# A decade of supply chain collaboration and directions for future research

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**Abstract**
**Purpose** – This paper aims to conduct a systematic review of the literature on supply chain collaboration published over a 10-year period from 2005 to 2014. It explores the nature and extent of research undertaken to identify key themes emerging in the field and gaps that need to be addressed.
**Design/methodology/approach** – The authors review a sample of 207 articles from 69 journals, after using an iterative cycle of defining appropriate search keywords, searching the literature and conducting the analysis.
**Findings** – Key themes include the meaning of collaboration; considerations for supply chain collaboration theory; emerging areas in collaboration for sustainability, technology-enabled supply chains and humanitarian supply chains; and the need for a more holistic approach, multi-tier perspectives and research into B2C collaborations.
**Research limitations/implications** – The paper provides discussion and scope for future research into the area which would contribute to the field tremendously.
**Originality/value** – There have been very few reviews in the past on supply chain collaboration, and this is one of the first extensive reviews conducted to address how well the body of knowledge on supply chain collaboration corresponds with our contemporary society.

**Keywords** Relationships, Collaboration, Partnership

**Paper type** Literature review

## 1. Introduction

The increasing number of organisations accessing new markets to seek higher efficiencies in sourcing and production has heightened the importance of supply chain management today. Consequently, intense competition has also required supply chain managers to consider various capabilities and value creation strategies for their customers. Supply chains are now operating in more dynamic environments, characterised by globalisation, rapidly evolving technologies and increased customer responsiveness, and, therefore, require more integrative and collaborative efforts.

While there are many views held by scholars on how to define supply chain collaboration, some common features are evident. We advocate that collaboration involves multiple firms or autonomous business entities engaging in a relationship that aims to share improved outcomes and benefits. To achieve these improvements in performance, the business entities need to establish an appropriate level of trust; share critical information; make joint decisions; and, when necessary, integrate supply chain processes. Supply chain collaboration is often defined as two or more companies working together to create a competitive advantage and higher profits than can be achieved by acting alone (Simatupang and Sridharan, 2002). Olorunniwo and Li (2010) take a relational position arguing that collaboration can also be defined as a relationship between independent firms characterised by openness and trust where risks, rewards and costs are shared between parties. Singh and Power (2009) adopt the view by Togar and Sridharan (2002, p. 19) where supply chain collaboration is:

> [. . .] two or more chain members working together to create a competitive advantage through sharing information, making joint decisions and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone.

Focusing more on the outcome of collaboration, Simatupang and Sridharan (2005, p. 258) also use the term collaboration to describe "the close cooperation among autonomous business partners or units engaging in joint efforts to effectively meet end customer needs with lower costs". However, Singh and Power (2009, p. 190) argue that cooperation is when firms exchange basic information and have some long-term relations with multiple suppliers or customers. Coordination occurs at a higher level where a continuous flow of critical and essential information takes place using information technology. Additionally, collaboration is higher than coordination, and, at this stage, a high level of commitment, trust and information sharing is required.

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Supply chain collaboration is considered a major factor in maintaining a supply chain's competitive position and deemed an important research topic. It has received increased attention in the field of supply chain management with the number of articles published over the years. Supply chains, being inter-organisational and inter-functional, are known to be more effective with the coordinated and collaborative efforts among partners. This concept was first highlighted by Ellram and Cooper (1990) as a motivation for successful supply chain management, and, subsequently, we see many researchers exploring diverse perspectives to discern the characteristics, drivers, barriers and outcomes of collaborative ventures between various supply chain partners. From the research findings published, it is widely accepted today that supply chain collaboration enables superior performance in firms due to the capitalisation on resources, capabilities, processes and routines residing in partners firms (Fawcett *et al.*, 2012; Mentzer *et al.*, 2008). Additionally, rapid developments in technology, globalisation and competition have heightened the interest and opportunities for inter-organisational relationships as firms seek productive efficiencies in sourcing, production, distribution, retail and other supply chain functions. These, together with changing consumer demand, give rise to uncertainties in firms when maintaining inter-organisational relationships. From a transaction cost perspective, Tokman *et al.* (2007) prescribe that the greater the uncertainty, the more likely it is that firms will seek to control activities through long-term collaborative relationships or vertical integration rather than through short-term relationships.

While there are many reasons for supply chain collaboration, the reality is that true collaboration across boundaries is often very difficult to achieve owing to cultural and structural barriers (Stank *et al.*, 2001; Fawcett *et al.*, 2010, 2012). However, those firms that do collaborate can benefit in several ways including efficiency in the exploitation of resources, the development of new competencies and better positioning in markets (Nooteboom, 2004). Nevertheless, there are many behavioural issues which continue to persist in supply chains, such as low levels of trust among firms, preventing them from sharing proprietary information or idiosyncratic resources (Fawcett *et al.*, 2008, 2010; McCarter and Northcraft, 2007). Also many organisations operate in dysfunctional silos, which impede the formation of productive relationships and value creation activities overall (Fawcett *et al.*, 2010). Supply chain collaboration is still viewed as a critical business strategy today to derive maximum benefits, as evident with the collaborative partnerships across planning, production, forecasting and replenishment functions in the supply chain. If firms can benefit from supply chain collaboration and we understand the reasons why firms fail to collaborate, what then have supply chain scholars in the past 10 years contributed to our knowledge of supply chain collaboration?

This paper aims to review the literature and address how well the body of knowledge on supply chain collaboration corresponds with our contemporary society pertaining to some key themes, and also to provide a discussion on areas for future research. This review is guided by the following three research questions:

*RQ1*. What is the nature and extent of research undertaken over the past decade on supply chain collaboration?

*RQ2*. What are the key themes emerging or gaps that need to be addressed?

*RQ3*. How can further research guide practitioners and supply chain managers to better address inter-organisational and inter-functional challenges in supply chains?

The rest of the paper is structured as follows. The next section outlines the steps undertaken for the literature review followed by the results. We then provide a discussion highlighting some of the key themes from our findings and suggest avenues for future research into supply chain collaboration.

## 2. Research methodology and data statistics

Literature reviews are used as a key tool to manage the diversity of knowledge under inquiry and to enable researchers to assess existing intellectual territory and specify research questions to develop knowledge further (Tranfield *et al.*, 2003). Accordingly, we use a systematic literature review as supported by Tranfield *et al.* (2003). These authors advocate that applying specific principles of the systematic review methodology in management research can minimise bias through explicitly stating the values and assumptions underpinning a review. This "enhances the legitimacy and authority of the resultant evidence" (Tranfield *et al.*, 2003, p. 208) enabling researchers with a reliable basis to formulate opinions and considerations for further research. A systematic literature review is also deemed a replicable and transparent process that provides an audit trail, while assisting in identifying major contributions to a research area. Although this method requires a great deal of time and effort, the results have proven to be efficient, reliable and viewed as a "fundamental scientific activity" (Mulrow, 1994, p. 597). Structured reviews are generally conducted using an iterative cycle of defining appropriate search keywords, searching the literature and conducting the analysis (Saunders *et al.*, 2009).

In the first stage, we defined the research aims and objectives after conceptualising the various factors, research developments and methods used in previous studies. The researchers debated on the suitability gauges and conditions as to which type of publications would be included for this study and decided on the use of Scopus database as a source. Scopus is managed by Elsevier publishing and is considered the largest abstract and citation database in the science, medicine, technology, social sciences and arts and humanities disciplines. Scopus covers 46 million abstracts of over 19,500 peer-reviewed titles from more than 5,000 publishers and 500 million quality Web pages through Scirus' Web search to cover the scientific Web. It is, by far, the most comprehensive database capturing many reputable journals in the area of supply chain management and recommended as a reliable source (Chicksand *et al.*, 2012).

In the second stage following Saunders *et al.* (2009), we undertook a systematic paper based review of the content of the final articles. After establishing and agreeing on key concepts, keywords were identified and utilising the data extraction approach suggested by Tranfield *et al.* (2003), two researchers

independently and manually reviewed the articles, then compared and reconciled their findings. The content analysis began by seeking to understand if and how collaboration was defined in each article; next, it was necessary to identify the other relationships and activities such as coordination, networking, partnering and integration that are associated with collaboration. We also attempted to identify and analyse trends that were of increasing interest to supply chain collaboration such as the role of people, sustainability, humanitarian supply chains, the role of technologies and customers or consumers. As Tranfield *et al.* (2003) recommend testing the theoretical adequacy of the articles, we analysed the content to identify the theories underpinning the literature on supply chain collaboration.

### 2.1 Search results

Using the "title, abstract and keywords" search in Scopus database, we employed the following keywords, "Collaboration", "Supply Chains", "Supply Chain Management" and "Supply Chain Collaboration", to identify articles from 2005-2014 published in English. The initial search resulted in 2,173 documents from various sources including journals, book chapters, conference reviews, short surveys, books, editorials, notes, trade publications, book series and conference proceedings. We, subsequently, restricted the articles to academic journals and excluded the health and physical science areas such as "medicine", "chemistry", "biochemistry", "nursing", "immunology" and "chemical engineering". This resulted in 642 articles from academic journals.

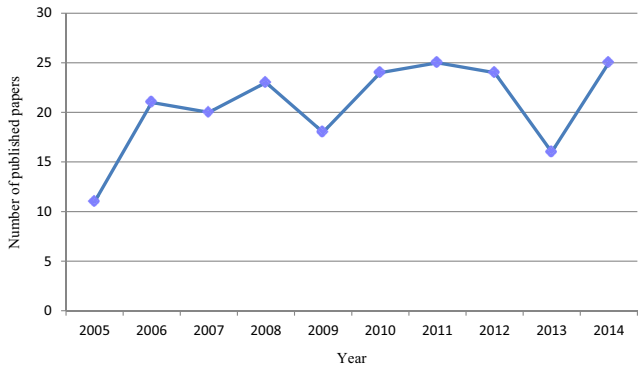
Thereafter, we thoroughly inspected each article's abstract to discern the content of the publication and excluded those with no authors or those not related to supply chain operations. Articles concerning collaboration within departments about new product development, radio frequency identification tags through collaborative readers, author collaborations in research, collaborative teaching in SCM, etc. were then excluded. This resulted in 235 articles from 91 journals which although included content about knowledge sharing, supply chain integration, inter-organisational relationships, partnerships, information systems, tools and technologies for enabling collaboration and factors affecting collaboration, had the word "collaboration" in its abstract or keywords.

After initial examination of these journals and articles, the authors decided to only include journals predicated on four conditions. These criteria were the journal's impact factor as published in the 2014 Thomson Reuters journal citation report or the 2013 SCImago journal rank (SJR), which is a measure of scientific influence that takes into account both the number of citations received by a journal and the importance or prestige of the journals. Additionally, if the journals were in the 2013 Australian Business Deans' Council (ABDC) list of journal rankings or the 2015 Academic Journal Guide (AJG) by the Association of Business Schools, they were also included. Therefore, we considered only those journals with Impact Factor or SJR > 1, or those ranked and included in the ABDC or AJG lists. This resulted in 207 articles from 69 journals (Appendix).

### 2.2 Data statistics

Figure 1 shows the trend in the quantity of articles published over the past decade about collaboration in the supply chain.

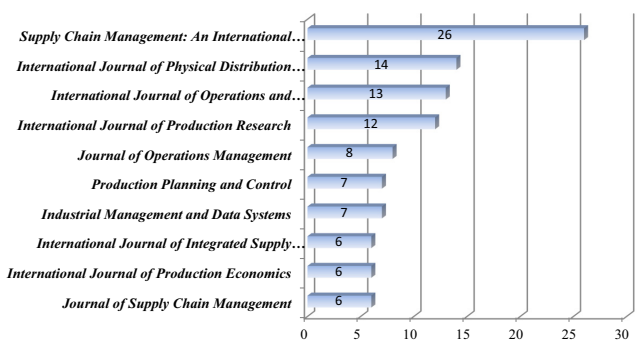
**Figure 1** Total number of papers published between 2005 and 2014




Apart from the dip in the number of publications in 2009 and 2013, there is somewhat an increasing stream of research over the years given the growing interest in supply chain collaboration. The largest number of publications was recorded for the years 2011 and 2014. Similarly, from the myriad of research carried out over the years towards discerning the elements of supply chain management, it is apparent that supply chain collaboration is also another key area of research within the field.

After considering the number of articles on SCC and their sources, we identified ten publication outlets most frequently published, namely, *Supply Chain Management: An International Journal* with 26 articles; *International journal of Physical Distribution and Logistics Management* with 14 articles; *International Journal of Operations and Production Research* with 13 articles; *International Journal of Production Research* with 12 articles; *Journal of Operations Management* with 8 articles; *Industrial Management and Data Systems*, and *Production Planning and Control* with 7 articles each; and *International Journal of Integrated Supply management*, *Journal of Supply Chain Management* and *International Journal of Production Economics* with 6 articles each (Figure 2). These journals in Figure 2 have been dedicated to publishing research on supply chain collaboration and represent approximately 51 per cent of papers on supply chain collaboration published over the decade. Other journals that make up the remaining 102 articles are not included because of their low frequency.

**Figure 2** Ten journal outlets most frequently contributing to the area of supply chain collaboration published during the period from 2005 to 2014



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Additionally, we also compare the articles published by country, based on the first author's country of affiliation as presented in Scopus and illustrated in Table I. The USA has the highest number of contributors to the field, followed by the UK, Taiwan, Australia, Canada and Germany.

Out of the 207 articles published, 35 per cent of them adopted quantitative methods, 27 per cent adopted qualitative methods, 16 per cent used mathematical or simulation techniques, 16 per cent were conceptual in nature, 3 per cent adopted mixed methods and the remaining 3 per cent were literature reviews. As the research on collaboration efforts is experiencing growth, a number of authors have adopted various methods to measure collaboration quantitatively.

## 3. Discussion

Having an overview of the publications evident in the field, we examine and discuss a few key themes based on our review.

**Table I** Frequency of publications by country of affiliation of first author between 2005 and 2014

| Country | No. of papers | % contribution |
|---|---|---|
| USA | 65 | 31.40 |
| UK | 30 | 14.49 |
| Taiwan | 19 | 9.17 |
| Australia | 13 | 6.28 |
| Canada | 13 | 6.28 |
| Germany | 12 | 5.79 |
| Italy | 11 | 5.31 |
| Finland | 10 | 4.83 |
| India | 9 | 4.34 |
| Spain | 9 | 4.34 |
| China | 6 | 2.89 |
| France | 6 | 2.89 |
| South Korea | 6 | 2.89 |
| Belgium | 5 | 2.41 |
| The Netherlands | 5 | 2.41 |
| Ireland | 4 | 1.93 |
| Greece | 4 | 1.93 |
| Hong Kong | 4 | 1.93 |
| Indonesia | 4 | 1.93 |
| New Zealand | 4 | 1.93 |
| Turkey | 4 | 1.93 |
| Norway | 3 | 1.44 |
| Singapore | 3 | 1.44 |
| Brazil | 2 | 0.96 |
| Sweden | 2 | 0.96 |
| Switzerland | 2 | 0.96 |
| Denmark | 2 | 0.96 |
| Portugal | 2 | 0.96 |
| Japan | 2 | 0.96 |
| Malaysia | 2 | 0.96 |
| Vietnam | 2 | 0.96 |
| Thailand | 1 | 0.48 |
| Colombia | 1 | 0.48 |
| United Arab Emirates | 1 | 0.48 |

### 3.1 Meaning of collaboration

We have found that a number of authors tend to use the term "collaboration" rather loosely in the context of their research. We need to be mindful that there are many possible types of relationships in the supply chain, some of which do not equate to collaboration. Harrison *et al.* (2014) cite Sako's (1992) work on inter-firm relations to highlight a continuum of relationship styles ranging from arm's length, transactional relations, cooperative agreements, coordination mechanisms, partnerships, strategic alliances and joint ventures to vertical integration. Each of these relationship styles has motivating factors that drive development and that govern the supply chain environment. These authors also state that the duration, breadth, strength and closeness of the relationship between supply chain partners vary according to firm and over time (Harrison *et al.*, 2014, p. 318). The networks and the degree of inter-firm collaboration have spurred alternative supply chain structures, practices and its management today. A strategic partner is a firm where the focal company has decided to develop a long-term collaborative relationship, probably as an ultimate objective after a number of phases where the relationship may have evolved from in the continuum. Harrison *et al.* (2014) also argue that the obligational aspects of a relationship may increase from cooperation to collaboration. They distinguish this from coordination (such as the information links, e-enablement and integration efforts), which they define in terms of established rules or customary practices whereby partners work together. Coordination, as they advocate, is the indispensable step to supply chain integration. However, "collaboration goes beyond integration by including long-term commitments to technology sharing and to closely integrated planning and control systems", where firms become interdependent and develop common goals and governance processes (Harrison *et al.*, 2014, p. 326). This can somewhat cause a paradox in the literature where some authors associate the need for collaboration with the need to achieve integration in the supply chain (Kache and Seuring, 2014).

Our findings reveal that there are also publications where authors equate the word collaboration with cooperation or even supply chain integration, as we have identified in some of the articles' content, abstracts and keywords. For example, the use of radio frequency identification, vendor managed inventory (VMI), collaborative, planning, forecasting and replenishment (CPFR) or e-commerce has been assumed by some authors to infer a truly collaborative supply chain. It has been mentioned that definitions of collaboration differ across disciplines and the term "collaboration" or "partnership" is customarily used as a general descriptor for joint efforts. Gadja (2004, p. 66) mentions: "In its overuse, the term 'collaboration' has become a catchall to signify just about any type of inter-organisational or inter-personal relationship". This sentiment had also been raised by Richey *et al.* (2012) in their paper, where they state that the term collaboration, although widely used in the supply chain literature, often seems to be taken for granted and infrequently defined. Collaboration in reality has a much richer description in the business and inter-organisational fields, particularly in the

supply chain domain where it characterises the highest form of relationships. In their review of the literature, Richey *et al.* (2012) provide a list of definitions of collaboration to identify some common themes and to conceptualise the elements. Similarly, we build on these themes to illustrate that collaboration is a multi-faceted approach.

From these definitions in Table II and based on our review, collaboration can be conceptualised as a strategy (Udin *et al.*, 2006; Fawcett *et al.*, 2010; Tsou, 2013), a unique dynamic capability (Singh and Power, 2009; Fawcett *et al.*, 2011; Hartmann and De Grahl, 2011; Richey *et al.*, 2012; Smith and Rupp, 2013; Soosay *et al.*, 2008) and the highest form of long-term, trust-based relationship (Bhakoo and Chan, 2011; Sheu *et al.*, 2006; Ha *et al.*, 2011; Vlachos *et al.*, 2008; Yazici, 2012; Van Echtelt *et al.*, 2008). It is characterised by joint planning and decision-making regarding strategic and operational matters (Kim and Oh, 2005; Kumar and Banerjee, 2012); resource, process, information and risk sharing (Moyaux *et al.*, 2007; Ruel *et al.*, 2013; Yigitbasioglu, 2010); and mutual understanding, working towards shared goals and achieving optimal solutions (Fawcett *et al.*, 2011). Hence, the key elements of supply chain collaboration from our analysis highlight the mutually beneficial relationships formed among firms to share improved outcomes and benefits, which are based on appropriate levels of trust, information sharing, joint decisions and, where necessary, processes of supply chain integration.

The widespread developments in supply chain technologies, tools and applications such as traceability systems, Quick Response, Efficient Consumer Response, Collaborative Planning, Forecasting and Replenishment and VMI have assumed firms will engage in a collaborative approach to the implementation and use of technologies (Lehoux *et al.*, 2010; Deakins *et al.*, 2008; Sari, 2008; Emberson and Storey, 2006; Derrouiche *et al.*, 2008; Blackhurst *et al.*, 2006). By taking this into consideration, Cao *et al.* (2010) argue that supply chain collaboration can be defined in different ways and could be either process focused or relationship focused. Notwithstanding, they derive a model for supply chain collaboration attributed to seven components (information sharing, goal congruence, decision synchronisation, incentive alignment, resources sharing, collaborative communication and joint knowledge creation), which they term as mechanisms to reduce costs and risks. The study by Simatupang and Sridharan (2005) also proposes a model for the collaborative supply chain comprising five characteristics:

1 collaborative performance system;
2 information sharing;
3 decision synchronisation;
4 incentive alignment; and
5 integrated supply chain processes.

Hence, as previously espoused by Barrat (2004), we reinforce the need for future research to define the context and meaning of collaboration under study. Greater understanding is still required on the interface between collaboration strategies, capabilities and relationships coupled with the various characteristics or elements to discern if it is truly a collaboration or just joint efforts between firms at a lower level in the partnering continuum (Thomson and Sanders, 1998).

### 3.2 Organisational theories underpinning collaboration

The structure, operations and behaviour of firms can be explained by organisational and management theories. Our review of the articles has found a number of theories applied and stemming from different perspectives. We identify 12 theories that have been used:

1 Resource-based theory;
2 Resource-advantage theory;
3 Relational view;
4 Social exchange theory;
5 Dynamic capability view;
6 Stakeholder theory;
7 Signalling theory;
8 Force field theory;
9 Transaction cost theory;
10 Contingency theory;
11 Agency theory; and
12 Technology-Organisation-Environment theory.

We briefly outline each of these below and highlight examples of studies that have applied them.

The *Resource-based theory* (Barney, 1991) has been expanded from a firm level to emphasise how resources, including technologies could be utilised and exploited from supply chain partners or synergistically combined to derive competitive advantage (Richey *et al.*, 2012; Gold *et al.*, 2010). Additionally, the collaboration in itself could be regarded as a strategic resource or a capability which is unique, valuable and hard to replicate, thereby providing competitive advantage (Fawcett *et al.*, 2011; Hartmann and De Grahl, 2011; Gold *et al.*, 2010). The *Relational view* (Dyer and Singh, 1998) extends from this theory and suggests that idiosyncratic inter-firm linkages are an important source of competitive advantage. As Zacharia *et al.* (2011) point out, relational rents are the supernormal profits jointly created in a collaboration through the combined idiosyncratic assets, knowledge and capabilities of firms. The underlying notion is that such resources can be distributed across partners in the supply chain (Iyer, 2014). Additionally, Hunt and Davis's (2008) *Resource advantage theory* has been applied to examine supply chain collaboration (Adams *et al.*, 2014). This theory highlights how firms that bundle resources of greater effectiveness and/or lower cost relative to competitors due to heterogeneously distributed resources within markets can achieve superior performance.

*Social exchange theory* (Homans, 1958) incorporates social factors into relationships and Wagner *et al.* (2011) explain how companies in exchange relationships in a supply network evaluate the outcomes of the collaboration against pre-conceived reward expectations. Wu *et al.* (2014) also apply this theory to study how collaborative behaviours and information sharing comprising trust, commitment, reciprocity and power can affect the performance of supply chains as a whole. Fawcett *et al.* (2011) view supply chain collaboration as a *Dynamic capability* (Teece *et al.*, 1997) where it enables a firm to access, shift and leverage supply

**Table II** Various definitions of collaboration

| Reference | Definition | Focus of definition |
|---|---|---|
| Stank *et al.* (2001) | Collaboration is a process of decision-making among interdependent parties. It involves joint ownership of decisions and collective responsibility for outcomes (p. 31) | Joint ownership of decisions and decision outcomes among interdependent parties |
| Simatupang and Sridharan (2002) | Supply chain collaboration is often defined as two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone (p. 19) | Mutual decisions, benefits sharing and information sharing that create competitive advantage through a greater probability of collective satisfying customer needs |
| Shore and Venkatachalam (2003) | Collaboration is defined as the supplier's ability to work in a close partnership with headquarters and its willingness to share a range of data from cost structures to scheduling and logistics. It manifests itself in attitudes that relate to a supplier's integrity, trustworthiness, helpfulness in reducing costs, synergy with headquarters, and support of customer service (p. 809) | To work with other intra-firm and inter-firm relationship partners' elements, sharing information and operational details, based trust, to improve performance outcomes |
| Barrat (2004) | A collaborative relationship based on information exchange in support of joint strategic, tactical and operational planning, forecasting and demand fulfilment processes (p. 74) | This definition is centred on planning and CPFR-type processes |
| Sanders and Premus (2005) | Internal collaboration is a construct defined as an affective, mutually shared process where two or more departments work together, have mutual understanding, have a common vision, share resources, and achieve collective goals. External collaboration is defined similarly to internal collaboration, with the exception that the focus of collaboration is between two or more firms, rather than departments (p. 3) | Mutually shared processes, work efforts, resources and goals between departments within the firm or between different firms |
| Corsten and Felde (2005) | Joint action in buyer-supplier relationships and focus on collaborative product and process development processes (p. 446) | Joint action in business relationships linking processes and process outputs |
| Kahn *et al.* (2006) | Demand collaboration is generally characterised as cooperative behaviour or joint decision-making between companies, and represents a willingness, versus a requirement, to engage in organisational efforts (p. 192) | Willingness to participate in, rather than compliance with, organisational efforts based on cooperation and joint decisions |
| Stefansson (2006) | Collaboration is a process of decision-making among interdependent parties (p. 81) | Interdependence between parties promotes collective decision-making |
| Fawcett *et al.* (2008) | SC collaboration is defined as the ability to work across organisational boundaries to build and manage unique value-added processes to better meet customer needs (p. 93) | Working across organisational boundaries to provide linked processes that better serve the customer |
| Min *et al.* (2008) | Collaboration requires more than just information sharing. Collaborative processes include joint decision-making and problem solving (p. 294) | Sharing of information represents one of many processes enabling sharing of risks, rewards, and responsibilities in crafting joint decisions |
| Skipper *et al.* (2008) | Collaboration is characterised by a higher level interest, representing an affective, volitional, shared interest process. There must be some form of investment in the relationship that includes mutual understanding, a common vision, shared resources, and achievement of collective goals (p. 41) | Mutual effort between trade partners requiring investment of resources based on common views and goals |
| Walters (2008) | Collaboration describes the overall willingness of organisations to seek and implement customer-based solutions using shared resources and producing shared benefits (p. 709) | A customer-focused effort to develop and execute inter-firm processes sharing resources and benefits |
| Daugherty (2011) | A number of different definitions of collaboration have been presented; however, they tend to focus on the same aspects of the cross-firm relationships. Collaboration has been defined as two or more companies sharing the responsibility of exchanging common planning, management, execution, and performance measurement information (p. 22) | Cross-firm sharing of planning management, operational execution and performance measurement between firms in a business relationship |
| Richey *et al.* (2012) | Collaboration is a mutually shared process where two or more firms display mutual understanding and a shared vision, and the firms in question voluntarily agree to integrate human, financial, or technical resources with the aim of achieving collective goals (p. 35) | Shared processes and integration of resources for collective goals |
| Tsou (2013) | Supply chain collaboration involves coordinating activities between buyer and supplier so that both parties can improve the supply chain performance such as reducing cost, increasing service level, better utilising resources, and effectively responding to changes in the market place (p. 5201) | Collaborative replenishment to improve total throughput of the supply chain and accomplish a win-win solution |

(*continued*)

Table II

| Reference | Definition | Focus of definition |
|---|---|---|
| Lozano *et al.* (2013) | (Horizontal) collaboration among shippers takes the form of merging their transportation needs so that their collective transportation demand can be met at lower cost (p. 444) | Collaboration enables shipment consolidation and bundling effects making LSPs more cost effective |
| Blome *et al.* (2014) | (Sustainability) collaboration involves sustainable management along the supply chain, requiring specific resources for joint activities and high knowledge exchange in attaining environmental solutions and sustainability goals (p. 642) | Collaboration in achieving sustainability |

**Source:** Building on Richey *et al.* (2012)

chain resources to respond to evolving and competitive environments.

*Stakeholder theory* (Freeman, 1984; Donaldson and Preston, 1995; Mitchell *et al.*, 1997) can be used to identify the dynamics of interaction between an organisation and its stakeholders, characterised by power, legitimacy and urgency. Co and Barro (2009) provide a framework for analysing stakeholder management strategies in supply chain collaboration which affect the choice between aggressive or cooperative strategies in managing such stakeholder relationships. *Signalling theory* (Spence, 1973) has also been applied to studies in supply chain collaboration where it supports the idea that potential signals (e.g. a firm's reputation, philanthropic actions or media announcements concerning strategic decisions) could positively or negatively affect buyer–supplier relationships (Wagner *et al.*, 2011). *Force field theory* (Lewin, 1951) proposes the need for managers to consider the driving forces and resisting forces when pursuing a collaboration capability. Fawcett *et al.* (2010) illustrate driving forces such as customer demand, aligned goals, shared customer-oriented vision, trust, supplier development and technological connectivity. Resisting forces include lack of senior management support, inadequate technology, organisational culture and structure, people, policy and processes, opportunism, information and power asymmetries which serve as barriers to effective collaboration.

*Transaction cost theory* (Williamson, 2008) can be used to explain supply chain collaboration in terms of the uncertainties, risks and opportunism in partners. Yigitbasioglu (2010) applied this theory to discern the impact on information sharing between buyers and sellers in Swedish and Finnish firms and showed that both demand uncertainty and environmental uncertainty and dependency affect the level of information shared with key suppliers, which in turn could have impacts on collaboration across the supply chain. Similarly, Richey *et al.* (2012) add that this theory explains the governing mechanisms used by firms to prevent opportunistic behaviour or uncertainty. *Contingency theory* (Fielder, 1964) supports that there is no best way to organise, lead or make decisions, where the optimal course of action is dependent upon the internal and external situation. This theory has been used to support collaborative planning initiatives in supply networks (Danese *et al.*, 2011; Hall *et al.*, 2012). *Agency theory* (Jensen and Meckling, 1976; Eisenhardt, 1989) provides insights into how social, political, legal and behavioural dynamics affect supply chain relationships (Fayezi *et al.*, 2012). Byrne and Power (2014) applied this theory to explore the agency-related factors such as unequal distribution of information and power, and the nature of interactions between firms in the supply chain. *The Technology-Organisation-Environment (TOE)* framework (Tornatzky and Fleischer, 1990) has been used in electronic collaboration studies to explain customer-supplier relationships (Jean *et al.*, 2014) and the adoption or diffusion of technology in supply chains (Chan *et al.*, 2012).

### 3.3 Considerations for supply chain collaboration theory

We acknowledge that the abovementioned theoretical viewpoints provide researchers with different orientations to the rationale or factors affecting collaboration and furnish insights into how organisations can manage resources, systems and relationships to sustain their competitiveness. We argue that many of these theories tend to stem from a one-sided, organisation-focused approach. A supply chain in essence comprises a network of firms, where collaboration should be viewed from a dyadic or multi-firm perspective. Correspondingly, collaboration is meant to achieve mutual benefits and win-win outcomes for all parties. Hence, to truly understand this, future research will have to explore the reciprocity in collaborative efforts, i.e. not just from a firm's perspective, but as a whole and also consider the collaborating firm/s' perspectives. Arguably then, researchers would need to reframe their research questions to address this, and investigate the collective outcomes or compare outcomes between firms involved in the collaboration.

Flowing from this point, we bring to light the issue of trust, dependency and power which has often been raised as key factors inhibiting supply chain collaboration (Wagner *et al.*, 2011; Wu *et al.*, 2014; Co and Barro, 2009; Chen *et al.*, 2014; Nyaga *et al.*, 2010; Islam and Olsen, 2014; Zeng *et al.*, 2012; Hammervoll and Bø, 2010; Chae *et al.*, 2005; Thomé *et al.*, 2014; Wang *et al.*, 2011; Centindamar *et al.*, 2005; Fawcett *et al.*, 2008). In their study of manufacturer–retailer collaboration, Sridharan and Simatupang (2013) discern the different power structures evident in the supply chain which make it difficult to design collaboration approaches. This was also supported by Småros (2007). Similarly, Byrne and Power (2014) apply Agency theory to explain the unequal distribution of information and power in the Australian bulk cereal supply chain, and the nature of interactions between firms. Due to the distribution system dominated by a single firm, their findings show that coercive power results in a relationship that is one of compliance rather than collaboration. From a business ethics point of view, Drake and Schlachter (2008) review the dichotomy between the use of power and the development of trust in supply chain collaboration. They coined the term "dictatorial

collaboration", whereby a firm, through its position in the chain, can force or influence partners to follow its edicts. Nevertheless, power asymmetry can affect not only behavioural but also performance outcomes (Nyaga *et al.*, 2013).

Many avenues are open for future research to explore this growing area of interest and whether current organisational theories are sufficient to fully address the complex nature of collaboration being structural, process and relational based, as well as the myriad of factors associated with it. Consequent to Wood and Gray's (1991) thought-provoking article, we put forward the suggestion that collaboration theory should, first, demystify the meaning of collaboration and embrace it as being at the higher end of the relationship spectrum (rather than being cooperative or coordinated efforts) with the necessary preconditions as established in the literature; for example joint decisions, shared goals, risks, information and resources, incentive alignment, etc. Second, researchers should consider the circumstances under which the collaboration occurs. Nooteboom's (2004) viewpoint on why firms collaborate provides a good overview, i.e. efficiency in resources, development of competencies and market positioning. There are also cultural, regulatory forces and socio-economic forces as espoused by Institutional theory (DiMaggio and Powell, 1983) pressuring firms to seek organisational legitimacy (Hofer *et al.*, 2014). We note that this theory is rarely used in the area of supply chain collaboration. Additionally, integrated information and communication technology systems such as (CPFR) and VMI require coordination and collaborative mechanisms among firms, and affect supply chain structures. Third, collaboration theory should take into account the environmental uncertainties and complexities inherent in supply chains which could affect the relational dynamics, processes and governance structures in supply chains. All these taken together could then uncover if collaboration truly results in optimal outcomes for the parties involved.

## 4. Types of collaboration

### 4.1 Vertical collaboration

Various researchers have studied supply chain collaboration from different perspectives. Our content analysis shows that majority of the studies explore vertical collaboration from a dyadic approach. The most looked at area is buyer–supplier collaborations (Fearne *et al.*, 2006; Lehoux *et al.*, 2011; Wagner *et al.*, 2011; Nyaga *et al.*, 2013; Emberson and Storey, 2006; Yoon and Kwon, 2006; Yazici, 2012; Lee *et al.*, 2010; Barros *et al.*, 2011; Fugate *et al.*, 2012; Yigitbasioglu, 2010; Ha *et al.*, 2011; Plane and Green, 2012). Ha *et al.* (2011) analysed the impact of two trust forms (affective trust and trust in competency) from suppliers about their buyers and whether they impacted collaboration. Based on data collected in Korean firms, their findings depict that affective trust enables information sharing and benefit/risk sharing, whilst trust in competency affects joint decision-making and benefit/risk sharing. Alternative terms used by researchers (Yang *et al.*, 2007; Kim and Oh, 2005; Cassivi, 2006; Van Echtelt *et al.*, 2008; Tang and Qian, 2008) for buyer–supplier collaboration include manufacturer–supplier collaborations, and grower–processor collaborations from an agri-food industry perspective. Using a single case study of a Greek agri-food supply chain, Matopoulos *et al.* (2007) identified macro factors such as changing consumer attitudes which enhance the intensity of collaboration, whereas micro factors such as product features which, in turn, affect logistics-related activities, hinder collaboration between the grower and processor.

Other studies which explored dyadic collaborations include processor–retailer collaborations in agri-food supply chains (Leat and Revoredo-Giha, 2013), retailer–supplier collaborations (Sheu *et al.*, 2006; Hofer *et al.*, 2014; Chae *et al.*, 2005) and retailer–manufacturer collaborations (Småros, 2007; Rosenzweig, 2009; Anbanadam *et al.*, 2011; Giminez, 2006; Thron *et al.*, 2006; Vlachos *et al.*, 2008; Mangiaracina *et al.*, 2012). The study by Vlachos *et al.* (2008) examined the collaboration between food manufacturers and retailers in the Greek food sector. Using the Supply Chain Council's SCOR model collaboration framework, these authors explored trust, commitment, information change, category management and physical distribution, and how they affect three types of collaboration (cognitive, cooperative and transaction) through a survey of 71 managers employed in food manufacturing and retail firms. Given the commodity based nature of agri-food supply chains, it was apparent that transaction collaboration, where partners simply exchange data, usually in a bulk format (Vlachos *et al.*, 2008, p. 269), was the preferred and most appropriate type.

### 4.2 Horizontal collaboration

We found that studies exploring horizontal collaboration were largely confined to transportation management (Wen, 2011, 2012; Mason *et al.*, 2007; Buijs and Wortmann, 2014; Lozano *et al.*, 2013; Islam and Olsen, 2014) with the exception of the studies by Bahinipati *et al.* (2009) that looked at horizontal collaboration among manufacturers and Leat and Revoredo-Giha (2013) which explored collaboration among agri-food producers. Hingley *et al.* (2011) assessed the advantages and barriers of fourth-party logistics (4PL) management as a catalyst for horizontal collaboration among grocery retailers. These authors discovered that the costly investment involved in 4PL management was a deterrent to retailers, as it could negatively affect their control and relationships with suppliers. Nevertheless, the suppliers and logistics service providers were supportive of 4PL and view it as an avenue for enhanced customer service, efficiencies and cost effectiveness.

### 4.3 Lateral collaboration

We espouse that the area of lateral collaboration remains largely unexplored in the literature, as there was only one study identified. The study by Chan and Prakash (2012) examined manufacturing supply chains from an inventory management perspective. The objective was to provide insights into the types of inventory policies adopted which could optimise costs. By applying a numerical example of two linear supply chains with different inventory policies in a simulation model, they emphasised how lateral collaboration is a preferable approach, as it embraces the capabilities of both horizontal and vertical collaborations,

and also overcomes their limitations. Their findings illustrate that a higher reorder point quantity will result in a lower total cost for lateral collaboration than that for horizontal collaboration.

## 5. Areas of growing importance

### 5.1 Collaboration for sustainability

Many researchers are recognising the strategic importance of sustainability and as an emerging theme in the supply chain management literature. It is widely accepted that sustainability cannot be achieved by firms in isolation and requires the involvement of supply chain members (Varsei *et al.*, 2014). We recognise the increasing number of publications over the past decade, which are dedicated to the area of collaborative efforts in attaining more sustainable supply chains (Beske and Seuring, 2014; Theißen *et al.*, 2014; Nanako and Hirao, 2011; Ramanathan *et al.*, 2014; Van Hoof and Thiell, 2014; Albino *et al.*, 2012; Vachon, 2007; Vachon and Klassen, 2008; Vachon and Klassen, 2006; Green *et al.*, 2012; Benjaafar *et al.*, 2013; Gold *et al.*, 2010). Ramanathan *et al.*'s (2014) qualitative study explores two case studies of manufacturers' collaboration with suppliers and buyers in reducing $CO_2$ emissions. They categorise three levels of collaboration, namely, preparatory, progressive and futuristic levels. The preparatory level of collaboration assists firms with the development of green policies for their supply chain, while the progressive level depicts firms already carrying out these policies, and the futuristic level is when firms and supply chain partners provide continuous support throughout the carbon reduction processes with regular open information exchange. Similarly, Benjaafar *et al.* (2013) investigate the incentives and supply chain collaboration impacts on cost and carbon emissions. Vachon and Klassen's (2008) study of the package printing industry discovered that collaborative green practices between manufacturers and suppliers were more intensive and resulted in process-based performance, while collaborations with downstream customers resulted in product-based performance.

### 5.2 Collaboration for technology-enabled supply chains

With technological progress over the past few decades impacting supply chain operations, we report the large and growing number of studies exploring collaboration in the area. These relate to either the joint efforts in implementing such technologies or the impact of various technology systems on performance. The areas include CPFR (Nanako, 2009; Danese, 2006, 2007; Chen *et al.*, 2007; Sari, 2008; Derrouiche *et al.*, 2008; Attaran and Attaran, 2007); VMI (Sari, 2008; Vigtil, 2007; Blackhurst *et al.*, 2006; Mangiaracina *et al.*, 2012), electronic-collaboration (Wiengarten *et al.*, 2013; Jean *et al.*, 2014; Yoon and Kwon, 2006; Chong *et al.*, 2009) and RFID (Sari, 2010; Pramatari, 2007).

### 5.3 Collaboration in humanitarian supply chains

The world has seen a number of man-made and natural disasters resulting in humanitarian crises. The logistics and supply chain aspects are critical and challenging. As a result, their management in humanitarian supply chains would require a different business model owing to the risks, high uncertainty levels, urgency and time pressures involved (Harrison *et al.*, 2014) and, hence, the reliance on collaborative efforts. We have found this area to be exceptionally under-researched with only three studies evident (Maon *et al.*, 2009; Scholten *et al.*, 2014; Ergun *et al.*, 2014). Ergun *et al.*'s (2014) study adopts a cooperative game theory to develop a mathematical framework to explore the cost structures and the benefits and barriers of information technology (IT) tools to facilitate collaboration at different points in a disaster response and recovery timeline. Their findings provide insights about the conditions where collaboration is effective and desirable. Using a qualitative case study, Scholten *et al.* (2014) determine disaster management best practices and a framework for a resilient supply chain, where collaboration is considered one of the primary capabilities. Similarly, Maon *et al.* (2009) offer a functional model for understanding how collaborative efforts between firms and disaster relief agencies enable improved supply chain management practices by disaster relief agencies, as they generally lack the SCM tools, personnel or expertise.

## 6. The need for multi-tier perspectives

Supply chain management scholars are increasingly concerned about how firms can collectively compete as supply chains. In our review of the research on supply chain collaboration over the past decade, we uncover the prominence of studies conducted from a dyadic perspective, i.e. data from pairs of supply chain members. We believe that dyadic approaches can provide valuable insights into collaboration to some extent; however, they are primarily limited to the level of relationship under consideration. A more holistic approach to supply chain collaboration research is warranted, where multi-tier perspectives should be considered simultaneously. There is now a vast body of literature establishing supply chains as related networks with the need for tightly coupled relationships and shared goals. Our contention is that a richer understanding of the collaborative and collective efforts can be gained from research on these interconnected relationships, processes and networks, thus requiring an inter-organisational approach and extending beyond the dyad. The success of supply chains reflects the growing recognition of the interdependence of organisations in achieving lower costs, shorter lead times, greater quality products and services, flexibility, responsiveness and sustainable practices. Underpinning the search for competitive advantage relies on the need for this inter-organisational approach and effective relations with various tiers both upstream and downstream. An understanding of the dynamics from networks may provide this much needed broader perspective, and we believe, will enrich the work already done and contribute to a wider context where we can begin to understand these complex phenomena of collaboration.

Nevertheless, there have been studies that considered collaboration more expansively using a three-echelon approach, such as the collaboration efforts of distribution centres with manufacturers and retailers (Kreng and Chen, 2007; Soosay *et al.*, 2008); manufacturers with customers and suppliers (Singh and Power, 2009); and buyers, suppliers and logistics providers (Ramanathan *et al.*, 2014; Meixell and Norbis, 2012). Sari (2008) takes this one step further with a four-echelon (comprising a manufacturer, warehouse

provider, distributor and retailer) collaborative approach to inventory management (VMI and CPFR) using a simulation model and analysed data using statistical methods.

## 7. The need to include consumers in collaboration

One area of supply chain management which often tends to be overlooked by scholars is the role that consumers play in the co-creation of value. Conventional approaches to supply chain management regarded consumers as passive recipients of products and services, who engage mainly through the value exchange or value extraction. However, with recent advances in electronic media and telecommunications over the past decade, consumers are not only better informed about products and services but also increasingly connected with brands and pursue a more participative role in their relationships with companies (Wuyts *et al.*, 2011). We advocate the need for firms to reconsider the ways on how to connect with consumers and develop co-creation strategies. The concept of "prosumerism" was first introduced by Toffler (1980) to identify consumers' involvement in the design and development of products with producers. But prosumerism today is becoming increasingly important and can be applied to differentiate collaboration from a value chain perspective not only in product design or manufacture but also other functions in the supply chain. For instance, Ta *et al.* (2015) draw attention to the various collaborative roles that end consumers play in co-creating value within the supply chain through their contributions in knowledge, information and tangible resources. These supply chain areas include customer relationship management, supplier relationship management, demand management, order fulfilment, manufacturing flow management, product development and commercialisation and returns management. Although some researchers have addressed order fulfilment through electronic transactions with consumers (Thirumalai and Sinha, 2005), developing product–service portfolio through business-to-consumer (B2C) (Bustinza *et al.*, 2013) and B2C in reverse logistics activities (Wang *et al.*, 2007; Weltevreden, 2008), the supply chain management literature currently lacks empirical research in B2C collaborations (Ta *et al.*, 2015). As such, there is great potential for future research to reconceptualise the strategic importance and contribution of consumers and consider B2C collaborations in the supply chain.

## 8. Conclusion

Our review of the literature sought to address how well the body of knowledge on supply chain collaboration corresponds with our contemporary society and also to provide a discussion on areas for future research. This has resulted in some key themes identified and issues in current research. We also question if current theories used are sufficient in fully addressing this complex nature of collaboration in the supply chain. Over the years, majority of studies have focussed on dyadic perspectives, and with only a few conducted on horizontal or lateral collaborations. While the research in this area is steadily growing, we have identified a number of areas that are worth investigating to provide further contribution to the field. These include adopting a more holistic approach, and discerning the multi-faceted concept and phenomena of what collaboration entails; exploring the reciprocity and collective outcomes of collaboration; and also the need to extend beyond the dyad. Additionally, we identify the area of B2C collaboration as having tremendous potential for empirical investigation and benefits to SCM.

As Fawcett *et al.* (2012) advocate, the people issues are fundamental to successful collaboration but are difficult to predict and manage. Similarly, information is a critical resource to effective supply chain operations and management. However, it is unclear how far firms will go in terms of information sharing, given the trust levels, power dynamics and governance structures evident in supply chains. It is also recognised that firms very often participate in multiple supply chains. Evidently, they will have to become selective as to whom to collaborate with, and whom to cooperate with. This notion of being selective is critical in business practice, as there have been criticisms about "partnership" and "collaboration" being "one of the most inflated terms in modern business; and it is well known that you can truly partner with only a few" (Harrison *et al.*, 2014, p. 404).

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## Appendix

**Table AI** Journals selected for the literature review

| Journals | No. of papers | 2013 Impact factor | 2013 SJR | 2013 ABDC rank | 2015 AJG rank |
|---|---|---|---|---|---|
| *Supply Chain Management: An International Journal* | 26 | 2.916 | 1.628 | A | 3 |
| *International Journal of Physical Distribution and Logistics Management* | 14 | 1.759 | 1.305 | A | 2 |
| *International Journal of Operations and Production Management* | 13 | 1.518 | 1.344 | A | 4 |
| *International Journal of Production Research* | 12 | 1.323 | 1.333 | A | 3 |
| *Journal of Operations Management* | 8 | 4.478 | 5.872 | A[a] | 4 |
| *Industrial Management and Data Systems* | 7 | 1.345 | 0.989 | – | 2 |
| *Production Planning and Control* | 7 | 0.991 | 0.713 | B | 3 |
| *International Journal of Integrated Supply Management* | 6 | – | 0.231 | C | – |
| *International Journal of Production Economics* | 6 | 2.081[b] | 2.393 | A[a] | 3 |
| *Journal of Supply Chain Management* | 6 | 3.717 | 2.928 | A | 3 |
| *Business Process Management Journal* | 5 | – | 0.841 | B | 2 |
| *Computers in Industry* | 5 | 1.457 | 1.19 | – | 3 |
| *International Journal of Logistics Management* | 5 | 1.135 | 1.088 | A | 1 |
| *International Journal of Services and Operations Management* | 5 | – | 0.376 | C | 1 |
| *Benchmarking: An International Journal* | 4 | – | 0.554 | B | 1 |
| *Journal of Cleaner Production* | 4 | 3.590 | 1.699 | – | – |
| *European Journal of Operational Research* | 3 | 1.843 | 2.595 | A[a] | 4 |
| *Expert Systems with Applications* | 3 | 1.965 | 1.487 | C | 3 |
| *Information and Management* | 3 | 1.788 | 1.469 | A[a] | 3 |
| *International Journal of Advanced Manufacturing Technology* | 3 | 1.779 | 1.227 | – | – |
| *International Journal of Logistics Systems and Management* | 3 | – | 0.472 | C | – |
| *International Journal of Procurement Management* | 3 | – | 0.254 | C | |
| *Applied Mathematical Modelling* | 2 | 2.158 | 1.153 | – | – |
| *European Journal of Industrial Engineering* | 2 | 1.500 | 1.168 | – | – |
| *Industrial Marketing Management* | 2 | 1.897 | 1.403 | A[a] | 3 |
| *International Journal of Computer Integrated Manufacturing* | 2 | 1.019 | 0.914 | B | 2 |
| *International Journal of Logistics Research and Applications* | 2 | 0.469 | 0.361 | B | 1 |
| *International Journal of Productivity and Performance Management* | 2 | – | 0.479 | B | 1 |
| *International Journal of Value Chain Management* | 2 | – | 0.202 | C | 1 |
| *Journal of Business and Industrial Marketing* | 2 | 0.907 | 0.632 | A | 2 |
| *Journal of Business Logistics* | 2 | 2.886 | 1.873 | A | 2 |
| *Communications of the ACM* | 1 | 2.863 | 1.822 | A | 2 |
| *IEEE Transactions on Automation Science and Engineering* | 1 | 2.162 | 1.287 | – | – |
| *Corporate Social Responsibility and Environmental Management* | 1 | 2.054 | 1.018 | – | – |
| *Decision Support Systems* | 1 | 2.036 | 1.814 | A[a] | 3 |
| *Production and Operations Management* | 1 | 1.759 | 2.417 | A | 4 |
| *Computers and Industrial Engineering* | 1 | 1.690 | 1.723 | – | 2 |
| *Internet Research* | 1 | 1.638 | 0.846 | – | – |
| *Journal of Purchasing and Supply Management* | 1 | 1.609 | 0.924 | B | 2 |
| *Decision Sciences* | 1 | 1.561 | 1.49 | A[a] | 3 |
| *Journal of Business Ethics* | 1 | 1.552 | 0.962 | A | 3 |
| *Journal of Product Innovation Management* | 1 | 1.379 | 2.115 | A[a] | 4 |
| *International Journal of Shipping and Transport Logistics* | 1 | 1.340 | 0.712 | – | 1 |
| *Journal of Intelligent Manufacturing* | 1 | 1.142 | 1.095 | B | 1 |
| *European Journal of Marketing* | 1 | 1.000 | 0.957 | A[a] | 3 |
| *IEEE Transactions on Engineering Management* | 1 | 0.938 | 0.673 | – | 3 |
| *Journal of the Operational Research Society* | 1 | 0.911 | 1.388 | A | 3 |
| *IEEE transactions on Systems Man and Cybernetics* | 1 | – | 1.033 | – | 3 |
| *Total Quality Management and Business Excellence* | 1 | 0.894 | 0.574 | C | 2 |

(*continued*)

Table AI

| Journals | No. of papers | 2013 Impact factor | 2013 SJR | 2013 ABDC rank | 2015 AJG rank |
|---|---|---|---|---|---|
| *Canadian Journal of Administrative Sciences* | 1 | 0.547 | 0.275 | B | 2 |
| *International Journal of Innovation Management* | 1 | – | 0.426 | B | 2 |
| *Research Technology Management* | 1 | – | 0.38 | A | 2 |
| *Concurrent Engineering Research and Applications* | 1 | 0.531 | 0.486 | – | 1 |
| *International Transactions in Operational Research* | 1 | 0.481 | 0.635 | B | 1 |
| *Operations Management Research* | 1 | 0.208 | 0.231 | C | 1 |
| *Facilities* | 1 | – | 0.34 | B | 1 |
| *International Journal of Enterprise Network Management* | 1 | – | 0.123 | B | 1 |
| *Journal of Information Systems* | 1 | – | 1.157 | A | 1 |
| *Supply Chain Forum* | 1 | – | NA | – | 1 |
| *Transportation Journal* | 1 | 0.326 | 0.402 | B | – |
| *Transportation Planning and Technology* | 1 | 0.255 | 0.502 | B | – |
| *Human Systems Management* | 1 | – | 0.281 | C | – |
| *International Journal of Business Information Systems* | 1 | – | 0.319 | C | – |
| *International Journal of Business Innovation and Research* | 1 | – | 0.247 | C | – |
| *International Journal of Electronic Customer Relationship Management* | 1 | – | 0.191 | C | – |
| *International Journal of Intelligent Enterprise* | 1 | – | 0.186 | C | – |
| *International Journal of Productivity and Quality Management* | 1 | – | 0.332 | C | – |
| *Journal of Food Products Marketing* | 1 | – | 0.2 | C | – |
| *Problems and Perspectives in Management* | 1 | – | 0.113 | C | – |
| **Total** | 207 | | | | |

**Notes:** [a] Denotes A-star journals; [b] impact factor for 2012; figure for 2013 not available

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