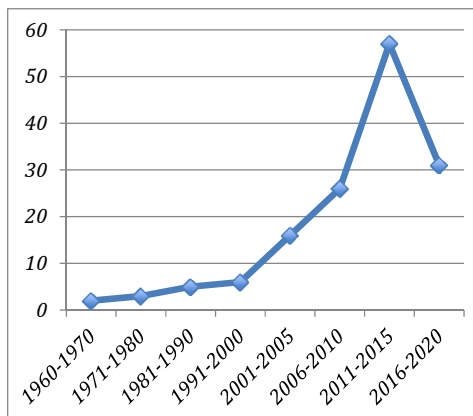
	Number of papers
A *	20
A	28
B	25
C	31
Scopus	79
<b>Total</b>	183

**2    Review of literature**

Systematic review of literature was adopted to analyse the current available research on the topic of the study. As there are various studies that exist on sustainability and buyer-supplier collaboration, a systematic selection criterion was devised to ensure review of only relevant studies. One of the eligibility criteria for choosing the relevant literature was screening on the basis of publication journal. Only those research papers were selected which were published in peer-reviewed journals such as EBSCO, Science-Direct, Proquest. This criterion ensured that high quality papers with research credibility were selected. The next step was to conduct search in the form of relevant key words based on the objectives of the study. Initial key word search included terms such as buyer supplier collaboration, collaboration supply chain, supply chain cooperation,

supplier integration, sustainability, sustainable practices and sustainable collaboration. After the initial key word search, advanced key word search was undertaken to include: collaborative advantage, supplier management practices, environment supplier collaboration, social supplier collaboration, collaboration performance, environmental practices, green supply chain practices, eco friendly practices, social practices, corporate social responsible practices, economic practices, and sustainability performance. After carefully selecting the papers that showed up in the identified research portals on the basis of initial and advanced key word search, total articles obtained were 467. Out of this, 47 articles were found to be duplicated and were therefore removed. The next criterion was to examine the fit of the paper. For this purpose, each paper was evaluated on the basis of its title and abstract to assimilate whether the paper is relevant with respect to the objective of the study. After removing 237 papers that were not found relevant, the list of articles was narrowed down to 183 papers. These selected 183 articles were then integrated and combined to form the basis and origin of fulfilling the objectives of the study. A flow diagram of planned search process is presented in Figure 1. Figure 2 shows the indexing of 183 papers used for literature review. Figure 3 demonstrates the distribution of these articles over a period of time. The graph shows that the number of articles started increasing in the year 2006 and showed a steep rise during the period 2010–2015.

**Figure 3** Distribution of articles over time (see online version for colours)



## 2.1 Buyer-supplier collaboration

Collaboration studies have been carried out as early as in 1980s. Contractor and Lorange (1988) demonstrated the effect of internal factors such as organisational dynamics and culture, on the cooperation between international businesses. Soon after, functional collaborations that signify association between the buyer and supplier made on the basis of carrying out same or cross function for the development of new products (Bowersox, 1990), gained a lot of importance. Alter and Hage (1993) developed a conceptual collaboration model focusing on the factors that determine the extent and type of collaboration. The subsequent studies then went on to develop the concept of strategic alliance where organisations collaborate on the basis of each other's strengths to generate synergy that ultimately results in strategic advantage (Hamel and Prahalad, 1994; Kanter,

1994). A detailed literature review highlights, that there can be different forms of collaboration in the supply chain viz. structural, functional, technological, strategic collaboration. Furthermore, supply chain collaboration (Ashkenas, 2015; Brettel and Cleven, 2011, Cai et al., 2013; Cao and Zhang, 2011; Matopoulos et al., 2007; Simatupang et al., 2004), cooperation (Adaileh and Elrehail, 2018; Arshinder et al., 2007; Castañer and Oliveira, 2020), buyer-supplier relationship (Kannan and Tan, 2006; Nyaga et al., 2013) and supply chain integration (Brito and Miguel, 2017; Fawcett et al., 2012; Huang et al., 2014) are few key words that have been used interchangeably in the research. Collaboration is not merely a sum of coordination and cooperation as suggested by few authors. It is a much more elaborate concept and signifies relational commitment and contribution from the parties involved towards common objectives. It refers to a distinct dimension of motivation, i.e., ‘the psychological best interests of the organisational parties’ and ‘inter-personal care and concern for their counterparts in the partner organisation’ that differentiates it from coordination and cooperation. Collaboration is based on the norms of reciprocity, solidarity, and mutual assistance toward counterparties (Castañer and Oliveira, 2020).

Buyer supplier collaboration (BSC) can be defined as the combination of internal resources of the buying firm with the resources and capabilities of the supplier (Wagner, 2005) to achieve greater success than when acting alone (Simatupang and Sridharan, 2002). Buyer supplier collaboration is comprehensive, more trust based (Corsten and Felde, 2005; Heide and Miner, 1992; Narasimhan and Nair, 2005; Simatupang et al., 2004; Zhao et al., 2008) and centres on sense of shared purpose to generate long-term relationships (Adaileh and Elrehail, 2018; Bowersox et al., 2003; Gimenez and Tachizawa, 2012; Joshi et al., 2017) and competitive advantage (Carter and Rogers, 2008; Hofer et al., 2014; Joshi et al., 2017; Klassen and Vereecke, 2012; Wu and Pagell, 2011; Zhu and Sakris, 2004; Zhu et al., 2005) to all the supply chain members.

Literature shows that effective buyer supplier collaboration leads to better matched demand and supply (Simatupang and Sridharan, 2002); improved productivity (Geffen and Rothenberg, 2000), better performance in terms of delivery, quality, flexibility, reduced inventory, shorter delivery times and producing valuable innovation through shared technical competence (Greco et al., 2015). Collaboration with suppliers has empirically proven to lower costs, maximise resources utilisation, enhance buyer’s competitiveness and reputation (Zhu and Sakris, 2004; Zhu et al., 2005), improve the market share (Matopoulos et al., 2007), increase firm performance (Cao and Zhang, 2011, Carter et al., 2000; Zhu and Sakris, 2004; Zhu et al., 2005) for partnering organisations, thereby, adding value to the end customer (Brettel and Cleven, 2011).

## 2.2 *Sustainable supply chain*

Supply chain management (SCM) has long been seen as management philosophy that integrates the dependent resources within and across organisations to improve long-term performance of the entire supply chain (Mentzer et al., 2001). The inclusion of sustainability dimension in the supply chain has broadened the concept to include environmental, social and economic aspects of the business practices (Svensson, 2007). In 2008, Carter and Rogers defined sustainable supply chain management (SSCM) as the strategic, transparent integration and achievement of an organisation’s social, environmental, and economic goals in the systemic coordination of key inter-organisational business processes. Seuring and Muller (2008a) maintained that

SSCM is the management of material, information and capital flows as well as cooperation among supply chain partners taking into consideration environmental, social and economic goals, which in-turn are derived from stakeholder requirements.

Few studies have tried to embed three aspects (economic, environmental, social) of sustainability into the supply chain by developing theoretical models (Sveinsson, 2007; Carter and Rogers, 2008), conceptual models (Pagell and Wu, 2009), structural framework (Seuring and Muller, 2008a), measures and indicators of SSCM (Beske and Seuring, 2014; Das, 2017; Seuring and Muller, 2008b), linking profitability to environmental and social goals using case study approach (Wu and Pagell, 2011). Empirical studies show sustainability in supply chain leads to improved: economic and environmental performance (Blome et al., 2014; Vachon and Kalsssen, 2006, 2008; Wong et al., 2012; Yang et al., 2013; Zhu and Sakris, 2004; Zhu et al., 2008; Zhu et al., 2012), social performance (Gimenez and Tachizawa, 2012; Lu et al., 2014; Luzzini et al., 2015; Marshall et al., 2015; Paulraj et al., 2014; Porteous et al., 2015).

Sustainable supply chain draws its theoretical backing from the RBV that focuses on resources, capabilities and strategic assets. A firms' sustainable competitive advantage emanates from its valuable, rare, inimitable, non-substitutable resources and the unique way they are utilised through core capabilities (Barney, 1991). Taking RBV as the theoretical basis, many studies find that firms need to cooperate and collaborate with the suppliers in the sustainable supply chain (Zhu et al., 2013) to ensure that the shared resources provide improvement in supply chain performance (Large and Thomsen, 2011) and competitive advantage to the supply chain partners (Cao and Zhang, 2011; Lu et al., 2014; Yang et al., 2013; Zhu et al., 2012).

### *2.3 Sustainable supply chain and buyer supplier collaboration*

Increasingly, buyer and supplier collaboration is not only restricted to economic aspects such as cost, quality, improvement in market share, etc. The companies are now focusing on social and environmental aspects of sustainability as well (Chen et al., 2017; Porter and Kramer, 2006). In order to successfully achieve these sustainability goals, buyer supplier collaboration becomes even more essential (Gold et al., 2010). Buyer-supplier collaboration in sustainable supply chain can be defined as a firm's willingness to devote specific resources to joint activities to attain sustainability goals (Blome et al., 2014). Collaboration between buyers and suppliers and undertaking sustainable environmental and social initiatives together, can help contribute significantly to the sustainable development of the society (Govindan et al., 2013). Buyer supplier collaboration in sustainable supply chain includes: forming multi-functional work teams, joint/ shared planning, joint goal setting, mutual understanding, exchange of technical information, participation and sharing of knowledge within the organisation to help solve operational problems (Basnet, 2013; Grekova et al., 2014; Pakdeechoho and Sukhotu, 2018; Cao and Zhang, 2011). Buyer-supplier collaboration on sustainability issues has shown to have significant impact on innovation (Zhu, Sakris and Lai, 2012) and leads to improved buyer performance (Perols et al., 2013). The inter-firm alignment on supply chain initiatives pays off and also improves the sustainable production (Blome et al., 2014). Environmental collaboration has been linked positively to quality (Vachon and Klassen, 2008), operation performance indicators like delivery, cost competitiveness (Holloos et al., 2012) and environmental performance (Large and Thomsen, 2011).

Most of the researches undertaken on buyer supplier collaboration, focus on the impact of sustainability initiatives on environmental and economic performances. Impact of social sustainable supplier collaboration on firm performance is very less represented in the literature (Hollos et al., 2012; Husgafvel et al., 2015). A study on buyer supplier collaboration on sustainability aspects also proved that a very small percentage of companies engage in social collaboration (Yang and Zhang, 2017). Social practices have a huge impact on the entire life cycle assessment of the product which in-turn influences many managerial level decision-making (Dreyer et al., 2010). Hence, there is a need to embed social aspect in the buyer supplier collaborative paradigm.

The literature review on buyer supplier collaboration on sustainability aspects, demonstrates emphasis on measures and basis of collaboration or on sustainability performance variables. However, there are very few papers that feature stages of buyer-supplier collaboration in sustainable supply chains. This study intends to fill this gap. Another gap area found during literature review is that though buyer-supplier relationship has been studied comprehensively in various studies, only few of them have incorporated the supplier perspective on the said issue. Buyers and suppliers have different perceptions of their relationship across different dimensions (Ambrose et al. 2010, Nyaga et al., 2010). From a buyer's perspective, emphasis is more on supplier selection in terms of supplier's internal integration activities, collaboration, trust, and commitment capabilities, corporate image (Hingley et al., 2015). Whereas suppliers focus more on continuity of relationship, cost savings, risk minimisation (Murfield and Tate, 2017) Although collaboration promises mutual benefits to the supply chain partners, few have argued that partners often tend to focus on one's own local perspective which leads to incompatibility between supply and demand and thus prevents the partners from gaining mutual benefit (Cox et al., 2003; Hingley et al., 2015). Power and information asymmetry, dependency, conflicting interest, governance mechanisms (Brito et al., 2017; Nyaga et al., 2013; Wang et al., 2016) are some of the reasons for the perceptual differences.

This study intends to fill this gap by incorporating both the buyer's and supplier's perspectives, in developing the levels of buyer-supplier collaboration. A collaborative supply chain must incorporate integrated policies to mitigate the disadvantageous effect of any opportunist behaviour. This study aims to understand if there are different forms and levels of buyer supplier collaboration in sustainable supply chain and if so, then what is the impact of these levels on the buyer supplier collaborative paradigm. Out of the indicators identified through literature review and those obtained through Delphi study, this paper attempts to establish significant buyer supplier collaboration indicators taking holistic perspective of both the buyers and suppliers into consideration.

### **3 Method**

#### *3.1 Delphi technique*

Delphi technique is a widely used methodology in the management research. In SCM as well, studies use this method to identify and generate consensus on different indicators of SSCM (Seuring and Muller, 2008a), risk analysis of global supply chain in wake of environmental changes (Markmann et al., 2013).

Delphi method focuses on bringing together experts and specialists from different sectors, to deliberate on a particular topic and share the insights until a common consensus is reached (Gordon, 2009). This method helps in correlating information and ideas pertaining to a definite subject or a policy area and allows the respondents the opportunity to react and assess differing viewpoints. Delphi method is used not only to reach consensus but also to layout all contradictory viewpoints while assessing the positives and negatives of each of the arguments (Turoff, 1970). It is suitable when the problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis' (Linstone and Turoff, 2002) In subject areas that involve multi-stakeholders and require to generate a group of indicators without affecting other's opinion, Delphi method is very helpful.

Squire and Chu (2011) applied the Delphi method in a complex, multi-stakeholder environment of global supply chains to identify risk factors and ranked them according to their implication. This study also attempts to identify, rank and categorise the significant factors in levels of buyer supplier collaboration using multi stakeholder view-points. Delphi method in this study is deemed fit as there are varying indicators and parameters of buyer supplier collaboration that need consensus building. There also seems to be a lack of consensus regarding the different levels and types of progression of buyer-supplier collaboration in a sustainable supply chain. This can best be accomplished by taking independent personal expert opinions.

### *3.2 Expert panel*

Selection of the expert panel for conducting Delphi is of greatest relevance and is the most crucial part as the focus of this method is on integrating the knowledge and opinions of the experts through structured communication. Proper panel selection must be made to ensure representation of all relevant stakeholder groups (Linstone and Turoff, 2002). The key point is to layout expectations in terms of knowledge required from an expert participating in the study (Okoli and Pawlowski, 2004). In this research project, we identified four different sets of experts: academicians, experts from non-governmental organisations working closely with sustainability issues, professionals involved in supply chain/ production representing buyer's perspective and tier one suppliers to the focal companies representing the supplier's perspective. The professionals and industry experts from automobile and textile sectors represented the buyer's and supplier's viewpoints in this study. The purposively sampled heterogeneous group of experts was selected based on their fit to a pre-defined criterion. The experts selected were:

- specialists in the area of sustainability and supply chain
- having minimum of five years of work experience at an intermediate level in the supply chain management.

### *3.3 Delphi procedure*

The three rounds of Delphi Study were conducted during the January 2019 to March 2019 time period, wherein sixty-six identified experts were formally invited through e-mails. Out of the 66 experts, 22 were academicians, 16 professionals working with NGOs, 14 representatives of buyer's perspective and 14 representatives of supplier's perspective. Of these, 55% responded to Round 1 representing over half of the invited

experts. Round 2 and Round 3 show 72% and 100% response rate respectively (refer Table 1).

**Table 1** Response rate across the participant group and rounds

<i>Group (sent)</i>	<i>Academicians</i>	<i>NGOs</i>	<i>Buyer side</i>	<i>Supplier side</i>	<i>Total received responses</i>	<i>Response rate</i>
Round 1 (66)	11	9	8	8	36	55%
Round 2 (36)	9	7	6	4	26	72%
Round 3 (26)	9	7	6	4	26	100%

### 3.3.1 Delphi round 1

66 selected participants were emailed a copy of the round 1 questionnaire and were requested to provide their responses to the demographic information and open-ended questions on buyer-supplier collaboration such as ‘What according to their expert opinion would be the key indicators, enablers and diverse aspects of buyer-supplier collaboration?’ (refer to Exhibit A). Two e-mail reminders were sent to the experts to ensure timely receipt of their responses. The 36 responses received from the experts were then inputted to NVivo to assign codes to the parameters generated thereof.

### 3.3.2 Delphi round 2

The parameters received from round 1 and the parameters reflected in the review of literature, were then compiled by the moderators. This list of 47 parameters was used as the basis for the second round questionnaire. The experts were to rate the questions on the scale of 1 to 5 wherein 1 signified not important at all and 5 meant very important. Out of the 36 questionnaires sent to the participants from round 1, only 26 duly filed responses (response rate 72%) were received.

Table 2 shows the consensus of the participants on the parameters of the buyer supplier collaboration in the sustainable supply chains. To assess the agreement among the respondents the criteria used were:

- a median score of the parameter greater than or equal to 4
- b interquartile range of one or less
- c standard deviation below one (Musa et al., 2015).

Out of 47 indicators, eight did not fit the above criteria and hence, were removed. The indicators that showed lesser than the acceptable value of median and standard deviation included exchange timely information (BSC2), exchange accurate information (BSC3), exchange complete information (BSC4) agreement to improvements that benefit the relationship (BSC18), bring together financial and non-financial resources (BSC27), If unexpected situation arises, a new deal is worked out (BSC35), agreements on objectives of the supply chain (BSC36), and long-term procurement strategy (BSC46).

**Table 2** Delphi round 2

Code	Parameters	Median	Minimum	Maximum	Inter-quartile range	Std. deviation
BSC1	Exchange relevant information	4	2	5	1	0.84
BSC2*	Exchange timely information	3	1	5	2	1.41
BSC3*	Exchange accurate information	2	1	5	2	1.30
BSC4*	Exchange complete information	3	1	4	1	1.24
BSC5	Exchange confidential information	4	3	5	1	0.62
BSC6	Frequent contact	4	3	4	1	0.57
BSC7	Open/Bi-directional communication	5	2	5	1	0.58
BSC8	Informal communication	4	3	5	1	0.64
BSC9	Different channels of communication	4	3	4	1	0.54
BSC10	Influence decision by dialogue or debate	4	4	5	1	0.45
BSC11	Plans volume demand together	3	2	4	1	0.43
BSC12	Plans new products and demand together	5	4	5	1	0.60
BSC13	Sale forecasts are shared	5	3	5	1	0.56
BSC14	Long term plans of products are shared	4.5	3	5	1	0.46
BSC15	Jointly solve problems	5	4	5	1	0.44
BSC16	Owe each other favors	4.5	3	5	1	0.67
BSC17	Responsibility of getting things done is shared	4	2	5	1	0.58
BSC18*	Agreement to improvements that benefit the relationship	3	1	3	2	1.66
BSC19	Evaluate and make known the performance of each other	4	3	4	1	0.50
BSC20	Share costs	4.5	3	5	1	0.47
BSC21	Share benefits	5	4	5	1	0.52
BSC22	Share risks	5	4	5	1	0.47
BSC23	Cross organisational teams frequently for design and development processes	5	4	5	1	0.48
BSC24	Personnel dedicated to management of collaboration process	4	3	4	1	0.55
BSC25	Share technical support	4	3	4	1	0.57
BSC26	Share equipment	4	3	5	1	0.69

Note: \*Did not fit the criteria and hence were removed from the next round.

Table 2 Delphi round 2 (continued)

Code	Parameters	Median	Minimum	Maximum	Inter-quartile range	Std. deviation
BSC 27*	Bring together financial and non-financial resources	2	1	4	1	1.40
BSC 28	Jointly acquire new knowledge	5	4	5	1	0.62
BSC 29	Assimilate and apply jointly most relevant knowledge	5	4	5	1	0.56
BSC 30	Jointly determine the needs of the final customers of the supply chain	4	4	5	1	0.59
BSC 31	Jointly discover new emerging markets	4	3	5	1	0.43
BSC 32	Jointly seek to know the intentions and capabilities of its competitors	4	2	4	1	0.58
BSC 33	Flexible in response to the changes in relationship with each other	4	2	4	1	0.79
BSC 34	Makes adjustments to maintain relationship with each other.	3	1	3	1	0.57
BSC 35*	If unexpected situation arises, a new deal is worked out	2	1	2	1	1.34
BSC 36*	Agreements on objectives of the supply chain	2	2	3	1	1.45
BSC 37	Agreement on the importance of collaboration across supply chain	4	3	4	1	0.67
BSC 38	Agreement on improvements that benefit the supply chain	4	2	4	1	0.74
BSC 39	Agreement on common supply chain goals	5	3	5	1	0.54
BSC 40	Carry out pre-design to achieve objectives of supply chain	4	2	4	1	0.65
BSC 41	Jointly plan promotional events	4	4	5	1	0.39
BSC 42	Jointly manage the inventory	4	3	5	1	0.57
BSC 43	Works out relationship between cost efficient and responsive.	4	3	5	1	0.65
BSC 44	To value chain from supply chain	5	3	5	1	0.64
BSC 45	Hand holding approach to self sustaining levels	5	2	5	1	0.75
BSC 46*	Long term procurement strategy	3	1	4	1	1.58
BSC 47	Investing in systems improvements	4	2	5	1	0.54
	Kendall's coefficient of concordance (W)			0.72		

Note: \*Did not fit the criteria and hence were removed from the next round.

**Table 3** Delphi round 3

<i>Code</i>	<i>Parameters</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Inter-quartile range</i>	<i>Std. deviation</i>
BSC1	Exchange relevant information	1	1	2	1	0.50
BSC5	Exchange confidential information	4	4	4	0	0
BSC6*	Frequent contact	2	1	6	2	1.45
BSC7	Open/bi-directional communication	3	2	3	0	0.51
BSC8	Informal communication	3	2	3	1	0.68
BSC9	Different channels of communication	2	1	2	1	0.74
BSC10	Influence decision by dialogue or debate	3	2	3	1	0.63
BSC11*	Plans volume demand together	2	2	6	2	1.45
BSC12	Plans new products and demand together	5	4	5	1	0.57
BSC13	Sale forecasts are shared	2	1	2	1	0.60
BSC14	Long term plans of products are shared.	1	1	1	0	0
BSC15	Jointly solve problems	4	3	4	1	0.43
BSC16	Owe each other favors	2	1	2	1	0.56
BSC17	Responsibility of getting things done is shared.	2	1	2	0	0.37
BSC19	Evaluate and make known the performance of each other	1	1	2	0	0.47
BSC20	Share costs	3	1	3	1	0.62
BSC21	Share benefits	1	1	2	0	0.36
BSC22	Share risks	6	4	6	1	0.67
BSC23	Cross organisational teams frequently for design and development processes	2	2	3	1	0.48
BSC24	Personnel dedicated to management of collaboration process	1	1	3	1	0.34
BSC25	Share technical support	4	2	4	1	0.53
BSC26	Share equipment	4	2	4	1	0.62

**Table 3**      Delphi round 3 (continued)

<i>Code</i>	<i>Parameters</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Inter-quartile range</i>	<i>Std. deviation</i>
BSC 28	Jointly acquire new knowledge	6	5	6	1	0.43
BSC 29	Assimilate and apply jointly most relevant knowledge.	2	1	2	1	0.36
BSC 30	Jointly determine the needs of the final customers of the supply chain	3	1	3	1	0.47
BSC 31	Jointly discover new emerging markets	6	4	6	1	0.65
BSC 32	Jointly seek to know the intentions and capabilities of its competitors	3	1	3	1	0.53
BSC 33	Flexible in response to the changes in relationship with each other	5	4	6	1	0.49
BSC 34*	Makes adjustments to maintain relationship with each other.	4	2	6	2	1.30
BSC 37*	Agreement on the importance of collaboration across supply chain	5	2	7	2	1.06
BSC 38	Agreement on improvements that benefit the supply chain	7	6	7	1	0.42
BSC 39	Agreement on common supply chain goals	4	4	5	1	0.65
BSC 40*	Carry out pre-design to achieve objectives of supply chain	6	2	7	2	1.45
BSC 41	Jointly plan promotional events	6	5	6	1	0.43
BSC 42	Jointly manage the inventory	5	4	5	1	0.54
BSC 43	Works out relationship between cost efficient and responsive.	7	6	7	1	0.46
BSC 44	To value chain from supply chain	7	6	7	0	0.34
BSC 45	Hand holding approach to self sustaining levels	7	6	7	1	0.59
BSC 47	Investing in systems improvements	7	6	7	1	0.68
	Kendall's coefficient of concordance (W)			0.81		

The Kendall's coefficient of concordance was also used to find out the level of agreement arrived from responses of different experts. The Kendall's coefficient of concordance (W) was calculated as 0.72 ( $> 0.50$ ) at  $p < 0.001$  showing good consensus on the responses (Cohen and Cohen, 1975).

### *3.3.3 Delphi round 3*

A list of 39 items found significant from the round two was emailed to the 26 expert group respondents. In this third round of Delphi, the experts were asked to group these 39 indicators in seven levels of buyer supplier collaboration wherein Level 1 would be more of a transactional level of collaboration between buyer-supplier and moving on to higher levels of collaboration, Level 7 would be a transformational level of buyer supplier collaboration in their sustainable supply chains. This round aims at determining how does the buyer supplier association in the sustainable supply chain move through the collaboration spectrum.

All the 26 respondents provided due responses in the third round and grouped the statements together in the seven categories of levels of collaboration, where 1 represented the least level of buyer supplier collaboration and 7 signified the highest level of buyer supplier collaboration. Each statement put in the relevant category by each respondent was given the corresponding rank. For instance, statements BSC 1, 14, 19, 21 were categorised in level 1 by respondent 1, so all these statements were allotted rank 1 by the moderators. Similarly, ranks were allotted to each statement on the basis of corresponding level categorised by each respondent. The median of the rank given to each parameter by different respondents was calculated. Table 3 given below shows the median and the standard deviation of the ranks. The parameters whose standard deviation of the ranks were less than 1 were accepted and categorised to the level suggested by the median of the rank. The statements where the standard deviation exceeded 1 were excluded from the grouping as no unanimous consensus was achieved.

The five parameters that were excluded from the seven levels of buyer supplier collaboration included: frequent contact (BSC6), plans volume demand together (BSC11), makes adjustments to maintain relationship with each other (BSC34), agreement on the importance of collaboration across supply chain (BSC37), carry out pre-design to achieve objectives of supply chain (BSC40).

## **4 Results**

On the basis of three-rounds of Delphi survey procedure, a level of buyer supplier collaboration was established that represented the consensus-based indicators and laid out stages of locally accepted assessment of sustainable supply chain collaboration.

The results show that the first level of collaboration is more on the inceptive side that reflects basic type of collaboration. Herein information is being exchanged, personnel dedicated for management of collaboration, benefits due to sustainable collaboration and long term plans ahead are shared between the supply chain partners. Evaluation and assessment of the progress made in the collaborative spectrum is shared with one another.

The second level of collaboration is where the buyer and supplier move together as an association wherein the partners share knowledge, sale forecasts and responsibilities. Cross-organisational teams of the supply chain partners meet frequently for process

integration and there are different channels of communication between the partners and they owe each other favours time and again.

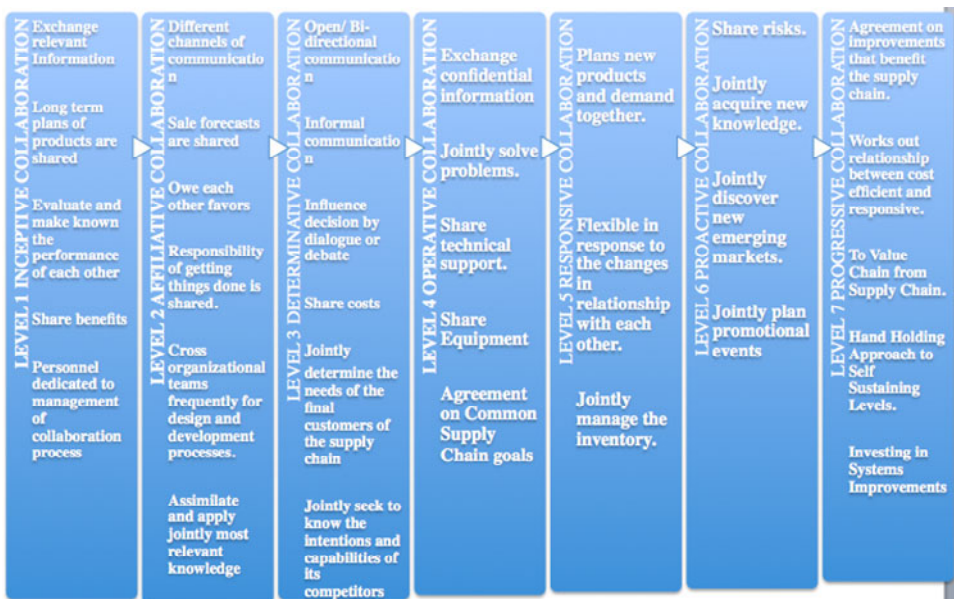
The third level of collaboration is considered formative as the buyer supplier alliance moves to a more determinative phase where the supply chain partners participate more on an informal level with open and bi-directional communication. They not only share benefits but also share costs of making their supply chains more sustainable and jointly assess their customers and competitors.

The fourth level of collaboration moves the association between buyer and supplier from functional to a more commitment-oriented relationship. The supply chain partners in this stage agree to common supply chain goals. They are dedicated to jointly solving the problems that might arise in their operations by not only committing to share their technical knowhow and equipment but also by sharing their confidential information with each other.

In the fifth level of collaboration the buyer and suppliers are more responsive in their approach and react to situation together as and when it arises. Here, the focus is on planning new products, jointly managing the inventory and being more flexible to the changes in relationship with each other.

The sixth level is closer to the transformational level of collaboration between buyer and supplier where the association is more pro-active in its approach than being reactive. The supply chain partners agree to share risks in their processes and jointly acquire new knowledge, discover new emerging markets and plan for promotional events together.

**Figure 4** Seven levels of buyer supplier collaboration (see online version for colours)



The seventh level of collaboration can be called as the most transformational level where buyers and suppliers are progressive in their association. At this level, the buyers and suppliers agree on making structural and radical improvements in their ongoing processes. The organisation re-assesses every process, activity and invests in systems improvement to achieve common supply chain goals that benefits both the parties. Here

both the buyers as well the suppliers focus on working out a relationship which is cost efficient and responsive and shifts focus on complete Value chain than limiting it to only supply chain. In this phase, the buyers handhold the suppliers and help them achieve self-sustaining levels.

## 5 Discussion

Though a lot of literature has already studied the importance of collaboration in sustainable supply chains and discussed its enablers, barriers, factors and characteristics (Simatupang and Sridharan, 2002; Vachon and Kalssen, 2006, 2008, Zhu and Sakris, 2004; Zhu et al., 2005), this study has tried to exhibit a level of progression from one stage of collaboration to another that builds the buyer supplier relationship and benefits the entire supply chain. Each parameter across different levels helps to bring the buyer and supplier closer to the common supply chain goal and can improve the performance of the supply chain as a whole.

### 5.2 *Linking the findings to the existing literature*

The first two stages of collaborative progression, i.e., inceptive and affiliative stage indicators can be linked to necessary collaborative characteristics like trust and commitment focusing on building robust buyer-supplier relationships. By building internal and cross-organisational teams, sharing information and benefits across the supply chain, this stage focuses on strengthening the long-term collaborative relationship on sustainability. The third stage, determinative collaboration, incorporates an extremely relevant theme discussed in the supply chain literature, i.e., customer needs. Supply chains cannot react to customer demands unless all members of the supply chain are aware about the current customer needs and also about the dynamic changes taking place in their requirements (Lummus et al., 2005). There is a need for the supply chain to not only pre-empt these changes in the customer demands but also to strategically develop practices keeping in view the competitors tactics. It requires the buyer and supplier to adopt synchronised strategies for cleaner production by anticipating their competitors move and satisfying their end customers. Another important aspect raised at this stage is the importance of informal communication. As previous studies elaborate that for collaboration on sustainability aspects, only formal communication may not be effective. When the suppliers are not involved in the formulation of these sustainability strategies, there may be a resistance from their side to adopt these practices and they may even perceive them to be more autocratic in nature (Touboullic and Walker, 2015a). Hence, as laid out in the existing literature as well, this stage asserts on the importance of open, bi-directional and informal communication enabling participation across the entire supply chain and better adherence to the sustainability practices. The fourth stage, operative collaboration, highlights the significance of complementary resources and capabilities of buyers and suppliers. The collaborative relationship can take advantage of each other's technical abilities and share resources that previous studies demonstrate, leads to innovation (Corsten and Felde, 2005) Sharing assets and capabilities in the supply chain builds more successful collaboration on sustainability (Blome et al., 2014).

The fifth stage, responsive collaboration, highlights a very important element of collaboration, flexibility. Flexibility to make adjustments is the bilateral expectation of

willingness to make adaptations in day-to-day management (Heide and John, 1990). The long-term perpetuation of the relationship is possible only when the partners are willingly to adjust to different situations as and when they arrive with the sole intention of keeping the collaborative association going (Carlo and Carlo, 2010). As we move further up the ladder towards more dynamic forms of collaboration, the elements involved become a lot more complex. The attainment of higher levels of collaboration depends on the extent of willingness amongst the buyers and suppliers to collaborate and strengthen their relationship (Nyaga et al., 2013). Sixth stage, i.e., pro-active collaboration focuses on acquiring new knowledge and new markets. However, the benefits of collaboration with respect to joint knowledge creation would lead to valuable innovations only when the degree of collaboration is high, otherwise it will be mere transfer of knowledge with no significant value addition (Greco et al., 2015). The seventh stage, i.e., progressive collaboration, can be linked and understood in previous studies as generating system-wide thinking. In order to follow this system wide approach, the organisations need to emphasise that collaboration is not only about generating profits but it is more about creating a long term relationship both internally and externally (Spekman and Carraway, 2006). Vanchon and Klassen in 2008 demonstrated the importance of having and developing relationship specific assets for sustainability. For such kind of relationship, cooperation from both sides is important. Radical changes within the organisation and other members of the supply chain may be required to bring about this system wide approach.

## 6 Conclusions

### 6.1 *Theoretical implications*

This Delphi study consolidates and extends the already existing literature on collaboration to formulate definitive levels and categories of buyer supplier collaboration with the help of methodologically grouped expert opinion. This study is carried out on the basis of open-ended questions and results in specific classifications of stages of buyer supplier collaboration. This method provides greater flexibility to understand and embed different perspectives, which might go un-noticed in other approaches. The framework developed encompasses various components of the theories supporting collaboration in sustainable supply chain. The study has established the importance of RBV and resource dependence theory (RDT) and found these two theories to contribute significantly towards understanding the collaborative practices in sustainable supply chain. These two theories have been found to be complementary to one another especially in terms of uncertainties faced by the organisations in a dynamic environment. In order to mitigate these uncertainties, the organisations have inter-firm dependency thereby utilising each other's core capabilities. Both the theories suggest that the partnering firms can gain from one another especially when one partners performance is lower or when the output of one partner is the input for another. Hence, in context of the buyer supplier collaboration where the focus is on mutual benefits to achieve common goals, RBV and RDT have been seen compatible and also necessary. The findings from this study suggest that in practice it might be difficult to assess the situations that particularly fall within the full collaboration. The buyer supplier collaboration practices for sustainability tend to exhibit a mix of both collaborative and compliance mechanisms (Alvarez et al., 2010). This

study discusses the phased categorisation of such practices. This study further differentiates itself from the rest of the studies made in this domain by taking into consideration all the three aspects (economic, social and environmental) of sustainability from the buyer's as well as the supplier's perspective. This model can help companies to assess their level of collaboration activities in view of their sustainability goals.

## *6.2 Managerial implications*

While the supply chain managers might already be aware of various collaboration parameters (knowledge sharing, information sharing, etc.) but our model assists them to make the transition from moderate level of practices to superior and modern collaborative practices in sustainable supply chain. The framework provides a starting point to the supply chain managers to assess their current phase of collaborative practices and move higher, towards attaining more robust competitive advantage in the supply chain. Though the study emphasises that the buyer and supplier perspectives are different in sustainable supply chains but there is a need to view the relationship more holistically by integrating common supply chain goals. The suppliers should not only be focused on short term goals like sharing benefits but have a long-term vision of creating robust collaborative relationship with the buyers by offering flexibility, sharing risks and undertaking joint supply chain activities to achieve mutual success. On the buyer side, our framework asserts that the focal company should not only limit itself to engaging with the suppliers but rather a constant progression should be made through the training and supplier development programs. This progression must continue until cost effective and efficient buyer supplier relationship is established and the supplier has become self-reliant thereby resulting in overall system improvement. The recommendation of the study to the policymakers would be to create awareness through seminars and workshops and also encourage companies to make voluntary disclosures of the collaborative practices adopted in the sustainable supply chain. It will not only increase firm's awareness about such practices but also assist in much synchronised uptake of sustainability practices across industries. This would benefit all the stakeholders' viz. economic, environment and community as a whole. Industry associations can also adopt benchmarking good collaborative practices that will help other firms to follow sustainable activities in their supply chain thereby expanding its scope and creating a positive impact holistically.

## **7 Limitations and future research**

Though there are significant theoretical contributions made by the study, it still has few underlying limitations. The study provides a research process and a starting point to grouping activities into levels of collaboration in sustainable supply chains but further studies are required to empirically validate the classifications made. Another limitation of this study is that the results have been formulated using knowledge of experts in automobile and textile sector. It would however be beneficial to further expand the scope of the study by including experts from more industries. Using this model, industry wise studies could prove beneficial. Further, future research can also try to study whether the transition between the levels is in the phased and progressive manner as emphasised in this study or there is any midstream possible for the supply chain partners to circumvent few levels of collaboration to reach the transformational collaborative relationship. Many

other collaborative elements like power asymmetry, dependency, length of relationship between buyers and suppliers may have an impact on the stages of collaboration in the sustainable supply chain. These aspects need to be dwelled upon and thoroughly studied in future researches. Another scope for the future research could be to understand the implementation of the sustainability collaborative practices in the supply chain (Touboullic and Walker, 2015a) and to recognise the human and behavioural change required for its effective implementation (Touboullic and Walker, 2015b).

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## Appendix

### *Exhibit A*

#### Questionnaire round 1

- a In your opinion, what are the key indicators/measures of buyer-supplier collaboration in sustainable supply chains?
- b In your opinion, what are the key characteristics or enablers of buyer-supplier collaboration?
- c On what aspects do you feel the buyer and supplier standpoints on buyer-supplier collaboration can be different?
- d Other particular aspects of buyer-supplier collaboration that require further research.