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# THE ROLE OF KNOWLEDGE SHARING IN SUPPLY CHAIN INTEGRATION PROCESSES

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## Abstract

Current issues in supply chain management focus increasingly on the interdependence between value forming and supply chain integration. This interdependence is interesting, especially in an environment with variable and heterogeneous demand, posing challenges and opportunities for the management of supply chain integration. The purpose of our conceptual paper is to introduce the drivers and the benefits of the supply chain integration process and to introduce the role of knowledge sharing in this context. In the pursuit of this goal, the concepts of supply chain integration and value forming are defined as the research context. The preliminary results propose that the essential integration elements can be identified and a more distinct supply chain integration process as well as knowledge sharing in this process can be defined.

**Keywords:** Knowledge sharing, Supply chain integration, Value forming

## Introduction

Supply chain management (SCM) seeks to enhance competitive performance by integrating the internal functions within a company and effectively linking them with the external operations of suppliers, customers and other supply chain members. As Tan et al. [49] state, “supply chain management is the simultaneous integration of customer requirements, internal processes and upstream supplier performance”. Jahre et al. [21] suggest that logistics and SCM search for more integration (adaptation) for increased efficiency as well as more flexibility (adaptability) in order to preserve the capacity to cope with changes. Generally, the entire concept of supply chain management is predicated on integration [36][47]. Integrated SCM has been found to offer benefits such as reduced cost, superior customer service levels and improved responsiveness to changes in the marketplace [45][39]. As Van der Vaart et al. [51] state, many authors do indeed agree that integrative practices and a high level of integration have positive impacts on corporate and supply chain performance [10][25][54]. Power [39] concludes among others that the requirement for integration of supply chains is inherently strategic, and a potential source of competitive advantage.

Recent work [17][52][54] has also provided convincing empirical evidence for the relationship between integration and performance.

These definitions of supply chain management and the benefits of integration mentioned above have encouraged authors to define the concept of supply chain integration (SCI) in many ways. Fawcett et al. [16] propose four types of integration being a) internal cross-functional process integration, b) backward integration with valued first-tier suppliers leading to integration with second-tier, c) forward integration with valued first-tier customers and d) complete forward and backward integration. The description by Frohlich et al. [17] is based on the concept of “arcs of integration”. To represent an activity’s strategic position they illustrate them graphically as an arc, with the direction of the segment showing whether the firm is supplier or customer inclined, and the degree of the arc indicating the extent of integration. Five arcs are defined representing the integration strategies: inward-facing, periphery-facing, supplier-facing, customer-facing and outward-facing. [46] Similarly, Narasimhan et al. [34] propose three components of supply chain integration, namely customer integration, strategic integration and supplier integration. Kim [25] names three levels of integration being a) company’s external integration with suppliers, b) internal cross-functional integration within a company and c) company’s external integration with customers. Kim [25] also mentions stages of SCI being independent operation stage, internal SCI stage and external SCI stage.

According to Fabbe-Costes et al. [14] the SCI framework includes three overall dimensions: layers, scopes and degree. The established layers of integration are a) integration of physical, information and financial flows, b) integration of processes and activities, c) integration of technologies and systems and d) integration of actors. The scope of integration, that is the nature and number of organizations or participants included in the integrated supply chain, may vary including phases such as a) limited dyadic downstream, meaning integration between the focal company and its customers, b) limited dyadic upstream, meaning integration between the focal company and its suppliers, c) limited dyadic, meaning integration between the focal company and

either its customers or its suppliers, d) limited triadic, meaning integration of suppliers – focal company – customers and e) extended, meaning integration between more than three parties along supply chain, e.g. customers' customers, suppliers' suppliers or other stakeholders. The third dimension is the degree of supply chain integration being either a) multi-dimensional, i.e. SCI is discussed for different layers and/or scopes and/or layers for different actors, or b) uni-dimensional.

Integration process has also been defined many ways. Some references like Harland [19] and Stonebraker et al. [48] propose characteristics in supply chain integration processes as having four sequential phases: a) internal flow of materials and information, b) dyadic relationships with immediate suppliers and customers, c) extended relationships with the supplier's supplier and the customer's customer and d) networks of inter-connected businesses involved in the delivery of product and service packages. The process of supply chain integration should progress from the integration of internal logistics processes to external integration with suppliers and customers [25]. Bagchi et al. [6] for their part propose two modes of categorization of integration, Information Integration and Organizational Integration, and three stages of integration within each mode, namely low, medium and high. They have also defined two stages of supply chain integration: low integration and high integration. [46] Integration has also been argued to be more difficult in practice than in theory; integration should be differentiated [7]; and integration is more rhetoric than reality [16]. Bask et al. [7] have recommended a change from holistic integration towards semi-integrated supply chains. They perceive the pressure in contemporary SCM to be towards the disintegration, divergence and differentiation [21]. Bagchi et al. [5][6] also challenge the argument that "high integration fits all". They emphasize that the degree of integration depends on a number of situational factors. In other words, they propose a contingency approach to supply chain integration arguing that factors such as dominance versus balanced power in the supply chain, the degree of competition in the industry, the maturity of the industry, and the nature of products may determine the desired level of integration in a supply chain.

However, the process of integration is not a simple one, as Cousins et al. [10] state. Integration of supply chain activities requires consistent involvement of both the buyer and the supplier and investing in socialization - the level of interaction and communication between various actors within and between the firms - is critical to success. [10] Frohlich et al. [17] state that closer coordination helps eliminate many non-value adding activities

from internal and external production processes including overproduction, waiting, transportation, unnecessary processing steps, stockpiling, and defects. In other words, better coordination translates directly into reduced variability, which, in turn, leads to greater efficiency along with faster delivery of finished goods. Coordination among functions is a critical precondition for effective supply chain integration and, together with shared information, improves the ability of supply chains to react to sudden changes in volatile demand environments [16][30]. Johnston et al. [22] also state that success for individual firms depends on how well the supply chain functions as a whole. Furthermore, the success depends largely on the openness and extent of sharing of the outcomes of the new relationship. Coordination becomes possible when information is transparently shared among supply chain partners [5][6]. According to the study by Sezen [43], flexibility and output performances of supply chains can be improved by emphasizing integration and information sharing. There are also many other studies showing that cooperative information sharing among supply chain members improves the effectiveness of supply chains and influences supply chain performance in terms of total cost and service level [32][41][55].

The formula for integration includes several strands. Power [39] emphasizes that organizations aiming to become part of an extended, integrated supply network can also expect that this will require an infrastructure enabling effective information flows and streamlined logistics. The most effective of these networks will be those succeeding in achieving the right mix of information requirements, physical logistics and collaboration, thus providing shared benefits to the majority of partner organizations. According to Kemppainen et al. [24], supply chains are undergoing considerable change and companies are repositioning themselves by assuming new roles and abandoning old ones. On the one hand, there will be dominant companies that coordinate and integrate the value offerings of supply chains. On the other hand, supply chains and networks are too large and complex to be controlled by only one company. Integration should vary from link to link since the focal company may not have the ability or the inclination to manage all the relations similarly.

Altogether, the literature fails to provide an unambiguous definition of the concept of supply chain integration [14]. Managers from various functional areas define SCM in unprecedented and varied ways and they also view the integrative nature of SCM differently [16]. Therefore it is difficult to provide decision-makers with normative advice as to how and what to integrate, the cost of integration, and its possible negative consequences for example, for innovation and flexibility. For researchers, too, it

is a problem if the same concepts are interpreted in different ways, and if different concepts are used with the same meaning. Hence, a better understanding of the concept of integration, its dimensions and implications, is of managerial relevance as well as academic importance, and contributes to theory-building in business logistics and supply chain management [14].

We argue that observing the supply chain integration process is insufficient; integration processes are not well defined and the objectives of the integration process are not sufficiently connected to decision-making processes. The reasons are the inconsistency of the terminology as well as difficulties in defining what kind of stages the integration processes contain and how the value of integration is added to the members of supply chain. Therefore, the goal of this conceptual paper is to examine supply chain integration as a continuous process in which the decision-maker easily estimates the potential and advantages of integration. Due to the complexities of the integration process the paper is written from the knowledge sharing point of view. In the pursuit of this goal, the following discussion first describes the background factors forming the theoretical framework of supply chain integration. The discussion then goes on to a brief epistemic consideration of the concept of knowledge in order to gain a better understanding of knowledge transfer in integration process. Then the schema for the integration process will be formed, with the help of which knowledge sharing in the integration process will be described.

### **Knowledge-based elements in supply chain integration**

#### **Perceiving the benefits of supply chain integration**

Bagchi et al. [5] define supply chain integration as a comprehensive collaboration among supply chain network members in strategic, tactical and operational decision-making. Integration can also be defined as follows [29][23]: *“Integration is a process of interaction and collaboration in which different operations work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization.”* The definitions of integration emphasize interaction and collaboration between different members of supply chains and supply networks. The definitions also stress the importance of common objectives and cooperation to achieve the expected outcomes. Trkman et al. [50] state that successful implementation of supply chain integration projects is not so much a technological problem. As Cousins et al. [10] emphasize, the concept of socialization is an important process that underpins the development of collaboration and supply chain integration. In other words, if the firms want to enjoy the benefits of collaboration, they have

to invest in socialization as well. Anderson et al. [2] found that cooperation is built by the interaction of both the supplier's and the buyer's beliefs and actions, leading to the commitment of resources. Commitment requires investment and takes time to build. The reward is a lasting business alliance capable of combining the coordination advantages of vertical integration with the entrepreneurial benefits of separate ownership. Akkermans et al. [1] also characterize the basis of integration as cooperation, collaboration, information sharing, trust, partnerships, shared technology, and a fundamental shift away from managing individual functional processes, to managing integrated chains of processes.

The meaning of supply chain integration is optimizing value activities between the focal firm's value chain and the value chains upstream and downstream. As Vickery et al. [52] state, the theoretical foundation for supply chain integration can be traced to Porter's [38] value chain model and its notion of linkages. A linkage is the relationship between the way in which one value activity is performed and the cost or performance of another. Porter argued for the identification and strategic exploitation of linkages within a firm's value chain (horizontal linkages) and between the firm's value chain and the value chains of its suppliers and customers (vertical linkages). Optimizing linkages among value activities and especially optimizing vertical linkages between suppliers, manufacturers and customers is the core purpose of supply chain integration. Such integration should also create superior performance and enable the achievement of financial and growth objectives [17][49]. In other words, value forming in the supply chain requires integration. Without fit and appropriate integration there will be value gaps in the supply chain. Unfortunately, value forming is not unambiguous between the supply chain parties because it is difficult for the company's customer to utilize and recognize added value, and the members of supply chain also understand value adding in different ways. [26][37][8] We argue that during the integration process and as a result of it, supply chain members should be aware of value adding. In a case where added value is difficult to prove to other supply chain members, a holistic understanding of the advantages of integration process is harder to achieve.

#### **Relationship formation during the integration process**

Relationships between supply chain members also affect the integration process. Generally speaking, the relationships in the supply chain management context are seen as relationships between the company and its customers and suppliers. Different relationships can be described, for example, by the power matrix, which relates power attributes between

the parties. [11] In other words, with the matrix it is possible to analyse the level of influence one person or firm has over another person or firm. Then it is possible to judge the degree to which one party is dependent upon the other party for their custom or services. A number of other attributes, such as switching costs and the number of suppliers or customers are also presented in the power matrix of Cox [11]. In the supply chain integration context, it is important that the participants work together in a collaborative relationship due to their interdependence. Although it is not easy to redress any imbalance in power levels (e.g. the dominant party does not want to forfeit its position), we suggest that by supply chain members' commitment and trust the imbalance in power level can be reduced. This also means that participants or actors should have common interests or goals in their supply chain management activities. Therefore, we suggest that a better balance in power levels increases the options in supply chain integration.

Bagchi et al. [6] state that it should become easier to generate trust among partners in an integrated supply chain. Trust can be defined in the activities that are inherent in high-trust relationships such as communication, informal agreement, absence of surveillance, and task-coordination [12]. Trust should promote collaboration and decision realignment, reduce irrational behaviour and "second guessing" among supply chain members thereby reducing the need for safety stocks. However, trust is not simply an input to a relationship, as Johnston et al. [22] put it. Instead, it is both a pre-condition and an outcome of relationship development. Trust may arise from frequent face-to-face contact, sharing of vital information and exposure of opportunistic behaviour. In other words, cooperative arrangements lead to successful intentions that build trust, but most firms would not undertake these activities without a sufficient initial level of trust. As mentioned above, trust between the members of the supply chain is conducive to integration. Trust is based on expectations which, in turn, are based on a perception of the motives and abilities of the person to be trusted. That is, identity will be shaped by the perceived motives and abilities. In marketing, the ability to achieve promised outcomes has been consistently suggested to be crucial for the development of trust [40][20]. Understanding is a basis of trust helping people to comprehend their partners' behaviour, state of mind and motives. The development of relationships directs the process. When a feeling of trust is established it affects the perceptions of a partner's commitment more than behaviour does. Trust in relation to the organisational mind and collective action is an important issue, because it ties together a complex and attentive system which forms the collective mindset required

for reliable performance. According to Weick and Roberts [53], co-operation is imperative for the development of the mind, and trust is imperative for co-operation. Interpersonal skills enable people to represent and subordinate themselves to organisations. This means that trust without a behavioural content is a non-complete trust [31][33]. According to Nonaka and Takeuchi [35], building trust requires the use of face-to-face dialogue that provides reassurance about points of doubt and leads to willingness to respect the others' sincerity. Thus, we conclude that trust has an indirect effect on the options in the process of supply chain integration.

One integration element is transparently shared information, which is related to commitment and trust and which also enables coordination between chain members. We can thus state that supply chain integration is apparently achieved by socialization and cooperative information sharing among supply chain members. These elements imply that there are various needs regarding quality and quantity of knowledge between the supply chain members making the decisions about integration. These needs concerning knowledge are related to a decision-maker's situation and background, i.e. how complex the decision-maker perceives the integration decisions to be. Badaracco [3] claims that a human being cannot take advantage of new information unless he or she has some kind of earlier "social software" connected to that information. Cohen and Levinthal [9], who introduced the "absorptive capacity" concept, also claim that an individual's capability to utilize new information in solving problems largely depends on his or her earlier knowledge. Thus, we can say that integration decisions depend on the decision-maker herself. The type of product delivered likewise affects the need for integration. For example, Lampel and Mintzberg's [28] product classification - dividing a product into categories such as pure standardization, segmented standardization, customized standardization, tailored customization and pure customization - defines different needs for integration. This, in turn, implies that the situations in supply chain integration processes also vary and depend on decision-maker's background and the products and services supplied.

Commitment implies that people are working for the integration of the supply chain. People can be committed to tasks by many means, such as money, promotion, travel, etc. However, many researchers [42][35] believe that genuine bonding and commitment derive from the interesting content of the work and from the significance of the goals of the job. Badaracco and Ellsworth [4] write that practitioners believe that people are committed through self-interest and the pursuit of power and wealth. However, in the opinion of Senge [42], if

people are only interested in themselves, then the organisation inevitably develops an atmosphere where people are no longer interested in common organisational objectives. In Senge's [42] opinion, an alternative model could be one where people want to be a part of activities that are greater and more significant than their personal and selfish goals. They want to contribute toward building something important, and they appreciate doing it with others. Then, according to the discussion above, we draw the conclusion that the acquisition and sharing of knowledge within the supply chain context is enhanced by a person's or firm's strong commitment to the goals of integration process and the common goals of the supply chain.

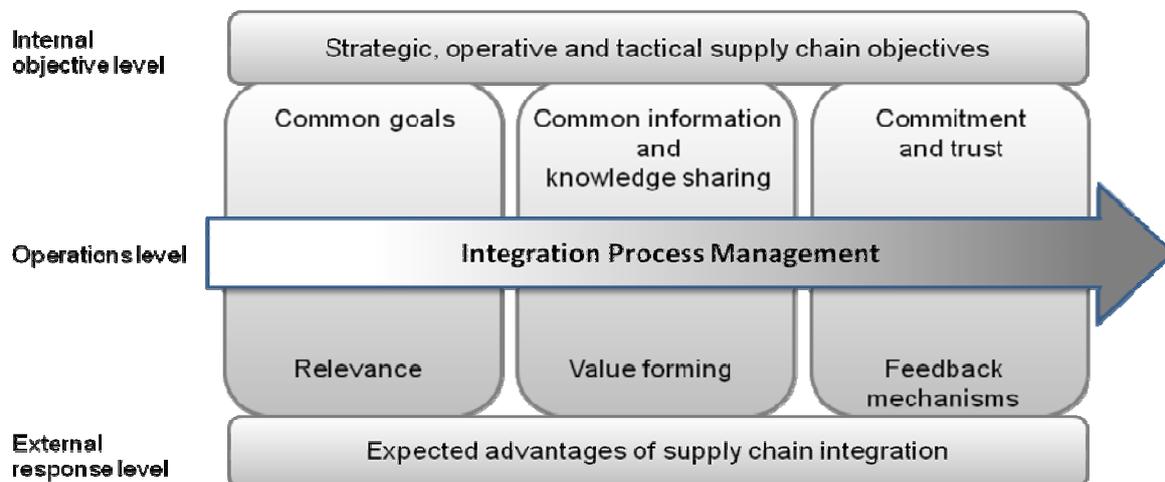
### Focusing on knowledge sharing in the supply chain integration process

Relying on the theoretical review, we can summarize that the central themes in integration are interaction, collaboration, information sharing, trust, partnerships, shared technology, managing integrated chains of processes and cooperation to achieve the common objectives. Cooperation, for its part, is built by the interaction of buyer's and supplier's beliefs and actions leading to commitment of resources. These different integration elements and their relative position and meaning during the integration process are at least partially unclear. Therefore it is useful to recognize different stages during the integration process to categorize and re-form the integration elements mentioned above.

These central themes and bases of integration lead to the idea of achieving more precise supply chain integration by using the following elements: common goals, common information and knowledge sharing, and commitment and trust. These three elements form the objective level of the proposed supply chain integration process. The response level in this process consists of the confirmed relevance of common goals, identified

value forming via information and knowledge sharing, and feedback mechanisms formed (see Figure 1). In this proposed model of the supply chain integration (SCI) process, the integrating companies' common goals are first observed against supply chain level objectives. The objectives may concern quality and quantity factors, which are related to issues like time, costs and quality. Common goals can be compared to individual members' own objectives and the same kind of comparison will also be conducted on the supply chain level. If the goals are relevant for both supply chain members separately and the whole supply chain collectively, the process of integration will continue to the next step. In this Common Goals – Relevance phase knowledge sharing is essential, because at the response level the relevance of common goals is discovered both at the company level and at the supply chain level. The relevance may also be concerned with the problem of quality and quantity factors, which are related, for example, to the relative position of the industry. Therefore it is important that awareness of the company's objectives and the expected advantages are ensured by the company's internal knowledge sharing.

If the relevancy of the common goals is ensured by the parties, in the next step the parties begin to share common information and knowledge between organisations. This can be called external knowledge sharing. The objective of external knowledge sharing is to make sure that the integration process will form real value to the parties and to the supply chain as a whole. At the response level the value of the integration process resulting from information and knowledge sharing is identified. The value added from supply chain integration may, for example, be improved customer service, reduced inventories and costs, reduced overproduction and variability, reduced waiting and faster deliveries. Such information and knowledge sharing is more related to the utilizing of common information and



communication systems. The utilization is based on the parties' interaction as well as information and knowledge sharing in different relationships and the objective is moreover to contribute to achieving common objectives.

If value formation takes place, members' commitment and trust are bound to increase. The effect of trust and commitment on people's awareness of the importance and meaning of their activities should be emphasized [42][35]. Trust enables communication, informal agreement, the absence of surveillance, and task coordination. Trust is both a pre-condition and an outcome, which means that a sufficient level of trust is needed in the first place. Therefore it can be argued that without knowledge sharing between the parties, commitment and trust cannot increase. At the response level, the feedback mechanisms ensure that the integration process is a continuum. At this phase, the openness and sharing of outcomes is vital for companies to be able to compare value added and the outcomes achieved with the outcomes anticipated. Therefore feedback mechanisms have an important role when knowledge is shared and collected during the integration process.

From the conceptualized schema above (Figure 1) we can identify the highlighted role of knowledge and knowledge sharing in supporting the whole process of SCI as well as in being a focal element of the integration process. Figure 1 also illustrates that knowledge sharing itself is not enough to sustain the integration process. In the integration process the process management is also needed, with the help of which knowledge sharing is sustained, coordinated, and controlled. The process management element controls the whole integration process and connects the integration process with the company's operations.

### Conclusions and Discussion

In a modern dynamic business environment a static position or unclear defining of supply chain integration do not form a sufficient basis for an efficient and effective process of supply chain integration. Furthermore, supply chain integration is a major challenge to companies striving towards superior performance and added value. Therefore, supply chain member relationships have been examined in light of the theoretical classification of the factors behind the concept of supply chain integration and the actors behind the processes of supply chain integration. The purpose of this paper was to discuss and introduce the role of knowledge sharing in supply chain integration and to introduce a schema for this integration process. Thus, six essential integration elements were identified: a) *common goals*, b) *relevance*, c) *common information and knowledge sharing*, d) *value forming*, e)

*commitment and trust* and f) *feedback mechanism*. These elements form the basis of SCI process and their content is determined by the company's supply chain objectives and expected advantages of supply chain integration. By defining the integration process it was possible to reveal the various roles of knowledge sharing behind the integration process.

Although we need more theoretical research and empirical tests, we can still argue that the first step toward an observable integration continuum has now been taken. When evaluating the need for integration and creating the statements and measures for observing the relationship between knowledge sharing and value adding in supply chain integration, the proposed model could be a useful starting point.

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