Coordinating activities in supply chains across disjunct firm boundaries

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Abstract

The coordinating of activities in supply chains is a key issue in the supply chain management literature. The main objective, and a necessity to achieve efficiency, is often described as to create 'seamless flows' of goods and information. In this article, we point to some inherent difficulties in this view. Starting with a micro-perspective analysis of how activities are coordinated by the firms in a specific supply chain, the paper addresses some of the major challenges faced by a company coordinating its activities in relation to activities coordinated by other firms. The conclusion of this analysis is that coordination of activities within supply chains needs to take into account that the coordination scope and concerns differ among the firms involved, and that the division of coordination activities among the firms may influence the performance of the supply chains as well as of the individual firms since the firms influence each others' coordination concerns.

Keywords: coordination, supply chain, activity, firm boundary

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. 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, Ballou et al. 2000). This complementary perspective meant an inter- rather than intra-organisational focus in SCM. A recent example of a definition of supply chains is suggested by Liu et al. (2005) as "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".

The coordination of activities in supply chains has developed into a key issue in the supply chain management literature as coordination is assumed to play a critical role in achieving better supply chain performance. For instance, Cooper et al. (1997) point to supply chain management as involving activity coordination on different levels within and between organisations in the supply chain, and Simatupang et al. (2002) argue that interdependence between units requires coordination of their operations to achieve the mutual goal of the supply chain as a whole as well as those of its units.

In the supply chain management literature activity coordination is often presented as a matter of acknowledging common goals and interests among firms in the supply chain. To achieve this, the involved firms need to set up a structure where 'channel captains' or 'dominant firms' generate the required data and governance signals necessary for all the firms in the supply chain so that they can do their part of the job and in order to divide the benefits from the management of the chain as a whole in a fair way between them. The main objective, and a necessity to achieve efficiency, is often described as to create 'seamless flows' of goods and information.

In this paper, we point to some inherent difficulties in this view. In particular, we refer to the possibility to analyse coordination challenges across supply chains. This challenge has been acknowledged by the SCM literature (see for example Cox 1999), and we wish to promote analysis based on industrial networks theory, and in particular the activity level of this theory, as a tool which can be developed to handle this challenge. Starting with a micro-perspective analysis of how activities are coordinated by a number of actors in a particular supply chain, the paper addresses some of the major challenges faced by the involved firms in respect to coordination of their activities in relation to the activities coordinated by the other firms. The discussion is supported by a case study that focuses on three focal actors in a supply chain. The coordination activities required in relation to the specific supply chain are discussed from the perspectives of the three firms respectively. The analysis is based to the framework presented next.

Analytical framework

The basis for analysis of activities is that activities are linked together in large patterns where the result of one or more activities is the input to another activity (Håkansson & Snehota 1995). Individual firms find their roles in such activity patterns by organising a number of such activities, although these sets of activities varies extensively even within two individual firms in the same industry, as well as over time. An analysis based on activities can be done statically, by looking at how activities are linked together and which firm are conducting which activities at a certain point in time, or dynamically, by following how actual activity patterns develop over time as some activities are modified or removed and other activities are added.

Returning to the role of the firm, each firm can be seen to coordinate its activities in relation to three parts of a supply chain: in relation to the supply chain up-stream, the internal part of the supply chain and in relation to the supply chain down-stream. The coordination, still on an overall level, can then be divided into three parts: (1) the supply chain up-stream in relation to the internal supply chain, (2) the coordination of the internal supply chain in relation to the supply chain down-stream, and (3) the coordination of the up- and down-stream in relation to each other. Based on the general sequential dependence among the three parts of the supply chain in need of coordination, the coordination of them, at the boundaries of a firm, may be featured by different concerns, see Figure 1. While Thompson (1967) points to planning in order to manage sequential interdependence among activities within the firm, the scope and conditions for such planning may differ among the firms in a supply chain context. The way in which the planning is carried out by the individual firms in one way or another needs to be linked to the planning of the other firms.

Moving on to how the firm coordinates its activities in relation to other firms in a particular supply chain, the coordination at the boundaries of each firm can be highlighted and the coordination at the boundary affects the coordination of the other firms, see Figure 1. The coordination of activities at these boundaries together set the terms for the coordination of the whole supply chain.

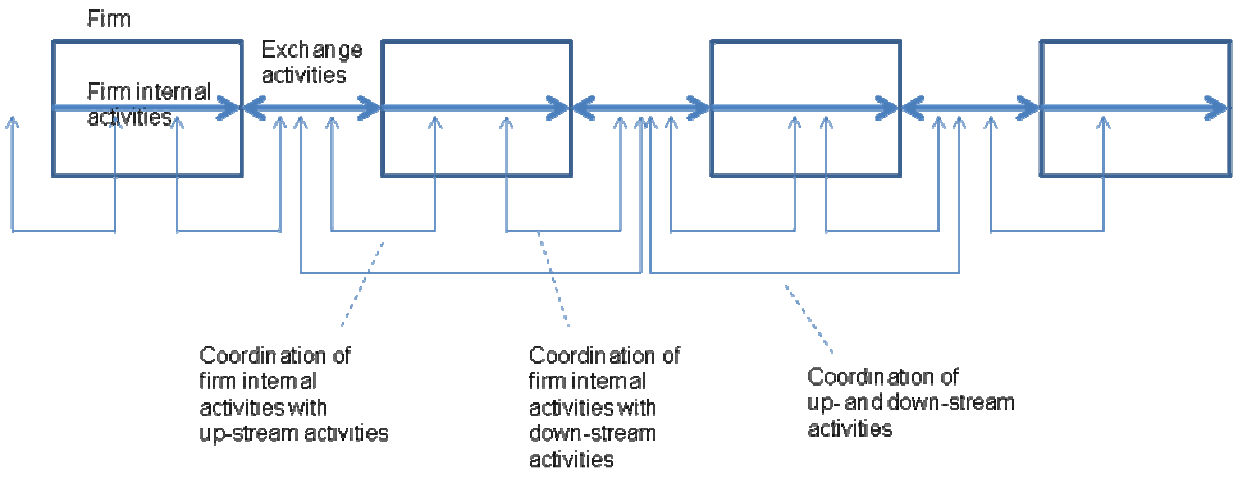

Figure 1. Coordination concerns of the firm

Expanding the level of analysis one step further, each firm linked to other firms in a particular supply chain are also involved in other supply chains, i.e. they are part of larger activity patterns beyond the level of analysis of the single supply chain (Dubois et al. 2004, Håkansson and Persson 2004)). Thus, they need to coordinate their up- and down-stream activities with their internal activities in view of a set of boundaries with different characteristics. Considering the coordination of the boundaries in relation to a focal supply chain in view of all other supply chains the firms need to manage, the disjunctions caused by the firm boundaries appear as vital in order to understand the coordination problem of the firm and of each supply chain by the set of firms involved in them.

In addition to coordination of activities in individual supply chains, inter-organisational relationships may be developed and used to facilitate coordination between two specific firms on a basis that extends individual supply chains, i.e. the efficiency gains are achieved on a larger scale than what an individual supply chain may give rise to. That is, relationships can be coordination mechanisms in relation to activity coordination in one or several supply chains but may also include relationship specific adaptations to coordinate other interdependencies such as pooled and reciprocal (Thompson 1967, Stabell and Fjeldstad 1998). Hereby, the effects of firm boundaries in the coordination of activities in individual supply chains take on additional features highlighting the resources used for coordination across the firm boundaries and the ways in which these are adapted to fit particular relationships and/or supply chains.

In the next section we will look into a case of a kitchen furnishing supply chain and some of its context. Based on this case we will analyze the coordination of activities in view of the firms' boundaries in order to point to some of the effects of these boundaries.

The kitchen furnishings supply chain

This case describes the delivery and installation of kitchen furnishings to a specific construction project. Initially, only activities directly involved in this particular supply chain will be accounted for, whereafter the description will be expanded into also including some additional description of related activities and resources of concern for the involved actors. Interviews have been made with four actors, three of them identified as having a

central role in the kitchen furnishings supply chain[1]. The client, responsible for prescribing the use of a particular kitchen supplier, set the conditions for the production and deliveries of kitchen but is not directly involved in the related material flow. The main contractor is responsible for negotiating and ordering the kitchens from the prescribed kitchen producer and is also in charge of installing the kitchen furnishings at the construction site. The kitchen producer manufactures the kitchen furnishings in accordance with the agreements made with the main contractor. The kitchen producer has a vast number of suppliers for sourcing everything from particle boards to cupboards and fittings. In this particular supply chain, we have chosen to focus on one of them, a specialized carpentry that supplies the kitchen producer with finished cupboards. This supplier is identified by the kitchen producer as a strategically important supplier, with which it has developed several innovative solutions over the years. In addition, two logistics providers were involved in transporting the kitchen furnishings from the cupboard producer to the kitchen producer, and from the kitchen producer to the construction site, respectively. The firms directly involved in the production and transportation of the kitchen furnishings, and included in this case description, are illustrated in the figure below.

Figure 2. The firms involved in the material flow of the kitchen furnishings supply chain

An initial contact was made between the client, the main contractor and the kitchen producer during the second half of 2005. After extensive discussions, including price negotiations and delivery planning, the first delivery was finally planned for in week 15, 2007. The actual ordering of the kitchens was preceded by a substantial amount of information sharing. The main contractor had, influenced by the local municipality, decided to build 18 rental apartments and 26 tenant ownerships. The combination of these two types was quite unusual on a single construction project and had profound effects on the ordering of the kitchens. The kitchen content in the rental apartments was standardized, decided upon by the main contractor and kitchen producer in interaction. The apartments built for tenant ownership, on the other hand, demanded that the final customers, the end-users purchasing the apartments, got to influence the content with regard to for example type of wood to be used and disposition of doors and drawers. For facilitating this choice, the main contractor met with all final customers, offering them a list of options and additions, from which they got to choose their preferred kitchen. This procedure resulted in the order being broken down into two parts; one containing the standardized kitchens, the content of which was known by the kitchen supplier long before the actual order needed to be introduced to the production process, and the other part which was less known, as the customized kitchen furnishings were specified just before the delivery time of the kitchen producer ran out.

The kitchen producer reserved production capacity in accordance with the agreed upon delivery dates to make sure that there was enough production capacity for the delivery in

[1] In total, eight interviews were made; one with the client, four with the main contractor, two with the kitchen producer, and one with the cupboard producer. The interviews ranged between one and two hours. Primarily, the interviewees were personnel responsible for delivering to the project in question, but also personnel with a more general responsibility for the purchasing strategy of the respective firms were interviewed.

question. After this, the kitchen producer awaited the actual call from the main contractor. This call came in the end of January of 2007. Once the incoming order was received, the kitchen producer broke it down and transferred it to the cupboard producer, who in turn manufactured the needed cupboards before loading them onto pallets in preparation for delivery. An external logistics provider delivered the cupboards to the kitchen producer and these were then integrated into the production process of the kitchen producer. Given that the cupboards were delivered as finished components, they were only to be fitted and assembled with the rest of the order, thus entering the production process at the fitting stage.

Once the pallets were loaded they needed to be transported to the construction site directly, since there is limited inventory space at the kitchen producer. However, delays on the construction site made it difficult for the main contractor to install the kitchen furnishings in the pace originally agreed upon. As a result, the logistics provider had to take on storing of the finished kitchens until they were needed at the construction site, since neither the kitchen producer nor the main contractor had any possibilities to store the kitchens. This translated into a delay of five weeks. The order was then, as originally planned, divided into five separate deliveries, taking place a few weeks in between. Once at the construction site, the kitchen furnishings needed to be carried into separate apartments, before being installed. This posed some difficulty, due to delays with other site related production activities.
As an example, the last of the five individual deliveries will be described. First off, this delivery did not arrive as expected on the agreed upon day of delivery. This was due to a mistake made by the kitchen producer, where they had not changed delivery date in their ordering system. Continuous delays had resulted in a human error. After discussion, the delivery was decided upon four days later. Once the delivery arrived, other problems occurred. The contracted wheel loader, which was to be used for unloading the kitchens from the truck, was delayed. This meant that the main contractor instead had to use a telescope crane, thus taking it away from another task for which it was originally intended. As the wheel loader never arrived, the entire load of kitchens had to be unloaded by the telescope crane, resulting in delays as the crane was not suited for this task. Moreover, the task of dismantling safety railings, initially intended to be done with the help of the telescope crane, was now not possible to be started before the kitchens had been unloaded. This resulted in two hired personnel to go unemployed for a number of hours. The unloading of the kitchens took twice as long as initially planned for, resulting in the truck arriving with the kitchens to arrive late to its next drop-off point.

Having briefly described the production and transportation related to the production and delivery of kitchen furnishings to the construction site, some additional descriptions relating to this delivery and to other activities of concern for the actors is given below.

The cupboard producer has three main customer groups, one of them being the kitchen producer. Utilizing different production facilities and having personnel assigned to specific customers, the cupboard producer avoids conflicts between individual orders. As of now, the kitchen producer is the single largest customer of the cupboard producer. Given that the kitchen producer orders from the cupboard producer based on confirmed customer orders, and has a very limited storing area for raw materials, the cupboard producer has a delivery time of only three weeks. This poses a challenge as some of its suppliers need four to five weeks delivery time. For this reason, the cupboard producer has to rely on a fairly large storage of raw materials and components.

The pallets used for deliveries from the cupboard producer to the kitchen producer consist of separate sections for enabling separation of individual customer orders. The change into these more elaborate pallets was made on initiative of the kitchen producer, where the personnel had complained on having to sort all incoming materials. This is now instead done by the cupboard producer. Another change in the delivery of the cupboards is the use of a smaller logistics provider enabling direct transport of the cupboards. This saves one day of transport, compared to the previously used logistics provider who reloaded the cupboard at a distribution central before delivering them to the kitchen producer. This change was made on initiative of the cupboard producer.

The kitchen producer manufactures and delivers to several customers in parallel and therefore need to match different orders with regard to the production process and of deliveries to different locations. The production process is not entirely integrated, but smaller intermediate storages are maintained between individual production activities, to achieve some flexibility within its production process. In times of high demand, different orders are coordinated by making reservations of production capacity up to a year in advance. As some orders are usually cancelled over time, the company reserves more than full production capacity, meaning that there is a chance that they need to work overtime to produce in accordance with actual demand. Delays in planned orders are also absorbed with this possibility of overtime in production. Balancing incoming orders with the capacity of the production process represents the kitchen producer's main challenge. Once orders are ready for delivery an external logistics provider is contracted for the actual transport. Coordination of different orders is the responsibility of the kitchen producer, who is interested in maximizing the utilization of the trucks.

The main contractor, responsible for ordering and subsequently receiving and installing the kitchens at the construction site, is conditioned by other ongoing activities, primarily related to the construction project in question, but also in relation to other projects running in parallel. As illustrated in the description above, the kitchen deliveries were delayed due to other delayed activities at the construction site. Delays in the work of setting up walls had resulted in a delayed paint job, which in turn made it impossible to install the kitchens at the time initially planned for. All activities ongoing on a construction site are in this way directly and indirectly interdependent, resulting in deviations from the project plan having potentially far reaching effects. In addition, the main contractor had more than one project running in parallel, making it necessary to allocate resources between the individual sites, which among other things resulted in an extensive use of external workers.

Case analysis

In this analysis we will focus on the specific conditions for activity coordination from the points of view of the firms involved in the supply chain of kitchen furnishings starting with the cupboard producer and moving down-streams. Thereafter, we will look into specific examples of how the firms influence each others' conditions for coordination. Finally, we will focus on the effects of relationship specific adjustments on coordination in the supply network.

The cupboard producer experiences challenges in coordinating down-streams activities in relation to up-streams activities in that the delivery lead time to the kitchen producer is shorter that the lead time to get deliveries from its own suppliers (represented as coordination concern I, in figure 3). As a consequence the firm has to maintain stocks of components. The more variants of kitchens that are allowed by its customers' customers, the more stock is needed (II, figure 3). Moreover, the cupboard producer has separated its production in relation to different customers which makes coordination of activities to the

respective customers less dependent but also means that possibilities to benefit from economies of scale in resource sharing is less than what it could have been (III, figure 3). Hence, coordination between supply chains directed to different customers is not in focus for the cupboard producer's coordination concerns. In relation to the kitchen producer the cupboard producer have invested in relationship specific resources in the form of pallets that facilitates the coordination of incoming materials for the kitchen producer. The direct deliveries from the cupboard producer to the kitchen producer has also simplified the coordination of activities between the firms and reduced the delivery time.

Moving on to the kitchen producer, this firm has several challenges in coordinating its activities. First, the firm needs to coordinate a range of up-streams supply chains including variants of kitchen components. In addition, the raw materials and kitchen components arrive at different stages of refinements and therefore feed into the chain of production activities at different stages (IV in figure 3). Second, although every kitchen is specific to individual customers and even to specific apartments, the production of the kitchen producer is not sensitive to variants in the same way as for the cupboard producer. Instead, the challenge here is to coordinate different customer orders in relation to the overall capacity planning with customers changing their orders over time (V, figure 3). Third, since the assembled kitchens cannot be stored by the firm, the need for coordination of the production activities in relation to deliveries is strongly felt (VI, figure 3). Fourth, the firm coordinates the deliveries to the construction sites, including coordination among different orders to achieve full loads on the trucks which entails coordination challenges both within and across supply chains (VI, figure 3).

The main contractor has a lot of coordination concerns that involves deliveries of materials to the site and of matching those deliveries with activities and resource use at the site. In general there are very strong needs for coordination among a huge number of activities relating to a large number of actors delivering to and working at the site. If we focus on the kitchen supply chain in relation to the activity coordination concerns of the main contractor, we can identify some particular ones. The closely coordinated sequence of delivery, unloading and installation of kitchens need to follow after some other specific activities at the site have been completed. Hence, there is a strong need for coordination of a sequence of related activities that indirectly involves several up-stream supply chains which entail a need for coordination across these chains (VII, figure 3). In addition, the sequence of activities within the kitchen supply chain need strong coordination since delivery, unloading and installation cannot be separated in time (VIII, figure 3). This coordination need is enforced by that each and every kitchen is dedicated to a specific apartment. Moreover, there are specific resources required in the performance of the activities. These are also needed for other activities which entails a need to coordinate the use of these resources across various activities at the site, and also among sites for the main contractor (VIII, figure 3).

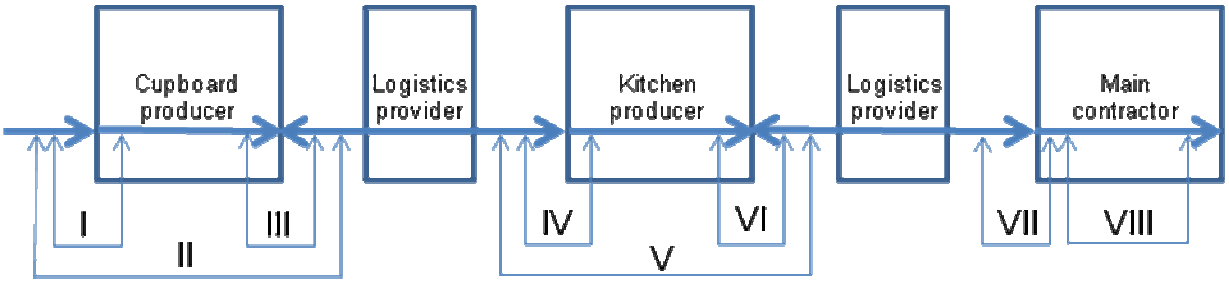

Figure 3. Summary of coordinative concerns experienced by the three firms focused upon in the case description

Above, we looked at coordination activities necessary in order for the focal firms to handle the coordination of activities related to the specific kitchen furnishings supply chain. However, the case also presents examples of how this coordination was affected by relationship specific adjustments that had been made by some of the firms.

First, the pallets used by the cupboard producer to sort the different parts of the cupboards before they are sent to the construction site are specific for the business relationship between the cupboard producer and the kitchen furnisher. The pallets were developed as a co-operative effort between the cupboard producer and the kitchen furnisher, and was an attempt to solve a problem for the kitchen furnisher by "moving" the activity of sorting of parts from the kitchen furnishers to the cupboard producer. Earlier on, the cupboard producer packaged all the parts as tight as possible, and let the kitchen furnisher (or the assembler on the construction site) break open the packages and sort through the materials to find the parts needed to assemble a specific cupboard. The pallet holds specific slots for each part and the packaging of a pallet at the cupboard producer thus actually also works as a sorting procedure. The drawback is that these pallets take more space in storage and transportation than the earlier packaging procedures did, where volume is minimized. Furthermore, these pallets are only used in orders related to this specific kitchen furnisher; in other words it is a relationship-specific asset which enables the assembly of the cupboards to be done faster on the construction site.

This example can be expanded further when considering the way in which the cupboard producer organises its internal production in relation to different customers and different orders. The cupboard producer tries to specify that certain resources in the production are reserved for certain customers/orders by allocating specific customer orders to specific personnel in the production facility. This means that production activities are to some extent decoupled. A change in production activities in one supply chain will not directly impact on other parallel production activities since they are, in principle, utilising two different resources. This makes the coordination activity easier to perform in some dimensions, particularly towards the specific order/customer, but more difficult to perform in respect to flexibility (if something happens that may cause delay) and resource utilization of common resources (resources shared by several orders/customers).

Another example of how business relationships are facilitating coordination is related to the final assembly of the kitchen. The normal procedure for handling this is to do the assembly on the construction site, based on components sent from the suppliers. In the case at hand, the main contractor had its own specialists which performed this production activity based on the pallets delivered from storage. However, this is not the only possible way of doing it. In other cases, a sub-contractor may be charged with this task, and in yet other cases, kitchen furnishers may have their own personnel (or sub-contractors). Each possibility has its own set of challenges related to resource use, timing, knowledge and competence, and creates different kinds of needs for coordination across firm boundaries. Consider for example the possibility for the kitchen furnisher to have specialists doing this. In this case, they could be well qualified for assembling the company's products and have a lot of knowledge about its products. They would also have a vested interest in performing well, since the reputation of their company is vital. From a coordination point of view, however, such a structure would be complicated, since the kitchens need to be installed on site in widely dispersed geographical locations. This would mean a lot of travelling for these specialists, and perhaps also raise certain questions as to resource utilisation (since a

considerable amount of time would be spent travelling, something which do not add value to the product). Also, given the above observation that production activities on-site are often rescheduled, the use of such specialists would mean that they would often come to a site and have to wait for hours (or come back next day or even later), meaning that even less of their time would be spent on value-creating work. When the assemblers instead work for main contractor, the possibilities for efficient resource utilisation is increased, but some of the other advantages (like thorough knowledge of the products and assembling of them) pertaining to specialists from the kitchen furnisher does not apply to these assemblers. In short, it seems as if resource utilization and specialist knowledge is at odds in these situations, and that on-site coordination is prioritized, leading to solutions where the main contractor (or a sub-contractor) handles the actual assembly, and the principal challenge when it comes to co-ordination is to ensure that the actual assemblers have sufficient information about the products and the assembly process to do a good job.

Concluding discussion

Firm boundaries serve as disjunction points between the internal activities of a specific firm in relation to the activities performed by other firms. If seen as "artificial" disjunctions in the larger activity patterns, they create a need for activities to be coordinated across these firm boundaries. A focus on coordination of activities in supply chains also requires a focus on the different firms' perspectives on activity coordination since they are involved in many supply chains simultaneously. The degree to which this is relevant for a particular firm depends upon the scope of its involvement in the larger activity pattern and on its relationships to other firms. Business relationships provide opportunities for companies to make relationship specific adjustments that may facilitate coordination of their activities and thereby increase the utilisation of their resources, which in turn can make the supply chains they are involved in more efficient. However, since the perspectives on activity coordination differ among the firms involved in supply chains, co-ordination is never limited to individual supply chains. Activities also need to be coordinated between different supply chains. Each individual firm will experience different levels of demand for such coordination, depending upon the conditions for coordination in the supply chains focused by the company, the related conditions in other supply chains they are involved in, and the flexibility and general nature of its resources used in production and coordination. Hence, perfect or 'seamless' flows and joint goals in supply chains are not possible unless supply chains become completely isolated and thus disconnected from other supply chains.

While issues concerned with specialisation or division of labour among firms in supply chains typically focus on how the production activities are divided among the parties in a supply chain, the division of coordination activities, i.e. *who* is coordinating what activities, with *whom* and *how*, within and across firm boundaries in supply chains is an additional issue of great importance for the efficiency of supply chains and for the companies involved. There is always a gamut of different ways of organising these activities and continuous reconsiderations made jointly by the firms involved might enhance the performance of individual supply chains as well as the performance of the parties involved. This also means that no individual firm can take on the role of managing a supply chain without sacrificing coordination concerns of the other parties. Hence, we suggest that enlightened voluntary cooperation between firms is needed to coordinate activities in supply chains rather that 'channel captains'. We further suggest that firms need to continually evaluate (jointly and individually) where production activities are to be situated to achieve the best compromise between different concerns including aspects of resource utilisation, and that the actors involved at the same time need to construct and reconstruct the necessary coordination activities accordingly. Running this process in any other way may be considered optimal

from the perspective of an individual firm or supply chain, but will quickly lead to sub-optimal processes for the firms who are involved in these supply chains and thus over time reduce the efficiency for all chains that the individual firms are involved in.

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