Triads at the interface between supply networks and logistics service networks

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Abstract

The research and literature on supply networks and on logistics service networks has largely been separated. In practice, the 'two networks' are integrated since the activities carried out in them are always subject to interdependencies and thus in need of coordination. In this paper we focus on the triads consisting of buyers and suppliers of goods and of the logistics service providers (LSPs) that take care of the logistics services between the two. We argue that these particular triads are generic in nature while still seldom considered as of importance. The latter may be an effect from transport services being considered by many firms as a non-strategic purchasing category. However, this may change as the need to increase the efficiency and effectiveness of transport services, as part of broader logistics service packages, is becoming one of the key issues for dealing with the environmental impact of transport.

Based on our scrutiny of the generic triads connecting supply networks and logistics service networks we discuss three themes with implications for research and practice; (1) the nature of the connections between the dyads in the triads, (2) the triads' functions in relation to fourth parties in the supply network, and (3) the triads' functions in relation to fourth parties in the logistics service networks.

Key words: triads, supply networks, logistics service networks, buyer-supplier relationships, interfaces

Introduction

Conceptualisations of supply networks on the one hand and of logistics service networks on the other have developed along separate lines. Typically, supply networks encompass buyers and suppliers of physical 'products', and logistics service networks include actors involved in the physical handling of goods. While actors may be possible to divide into these categories their activities are subject to interdependencies and therefore the separation between them limits the possibilities to consider change, at least when logistics service networks are concerned.

In this paper we scrutinise the interface between supply- and logistics service networks. We suggest that the triads connecting buyers and suppliers of products with buyers and suppliers of logistics services are generic units of analysis that are key to development of the interfaces between the two 'networks'. Hence, the aim of this conceptual paper is to develop the notion of the triads connecting supply and logistics service networks, and to elaborate on their functions in relation to the two sides of the interface.

The outline of the paper is as follows. In the next section we present and discuss prior theory and research on triads as a unit of analysis. In section three we present the notion of the specific triads that connect supply- and logistics service networks. In the fourth and fifth sections we discuss literature on supply networks and logistics service networks respectively. In the sixth section we discuss the triads as interfaces between the two networks and the potentials in this approach for research and practice. The final section presents conclusions and implications for practice and research.

Triad as a unit of analysis

The focus of this paper is on two conceptually separated networks and their common interfaces. Prior research claims that a triad is the smallest conceivable unit of analysis where connectedness of relationships can be investigated indirect (Halinen & Törnroos, 1998; Havila, 1996; Ritter, 2000). Connectedness refers to a situation where *"… exchange between A and B to some extent affects exchange between B and C and vice versa*" (Yamagishi, Gillmore, & Cook, 1988: 835).

In Figure 1, two triads and connections between their actors are illustrated. In both triads, there is a dyadic relationship between A and B, which is a part of the triad involving A, B, and C. The relationship between A and B is consequently connected to the relationship between A and C as well as to the relationship between B and C. Furthermore, each of these actors (A, B and C) are also connected to other actors, indicating that the focal triad is embedded in a number of other triads, and thereby also in a larger network.

The difference between the two triads is the nature of the connection between B and C. In business research with a triad as a unit of analysis, the focus has generally been set on direct connections between the three parties (Havila, Johanson, & Thilenius, 2004), as illustrated in the triad on the left side in Figure 1. However, a dyadic relationship (B-C) may also be derived from the common relationship to a third actor (A) (Granovetter, 1973), as illustrated in the triad on the right in Figure 1.

Social network literature discusses the concept of structural hole (R. S. Burt, 1992), which demonstrates the lack of connection between actors that are not directly connected (B-C). In such situations, actor A may act as "an initiator" who unites the two indirectly connected actors. In his early works, the sociologist Simmel (Wolff, 1950) makes a distinction between three types of groups, where the "third actor" (A) can take different roles. The third actor may keep the triad together by softening the conflicts between the other two. The third actor may

also act as a tertius gaudens (the third who rejoices), seeking to turn to his own advantage a disagreement between the other two. Furthermore, through a strategy of "divide and rule", he/she may intentionally create conflicts between the other two in order to attain a dominant position or other gains (Simmel, in Wolff, 1950). In (Obstfeld, 2005) research the third actor increases coordination between the other two. The coordinative role may afterward recede in importance, or it may sustain over time (ibid.). (Madhavan, Gnyawali, & He, 2004) suggest that firms create triadic connections for both competitive and cooperative reasons. Cooperative motivation for uniting the three may be the pooling of resources. Formation of triads with the goal of reducing the value appropriated by a competitor, captures the competitive motive (Madhavan et al., 2004).

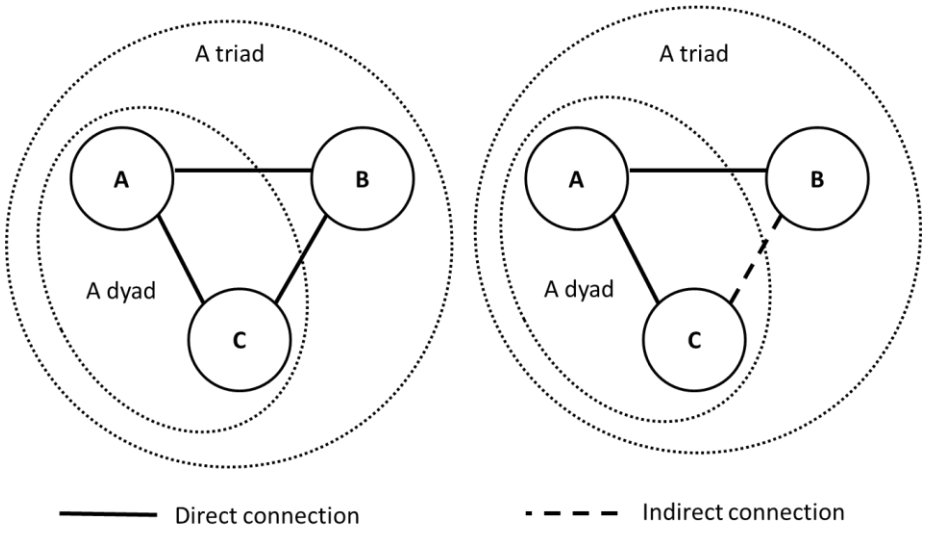

Figure 1: **A dyad embedded in a triad**

The concept of structural hole, which emphasizes the benefits of bridging two disconnected networks, is closely related to the concept of bridge. A firm in the bridge position is likely to perform better because of superior access to information (R. S. Burt, 1992; Zaheer & Bell, 2005). Assumed that there is greater similarity within than between groups, the actor in a bridge position has earlier access to a wide diversity of information and has experience in translating information across groups (R. Burt, 2004). Andersen and Christensen (2005)

have investigated subcontractors as connective nodes in supply networks. They call for further research of two important bridging roles; the capability of connecting and the capability of translating. In their explorative case study, the capability of connecting is found to be continual when the fields of knowledge and technology are highly dispersed and have to be integrated by some mediating key actor (ibid., 1272).

Madhavan et al. (2004) argue that the triadic structure is an important but neglected characteristic of inter-firm networks. Recently, however, the interest in triadic approaches in business research has increased. Stock et al. (2010, p. 38) call for the use of triads or "quadrats" when examining relationships in supply chains. Dubois (2009) and (Choi & Wu, 2009a)Choi and Wu (2009b) suggest the use of triads as a methodological tool to explore certain network processes, for example, when discovering the effects of connected dyads in certain processes. Furthermore, Havila et al. (2004) propose that the dyadic perspective should be extended to triadic in situations where an increase in buyer-supplier interaction leads to decreasing buyer-intermediary interaction, and vice versa. Furthermore, a triadic perspective is useful in capturing the dynamics of business networks (Ritter, 2000; Stock et al., 2010).

Triadic perspectives have recently been applied, for example, in relationship marketing and management (Holma, 2010; Vedel, Geersbro, & Ritter, 2012), and in purchasing research (Choi & Wu, 2009a; Forslund, Jonsson, & Mattsson, 2009; Phillips, Liu, & Costello, 1998). Also service outsourcing inherently involves three actors (Li & Choi, 2009), and the 'service triad' of a buyer, supplier and customer has raised researchers interest (Rossetti & Choi, 2008; van der Valk & van Iwaarden, 2011). Li and Choi (2009) pay attention to the bridging role, and suggest that the buyer should actively interact with its customer in order not to lose the control over the purchase.

In supply chain management a triadic perspective has been applied, for example, in buyer-supplier-supplier 'co-opetition' relationships (Choi & Wu, 2009a; Dubois & Fredriksson, 2008; Peng, Lin, Martinez, & Yu, 2010; Wilhelm, 2011; Wu,

Choi, & Rungtusanatham, 2010; Wu & Choi, 2005), in situations with two buyers and a supplier (Choi & Kim, 2008), and in analysis of buyer-intermediary-supplier relationships (Holma, 2012). Recently, Kühne, Gellynck and Weaver (2013) examined how the perceived relationship quality among three linked chain members affects the innovation capacity in traditional food supply chains. Mena, Humphries and Choi (2013) discuss the structural dynamics involved in three-tire supply chains (buyer-supplier-supplier's supplier). Furthermore, Finne and Holmström (2013) have conducted a study of servitization in the context of the service supply chain and the relationships between supplier, system integrator, and end user.

In logistics research, a triadic approach has been applied, for example, by Gentry (1996), who presents a study of the role of carriers in buyer–supplier relationships, and by (1995), who investigate the effect of trilateral collaboration on transportation costs for the purchasing firm, the supplier firm and the carrier firm. However, Selviaridis and Spring (2007, p. 138) notice that existing studies of logistics triads do not provide "supra-dyadic" insights, i.e. insights that cannot be captured by dyadic approaches. For example, they do not focus on indirect relationships and mediating roles that are essential in third party logistics (TPL). The TPL provider fulfils part or all of the logistical needs in transactions between the buyer and the supplier, and a triadic approach could explicitly capture the indirect links in the network and the mediating role of a TPL provider (Selviaridis & Spring, 2007). Beier (1989, p. 78), for one, argues that the triad should be the 'minimum unit of analysis for logistics research', because the logistics service provider, having a different perspective on the transactions, occupies a potent position in a logistics triad and may be able to identify and pass on information that may lead to more efficient transaction processing. Bask (2001) also points out that the term TPL in itself indicates a triadic link between suppliers of goods, their customers and logistics service providers (LSPs).

The focal triad connecting supplier and logistics service networks

In this paper we focus on a specific type of 'focal triad' (see Figure 2). The focal triad consists of the seller of goods (S), the buyer of goods (B), and the logistics service provider (LSP). The seller (S) and buyer of goods (B) have a direct relationship with each other involving the transactions and exchanges taking place between these actors. The LSP is directly connected to either S or B (and indirectly connected to the other) depending on the arrangement in each specific case. Another generic feature of this type of focal triad is that the actors are related to one of the two different networks referred to earlier, i.e. to the supply network and to the logistics service network respectively. The seller and buyer of goods are nodes in the supply network and the logistics service provider in the logistics service network (see Figure 2). They act as bridges, connecting the two networks and the fourth parties to the networks. We now go on to a more in-depth elaboration of these two interconnected networks.

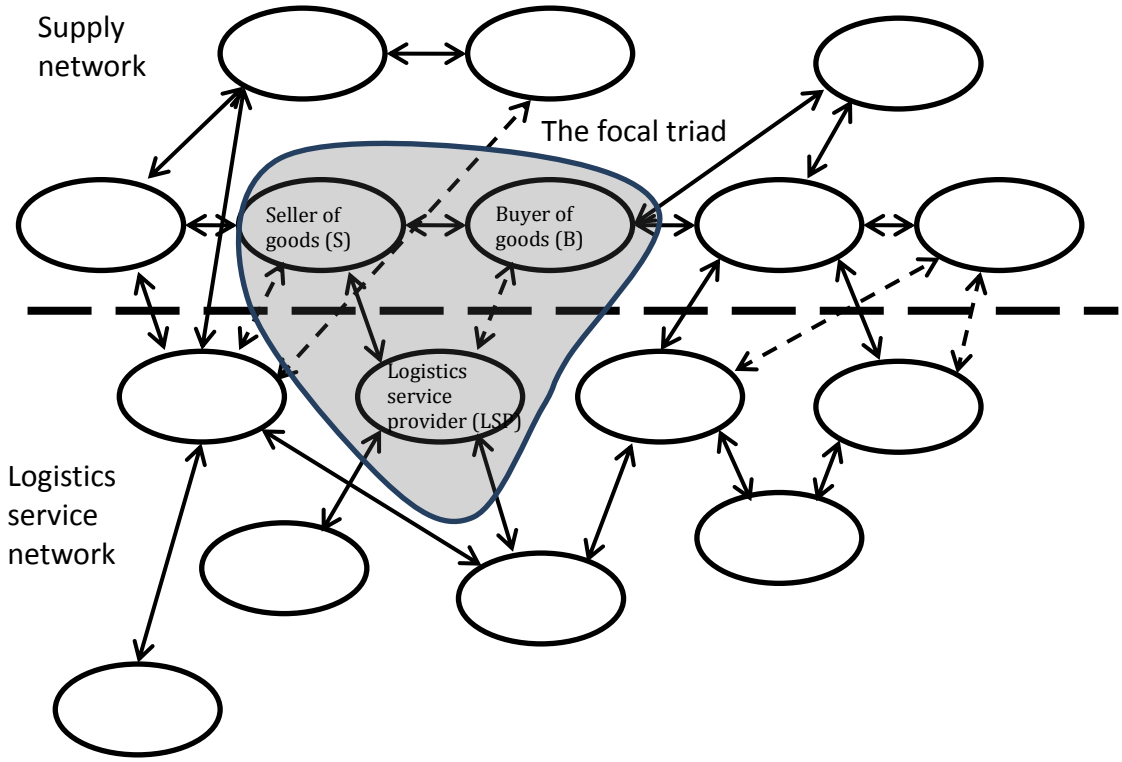

Figure 2: The focal triad connecting the supply network and the logistics service network

Supply networks

There is no single definition of the supply network concept. According to Harland (1996), a supply network is a set of supply chains, which describes the flow of goods and services from original sources to end-customers. Christopher (1992) defines supply networks as a manageable set of operational tasks performed in supply chains to serve end-customer segments now and in the future. Comparing the supply network concepts with how business networks have been conceptualized (e.g. Ford, 1990; Håkansson & Snehota, 1995), these definitions are most often limited to operational and managerial activities. However, according to Harland, Lamming, Zheng and Johnsen (2001, p. 22) the supply network concept is more complex than the supply chain concept. They describe supply networks with mess and complexity, ”involving lateral links, reverse loops and two-way exchanges”, which include a “broad strategic view of resource acquisition, development, management and transformation”.

Supply networks have mainly been studied by use of models from the marketing and purchasing field but also with approaches developed within supply chain management. The supply chain management field has primarily taken a ‘chain perspective’. The focus on chains, and thus mainly on sequential interdependence (Dubois, Hulthén, & Pedersen, 2004) has been criticized since it over-simplifies a complex reality (see also Andersen & Christensen, 2005; Choi & Kim, 2008; Kim, Choi, Yan, & Dooley, 2011). This is in line with Lambert and Cooper (2000, p. 65) arguing that: “strictly speaking, the supply chain is not a chain of businesses with one-to-one, business-to-business relationships, but a network of multiple businesses and relationships.” In a similar vein Cox (1999, p. 211) argues that, “the process by which raw materials are turned into end products and services is rarely a simple linear process chain, and much more like a spaghetti web of complex interconnecting relationships.” Furthermore, Christopher (2011) also points in this direction stating that the world ‘chain’ should be replaced by the word ‘network’.

Even though interdependencies among supply chains have obtained limited attention (Dubois et al., 2004), one exception can be found in Lambert and Cooper (2000) recognizing that 'non-member links' might be important to consider, for example when a supplier to a company is also a supplier to that company's competitor. Another important source of inspiration when interconnectedness of supply chains is concerned is the notion of transvections (Alderson, 1965). Transvections are defined as comprising "...all prior action necessary to produce this final result, going all the way back to conglomerate resources" (ibid.: 92). Alderson argues that by studying one transvection and following it through the net of connected branches, relevant connections to other branches can be considered. Hence, he points at the importance of taking interconnectedness among (what was much later labelled supply chains) into consideration.

In this paper we argue for the need to extend the scope of research from a supply 'chain' perspective to a supply 'network' perspective. The idea of a 'network' sets the focus on efforts to achieve improvements in efficiency and effectiveness (Gadde & Persson, 2004; Lamming, Johnsen, Zheng, & Harland, 2000). Technical and organisational developments in production, transport and information systems have facilitated new strategies and arrangements in supply networks (Gadde & Persson, 2004; Gadde, 2004; Hoyt & Huq, 2000). The stream of research on supply networks has also dealt with innovation, organisational learning, and knowledge sharing (Dyer & Nobeoka, 2000; Harland et al., 2001; Håkansson, Havila, & Pedersen, 1999; Lamming et al., 2000).

The network view has become increasingly important, due to, for example, specialisation and outsourcing. For example, new requirements on the supply side force companies to reconsider purchasing strategies and purchasing behaviour (Gadde, Håkansson, & Persson, 2010). In an industrial setting, the context of purchasing management has moved from 'simple' outsourcing of production and supply of resources to complex decisions including, for example, design and product development (Gadde et al., 2010). Suppliers can be

significant contributors in technical development and innovation for the buying firm, and the success of a company is dependent on its operations on the supply side (Gadde et al., 2010; Svahn & Westerlund, 2009).

We now turn our attention to the logistics service networks, which play a crucial role for the performance in supply networks.

Logistics service networks

Logistics service networks have most often been conceptualised with models related to the fields of logistics management, supply chain management, and operations management. Sachan & Datta (2005, p. 676) call for application of theories from other disciplines that are potentially relevant to the examination and study of various logistics issues. Furthermore, logistics research, in general has often been accused of being weakly theoretically grounded. Kent and Flint (1997), for example, call for useful models using sound and rigorous scientific methods that can bring marketing, engineering, operations management and logistics closer to each other. Moreover, logistics research has mainly been considered as 'managerial' in nature, lacking a rigorous orientation towards theory development, testing and application (Mentzer & Kahn, 1995; Mentzer, Min, & Bobbitt, 2004). Research on 'third party logistics' (TPL), in particular, is claimed to be empirical-descriptive in nature, applying a positivistic research tradition with surveys as the dominant method (Selviaridis & Spring, 2007).

We define the *logistics service network* as the actors (the logistics service providers) involved in these logistics services (i.e. the actors involved in the physical handling of goods). Logistics service providers can serve as mediators in logistics service networks, connecting supply network partners with various transport and logistics specialists, where the service providers take on different roles with regard to their supply network partners (Ojala, Andersson, & Naula, 2008). Berglund (2000) discusses how third party logistics services can be produced more efficiently by taking advantage of scale economies of different

kinds. He argues that this can be accomplished by buying services from other providers (see also Abrahamsson & Wandel, 1998), i.e. the development of a logistics network. Abrahamsson and Wandel (1998) argue that both the service provider (the seller of logistics services) and the shipper (the buyer of the logistics services) are engaged in several other relationships that have a strong impact on the focal dyad (the one involving the seller and buyer of logistics services). Based on this observation they conclude that third-party logistics cannot be studied simply as a series of separate shipper–provider dyads. Even if these multi-tire relationships had not been depicted in this way earlier the use of sub-providers of different services is since long well established in practise. For instance, Lieb and Randall (1996) point to that logistics service providers use tiring as a means of broadening their services. In addition, Berglund (2000) argues that third party logistics providers can create value for their customers by using conceptual logistics skills to improve supply chains, thereby implying an important link between the logistics service network and the supply network.

Cui and Hertz (2011, p. 2) argue that considering the logistics firm as the focal one may contribute to our understanding of logistics management. Furthermore, logistics firms often try to develop their horizontal networks in order to obtain access to complementary resources (Berglund, 2000; Carbone & Stone, 2005) and, as suggested by Hertz and Macquet (2006), logistics firms are in essence networking firms in the sense that their business idea is based on connecting organisations, coordinating activities and combining resources. Logistics service networks have also been discussed by Abrahamsson and Wandel (1998). They argue that it is not sufficient only to consider the relationship between a shipper and a service provider since both parties are involved in other relationships that often strongly influence the individual shipper-provider relationship. These authors note that the relationships between shippers and their first tier of logistics providers (i.e. the dyad) have been relatively extensively researched but that there is a lack of research regarding the relationship between the different tiers of service providers. Selviaridis and Spring (2007) propose network theory as a framework for mapping activity, resource, and capability dependencies for logistic services and their evolution over time. However, when dividing the

existing literature on complex logistics services, labelled 'third party logistics' (TPL), into categories focusing on the firm, the dyad, and the network level, Selviaridis and Spring (2007) find the network level to be under-represented.

The terms used to label the actors and the activities performed in logistics service networks cause confusion as a number of different terms are being used interchangeably (Fabbe-Costes, Jahre, & Roussat, 2009; Selviaridis & Spring, 2007). Fabbe-Costes, Jahre and Roussat (2009) found more than 20 different terms for logistics service providers, based on the activities performed, the geographical scope and the type of relationship. The actors providing more complex services, such as third party logistics firms, are acting as middlemen between buyers and sellers of logistics services providing all, or a considerable number of, logistics activities as bundled services including warehousing, transportation, and value-added activities (Berglund, 1999; Skjoett-Larsen, T. Halldorsson, Andersson, Dreyer, Virum, & Ojala, 2006; Virum, 1993). Several authors point at a number of logistics activities that can be outsourced to a third party (Dapiran, Lieb, Millen, & Sohal, 1996; Lieb & Randall, 1996; van Laarhoven, Berglund, & Peters, 2000). The scope of activities included in a logistics service provider's service provision could vary from a single standard service (e.g. a transport from A to B or warehousing) to complex service packages (e.g. an entire distribution system including management and value added services including activities traditionally performed in the supply networks) (c.f. Andersson & Norrman, 2002; Lieb & Randall, 1996; van Laarhoven et al., 2000).

In the next section we will introduce and discuss the suggested notion of triads at the interface between supply and logistics service networks.

Triads as the interface between supply and logistics service networks

The theoretical notion of triads points to the importance of analysing dyadic relationships and the connections among the dyads involved in a triad. In the case of analysing connections between what has been conceptualised as supply

networks and logistics service networks we argue that the focal triad, consisting of the relationship between the buyers and suppliers of goods together with the relationship(s) with the LSPs, is key to the understanding of how 'demand' for logistics services are generated and how these are transferred to the LSPs and their counterparts. Figure 3 illustrates a focal triad wherein the seller of goods (S) and the buyer of goods (B) have a business relationship to which the relationship with the logistics service provider (LSP) is directly connected. However, typically only one of the parties (S or B) is involved in a business relationship with the LSP and there is hence an indirect relationship between two of the three parties involved in the triad. Actors outside the triad represent the "fourth parties".

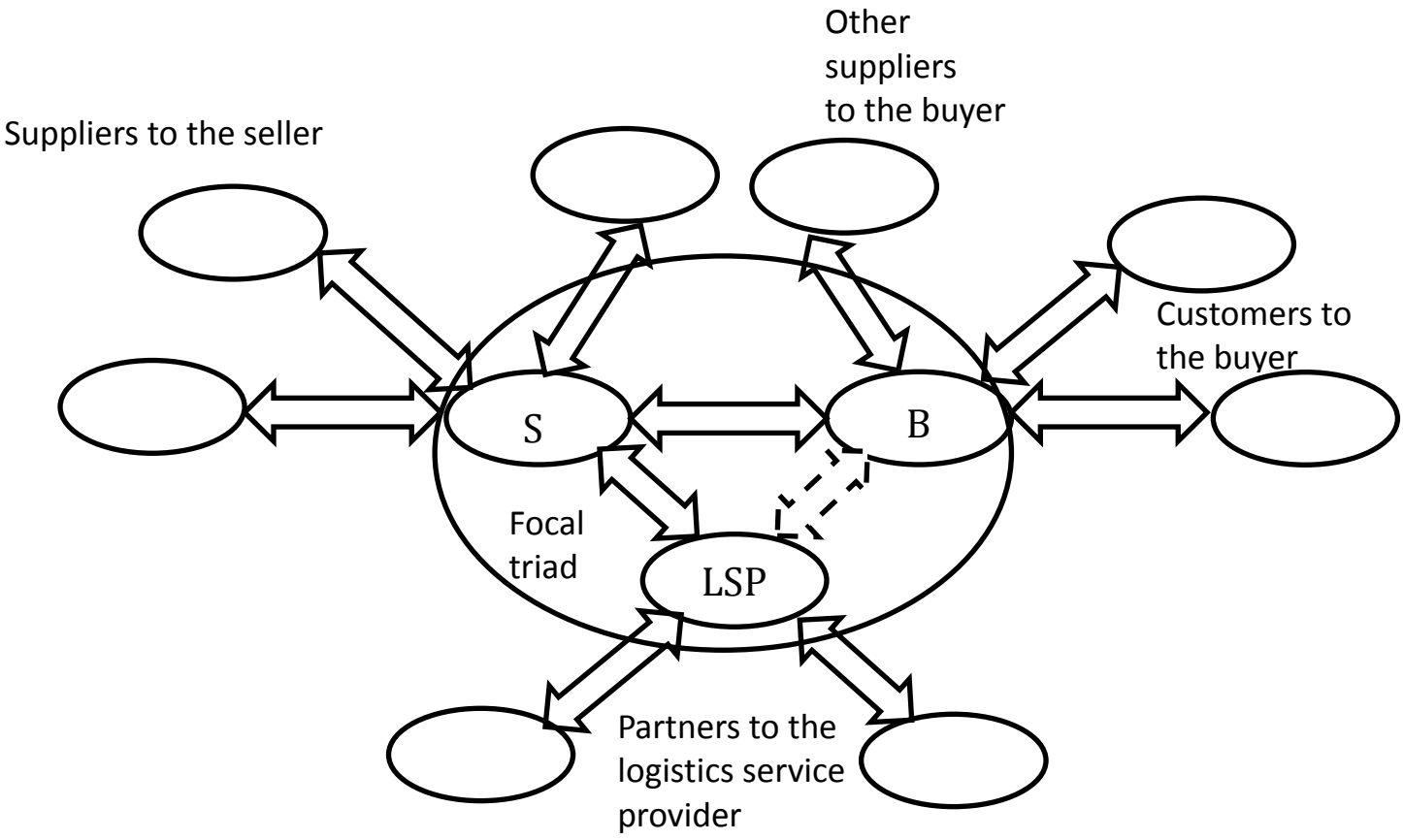

Figure 3: The focal triad in its network context

The suggested micro level analysis takes its starting point in the key dyad between the buyer and seller of logistics services. In this case the buyer is assumed to be S in Figure 3 (the seller of goods - the shipper) and the seller of logistics services is the LSP. Analysis of the relationships between the buyer and seller of logistics services is enabled by analysis of the services carried out and the associated interdependencies that are managed by or through the relationship. This analysis provides a basis for identifying and analysing connections to *the third party* in the triad (in this case B) and to other relevant 'fourth parties' that influence and/or are influenced by the operations in the focal dyad and in the triad respectively. Inclusion of such fourth parties to the analysis of the triad is essential in order to address different potentials in the network (see Figure 3). Specific 'fourth parties', and the relationships with them, may influence and be influenced in different ways and to different extent in relation to a focal triad. Next, we will discuss the focal dyads, i.e. the direct relationships between a buyer and supplier of logistics services, and then we will scrutinise the impact on and of different kinds of fourth parties relating to the focal triad.

The focal dyad

From the viewpoint of the triad involving the seller of goods (S), the buyer of goods (B) and the LSP, the relationship between the buyer of logistics services (either the buyer or seller of goods) and the LSP is the key dyad and link between what has been conceptualised as the supply network and the logistics service network. From this key dyad's perspective, we discuss two issues: (1) the content and scope of the service, i.e. content of the exchange between the parties, and (2) how the service is developed and by what actor(s).

The scope of services included in what is known as a 'TPL service package' has over time become wider and the services have become more complex (Andersson & Norrman, 2002; Chapman, Soosay, & Kandampully, 2003). Buying and selling advanced or bundled logistics services (i.e. a function) put high demands on how the service is defined (cf. Andersson & Norrman, 2002). Axelsson and Wynstra (2002) emphasise the importance of service definition

when buying services in general, while Sink and Langley (1997) argue that the service definition is one of the most difficult steps in the process of buying third party logistics services. However, it is also considered one of the most important issues since it is closely linked to some of the key success factors for third party logistics, such as well-defined requirements, procedures and systems (Andersson, 1997; Bagchi & Virum, 1998; van Laarhoven & Sharman, 1994).

Depending on the scope of services, the interface between the buyer and the seller of logistics services has different needs of coordination, which can be classified into operational, functional, geographical and development coordination (Andersson, Pruth, & Rehme, 2007). These coordination roles are, however, considered as insufficient. The authors suggest that LSPs in the future will be more involved in the definition of resources, processes and to some extent also intangible output. This means working more within the relationship, which in turn entails a shift into more of a function or performance based definition of the service.

One way of categorising how services are developed is presented by Araujo, Dubois and Gadde (1999) who define four types of relational interfaces between a buyer and a supplier: standardised, specified, translational, and interactive.

In our setting a *standardised* interface refers to when the shipper is a manufacturer which is buying single standardised services from a freight forwarder who will deliver goods to the customer of the manufacturer. The LSP can obtain economies by handling a large number of customers in a standardised way, e.g. transport services produces in terminal system where also warehousing services can be offered at the hubs. The party receiving the goods will not have any influence on the services offered, but there is a transfer of information between this company and the LSP, e.g. notification about deliveries.

A *specified interface* refers to when the shipper, e.g. a manufacturing company, specifies the service in detail, based on the product characteristics and service requirements of its customers. It could be the inbound flows to an assembly

plant for which a dedicated transport system is set up. This may require specialised transport equipment and load units and in order to be able to offer the services the LSP may in addition to these adaptations also start working with new sub-providers of specific services (e.g. local pick up).

An outsourced distribution system could be an example of an application of a *translational (or functional) interface*. The shipper, e.g. a manufacturing company, has outsourced the distribution to a logistics service provider and the company has no resources or personnel working in transport and logistics specify certain service levels in accordance with the requirements of its customers (e.g time windows and lead times). The shipper focuses on developing the relationship with his customer and the logistics service provider is free to design the processes and use any resources, and sub providers deemed appropriate to produce the required service. This makes the LSP able to plan and develop the service so that resources (both internal and external) can be utilized in an efficient way.

Finally, the *interactive interface* can be illustrated by an outsourced distribution system similar to the one used in the functional case above. However, in this case the shipper together with the LSP defines and develops the service taking into consideration both requirements of the shipper (including the demands of its customers) and the provider and considering its capabilities and resources (including those of sub providers). In the interaction the shipper may, in collaboration with its customers change the production and delivery schedule in order to maximising the utilisation of the provider´s transport capacity (including sub providers) e.g. vehicles and distribution centres.

When the service is defined it needs to be 'produced'. In order to do so different parts of the logistics service network can be activated. Hence, the character of the relationships and interfaces among the actors in the triad will have an impact on how the production of logistics services can be accomplished; which

resources that will be used, how activities will be linked, and what other actors that will be included.

If the buyer influences the specification of the service too much, the service provider will be unable to take full advantage of its resources in designing efficient solutions and that may hamper, for example, the ability to achieve economies of scale. According to (2003) logistics service providers could become more efficient and effective if they rely on standardised processes while at the same time serving their customers in such a way that each one gets an adapted package of services. This can be achieved through providing differentiated services. The provision of logistics services, hence, needs to be coordinated both internally within the LSP's organisation and externally by activating other actors and their resources in the logistics service network.

Hertz and Alfredsson (2003) address the importance of analysing the influence of the service providers' (other) customers, and also the customers' customers. According to Andersson et al. (2007), TPL providers must coordinate their internal capabilities with their strategic objectives, derived from their customer relationships, if TPLs shall continue to grow and add value in supply chains. To develop efficient logistics service production, two coordination dimensions are considered of particular importance. TPL-providers can develop their relationships through *a dedicated coordinating function*, which serves their customers' specific operational and strategic needs through all phases in TPL relationships. These external needs must also be *coordinated internally* so that the provider can learn from their customers' specific needs, in order to adapt and improve the services.

Fourth party connections

To identify relevant fourth parties that may influence and be influenced by the triad we need to consider what kinds of conditions that the relational interfaces between the buyer and supplier of the logistics services set.

Standardised: S choses a service from a standardised range of services offered by the LSP. The LSP can in this way gain economies of scale by treating many customers in a standardised way, for example daily milk rounds that are the same for many customers. This could be used if exact delivery times are not important for B or if B could adapt its organisation to this standardised service. Adaptations of activities of B, and of the fourth parties, might consequently be necessary.

Specified: In this case S specifies the service in detail (maybe as a result of the requirements of B). For example B might have certain requirements on the use of specific carriers or certain environmentally friendly mode of transports. This could mean that in order to satisfy the requirements of S (and B) the LSP needs to adapt its internal resources or start working with new sub-suppliers instead of making use of its existing network. Furthermore, it could also mean that adaptations of resources with regard to fourth parties are required.

Functional: S specifies some certain service level in accordance with the requirements of B (for example a time window, or exact time for delivery) but the LSP is free to choose carrier, mode of transport etc. This makes the LSP able to plan and develop the service so that resources (both internal and external) can be utilized in an efficient way.

Interactive: The LSP together with S develops the service taking into consideration both the needs of S and B as well as the needs of specific fourth parties. It allows taking into consideration the capabilities and resources of the LSP and relevant fourth parties. For example, it might lead to that S can convince B to change its requirements on delivery times so that the LSP can better utilize its resources as well as the resources of for example carriers and distribution centres.

Conclusions and implications

We conclude by suggesting that generic triads connecting buyers and suppliers of physical products with buyers and suppliers of logistics services as a key unit of analysis can support understanding and development of an increasing variety of services and specialists in logistics service networks. Hence, we suggest that it is a suitable ground for analysis of change in these structures. Each actor can take on many different roles in relation to other actors and these roles may change over time as their relationships and the services developed in these relationships change. Hence, this approach enables a theoretical platform for systematic study of change in logistics service networks and supply networks.

In view of an expected increase of the interest in developments of more elaborate relationships between buyers and suppliers of logistics services, the framework suggested in this paper may support analysis of new forms of exchange and networking. Starting in standardised interfaces that do not require any particular in-depth analysis of the network contexts in which they take place, the more advanced forms of interfaces (Araujo et al., 1999) require a contextual understanding to be efficiently applied. Three broad issues of current managerial relevance and of interest for further studies, for which the framework would be instrumental, are addressed below.

From a logistics service network perspective the efficiency of logistics operations is subject to increasing pressure. Elevating the efficiency the uses of the resources within the logistics service network, e.g. increasing the filling rates, developing designs of more efficient routes etc., cannot be made with assumptions of *given* demands of transport services. Relationships between buyers and suppliers of goods develop over time with various consequences for the requirements on logistics services. For logistics service providers these changes may entail opportunities if they are aware of, and alert to, this part of their business context and even more so if they are actively involved in the interaction with both the buyers and suppliers involved in exchange of the goods to be transported.

Moreover, increasing awareness of the business context may inspire to new 'business models'. These can be described and analysed by use of triads as the key unit of analysis since such new roles also entail some form of change in the activities performed and of the resources activated. The suggested framework may contribute to an understanding at the business exchange level, in contrast with traditional market analysis approaches that focus on aggregated levels of business exchange. Hence, the division of labour may change and that changes the interface between the supply and the logistics service networks. In particular, the 'logistics activities' may be extended or reorganised among the actors as a result from their interaction. The triads are instrumental in the understanding of such changes.

From a supply network perspective the issue of how to make better use of logistics service networks can be expected to become increasingly salient with growing demands on logistics services, owing to increasing specialisation and globalisation, and with increasing costs for transport (Ehsanifar et al., 2010). Previously the services of the LSPs have often been taken for granted and made subject to standardised exchange. Hence, the services have been treated as commodities where costs should be minimized (Potter & Lalwani, 2005). These practices do not promote long-term relationships and joint development of new solutions. However, an improved understanding of the specific conditions for logistics actors' efficiency may result in adjustments in the exchange of goods between buyers and suppliers in supply networks in order to better fit with e.g. the demand patterns of other customers of the logistics service providers. If all three actors in the focal triad, with their knowledge of relevant 'fourth parties', can be involved in the development of logistics service services, the possibilities to increase the efficiency of their operations may be dramatically enhanced.

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