INTERDEPENDENCE WITHIN AND AMONG 'SUPPLY CHAINS'

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Abstract

It has been argued that the SCM area lacks sufficient theoretical underpinnings resulting in simplified conceptualisations of supply chains and their contexts, and furthermore, that theory may be helpful to uncover some of the complexity characterising supply chains. The aim of this article is to analyse interdependencies existing within as well as among supply chains. Thompson's (1967) and Richardson's (1972) dependency concepts are used to elaborate on this issue. We conclude that supply chains need to be analysed within their contexts, since this has consequences for recommendations concerning the organising and management of supply chains.

Keywords: supply chains, interdependence, inter-organisational context

Introduction

The term 'Supply Chain Management' (SCM) was first introduced by consultants in the early 1980's (see e.g. Oliver and Webber, 1982). The concept was mainly used to discuss the benefits of integrating a firm's internal business functions; such as purchasing, manufacturing, sales, and distribution (Harland, 1996). Hence, the original view of supply chains had an intra-organisational focus and was primarily focused on the firm's internal supply chain and how different functions could be integrated in order to smooth the material flow within the company. This view of the supply chain is closely related to what Porter (1985) labels the firm's value chain (Harland, 1996). From this intra-organisational focus the scope of the supply chain was later extended beyond the boundary of the (focal manufacturing) firm to include 'upstream production chains' and 'downstream distribution channels' (Lamming et al., 2000). This complementary perspective meant an inter- rather than intra-organisational focus in SCM.

A different approach was taken by Houlihan (1983) and others, discussing SCM as the 'modern approach to logistics'. Consequently, SCM has often been equalled to (integrated) logistics. According to Gattorna and Walters (1996) *'In a very short space of time 'physical distribution management' became 'logistics management' and now, in the more forward-thinking companies, is developing into 'supply chain management'*. (p. xv). In contrast, other authors have argued that there is a significant difference between logistics and SCM. The Global Supply Chain Forum's definition of SCM in 1998 reads '*Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*.' (Lambert et al., 1998, p.1). This definition thus also includes business processes that logistics exclude and does not highlight logistics as an especially important function to consider above others.

Hence, it seems as if the scope of SCM has widened over time from having an intra-organisational focus on logistics to become focused on inter-organisational issues including 'all key processes and functions'. However, even though the concept as such has been widely spread and used by practitioners, and later on by academics, there seems to be little consistency in its use as well as of its exact meaning (Harland, 1996; New, 1997; Tan, 2001). New (1997) argues that the interpretation of the supply chain and its many applications displays a profound ambiguity as to the concept's definition and scope. This is in line with Tan (2001) arguing that there are some common ideas about what SCM is 'broadly about' but that there is no universally accepted definition. According to Harland (1996), the concept appears in many different bodies of knowledge and these, in turn, have remained more or less unconnected. However, although there seems to be a large inconsistency regarding SCM, some similarities among the recent uses of the concept can be identified. For example, Cooper et al. (1997, p. 4) found the following similarities concerning how SCM has been dealt with in different publications: (1) It evolves through several stages on increasing intra- and inter-organisational integration and co-ordination; and, in its broadest sense and implementation, it spans the entire chain from initial source (supplier's supplier, etc.) to ultimate consumers (customer's customer, etc.). (2) It potentially involves many independent organisations. Thus, managing intra- and inter-organisational relationships is essential. (3) It includes the bi-directional flow of products and information, as well as the associated managerial and operational activities. (4) It seeks to fulfil the goals of providing high customer value with an appropriate use of resources, and to build a competitive chain advantage.

Several authors, e.g. Aronsson (2000), argue that the SCM area needs further theoretical underpinning as a complement to the heavy managerial focus. In line with this, New (1997) argues that the *'...management aspect of supply chain work, however, has largely drawn from the intellectual traditions of logistics and operations management. In my view,*

this presents problems for developing the field because of implicit assumptions about the role of research and its relationship to managerial practice, i.e. the ultimate purpose of research is to generate useful knowledge for managers'. (ibid., p. 15). Furthermore, New argues that the supply chain has been used in a normative rather than descriptive way, i.e. the *ought* rather than *is* aspect has been emphasised. The managerial focus in SCM has also led to a heavy reliance on so called best-practice and benchmarking studies while deep case studies, trying to 'get under the skin' of the SCM concept, seem to have been less frequently applied. In order to conduct such studies, however, some theoretical assumptions are needed that conceptualise supply chains in a way that not oversimplifies what is described as a complex reality. Cox (1999, p. 211) argues that '*the process in which raw materials are turned to end-products and services is rarely a simple linear process chain, and much more like a spaghetti web of complex interconnected relationships*.' Obviously, the 'whole' complexity cannot be captured but *what* particular structures and patterns are focused and *how* these are studied need consideration. In this article we argue that the prevailing SCM literature tends to simplify in a way that strongly limits the possibilities to take into consideration interdependencies within as well as among the supply chains that constitute this 'spaghetti web'. These interdependencies provide certain limits to what individual actors can do, but they also provide opportunities to increase the efficiency and innovativeness in supply chains.

Aim and outline of the article

As discussed above, the SCM concept has been widely used in both practice and academia. The ambiguity regarding its definition and scope is mirrored in its vast area of applications. Hence, the concept seems to lack solid theoretical underpinnings, which has resulted in a rather simplified use of a concept that is indicating a very complex reality. In line with this, the aim of this article is to analyse interdependencies within and among supply chains based

on some theoretical notions on interdependence. Furthermore, the consequences for further studies of supply chains, taking interdependencies into consideration, are also addressed.

The outline of the article is as follows. We start with a discussion on the SCM concept's theoretical roots and related approaches. The second section focuses on Thompson's (1967) dependency theory and is followed by a discussion concerning how the forms of interdependence can be applied on supply chains. The fourth section deals with supply chains in a context where particular dependencies are highlighted. The article ends with a concluding discussion on the consequences for studies within the SCM area.

Theoretical roots and approaches

The first attempts from academia to describe SCM in relation to earlier descriptions of material and information flow management appeared about 1990 (Cooper et al., 1997). However, according to New (1997) the idea of the supply chain can be traced back to the 1950's and the emergence of a system theory and the notion of 'holism'. The basic idea was that the behaviour of a complex system could not be understood completely by the isolated analysis of its constituent parts. This is also in line with Cooper et al. (1997) who argue that the SCM concept can be traced back to the systems integration research in the 1960's.

Lambert and Cooper (2000) point to the importance of the channel research by for example Wroe Alderson and Louis P. Bucklin in the 1960's that contributed to conceptualise the key factors for why and how marketing channels are created and structured (see e.g. Alderson, 1950, 1965; Bucklin, 1960, 1966). Lambert and Cooper (2000, p. 68) argue that: '*From a supply chain standpoint, these researchers were on the right trac*k…'. For example, Bucklin (1960) included production as one of five marketing functions, arguing that the character of the production process has great impact on channel structure. Furthermore, he emphasised the importance of the consumer, although not including it in the channel. Another

important concept from this time is Alderson's (1965) 'transvection' defined as the total process from raw material (referred to as 'conglomerate resources') to the end product in the hands of the ultimate consumer. The similarity between this concept and current interpretation of 'supply chains' is striking.

Even though it seems like some solid research had already been conducted closely related to what became SCM this research area has not been taken into consideration to a sufficient degree (Lambert et al., 1998). Why were these thoughts not considered when developing the SCM concept during the 1980's and 1990's? One answer might be that the channel researchers became interested in other aspects of this area during the 1970's and 1980's, focusing more on behavioural aspects, such as power and conflict in distribution channels. Furthermore, Lambert and Cooper (2000) argue that many channel researchers as a consequence of other research interests came to ignore two critical issues; '*First, they did not build on the early contributions by including suppliers to the manufacturer and thus neglected the importance of a total supply chain perspective. Second, they focused on marketing activities and flows across the channel and overlooked the need to integrate and manage multiple key processes within and across companies*.' (ibid., p. 68). Another explanation is that consultants and managers mainly have driven the development of SCM and that these have 'ignored', or not been aware of, the pioneering work done in early marketing and channel research (Kotzab and Otto, 2000). Furthermore, the initial logistical focus might have resulted in that the early 'marketing contributions' was not taken into consideration by the researchers within the logistics field.

According to Spekman et al. (1998) the traditional view of SCM has been to organise the supply chain to achieve the lowest initial purchase prices while assuring supply. The underlying assumption of this view is that trading partners are interchangeable and that they will take advantage if they become too important. Furthermore, it relies on the assumption

that a maximum of competition, in a free market, promotes a healthy and vigorous supply base that is based on the belief of the survival of the fittest. This view is shared with Hobbs (1996) who argues that most approaches to SCM have been based on neo-classical theory. As an alternative, a Transaction Cost Approach (TCA) to SCM is suggested as it *'provides an explanation for the existence and structure of firms and for the nature of vertical co-ordination within a supply chain'*. (ibid., p. 26). Hobbs (1996) also emphasises that neo-classical theory does not consider how business relationships arise. The increasing degree of integration among companies in supply chains has led to a focus on the ways in which companies interact. Relationships and partnerships between companies involved in supply chains have therefore become highlighted and discussed by several authors (see e.g. Lambert et al., 1996; Spekman et al., 1998; Mentzer et al., 2000). An increasing focus on relationships and inter-organisational co-ordination as opposed to vertical integration and market co-ordination is stressed by for example, van Hoek (1998, p. 187) who states that SCM '*…is characterised by control based on networking and integration of processes across functional, geographical and organizational interfaces*.' He further argues that this view is very different from the view of control based on hierarchy. Since TCA can explain why these relationships, or 'hybrid forms', occur this approach has lately been widely used in the SCM area. The use of this approach might also be an inheritance from SCM's roots in logistics as '*TCA is generally accepted among logistics researchers as a useful theoretical framework for analysing strategic logistics decisions. In the literature, there are several examples of theoretical and empirical studies, based on asset specificity, governance structures and safeguards against opportunism*.' (Skjoett-Larsen, 1999, p.7).

However, the TCA may not be instrumental in an effort to identify interdependence across chains owing to its focus on dyadic relationships. In order to deal with situations where several firms in different ways are involved, we therefore need a framework permitting

analysis of wider structures. The framework developed here takes Thompson's (1967) dependency concepts as a starting point, which is further discussed in the following section.

Three forms of interdependence

Thompson (1967, p. 54) states that most models of complex organisations *'assume interdependence of organizational parts'*. In his framework, Thompson (1967) distinguishes between three types of interdependence: (1) pooled, (2) sequential and (3) reciprocal to co-ordinate action of interdependent elements within an organisation. Thompson (1967, p. 54) defines *pooled* interdependence as a situation '*...in which each part renders a discrete contribution to the whole and each is supported by the whole'*. Furthermore, if direct interdependence can be pinpointed between parts, and the order of that interdependence can be specified, we have *sequential* interdependence. *'The third form of interdependence can be labelled* ***reciprocal****, referring to the situation in which the outputs of each become inputs for the others'* (ibid., pp. 54-55).

Thompson (1967) elaborates on these dependency concepts in a discussion on how different parts within an organisation need to be connected given the interdependence among their operations. He also discusses how interdependence can be managed within the organisation. With pooled interdependence, co-ordination by standardisation is suitable, with sequential interdependence co-ordination by plan is used, and with reciprocal interdependence co-ordination by mutual adjustment is necessary. Thompson (1967) relates this dependency framework to different kinds of technologies: (1) long-linked, (2) mediating and (3) intensive.

The long-linked technology is defined in the following way: *'A long-linked technology involves serial interdependence in the sense that act Z can be performed only after successful completion of act Y, which in turn rest on act X...'* (Thompson, 1967, pp. 15-16). Thus, long-

linked technology is closely related to the mass production assembly line, which is often found in the automotive industry. The focus is on transforming inputs (e.g. raw materials and intermediate products) into outputs in the form of products which are sent to customers. The assembly line is designed to produce standard products, repetitively and at a constant rate, thus exploiting economies of scale.

The mediating technology is defined as *'...the linking of clients or customers who are of wish to be interdependent'* (Thompson, 1967, p. 16). Examples of such organisations are banks (linking depositors and borrowers), telephone companies etc., who facilitate relationships among different customers distributed in time and space. The mediating technology requires operating in standardised ways, which implies that customers can be categorised into aggregated groups and connected.

'This third variety we label intensive to signify that a variety of techniques is drawn upon in order to achieve a change in some specific object; but the selection, combination, and order of application are determined by feedback from the object itself' (Thompson, 1967, p. 17). The intensive technology is illustrated with examples from hospitals and the construction industry, where a client or a customer problem is solved by a specific combination of activities and resources. Thompson (1967) argues that a successful use of the intensive technology rests both on the availability of all the capacity potentially needed, but equally on the suitable combination of selected capacities as required by the specific project.

Thompson's (1967) dependency framework is applied by Stabell and Fjeldstad (1998) in an effort to scrutinise Porter's value chain concept. While this concept relies heavily on sequential interdependence among firms, the authors identify two additional 'value configurations': value shops and value networks, relying on pooled and reciprocal interdependence respectively. They conclude that *'the concepts promoted in value chain analysis are adaptable beyond the traditional manufacturing context to which its description*

and sequencing of activities are best suited' (ibid., p. 435). Of greater interest here though is that their analysis points to inter-firm dependencies of all three forms which in turn implies that other forms of dependencies among firms than what the chain concept strictly implies need to be included when trying to understand how values are created by the firms together.

Interdependence and supply chains

Some kind of starting point is needed for identification of supply chains. For instance, an end product of some kind may be used for identification and analysis of the activity structure organised 'behind' it. This is in line with the transvection concept coined by Alderson (1965, p. 92) who defines transvections as comprising *'...all prior action necessary to produce this final result, going all the way back to conglomerate resources'*. This, however, entails a first important connection among chains as they typically merge in different stages within an activity structure where different parts of the end product are assembled, welded etc, tying different chains together successively (Dubois, 1998). Consequently, several different products (and thus also several chains, if defined by products) are involved in every 'supply chain' resulting in some kind of end-product. Taking transvections, or end-product related structures, as a starting point we will further analyse the ways in which the activities and resources within 'supply chains' are connected by analysing how they are subject to the three forms of interdependence.

The supply chain concept strongly relies on the notion that there exists *sequential interdependence* among activities. These activities therefore need co-ordination. According to Richardson (1972), sequentially dependent activities may be of two kinds. First, 'complementary' activities are defined as *'representing different phases of a process of production and require in some way or another to be co-ordinated'* (ibid., p. 889). Second, sequentially dependent activities may also be 'closely complementary' if there is a need to

'match not the aggregate output of a general-purpose input with the aggregate output for which it is needed but of particular activities' (ibid., p. 891). Hence, closely complementary activities imply a bilateral form of dependence since the two activities only contribute some value in specific relation to each other and, thus, to their common purpose e.g. a particular end product. Closely complementary activities therefore need *ex ante* matching of plans by those involved in their performance.

Pooled interdependence is of vital importance for the efficiency of any kind of operation since this form of interdependence has to do with joint utilisation of resources. By utilising common resources, economies of scale can be achieved in the performance of individual activities that belong to different supply chains. Richardson (1972, p. 889) defines activities as 'similar' if they *'require the same capability for their undertaking'*. Creation and utilisation of pooled interdependence thus imply that supply chains need to be connected in terms of joint resource use in order to be efficiently performed. This, furthermore, requires some degree of standardisation, or likeness, in the use of the common resources. Hulthén (2002) refers to these resources as crossing points in which products are refined either in form, place or time. Pooled interdependence implies that individual activities within a particular chain are subject to similarities with individual activities belonging to other chains. Hence, to analyse the efficiency within a particular chain, activities need be the units of analysis. Hereby, each individual activity's connections to other activities can explain the efficiency of the performance of that activity, which is thus a function of the utilisation of resources that are jointly activated by similar activities.

Where activities are subject to counterpart, or end product, specific interdependence and hence are closely complementary, this points to the need to also include *reciprocal interdependence* in the analysis of supply chains. That is, where *ex ante* matching of plans is required, firms need to interact in order to make the plans fit into their different production

contexts. This interaction may also include adjustments of resources used in, or refined by, the activities subject to co-ordination to improve resource utilisation or the means by which the activities are co-ordinated. Hence, interaction among actors who are involved in undertaking activities and/or in developing the resources activated, or the end-products resulting from the activities, are of vital importance to understand and analyse change in these structures.

While we have here identified interdependence among activities within and among supply chains in principle, we have omitted the organisations involved in performing and co-ordinating the activities. Returning to Thompson (1967) he mainly focuses on intra-organisational interdependence, and considers the environment in general terms by variables such as uncertainty. Where 'boundary-spanning' activities are concerned he states that: '*The crucial problem for boundary-spanning units of an organisation, [...], is not coordination (of variables under control) but adjustment to constraints and contingencies not controlled by the organisation - to what the economist calls exogenous variables'.* (ibid., pp. 66-67). However, if assuming that activity chains are subject to the three forms of interdependence as described above this assumption of anonymous markets surrounding the firm does not fit our aim. Instead, we need to take into account the specific interdependence among activities that work across the boundaries of firms (Dubois, 1998). To analyse these complex patterns of interrelated chains we need three units of analysis: products, activities and resources. In addition, we need to add firms (or business units) and relationships as they are organising the performance and co-ordination of activities, as well as the development of products and resources. We will assume that individual firms are trying to 'optimise' their respective sets of activities and resources but that this cannot be done without taking interdependence across their boundaries into account. We will thus also assume that relationships between firms provide them with means to co-ordinate their activities and to interact in the development of

the resources activated by, and of the products resulting from, their respective activities. This is in line with Richardson (1972) arguing that inter-firm co-operation is required in certain situations: *'This co-ordination cannot be left entirely to direction within firms because the activities are dissimilar, and cannot be left to market forces in that it requires not the balancing of the aggregate supply of something with the aggregate demand for it but rather the matching, both qualitative and quantitative, of individual enterprise plans.'* (ibid., p. 892).

Illustrating supply chains in context

Complex patterns of interrelated supply chains appear when considering supply chains within a context of other supply chains. In order to facilitate the efforts to conceptualise and understand interdependence within and among supply chains, we will illustrate and discuss an empirical example (see Figure 1). The focal firm, F, in the illustration is a producer of wooden wall elements for the construction industry. The example is simplified to pinpoint the main principles in our arguments. However, more detailed empirical examples of how supply chains are interrelated are provided in Hulthén (2002), analysing how different supply chains in the PC industry are interrelated in various ways.

The simplified illustration in Figure 1 involves five (end product related) supply chains (ending in product a,b,c,d,e) that are subject to interdependence.

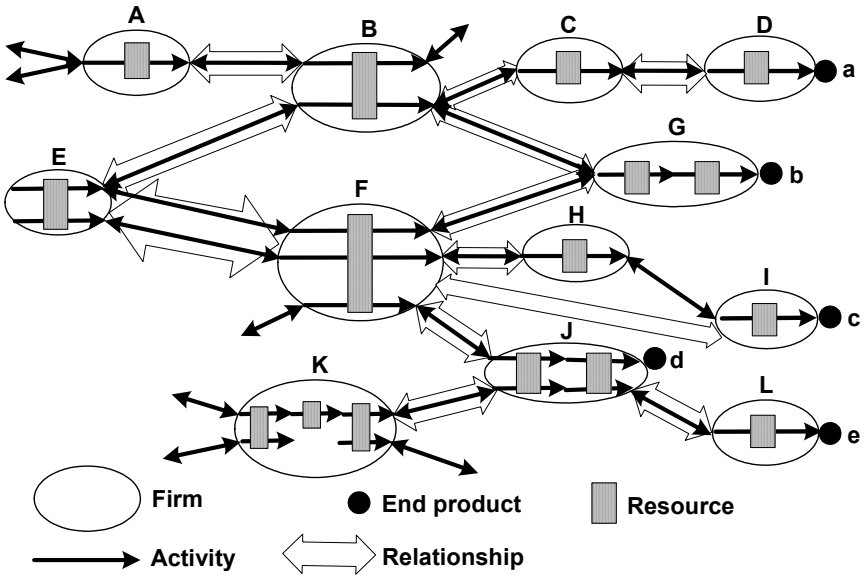

Figure 1. Supply chains in context

Above we have defined supply chains in relation to specific end products. However, the firms involved in any sort of supply chain will perceive products differently. For instance, for firm F in Figure 1 there are three products produced (wooden wall elements) that will end up in three different end products (b, c, and d). If firm F perceives the products resulting from its (similar) activities, or as parts of the end products will presumably impact on its behaviour in relation to its counterparts. For firm F there are also other products of relevance. Two products (for example two different types of timber) are used as input and supplied by firm E. Firm E is also selling one of these products to firm B, to be further refined by firms C and D into end product a. Furthermore, firm F's activities (utilising a common resource) result in three products that are further refined by G, H, I, and J into end products b, c, and d. By this way of organising the activities, the supply chains resulting in end products b, c, and d utilise resources also activated in other chains within, for example, firms B, F, E, and J. Hence, there are quite a number of interdependent products, activities and resources involved even in this simplified example. And, since they are distributed among several firms their different perspectives on how to organise and manage their activities, resources and products will impact on their efforts to improve their perceived parts of the supply chains.

The exchanges taking place within relationships make it possible to identify products as part of that exchange. However, as with the resources activated in supply chains, business relationships may be used for exchange of several products as illustrated by the relationship between firms E and F in Figure 1. Furthermore, who is buying or selling from whom is not apparent if just looking at the sequence, or flow, in a chain of firms since e.g. a producer may buy refinement, transportation, storage etc. from the next firm in the chain. For instance, firm H might be painting the wall elements produced by firm F, on F's assignment, before they are delivered to firm I. This also blurs product definitions since activities may be carried out by a firm who does not own the subject of these activities. Hence, what is considered products, or end products, in supply chains is arbitrary and depends on whose perspective is taken and what the analysis aims at.

The activities that are parts of a supply chain (regardless of how it is defined) are interdependent with other supply chains as they share various common resources. The individual firms involved need to match activities and resources to the best of their ability to be efficient. Through relationships they are also able to interact with customers and suppliers to make adjustments that may improve some part of their performance. These adjustments may result in relationship specific investments that tie firms to one another and thus can make other changes costly. In figure 1, firm K may have invested in a resource (e.g. production equipment) that is only activated in the production of the product supplied to firm J. This investment, in turn, will probably affect firms K and J and their relationship when changes are concerned.

Owing to the interdependence any adjustment may impact on other supply chains, and thus on other firms, which may invoke reactions of various kinds. If, for instance, firm G wants to improve the performance of its end product b by developing the material supplied by firm E, and used as input by B and F, this may call for adjustments of firm B's and/or firm F's

resources. This, in turn, may entail changes that impact on the other four end products as some of the activities included in their supply chains share common resources with end product b's supply chain.

Here we assume that changes take place among existing members of the structure. Although firms may, and sometimes do, change counterparts the key issues are arguably more often concerned with how to interact with existing counterparts (Wynstra 1998). This may be perceived as of even greater importance when recognising interdependence within and among supply chains as exemplified here.

Concluding discussion

The focus of the research in the SCM area has mainly been on economic aspects, and especially on efficiency (New, 1997). Accordingly, one area of interest has been the measurement of supply chain performance, discussed in for example van Hoek (1998). In turn, there has been a focus on the redesigning of supply chains in order to improve efficiency. In relation to this, one focused area has been that of how to select the most appropriate supply chain. This indeed implies a view of the 'members' of the supply chains as independent and interchangeable. An important underlying belief in this kind of perspective on SCM is that it is possible to identify and establish *the* most efficient supply chain by selecting the best set of members. Furthermore, the focus has been on firms employing long-linked technologies, i.e. each stage of the production uses as its inputs the product of the proceeding stage. What is not considered is that each of the involved firms is also involved in many other supply chains through its exchange relationships with other parties, thus forming a unique context to each supply chain. Furthermore, that firms often adapt to each other's resources and activities, and thereby create interdependence, is not considered. If this had been identified as a central aspect, the reorganisation of supply chains would arguably have

been regarded and discussed as more problematic than what is often the case. Considering interdependence within and among supply chains implies that all supply chains need to be dealt with as unique. In line with this, Cox (1999) concludes that there *'...is no best way to manage supply chains'* (p. 209). This is due to the fact that *'...the physical structures of supply chains are very different. Each case demonstrates relatively more or less degrees of complexity, with a variety of stages and with a wide diversity of participants at each supply chain stage. There are also varying degrees of contestation over the resources that must be provided at each stage of the physical supply chain, and significant differences in the ability of companies to appropriate value from their position within the chain.*' (ibid., p. 209)

All in all, interdependence has only been dealt with in SCM to a very limited degree and in most cases in an intra-organisational setting, discussing how functions within a firm depend on one another. Interdependence *within* the supply chain has to some degree been dealt with in terms of how the involved firms are sequentially dependent and thus need to co-ordinate their activities while interdependence *among* chains has only been slightly touched upon in the SCM literature. One explicit notion of this kind of interdependence is made in Lambert et al. (1998) followed by Lambert and Cooper (2000) suggesting that 'non-member' links can be of importance to consider. The non-member links are described as links between members of the focal company's supply chain and non-members of the supply chain that are of importance to the focal company. For example, a supplier of the focal company can also be a supplier to its main competitor why this link becomes important to take into consideration. What is interesting is that these kinds of links have not been further considered in the SCM literature. Moreover, if considering the forms of interdependence discussed in this article, role categories such as 'competitors' become problematic to apply since these may also take on several other roles in relation to different firms in a particular supply chain. Further, in

relation to a particular firm in this chain, a 'competitor' may contribute to the focal firm's efficiency if their activities utilise common resources.

Considering interdependence as suggested in this article, implies that supply chains cannot be optimised. Efforts to optimise individual supply chains, without considering interdependence among chains, may hamper the efficiency elsewhere in the network, which may call for reactions. In addition, neither activities, resources nor products can be considered 'given' when supply chains are organised and managed since conditions for activity co-ordination and resource utilisation constantly change. Other firms, directly or indirectly connected to a particular supply chain, may change the ways in which they organise and manage their parts of the supply chains. Consequently, firms are never in full control of the parts of the complex patterns of supply chains they are involved in. This is in line with Gadde and Håkansson (2002) discussing supply network strategies and the possibilities and constraint of firms to act within these supply networks.

Further research

While having here focused on structural aspects of supply networks, the theories referred to may also provide further guidance for dealing with managerial aspects in these structures. Alderson (1965) introduces the concept of sorting as being one central part of the transvection. This type of activity is generic to its character and helps defining or delimiting the transformation activities of relevance for any supply chain. This is so since sorting is the decision aspect of marketing that directs products in supply chains to different resources used to perform transformation activities. Sorting hence is the main factor that interlinks supply chains to each other. For example, activities such as sales forecasting, production planning and composition of assortments is closely related to how sorting is performed.

What are the implications for further studies of supply chains and the management of them? First, where studies of structures are concerned we suggest studies that start out from particular activities, resources or products in order to identify and analyse their interdependence to other activities, resources and products. Studies of this kind permit exploration of structures and analysis of dependency patterns reaching far beyond the firm and dyadic levels of analysis. In order to do so, we argue that Alderson's transvection, with its two generic activities sorting and transformation, is a useful analytical tool if aiming to understand how supply chains are connected into supply networks and how these are organised and coordinated. Second, where studies of processes in these structures are concerned we suggest a focus on interaction patterns as studies of this kind may improve the understanding of firms' efforts to influence their counterparts and the effects hereof. Hence, although there are no simple solutions available in these complex structures, lessons from efforts to effectuate change in them are essential to develop the understanding of their dynamics. Hence, in-depth case studies of structures and processes considering interdependence within and across supply chains, by making use of the theoretical concepts suggested, would arguably contribute to the development of the field of supply chain management.

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