Supply Chain Management Integration - a critical analysis

Dag Naslund*

Hana Hulthén**

*) University of North Florida, Department of Management, FL 32224, Jacksonville, USA
e-mail: dnaslund@unf.edu, Tel: +1 (904) 620-1228 and
Lund University, Department of Industrial Management and Logistics, 221 00, Lund, Sweden, e-mail: dag.naslund@tlog.lth.se, Tel: +46 222 91 53
**) Lund University, Department of Industrial Management and Logistics, 221 00, Lund, Sweden, e-mail: hana.hulthen@tlog.lth.se, Tel: +46 222 91 54

Abstract

Purpose
The purpose is to examine various aspects of integration in order to structure and define the concept of supply chain management integration.
Design/methodology/approach
The study is based on an extensive literature review in three steps and a series of interviews with leading SCM consulting firms.
Findings
We found limited empirical research discussing SCM integration beyond the dyadic level and there is a lack of empirical evidence supporting the claimed benefits of supply chain management integration, especially beyond the dyadic level. There is also a lack of detailed frameworks and concrete recommendations for how supply chains can become more integrated. In fact, there is significant confusion regarding the term SCM integration and thus we propose a definition of Supply Chain Management Integration.
Research limitations/implications
In terms of limitations, it is feasible that an extended literature review could have provided additional information. Similarly, additional interviews would have been preferable, yet given the level of expertise; and the access granted, we believe the current number of respondents is sufficient.
Practical implications
Our findings, and our effort to structure and define the term supply chain management integration, can facilitate organizational developments in this area.
Originality/value
Academic literature suggests that integration is a requirement for Supply Chain Management. However, integrated supply chain management is difficult to define and it seems hard to operationalize in practice. One could also argue that there has been a significant amount of hype regarding the potential as well as the results of SCM integration.

Keywords: supply chain management, integration, information sharing, collaboration

INTRODUCTION

Integration is frequently mentioned as a key characteristic of Supply Chain Management (SCM). Most SCM definitions relate to integration (Pagell, 2004; Stock and Boyer, 2009). Mentzer et al., (2001) discuss how integration is one of the management actions essential to implement SCM, while Lambert et al., (1998) state that the goal of integration is to enhance total process efficiency and effectiveness across members of the supply chain. Integration of supply chains can exist at both strategic and operational levels (Mentzer et al. 2000; Frohlich and Westbrook, 2001; Zailani and Rajagopal, 2005).

Globalization is one reason for organizations to integrate their supply chains. Globalization leads to increased demand for product variety as well as shorter product life cycles and thus one can argue that competition is no longer between companies, but rather it is between supply chains. One stated benefit of SCM integration is the ability to design products faster, with higher qualities and lower costs as compared to a single company (Ajmera and Cook 2009). Similar statements of the benefits of integration are made by a number of authors. External collaboration among supply chain partners leads to reduction of costs, stock-outs and lead-time (Gimenez and Ventura 2005). Integrated supply chains result in lowered costs across the supply chain (Sundaran and Mehta 2002). Costs can be minimized through establishing consistent and predictable demand/-supply pattern (Sabath and Whipple 2004). External (supply chain) integration leads to enhanced effectiveness and efficiency (Narasimhan and Kim 2001). Integration contributes to significant improvements in service effectiveness and cost efficiency (Richey et al. 2010). Finally, one assumption seems to be that the more integration, the better (Stock et al., 1998; Gimenez and Ventura, 2005).

However, the concept of *supply chain management integration* does not come without problems. First of all, academic literature provide little, if any, empirical evidence of integration of supply chains beyond the dyadic level (e.g. Fawcett and Magnan 2002; Vepsäläinen 2003; Fabbe-Costes and Jahre 2008). Lambert et al. (1998), for example, found no empirical evidence of supply chains that were linked from the initial source of supply to the end-customer. In practice, there have been only minor integrated dyadic process links (ibid). Similarly Bagchi et al., (2005) did not find evidence of companies that have established close integration with supply chain partners. Fabbe-Costes and Jahre (2008) found only few studies that focus on an extended scope of integration beyond the dyadic integration. Mejza and Wisner (2001) concluded that while studies suggest a wide scope of coordinated processes across supply chains, there is little empirical evidence that confirm these claims. According to Kemppainen and Vepsäläinen (2003), the best practice of managing supply chains needs to be re-examined in a wider context, and Richey et al (2010) emphasized the need for quantification to ensure that the increased efforts to integrate pay off. Thus, while the benefits of supply chain management integration are frequently discussed, there seems to be less empirical evidence to back up these claims.

Second, there is a lack of clear definitions and understanding of the notion of supply chain management (Skjoett-Larsen, 1999; Mentzer, et al. 2001). This problem remains despite a considerable growth in the number of published articles dealing with the topic since the mid 1980's (Stock and Boyer, 2009). Furthermore, there is no widely accepted definition of *supply chain management integration* or even related topics as *supply chain integration* and *supply chain collaboration*. Fabbe-Costes and Jahre (2008) pointed out the substantial variations in the scope of supply chain integration in existing studies and they also state that it is problematic for researchers if the same concepts are interpreted differently, or if different concepts are used with the same meaning (see Table 1).

	Definition	Reference
SCM	"…is the integration of business process from end user through original suppliers that provides products, services and information that add value for customers."	Cooper, et al. (1997a, p.2)
	"…is generally considered to involve integration, coordination, and collaboration across organizations and throughout the supply chain."	Stank, et al. (2001b, p.30)
	"The systematic and strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole."	Mentzer, et al. (2001, p.18)
	"…is an integrative philosophy to manage the total flow of a distribution channel from supplier to ultimate customer."	Ellram and Cooper (1990, p.2)
	"… encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies."	Developed by Council of Logistics Management (2003) cited in Gibson, et al. (2005, p.22)
SC Integration	"The concept of integration as a mechanism to support business processes across a supply network is closely related with the effort to overcome intra- and inter-organizational boundaries."	Romano (2003, p.122)
	"…includes both upstream or supplier integration and downstream or customer integration, as well as horizontal integration within the firm."	Vickery, et al. (2003, p.524)
	"The strategy must span material and product flow from vendors to final consumers and encompasses array of different organizational entities, external (e.g. suppliers) as well as internal (e.g. functions)."	Kim (2009, p. 328)
	"The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organizational processes, in order to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer."	Flynn, et al. (2010, p.58)
SC collaboration	"Ideally, collaboration begins with customers and extends back through the firm form finished goods distribution to manufacturing and raw material procurement, as well as to material and service suppliers."	Stank, et al. (2001a, p. 29)
	"Two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation."	Simatupang and Sridharan (2002, p.19)
	"Collaboration in the supply chain have a common goal to create a transparent, visible demand pattern that paces the entire supply chain."	Holweg et al. (2005, p. 171)
	"It´s a fundamental agreement among supply chain partners to integrate their resources for mutual gain."	Bowersox, et al. (2003, p. 18)

Table 1: Definitions of SCM, SC integration and SC collaboration

The confusing terminology, the lack of empirical results and the lack of understanding regarding the implication of integration prevents the development of normative recommendations to practitioners of why, how, when and what to integrate. The goal of this study is therefore to examine various aspects of integration in order to structure and define the concept of supply chain management integration.

METHODOLOGY

The study is based on an extensive literature review in three steps with an increasing level of depth of the analysis, and a series of explorative practitioner interviews. Step one was an extensive review in order to categorize the key aspects of supply chain integration in terms of scope, areas of integration, and the level of the relationship. In step two, we conducted additional literature reviews in order to identify how the topic has been empirically covered in major logistics and SCM journals. The five journals were selected based on ranking in Gibson et al. (2004). Out of 117 identified papers, we selected the 49 empirically based articles for further analysis using our initially developed framework (see Table 2). In our third step, we reviewed the 49 articles for an in-depth analysis in terms of *What*, *How*, *Who* and *Why* to integrate as well as *Proved Benefits* of integration (Table 3 is a summary of the third review. The complete review is available upon request).

- *Journal of Business Logistics*
- *International Journal of Physical Distribution and Logistics Management*
- *Journal of Supply Chain Management*
- *International Journal of Logistics Management*
- *Supply Chain Management: An International Journal*

We collected primary data via ten exploratory and descriptive interviews. Planning and constructing the interview protocol is an important step in order to ensure the validity of the research. Planning requires that the researcher has a clear vision of the goal of the study, as well as how the analysis of the collected data could potentially be conducted. For this study, the lead researcher has a significant background in the areas of process and supply chain management as well as related information systems. The interview protocol was developed in line with a data gathering and analysis plan that covered the entire study.

An aspect that is of obvious significant importance is the respondent's level of expertise and understanding of the specific research area. The interviews included respondents from management consulting firms and/or companies with a specific focus on supply chain management and information systems. These consulting firms have accumulated broad knowledge based on their experience from projects in different organizations over several years. We also included two respondents from industrial organizations as they have research degrees in this field, and thus they possess significant theoretical and practical experience. Two of the respondents are either the CEO or the co-CEO, while seven are senior managers with many years of project experience. One respondent was a junior manager. The organizations and respondents were selected based on different reasons. Our University has a long established tradition of conducting applied research, thus, our department has developed strong relationships with the respondents and their firms over several years. In some cases

they are alumni, in some cases they have participated in previous research projects, and in some cases they have been guest lecturers in our courses.

The interviews were conducted in a semi-structured format (interview protocols are available upon request). Both detailed and broader, open questions were employed to capture the respondents' opinions. All interviews followed the same format but different follow-up questions were utilized in order to ensure that the researcher understood the respondent's answers. Each interview lasted between two and four hours. Nine of the interviews were face-to-face interviews, while one interview was conducted over the phone. Each interview was transcribed within 24 hours. All interview data are recorded in a case databank. The results of the interview series were sent to all respondents for verification. Six respondents replied and supported our results and conclusions.

LITERATURE REVIEW I

Scope of Integration

A frequent debate is the relationship between internal and external integration. One group of authors supports the idea that internal (intra-organizational) integration is almost a prerequisite for SCM integration. In other words, external integration follows internal integration (Stevens, 1990; Croxton et al, 2001). The goal of internal integration is to eliminate the traditional functional "silos" and stress better coordination among functional areas (Morash and Clinton, 1998). *External integration,* on the other hand, represents the integration of the activities and the flows across organizational boundaries. External integration is related to the coordination and collaboration with other supply chain partners (Stock et al., 1998; Chen et al. 2007). Soonhong and Mentzer (2004) concluded that when integration inside the individual firm precedes the integration across firms, it leads to improved business performance of individual firms within a supply chain in terms of product and service offerings, growth and profitability.

External Integration with Internal Integration

While some authors do not necessarily disagree that internal integration is important for SCM integration, they also mean that external integration can be an incentive to internal integration. Employees working with customers and suppliers can use the external relationship to inspire closer internal relationships (Rodriguez et al. 2004; Halldórsson et al. 2008). Richey et al. (2010) propose keeping internal focus and external focus in balance, and understanding the interdependencies. Similarly, Stank et al. (2001a) claim that the best practice is for the firm to focus on internal and external integration simultaneously.

Direction of Integration

There are two obvious directions of integration: forward integration and backward integration (Trent and Monczka, 1998). Forward integration refers to integration with customer while backward integration, represents integration with suppliers. Although integration could include several members of a supply chain, in reality, the dyadic integration is the most common (Fawcett and Magnan, 2002). On the other hand, close relationship with suppliers can not only lead to better supplier performance, but also to improved manufacturing as well as product and process improvements which, in turn, can increase customer satisfaction (Koh et al. 2006).

Stages of Integration

Several authors have also tried to define, or structure, different stages of integration. Stevens (1989), describe four stages. Stage 1 represents functional independence and is typical for companies that delegates responsibility for different activities in the supply chain to separate departments. This stage is characterized by:

- Independent and often incompatible functional systems and procedures

- Organizational boundaries - purchasing control the incoming material flow, production would control flow from raw material to finished goods etc.

- Short-term company planning.

Stage 2 involves functional integration with the focus mainly on the inward goods flow. This stage is characterized by:

- Separate business functions

- Poor visibility of real customer demand - customer service is still reactive.

- Inadequate planning and generally poor performance - focus on cost reduction rather than performance improvement.

In stage 3 it is recognized that there is no point to only focusing on the inward flow of goods into the organization unless the flow is appropriately managed on the way to the customer. In this stage, the focus is on integration of activities that are directly under the control of the company and embraces outwards goods management, integrating supply and demand within the company´s own chain. The internal integration involves planning and control system. This stage is characterized by:

- An emphasis on efficiency rather than effectiveness.

- Broad use of EDI to facilitate faster customer response, yet reacting to customer demand rather than managing the customer.

- Medium-term planning -focus on tactical rather than strategic issues.

In stage 4, the scope of integration is expanded to suppliers and customers. The focus is changed from being product-oriented to being customer-oriented. The attitude is altered away from adversarial to mutual support and cooperation. The cooperation starts at an early stage of product development and includes full management involvement at all levels. This stage is characterized by:

- Shared information on products, process and specification changes.

- Technology exchange and design support.

- A focus on strategic rather than tactical issues.

Similar multi-stage models are discussed by other authors (Sundaran and Mehta 2002; Jüttner et al. 2010) and Sabath and Whipple (2004) who state that linking the operations-focused and customer-facing processes such as purchasing, production, logistics and marketing need to be conducted before extended integration efforts across SC partners are possible.

Areas to integrate

The aspects of what to integrate and whom to integrate with are relatively poorly covered in the literature. Fabbe-Costes and Jahre (2007) identified four areas of integration; flows (physical, information, financial), processes and activities, technologies and systems, and integration of actors (structures and organizations). Similarly, Barber (2008) pointed out that both tangible and intangible areas, such as processes, procedures, information and financial linkages, management of knowledge, innovations and strategies need to be integrated.

Lambert et al., (1998) emphasize the importance of identifying appropriate processes to link with vital supply chain partners. To integrate with all partners across the supply chain is not desirable and not even possible since companies in the same supply chain may have a functional structure, process structure, or a combination of both. Therefore, Lambert et al. (1998) stress the necessity of mapping individual (internal) processes before developing a common supply chain map (ibid.). Yet, as Fawcett and Magnan (2002) point out, few companies map their supply chains, and process management research also indicates that few organizations map cross-functional processes.

Information technology/systems/ Information sharing

Information systems/technology (IS/IT) is important for supply chain management integration. In order to integrate, organizations need to invest in IS/IT as it facilitate the information exchange across firms' borders (Trent and Monczka, 1998; Al-Mashari and Zairi 2000; Narasimhan and Kim, 2001; Rodriguez et al. 2004). Fawcett and Magnan (2002) identified three levels: first, use IT to increase the quality and speed of information exchanged among channel members; second, develop core building blocks as linked information systems, integrative inter-organizational processes, aligned goals, consistent measures, and shared risk and reward. The third level (3) is based on the previous concepts but also consider SCM as a cultural orientation and philosophy.

Visibility is another frequently mentioned aspect for integration (Cooper et al., 1997a; Richey et al. 2009).Yet, visibility in supply chains still seem limited (Barrat and Oliveira, 2001; Kemppainen and Vepsäläinen 2003). Although many managers are prepared to share information necessary to ensure a smooth flow of materials, more sensitive information is shared only selectively (Kemppainen and Vepsäläinen, 2003; Bagchi et al., 2005). Similarly, Mentzer (2000) indicates that there is a managerial unwillingness to share information with other firms. In addition, Forslund and Jonsson (2007) identified a lack of standards and inappropriate ERP functionality as barriers.

Level of relationship

Lambert et al., (1998), state that managers integrate and manage different supply chain links for different business processes. An important step is therefore to determine the type/level of integration which is relevant for each process link. The potential range of relationships can include everything from arm's length ones to strategic alliances. Arm's length relationships are characterized by short term transactional focus, involving only limited information exchange and some operational coordination. According to Cooper et al. (1997b), the arm's length relationship is typical for SC members farther from the focal company. It is recommended to distinguish between those relationships that should remain only arm's length and those that can be developed into partnerships. They recommend beginning with one partnership relationship and expand as more experience is gained. Companies often also segment their relationships (Masella and Rangone, 2000). Organizations build high

collaborative relationships with some supply chain partners while they maintain arm's length relationships with others (Gimenez and Ventura, 2005).

From an ideal strategic perspective integration means that companies will share resources, benefits and risks (Ajmera and Cook, 2009). Integration activities of a more strategic nature include joint planning, decision making and execution of supply chain activities, (Vickery et al., 2003; Ajmera and Cook 2009). This level of supply chain integration is sometimes referred to as inter-organizational collaboration (Bowersox, 1990). Strategic integration activities are long-term, collaborative, and encompass relationship building, joint development and information sharing regarding costs and capability with customers and suppliers as companies consider their partners' processes as extensions of their own (Swink et al., 2007). Focus is also often on the behavioral, communicational, and interactive aspects and relationships in the supply chain. If these relationships are not managed effectively, any attempt towards managing the flow of information and materials along the supply chain is likely to be unsuccessful (Handfield and Nichols, 2004).

LITERATURE REVIEW II

Table 2 shows that few articles address integration of the extended supply chain and there is not enough empirical evidence to prove that extended SC integration leads to improved performance. This fact is in line with findings made by McAdam and McCormack (2001) and Fawcett and Magnan (2002) who found no evidence of entire supply chains that were actually integrated or managed. According to Bagchi et al (2005), supply chain integration is more rhetoric than reality. In fact, the most studied scope of integration is *Internal integration* (15 articles) followed by *Dyadic backward* integration (11 articles). The research on integration with customers is underrepresented; for example, *Dyadic forward* integration was studied in only four articles. This indicates that focus of previous research is on integration with suppliers (backwards) and less frequently on integration with customers (forwards) This corresponds to the findings made by Fawcett and Magnan (2002) stating that there is little empirical evidence of integration to customers' customers, while the backward integration is the most common form of supply chain integration and represents integration with first-tier suppliers.

Table 2 also indicates that integration of technologies and information systems is a frequently studied topic. Integration of functions and processes has been an important subject for internal integration while for dyadic and triadic integration the focus has been more on integration of processes. Regarding the levels of the relationship, a majority of studies has focused on coordination and collaboration and less on arm's length relationships. Kemppainen and Vepsäläinen (2003) found that coordination is focused on inter-functional operations and relations with only selected partners. Companies hesitate to extend coordination beyond order processing and operational scheduling within the dyadic relationship. Collaborative relationship has been mostly emphasized in articles which studied triadic relationship between first-tier supplier and second-tier supplier. However, it has to be stressed that no clear distinction between collaboration and coordination has been made in a majority of articles.

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LITERATURE REVIEW III

What to integrate

The most common recommendations on what to integrate are related to information sharing, integration of technologies/systems, processes, and performance measures. Another important aspect is integration of external and internal processes. Barratt (2004) stresses internal integration as a prerequisite for collaborative planning. Combination of internal and external integration is discussed by Stank et al (2001a) and Richey et al (2009) while the external integration with customers and suppliers is mentioned by Wisner (2003), Kannan and Tan (2010), and Kemppainen and Vepsäläinen (2007). However, while a majority of articles highlight different aspects that need to be integrated, they do not offer any clear guidelines regarding what should be integrated in the different stages of the integrative process. The sole exception is Fawcett and Magnan (2002), who identified three levels of SCM integration. These stages represent concrete recommendations in order to achieve advanced levels of SCM integration.

Scope of integration	Total Articles	Areas of Integration					Levels of Relationship		
		Functions	Flows	Processes	Actors	Technology/ IS	Arm's length	Coordination	Collaboration
Internal	15	5	1	6	0	8	1	2	3
Dyadic: Forward	4	0	0	3	0	0	0	0	1
Dyadic: Backward	11	0	1	3	2	2	0	2	2
Triad: T2-T1-F	7	0	2	3	0	3	1	3	6
Triad T1-F-C1	5	2	0	1	0	3	1	1	2
Triad: F-C1-C2	0	0	0	0	0	0	0	0	0
Extended or Entire Supply Chain	3	1	0	0	2	0	0	0	0
Network	3	1	1	2	0	2	0	0	0
Horizontal	1	1	0	0	0	0	0	0	0

Table 2: Summary of the articles addressing the specific aspects of SCMI

How to integrate

Inter-firm collaboration and SC design are mentioned by several authors as examples of how to achieve SC integration (Stank et al. 2001a; Bagchi et al. 2005; Pires and Neto, 2008; Sezen, 2008. Other examples are new technologies to increase quality and speed of information sharing (Fawcett and Magnan, 2002; Håkansson and Persson, 2004). The technical integration of information systems (IS) and ERP systems, as well as information sharing, is widely recommended at each stage of integration. Information sharing as an enabler of inter-firm cooperation is discussed by Wisner, (2003), and Rodrigues et al (2004). However, in reality, information is shared only selectively (Kemppainen and Vepsäläinen, 2003). Furthermore, internal integration can be achieved through information sharing while external integration calls for cross-functional teams and consumer focus, according to Stank et al (2001a). However, while there are many recommendations on how to integrate supply chains, the recommendations are mainly of a general nature and they do not provide practitioners with specific information on how to implement SC integration.

Who to integrate with

Integration with suppliers and customers without closer specification regarding how many tiers backwards or forwards is discussed by Thun (2010); Wisner (2003); Richey et al (2009), while integration with key suppliers and key customers is mentioned by Lambert et al., (1998); Richey et al (2010); Bagchi et al (2005). A broad approach to SC integration is suggested by Kannan and Tan, (2010), while supply networks are discussed by Kemppainen and Vepsäläinen (2003; 2007). However, according to Fawcett and Magnan (2002), the empirical evidence shows that only a few companies are actually engaged in extensive SC integration. Moreover, SC practice seldom resembles theory. None of the studied companies manage their relationships in a strategic and systematic way beyond the 1-tier supplier and 1-tier customer. Kemppainen and Vepsäläinen (2003) concluded that companies hesitate to coordinate within the dyadic supplier-buyer relationship beyond order processing and operational scheduling. According to Briscoe and Dainty (2005), a truly integrated SC practice is rare to find.

Why integrate

Although several benefits are presented, these benefits are predominantly described in general terms. In fact, none of the articles provide concrete empirical evidence that confirm the proposed benefits have been achieved. This fact is in line with findings made by Richey et al (2010) and Wagner (2003) who calls for a more systematic view in a wider context to understand the benefits of supplier integration.

	Areas of Integration		
	Internal	**Dyadic: Forward**	**Dyadic: Backward**
What?	• Integration of all functional areas and processes • Technical integration (IS, ERP)	• External integration of logistics, marketing, operations-oriented processes • External integration of IT • External integration of PM processes • SCM strategies	• External integration of IS, technology • External integration of PM process • External integration of NPD process • External logistics integration • Cooperation, collaboration, coordination
How?	• Alignment of business strategy with SC strategy, objectives with broader scope • Information system infrastructure • Internal information sharing • Process oriented performance measures • Reward system across different units • Resources coordination • Standardization of processes • Teamwork • Breaking decentralization	• Development and maintenance of cooperative relationships • Provide accurate information • Benchmarking of competitors performance • Formulate service strategies • Determine coordination mechanism (standardization, direct supervision, mutual adjustment) • IT and communication	• Taking joint actions (synchronized objectives, joint approaches to service and product delivery, lowering costs and risks, measures to support trust) • Apply more systematic and holistic view (wider context) • External integration of IS, technologies • Dependent suppliers should follow technology used by powerful buyer
Who?	• Integration with suppliers and customers necessary to gain competitive advantages	• Customers	• Buyer-supplier
Why?	• Improved performance (financial, time-based) • Could improve customer satisfaction, competitiveness	• Effect on SC performance • Customization • Sales, market shares, profit	• Improved performance (NPD, cycle time, inventory levels, stock-returns) • Reduce source of negative behavior (deal with asymmetric power within supplier relationship)
Note	• Improvement in each functional area and	• Focus first on integration of one or few	• New products require early integration with suppliers

	• high level of IT before initiating external integration • Highly uncertain supply environment: high need for integration with information exchange	processes • Weigh if additional process integration brings further gains • Integration of two or more processes do not conduct in isolation from each other	• Procurement of strategic items and positive prior experience with suppliers lead to tighter integration • Reduction in supply base leads to more equal relationship and reliance
Proved Benefits	No	No	No

	Areas of Integration			
	Triadic: T2-T1-F	**Triadic: T1-F-C1**	**Extended or Entire SC integration**	**Network**
What?	• Focus both on internal and external collaboration • External integration of information sharing and operations • SC design	• IT implementation • SC design • CRM, SRM • Information and coordination	• Integrative mechanism • SCM culture • SC design	• Integration of operations • Tighter inter-firm collaboration • Integration of IS • Specialization, outsourcing
How?	• Partnership • Establish common goals and objectives • Information based culture • Effective communication system • Risk & reward sharing • Performance measures • Alignment of systems (standards)	• Information sharing • Alignment of IT implementation with SC strategy • Identify capable SC partners • Share future strategic plans • Align incentives systems • SC wide perspective	• Integrative mechanism to improve coordination with key 1-tier customers and 1-tier suppliers • Establish SCM • Map and evaluate SCs	• First, developing capabilities through logistical and technological differentiation of organizational activities within supply network • Second, integrate operations and IS to build tighter inter-firm collaboration • Analyze scope and intensity of info sharing and process

				integration between firms
	• Employee empowerment			
Who?	• Collaborative planning with suppliers	• Integration both with customers and suppliers • Start with supplier integration	• Suppliers and customers beyond the 1-tier	
Why?	• Improved logistical performance, cost efficiency, inventory reduction, customer service	• Improve competitiveness, customer service, product quality, operational performance	• Enhanced coordination • Improved performance	• Chain-wide benefits • Specialization • Innovation
Note	• Internal integration is prerequisite for collaborative planning with suppliers • SC design: higher influence on SC performance than integration and info sharing			
Proved benefits	No	No	No	No

Table 3: Summary of in-depth analysis of 49 empirically based articles

RESULTING FRAMEWORK

Figure 1 presents a synthesis of the main aspects of SCM integration based on our review. *Internal integration* aspects are technical integration, information sharing, reward system process-oriented performance measures and standards. They are valid for the other areas of integration as well. There are also specific aspects for each area of integration. Specifically, for the *Dyadic Backward Integration*, cooperation, collaboration and coordination, as well as joint actions such as synchronized objectives, lowering risks and costs and measures supporting trust are typical. *Dyadic Forward Integration* also stresses cooperative relationships, in addition to, SCM strategies. *Triadic Integration: T2-T1-F* emphasizes the importance of a properly designed SC and partnership, while *Triadic Integration: T1-F-C1* relies on supplier relationship management (SRM) and customer relationship management (CRM). To achieve *Extended Integration or Entire Supply Chain Integration*, SCM culture and mapping, as well as regular evaluating of SCs, is crucial. *Network Integration* is mainly based on outsourcing and specialization.

Additionally, as is shown in *Figure 1*, there are many integrative mechanisms such as integrated information systems and inter-organizational processes, aligned strategic goals, consistent performance measures, jointly shared rewards and risks, that are expected to lead to establishment of closer relationships among SC partners. Nevertheless, as our results show, these integrative mechanisms are highly fragmented and a systematic approach on how to proceed from one level of integration to another is missing. An overall supply chain framework is lacking.

INTERVIEW STUDY

Inspired by the literature review, we asked the respondents to rank the terms supply chain management integration, supply chain information sharing, and supply chain collaboration on a seven point scale (1=worst, 7=best) based on their perception of the current state of these terms in practice.

The respondents discussed several problems with the term integration (score=2), ranging from a general confusion with the term itself, to the lack of integration even internally in companies. Comments included:

- It is difficult to understand and define the term integration

- Most respondents referred to two different types of integration: technical and more "soft" business oriented integration.

- In the SCM context, integration is primarily understood to be more technological.

- Very little, if any SCM integration exists – not even integration of internal processes within companies.

- Most of the systems (e.g. SAP and Oracle) are too functional and modular in nature (and thus not process or supply chain oriented).

- The integration that does exist is primarily dyadic in nature.

- The technology used is EDI.

One respondent summarized his opinion of supply chain integration as follows: *"I consider supply chain integration to be a technical issue. Very little technical integration exists in the supply chain. Some technical integration exists at the dyadic level."*
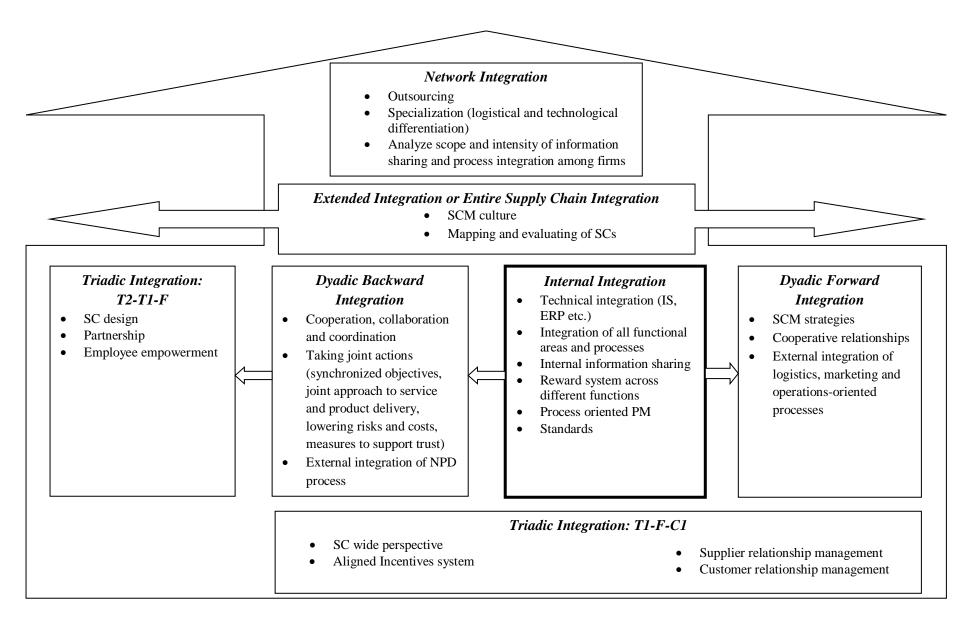
Network Integration
- Outsourcing
- Specialization (logistical and technological differentiation)
- Analyze scope and intensity of information sharing and process integration among firms

Extended Integration or Entire Supply Chain Integration
- SCM culture
- Mapping and evaluating of SCs

Triadic Integration: T2-T1-F
- SC design
- Partnership
- Employee empowerment

Dyadic Backward Integration
- Cooperation, collaboration and coordination
- Taking joint actions (synchronized objectives, joint approach to service and product delivery, lowering risks and costs, measures to support trust)
- External integration of NPD process

Internal Integration
- Technical integration (IS, ERP etc.)
- Integration of all functional areas and processes
- Internal information sharing
- Reward system across different functions
- Process oriented PM
- Standards

Dyadic Forward Integration
- SCM strategies
- Cooperative relationships
- External integration of logistics, marketing and operations-oriented processes

Triadic Integration: T1-F-C1
- SC wide perspective
- Aligned Incentives system
- Supplier relationship management
- Customer relationship management

Figure 1: The main aspects of SCMI

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Regarding information sharing (score=1.8), the respondents mentioned that technology IT/IS aspects have often acted, and in many cases still act, as barriers to increased information sharing (as well as collaboration and integration) in the supply chain. The respondents also highlighted trust and fear as barriers towards information sharing. Comments included:

- More of a "soft" issue compared to integration

- In reality, most information sharing is dyadic via "simple" technologies such as phone, fax, email and EDI

- Portals have significantly helped organizations share information, yet this cannot be considered a true form of supply chain information sharing.

- Point of Sales (PoS) data sharing has been discussed for years, but little is happening in reality in most industries.

- Organizations are still afraid to share any type of data/information they think is sensitive.

Regarding supply chain collaboration (score=1.8), the respondents emphasized different aspects from organizational ones such as power in the chain, structure and common agreements between organizations to the complexity of IT/ERP systems. Comments included:

- Companies have agreed upon a common approach (process/technology).

- It is structured – structured collaboration requires executable processes

- More than just EDI, more than some homemade solution.

- Collaboration is a combination of "soft" aspects and more "hard/technological" aspects.

- The size and complexity today's IT solutions makes collaboration hard.

- VMI is a good example of collaboration that could work.

One respondent summarized his opinion of supply chain collaborations as follows: *"Collaboration in the entire chain does not exist. BUT a strong actor (Wal-Mart, Dell) can force "collaboration" by having the network/SCM view."*

DEFINING SUPPLY CHAIN MANAGEMENT INTEGRATION

Based on our discussion, we propose the following definition of SCM integration: *"Supply chain management integration is the co-ordination and management of the upstream and downstream product, service, financial and information flows of the core business processes between a focal company and its key supplier (and potentially the supplier's key suppliers) and its key customer (and potentially the customer's key customers)"*

It is our ambition that this definition will eliminate some of the existing confusion regarding the scope of supply chain management integration. SCM integration refers to the integration of an extended supply chain (including three or more echelons) as defined by Mentzer et al. (2001). Thus, SCM integration is different from internal integration (within organizational boundaries) and dyadic integration.

We further believe it is important to discuss the goal of SCM integration. In an ideal situation, the goal of SCM integration is to enhance process efficiency and effectiveness across members of the supply chain while creating value for the end-customer. While this may be a somewhat naive goal in some circumstances, it should be the ambition of all included organizations to strive towards this goal.

Regarding levels of integration, the desired level of integration will most probably vary between different types of supply chains, and it will depend on a variety of factors. Thus, future research will focus on the development of a comprehensive framework and concrete advice for how to facilitate an increased level of supply chain management integration. The ambition is that the framework will provide a systematic approach with specific guidelines for how to evaluate current and desired levels of integration, and it will offer normative recommendations for practitioners on *what*, *how*, *who* and *why* to integrate.

DISCUSSION

Based on literature review, we developed an initial framework depicting the main aspects of the concept of SCM integration in three categories, *scope of integration*, *areas to integrate,* and *level of relationship*. This framework was then utilized for further analysis of SCM integration as presented in leading SCM journals. Our review highlights the limited number of articles addressing integration of the extended supply chain. Second, current level of SCM integration, as presented in these articles, mainly covers internal or dyadic integration with significant emphasis on integration at the operational/transactional level. Third, although academics state that organizations should embrace integration since it can lead to enhancements in both efficiency and effectiveness, our findings show that there is a lack of empirical evidence to confirm these benefits. Fourth, there is a need for an overall supply chain framework, a systematic approach that would serve as a specific guideline, and normative recommendations for practitioners on *what*, *how*, *who* and *why* to integrate. Our findings were also supported by the results of the interview study. One aspect to highlight is the general confusion concerning the terminology. Another aspect is the lack of integration (and sharing/collaboration), even internally, inside organizational boundaries. The respondents discussed the importance of process orientation almost as a prerequisite for supply chain management integration. Despite significant efforts, it still seems difficult for organizations to become process oriented. One can therefore not help but speculate how difficult it will be for organizations to integrate across the organizational boundaries. Another aspect is the important role of information technology. Currently, technology acts both as a barrier and a driver of integration.

Since the issue of generalization is a controversial aspect for qualitative research, the criterion "transferability" is often applied instead. The criterion of transferability refers to the extent to which a study's findings apply to other contexts. By clearly presenting the research process, as well as aspects such as Unit of Analysis, authors can facilitate the evaluation of the transferability of the findings. Given the in depth approach to our literature review and level of expertise of the respondents, we believe our findings are transferable. A potential weakness of our study in the second and third review is the limitation to five leading logistics/SCM journals. In future research it would be contributing to conduct an analysis of other leading journals such as *Journal of Operations Management, Production and Operations Management, and Decision Sciences.*

In conclusion, while many authors write about the benefits of supply chain management integration, and while most SCM definitions emphasize the importance of

integration, the two main results from our literature review and interview study suggest that there is limited empirical research studying integration beyond the dyadic level and a lack of empirical evidence supporting the claimed benefits of SCM integration. Similarly, the results indicate that SCM integration beyond the dyadic level is rare in practice. I was also interesting to note that few concrete recommendations or frameworks exist in order to facilitate increased levels of supply chain management integration. Thus, our proposed definition and the developed framework that structures the concept of SCM integration is an attempt to contribute to this area. SCM integration is a research area which needs more empirical research, or we will have to reconsider the stated potential benefits of supply chain management integration.

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