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Transport Efficiency:
Analysing the Transport Service Triad

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ABSTRACT

This thesis deals with transport services and transport efficiency. There are growing environmental concerns for many industries and the freight transport industry in particular faces challenges in reducing its CO_2 emissions. It has been argued that technical advancements on their own are insufficient in dealing with environmental impact from road freight transport and that one way forward could be to look at how firms organise and exchange transport services. The exchange of transport services are highly dependent on the exchange of goods since every exchange of goods generates a demand for transport services. The Transport Service Triad (TST) is introduced as a unit of analysis to explore the connections among firms involved in the exchange of transport services and the exchange of goods. Hence, the aim of this thesis is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach.

The theoretical framework is based on the Industrial Network Approach. This approach, with its three interrelated concepts; activities, resources, and actors, are used to capture transport efficiency on various levels in the network. A single case study approach is used to study a focal TST that illustrates the business relationships among three actors, the seller of transport services (a haulier), the seller of goods (a technical wholesaler), and the buyer of goods (a construction firm). The study shows how a TST approach provides a broader scope for analysis of transport efficiency than a firm or dyadic perspective since it captures all relevant parties in the exchange of transport services. Moreover, the study shows how improving transport efficiency from one actor's perspective might not align with other actors' views on improved transport efficiency or might conflict with other aspects of efficiency. To manage these issues interaction among firms is necessary to secure that the needed adjustments and adaptations of activities and resources are accomplished.

Keywords: transport efficiency, triad, transport service, activities, resources, actors, freight transport, business relationships, industrial network approach, transport service triad

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I have often described this process as a football match, in which this licentiate thesis is the first half. First and foremost, upon writing this, I feel like a winner and I will in the 15-minute break that follows. However, anything can happen, and I know that the only way of succeeding is to go out in that second half fighting and continue to work hard until the whistle blows. Second, a match without mistakes is an easy one. That said, I have no doubt made mistakes during this first half, and if you find any, they are mine alone. The good thing is that I have learnt a lot about research in general and academic writing, albeit there is a long way to the top. Additionally, and very importantly, I have discovered a great deal about myself during this process, which is instrumental in going forward. Finally, just as in a football match you are not alone, several people have helped me in my endeavour writing this thesis, and for that, I am very grateful. *Ann-Charlott, Frida, Jens, Klas, Lisa, Nojan, and Viktoria*, thank you for all your feedback, support, and the fun and enlightening discussions we have had thus far, I look forward to continuing them. *Lars-Erik*, you have helped me in the right direction as well as provided the so often needed helicopter perspective, and you have also provided clarity and structure to my work – thank you.

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Mum, Dad, and *Sister,* thank you for your unlimited support and for believing in me. Whatever I do I know that you are proud. Last but not least, my partner: *Line,* I love you! Thank you for your endless support, tolerance, love, and understanding. I would never have been able to see this through without you.

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1. Introduction

In this chapter, a background to the research area is presented, followed by practical and theoretical motives for the study. Following the motives of the study, the aim of the study is discussed. This chapter ends with a description of the structure of the thesis.

This thesis deals with transport services and transport efficiency. A specific focus is on which activities are performed in relation to transport services, by whom the activities are performed, and what resources are used to perform the activities, and what implications this has for transport efficiency.

1.1 Background

There are growing environmental concerns for many industries, and the freight transport industry in particular faces challenges in reducing its CO_2 emissions. Freight transport has increased in recent decades and is thus a particular area of concern for industries as well as the society at large. In 2016, the transport sector alone accounted for approximately 20–27% of all CO_2 emissions in Europe (European Environment Agency, 2018), approximately 70–74% of which resulted from road freight transport (European Commission, 2016). For example, heavy-duty vehicles (HDVs) carry 70% of all transported goods and account for 25% of CO_2 emissions related to transport and 6% of total CO_2 emissions in Europe. Projections for 2030 point to further increase in CO_2 emissions from HDVs as a result of increased transport activities in the coming years (European Commission, 2018). Overall, road freight transport is rising, which could result in an upsurge of negative environmental effects, in spite of decades of substantial technical advancements (Aronsson and Huge Brodin, 2006; Johansson, 2009) and efforts from the EU to promote more sustainable transport, particularly in terms of intermodal transport solutions (Bask and Rajahonka, 2017).

To tackle the environmental effects of transport, the European Union (EU) has developed an environmental agenda that sets its goals for 2030 and 2050. In addition to CO_2 emissions from transport, there are other problems that require increasing attention, for example, traffic congestion, air pollution, and nitrogen dioxide emissions. For CO_2 emissions from transport, the goal is to reduce them by 60% as of 2050 (relative to 1990 levels) (European Commission, 2011). Increased energy efficiency is one way to combat the rising CO_2 emissions. The European Commission (2012, p. 31) defines energy efficiency as ‘a ratio between an output of performance, service, goods or energy, and an input of energy.’ They also define energy efficiency improvement as ‘an increase in energy efficiency as a result of technological, behavioural and/or economic changes.’ However, energy efficiency is difficult to measure and the implementation of current regulations aimed at improving energy efficiency for transport has been deficient (Léonardi and Baumgartner, 2004). Nevertheless, it is one of the most important issues in supply chain management (SCM) (Seuring and Müller, 2008). To achieve the needed reductions, the focus has been set mainly on the development of infrastructure, vehicle technologies, and alternative fuels. Moreover, Ruzzenenti and Basosi (2009) conclude that the main causes of the last decade’s efficiency leap in the sector can be traced to the quest for new technology by firms. New technology has ramped up the fuel economy of trucks and made the transport fleet more capable in carrying goods by, for instance, by allowing longer and heavier trucks (Ruzzenenti and Basosi, 2009). Yet Kalenoja et al. (2011) state that a large amount of information is needed to measure energy efficiency in transport, such as goods volumes, delivery frequencies, mileage, and suppliers’ location. Gathering this data poses some challenges and makes it hard to give performance results to one specific actor. In addition, Evangelista et al. (2018, p. 27) argue that there is a research scarcity dealing with collaborative initiatives among actors in the supply chain and state that it is ‘crucial to study the relationships among these actors to improve energy efficiency through collaborative activities.’ Researchers in the field of sustainable supply chain management (SSCM) have decreasingly debated whether sustainability is the most salient issue and increasingly addressed how to make firms more sustainable (Castillo et al., 2018).

Banister et al. (2000, p. 27) suggest that new organisational structures for transport are needed to achieve the desirable emissions reduction to reduce transport intensity and introduce more efficient travel modes. This is because ‘[I]mprovements in vehicle technology alone will not achieve the targets. More fundamental changes have to take place in the way in which people make travel choices and in the means by which freight is transported.’ In the same vein, the Swedish Ministry of the Environment and Energy (2013) states that energy efficient vehicles and renewable energy sources are not enough to achieve the desired goals to reduce the environmental impact from transport. In Sweden, the goal is to achieve a 70% reduction of transport-related CO_2 emissions by 2030 compared to 2010 (Swedish Government, 2016). The ministry argues that there is great potential in the way firms could organise their transport in the future by, for example, changing the mix of transport modes, improving coordination and utilisation, and changing behaviours (Ministry of the Environment and Energy, 2013).

There are many different aspects related to changing behaviours, for instance, how companies organise their different internal functions to enable more efficient transport, how they determine what modes of transport should be used, and how they organise and coordinate transport operations. One additional behavioural aspect is procurement of transport services, which has been considered of high importance for the environmental and logistical performance of supply chains (Björklund, 2011; Large et al., 2013). Logistical performance is important and it has been shown that the majority of transport services are outsourced (Daugherty et al. (1996). Liu et al. (2015) state that the underlying reasons for firms to outsource their basic logistics operations – such as transport, warehousing, and delivery – to a logistics service provider are because they are striving to increase the efficiency of these activities. In addition to outsourcing being a common practice in SCM, the transport market is also characterised by extensive subcontracting, as many transport firms neither own nor operate their own transport resources (Flodén and Williamsson, 2016). For example, only 5% of Swedish firms in 2007 met their transport needs with in-house transport resources (Lammgård, 2007).Transport needs are often handled by small firms with relatively few trucks. For example, only 4% of the road hauliers in Sweden have more than 15 trucks in their fleet (Flodén and Williamsson, 2016). Abbasi and Nilsson (2016) explore sustainable logistics from service providers' perspective. They state that customers commonly see transport as a non-value-added activity deemed to be carried out swiftly at the lowest price. To further enhance both the environmental and logistical performance of supply chains, a focus on how firms purchase transport services has been suggested as a salient issue (Large et al., 2013). Most research on transport service procurement has focused on choice of transport mode and service provider and on direct cost reductions (e.g. Golicic et al., 2010; Dubois and Hulthén, 2013). Lammgård et al. (2013) find that when choosing a transport provider, firms consider price, reliability, and transport time as the most important criteria. In contrast, figures from the World Bank's Logistics Performance Index (Arvis et al., 2016) show that while the speed of delivery is important, supply chain reliability is the most important performance factor. However, issues related to the organising, planning, procurement, and management of transport have not gained much attention in research related to logistics and supply chains (Rogerson et al., 2014; Rogerson, 2016).

The environmental impact from transport has fuelled transport service providers to set ambitious targets to reduce their emissions (McKinnon and Piecyk, 2012), even if key decisions that limit the scope for action by transport service providers are taken by the buyers of transport services. Furthermore, it has been noted that the actual transport is often neglected in business agreements between buyers of transport, transport service providers, and the buyers and sellers of goods; instead, the business agreements are set on an overarching logistics level (Isaksson, 2012; Rogerson, 2016). Buyers and sellers of goods are dependent on transport services, either as the consignor or the recipient. Consequently, transport service providers need to relate both to the sellers and buyers of goods and the actors' different perspectives on efficient performance have to be taken into account. Therefore, understanding the roles of and relationships among these key actors – the supplier and buyer of goods and the transport service provider – becomes important. The relationships and interactions therein enable the firms to coordinate their activities and to access and develop resources that are essential to developing more efficient transport services.

Transport services can be considered as being embedded in supply networks. Johnsen et al. (2000, p. 162) identify supply networks 'as a set of supply chains, embodying the flow of goods and services from original sources to end customers.' Such networks are subject to frequent decisions that require considerations of numerous dimensions and from numerous perspectives. In turn, Harrison and Van Hoek (2008, p. 30) identify supply networks as 'a system in which each organisation is linked to the others. Therefore, the overall performance of the network results from the combined performance of the individual partners.' Supply networks are proposed to be emergent and dynamic, in contrast to being purposefully designed and linear, and relationships are one key component in this regard (Braziotis et al., 2013). The relationships connecting the organisations directly or indirectly are therefore important to consider in order to understand structures and processes in supply networks. These structures and processes are manifested via complex interactions between multiple suppliers, buyers, manufacturers, and logistics service providers. Yet how firms organise their functions are often based on a firm-internal view (Kahn and Mentzer, 1996; Gadde et al., 2010). Thus, the relationships among key actors require scrutiny to provide a better understanding and to shed light on the complexity of the integration of transport services into networks. Previous studies have highlighted logistics services rather than transport services (Holter et al., 2008). In addition to the connection between transport and the goods subject to such transport, individual freight transport is embedded into broader transport networks including numerous actors. Consequently, transport services are related to other undertakings in supply networks.

First, Figure 1 serves as an illustration of how transport is embedded in a supply network. The flowchart by Tillman et al. (1991) shows their comprehensive life cycle analysis of aluminium, tracing it from material extraction to final product and waste handling process. In total, 34 different sequences are identified, 14 of which are related to transport. This is an example of how embedded transport is in supply networks. Transport plays a key role in every step of the supply network.

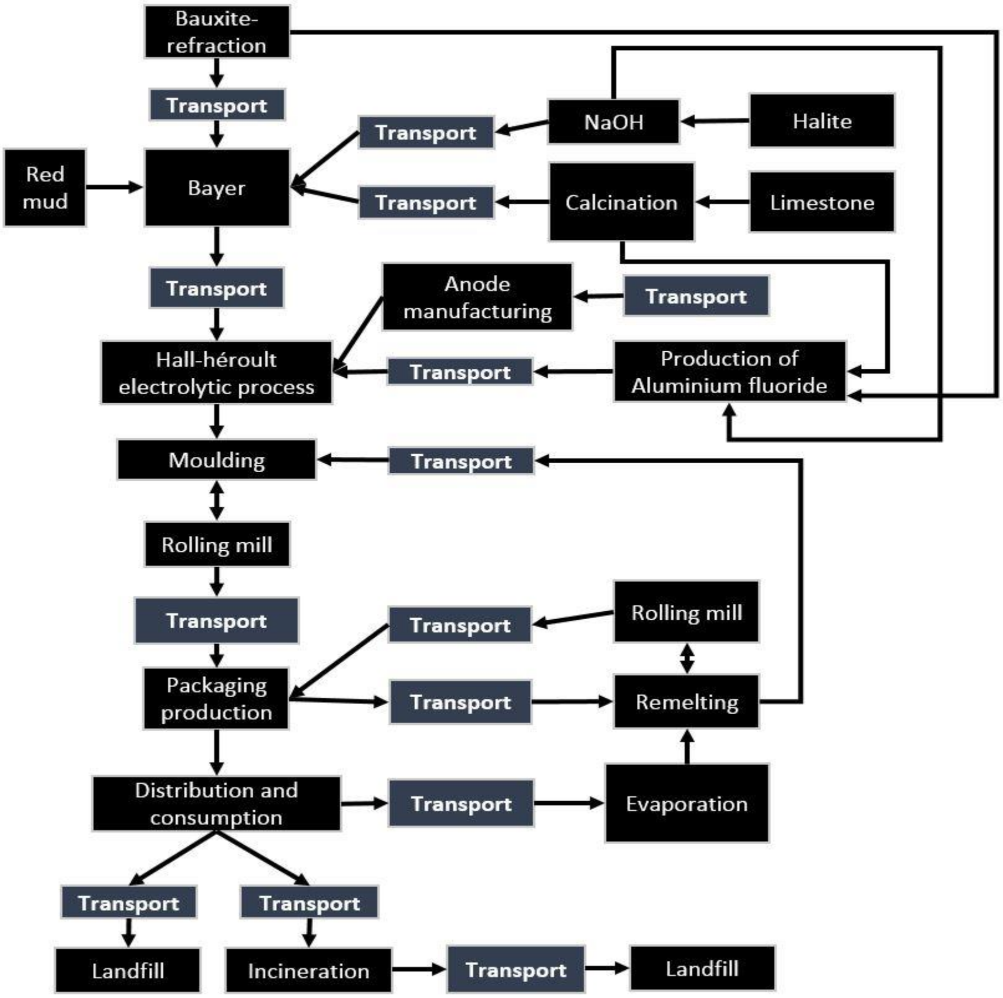

Figure 1. Flowchart for aluminium. Adapted from Tillman et al. (1991)

Second, in light of the many problems caused by transport, one area which is gaining attention is urban logistics. The importance of transport is prevalent in urban spaces with cities being densified (Lagorio et al., 2016). The densification of cities creates a need to build infrastructure as well as places to both live and work (Janné, 2018). Moreover, the densification is a catalyst for increased transport in urban spaces involving numerous stakeholders. Thus, stakeholders play a major part in these urban spaces and stakeholder involvement is key to the development of urban logistics (Lagorio et al., 2016). One important aspect is that the development of urban logistics solutions exists vis-à-vis other solutions and not in isolation. In addition, Lagorio et al. (2016) suggest that future research ought to take a holistic approach focusing on the interaction between the involved firms and the space they use; while Janné (2018) address coordination issues in the urban transport system.

The two examples above illustrate that transport services are related to other activities in supply networks. The transport service is dependent on the exchange of goods between a seller and buyer since each exchange of goods between two firms generates a demand for a transport service. Three key actors are identified: the seller of goods, the buyer of goods and the transport service provider. The combined unit of the three actors in the supply network is henceforth referred to as the Transport Service Triad (TST). The TST is conceptualised in Figure 2 below where the seller of goods buys the transport service and incorporates it into the offering to the buyer.

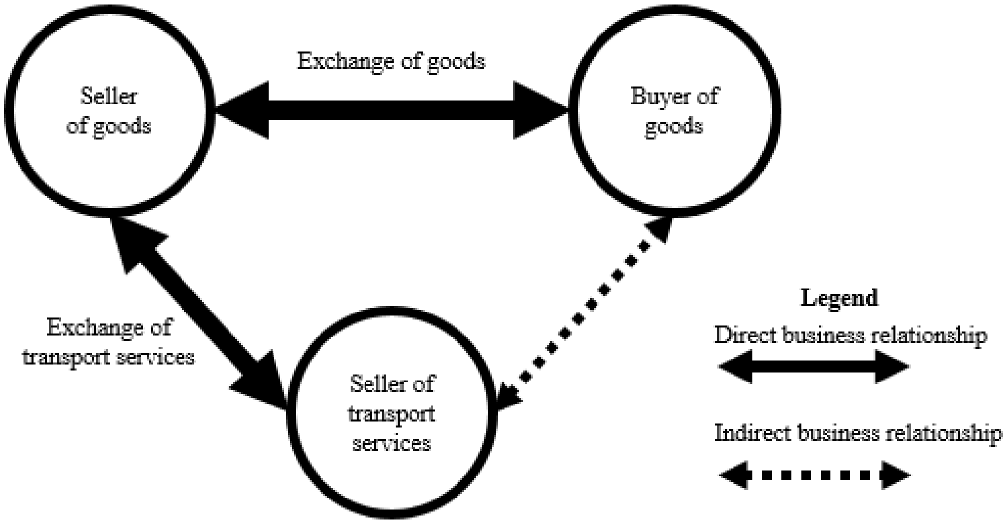

Figure 2. The Transport Service Triad

The TST depicted in Figure 2 can also reflect situations in which the buyer of goods is also the buyer of transport services. In that case, however, the arrow indicating the ‘exchange of transport services’ in the figure switches places with the dotted line on the opposite side to indicate that the buyer of goods now has a direct relationship with the seller of transport services. The dotted line reflects the absence of a formal relationship between the seller of transport services and the seller or buyer of goods.

1.2 Practical and theoretical motives for the study

The study is motivated from a practical perspective by the need to develop more sustainable transport. From a theoretical perspective the study is motivated by a need to understand how firms organise transport services in supply networks—that is, how transport is embedded in complex network structures. Therefore, the current study aims to shed light on issues related to organising transport services in supply networks, and the Transport Service Triad in particular, in order to provide a better understanding of the complexity and embeddedness of transport services in supply networks as this is a prerequisite to enhance transport efficiency. For the remainder of this thesis the word ‘transport’ is used to indicate freight transport.

1.3 Aim of this thesis

Transports as well as firms are embedded in supply networks and a theoretical approach supporting the analysis of interorganisational phenomena is therefore needed to capture this issue. The study provides a framework and an understanding for how transport activities are embedded in supply networks. Previous research has often taken a single firm's perspective or a dyadic buyer-supplier perspective on how firms organise their activities and resources (e.g., Ellram and Hendrick, 1995; Kannan and Choon Tan, 2006; Wynstra et al., 2006; Van der Valk, 2008; Öberg, 2010; Mena et al., 2013; Andersen et al., 2016; Chen et al., 2016). Research on how firms organise and manage their activities in networks has not gained as much attention (Johnsen et al., 2000; Selviaridis and Spring, 2007; Carter et al., 2015; Vedel, 2016; Johnsen, 2018). In this thesis, a triadic approach and interorganisational perspective are taken to shed light on how firms organise transport in supply networks. This, in turn, can enhance our understanding of existing interdependencies and embeddedness in networks. This is in accordance with Van den Bulte and Wuyts (2007, p. 81) who suggest that moving from a dyad to 'very small networks with three to five actors may be enough to learn about such complex issues.' In the same vein, Ritter (2000) argues that a triadic approach can capture the interconnectedness – and thereby the network effects – between relationships in a network. These network effects show the complexity of supply networks. Supply networks are seen by Harland et al. (2001, p. 22) as 'nested within wider interorganization networks and consist of interconnected entities whose primary purpose is the procurement, use, and transformation of resources to provide packages of goods and services.' Transport services are often included in the broader term of logistics, and Norrman (1997) argues that the inbuilt cross-functionality of organisational structures is one of the bigger hurdles to overcome when changing logistics activities. The cross-functionality is thus important since it implies that other functions simultaneously have to change, and that changes in logistics networks affect the coordination of related activities.

In view of the need to develop and to make transport more sustainable, and in recognition of the interdependencies existing between transport and other activities, the aim of this thesis is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach.

1.4 Structure of this thesis

The thesis is outlined as follows. Following the introductory chapter, Chapter 2 presents the theoretical frame of reference and ends with the research questions. Chapter 3 discusses the methodological considerations including the research context, research design, choice of a single case study, data collection and analysis, research process, and reflexivity and quality. Chapter 4 presents a case study of a Transport Service Triad involving three firms: a supplier of goods, a buyer of goods, and a transport service provider. Chapters 5 to 7 discuss and analyse each of the three relationships in the focal Transport Service Triad and Chapter 8 discusses and analyses the focal Transport Service Triad as one unit. Chapter 9 discusses transport efficiency in supply networks, after which Chapter 10 discusses the influence of a third actor upon a focal business relationship and upon the different roles in the TST. Last, Chapter 11 discusses the implications of a triadic approach, implications for managers, and future research.

2. Frame of reference

This chapter addresses three central themes: (1) the industrial network approach as a way to understand industrial markets; (2) the Transport Service Triad as a key unit of analysis; and (3) transport efficiency. The chapter ends with an elaboration of the research problem and two subsequent research questions.

To recapitulate, the aim of this thesis is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach. Transport activities play a key role in the exchange of goods in a supply network. As firms are embedded in supply networks, a theoretical approach to capture such issues is needed. One such approach is the industrial network approach (INA). The industrial network approach makes it possible to analyse business relationships in networks and thus provides a framework for analysing how firms organise their activities and resources in regard to the transport activities embedded in supply networks.

2.1 The Industrial Network Approach

The industrial marketing and purchasing (IMP) research tradition focuses on the business relationships between buyers and sellers and the interactions in and between these business relationships (Håkansson et al., 2009). Håkansson and Snehota (1995) state that industrial markets are regarded as networks of numerous connected business relationships. Hence the focus is on how firms are interconnected in networks rather than the undertakings of firms as separate or isolated entities (Håkansson and Snehota, 2006). Håkansson (1987) identifies three interrelated layers in business networks: (1) activities, (2) resources, and (3) actors, also referred to as the ARA model. Their basic features are that actors perform activities with the use of resources, and resources are controlled by actors.

Firms in business networks rely on several activities to produce goods, transport goods, assemble goods, and produce services. To perform these activities, firms need resources. Resources can be either physical or non-physical and they are used, produced, exchanged, and combined with other resources. Business networks consist of many types of actors. Actors have intentions and a specific purpose; an actor can be a company, business unit, a team, or a single individual. Examples of actors are logistics service providers, freight carriers, wholesalers, distributors, and manufacturers.

Håkansson and Snehota (1995) provide an expansion of the ARA model to understand business relationships as they evolve (see Figure 3) by introducing the substance of business relationships and what functions they have for (1) the companies involved in the business relationship, (2) the business relationship itself, and (3) the network of connected business relationships. The model (Figure 3) is used as an analytical scheme for examining who is affected (functions) by the business relationship and also what is affected (substances). The model consists of nine variables, three for the substances of business relationships and three for the functions of business relationships.

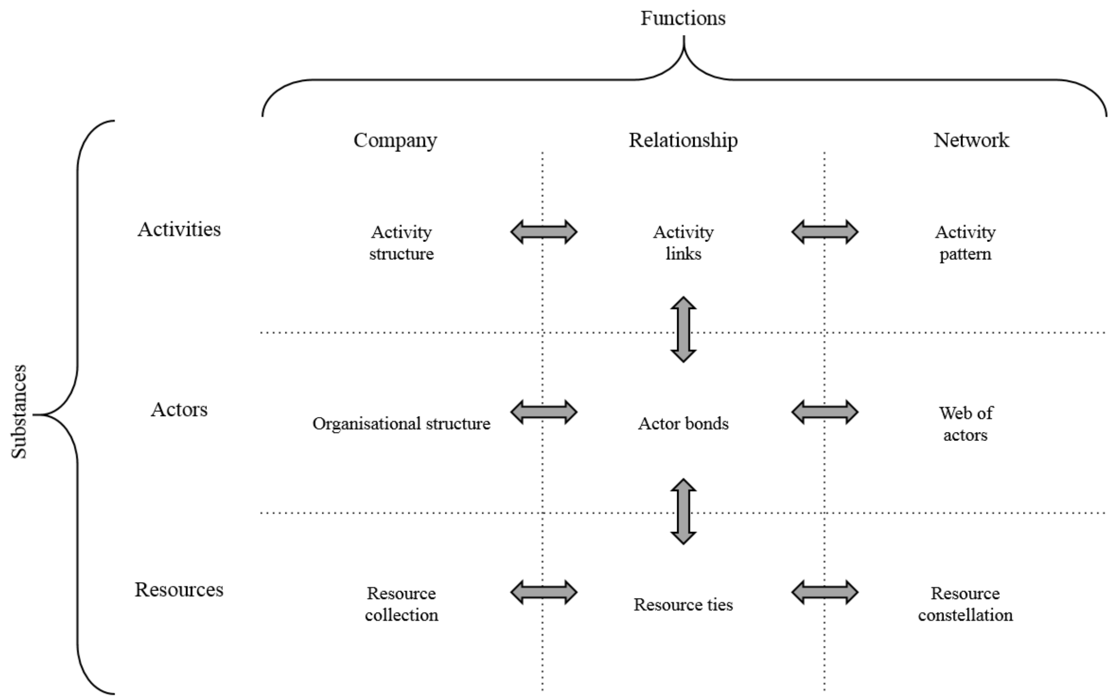

Figure 3. Functions and substances. Adopted from Håkansson and Snehota (1995, p. 45)

As stated above, activities relate to what is done in business networks, and firms in business networks rely on several activities in order to produce, transport, and assemble goods. Three activity variables are highlighted (Håkansson and Snehota, 1995): activity structures, activity links, and activity patterns. The activities performed by a firm constitutes the firm's activity structure. These activities are not undertaken in isolation. Instead, they are interrelated and can be both backward-looking and forward-looking. When a firm engages in a business relationship, the activity structures of the two firms are linked. Two activity structures are linked through activity links. Activity links are part of the substance of business relationships and are essential to facilitate the coordination of two activity structures. The links of connected activity structures contribute to the formation of the overall activity pattern in the network, allowing for changes in the economy of scale and scope for firms as they consider their activities in relation to others in the broader activity pattern. Thus, activity patterns are related to the organisation of activities on a network level.

In order to perform activities, firms need access to resources. Håkansson and Snehota (1995) highlight three resource variables: resource collection, resources ties, and resource constellations. The resources within a company constitute the firm's collection of resources. These resource collections reflect the purpose of the company, such as producing goods or providing a service. However, it is very rare that all resources that are important to a firm can be found within the boundaries of that single firm. Most often, a firm needs to access the resources of other firms through business relationships. Resource ties are created when resources of two firms are connected through a business relationship. Resources are developed as the parties interact and develop insights about each other's resources. Håkansson and Snehota (1995, p. 137) argue that 'novel resource ties tend to emerge in relationships as new uses for resources are discovered and as new resources for actual purposes are developed. Resources can thus be developed in and through relationships.' Resource ties are interconnected as they span several business relationships and firms involving several resource collections. The resource constellations are developed and adapted over time. Resource constellations provide explanations of how resources are related to other resources owned by different actors across the business network.

Actors have intentions and a specific purpose. Three actor variables are highlighted: organisational structures, actor bonds, and a web of actors (Håkansson and Snehota, 1995). Actors consist of different organisational structures. Actors relate to each other and they engage in business relationships in the network, that is, they organise by combining resources and linking activities. Business relationships are actor specific and are created and formed through interaction (Håkansson and Waluszewski, 2002). In this process, actors acquire knowledge about other actors' activities and resources which means that they form actor bonds to each other (Håkansson et al., 2009). Actor bonds impact on actors' identities, acting, and behaviour. Also, actors become orientated to each other as they interact, thus creating interdependencies on one another. Actor bonds are the result of the on-going process between two actors when the actors establish their identities (Håkansson and Snehota, 1995). Actor bonds between two actors can be connected to third parties in the network, forming a web of actors. This web of actors is the result of direct and indirect interaction between the actors in the network.

Next, the activities, resources and actors are each presented separately. Section 2.2 deals with the activity layer. Section 2.3 deals with the resources layer. Section 2.4 deals with the actor layer. The sections identify concepts for analysing activities, resources, and actors connected to transport services.

2.2 Transport services from an activity perspective

This section deals with transport services from an activity perspective. The aspects connected to the activity layer most relevant for this study are discussed. The section starts with an outline of transport services as transport activities. This is followed by a selection of concepts for analysing activities and their interdependence.

2.2.1 Activities related to transport services in supply networks

A supply network involves many activities, resources, and actors involved in buying and supplying transport services. Transport services play a pivotal role in supply networks as a means to transport goods from the consignor to the consignee as the exchange of goods between the two generates a demand for transport services. Transport services comprise several activities related to the undertaking, for example, moving, storing, and consolidating goods, as well as other logistics activities. These activities are all important in a supply network. Transport services involve two types of activities: transport activities and logistics activities[1]. Logistics activities are here defined as activities connected to the movement and handling of products except for the physical transport. Logistics activities are, for example, performed in warehouses and terminals. The second activity is transport activities – that is, transporting goods from one place to another – which are performed between different locations as well as actors' facilities (see Figure 4).

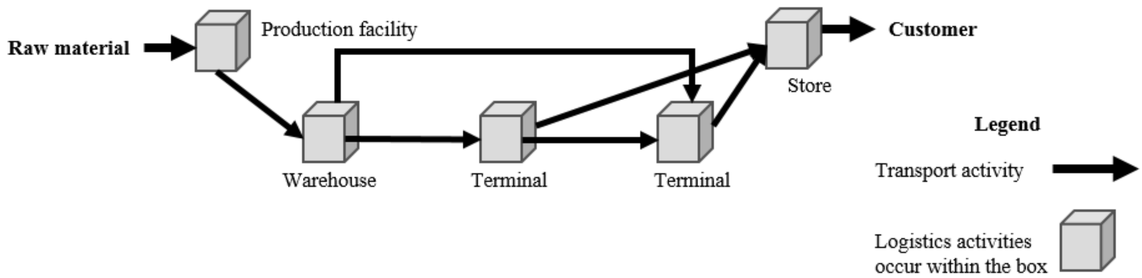

Figure 4. Transport and logistics activities in a supply network

These two types of activities need to be coordinated as they affect and are affected by each other being, therefore, interdependent. Given that transport and logistics activities are characterised by interdependence, they also have to be adapted to each other as they in turn are connected to other logistics and manufacturing activities. Thus, an isolated transport activity is related to a number of other activities which they are adjusted to, these adjustments

[1] For the purpose of this thesis, transport activities and logistics activities are separated, although transport activities could be seen as one part of logistics activities. The reason for separating the two is to place emphasis on the transport activities in relation to other activities.

occurring in interaction between actors. The transport activities in Figure 4 follow a sequence from raw material on the left side to the customer on the right. These activities are sequential and interdependent. Håkansson et al. (2009, p. 105) state that a sequential interdependent 'activity cannot be performed until another one has been completed.' In addition, Dubois et al. (2004) and Gadde et al. (2010) have pointed to the importance of the sequence in the chain of activities. This sequence is visible in many situations, for example, regarding transport and just-in-time deliveries as well as manufacturing and build-to-order arrangements.

Sequential interdependent activities are either performed within a firm or between firms. Activities performed within one firm can be loading and discharging containers in a terminal or conducting a transport between two facilities. For example, the production facility and warehouse in Figure 4 may be owned by the same actor. Activities performed between firms can be transport between the warehouse and one of the terminals in Figure 4, that is, activities across the boundaries of the firms. These activities are connected with other activities carried out by other firms. Figure 4 illustrates several activities connected to transport activities. Firstly, after the production, there are several logistics activities related to warehouse operations, such as storage, repacking, order-picking, and consolidation. Lastly, in a terminal, goods are transferred from inbound to outbound trucks to their new destination, the customer. Relating back to activity structures, activity links and activity patterns, they become important as they span across and connect firms in supply networks and in different activity chains, making the embeddedness of activities an important issue. Thus, how activities are configured across the network is important if one wants to understand the issues related to how activities are performed as well as their efficiency and effectiveness. Håkansson et al. (2009, p. 100) stress that 'an activity configuration is thus characterised by interlinked activities and the actual configuration is a subset of the overall activity pattern and involves parts of the activity structures of various firms.'

2.2.2 Concepts for analysing activities and interdependence

Activities relate to what is done in business networks, and firms rest on several interdependent activities to produce and transport goods (Håkansson et al., 2009). Håkansson and Snehota (1995, p. 52) state that 'all activities of a company have to be regarded as linked to those of other companies,' even if the activities occur internally or externally from the firm's perspective. One perspective on activities is internal and external activities. They are part of a larger whole, involving a large number of more or less interrelated activities. Internal activities are activities performed within a firm's activity structure and thus do not directly involve other firms. A firm's activity structure is specific to that particular firm and what is internal for one actor may be external for another actor. External activities are performed across the boundaries of an actor. In addition, these activities can be characterised as either physical flow or information exchange. The activity links are essential to facilitate the coordination of two activity structures through adjustments on either side of the business relationship (Bankvall, 2011). These adjustments help to improve the two firms' joint performance (Håkansson et al., 2009). Activities are predominantly linked to each other in two ways (see Figure 5). First, the output of one activity is the input for the next in a sequence of activities. Second, several activities are performed in parallel, since they altogether are the input for the following activity.

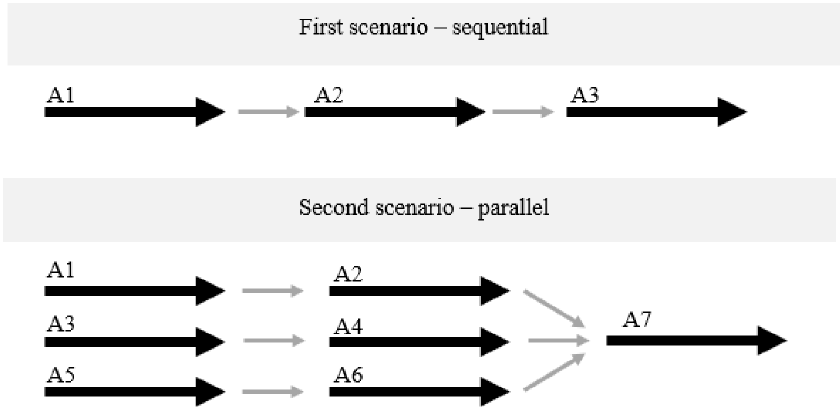

Figure 5. How activities are linked

The linking of activities enables firms to capture efficiency gains as they coordinate certain activities with each other (Håkansson and Snehota, 1995; Bankvall, 2011). Freytag et al. (2017) state that interdependencies among activities are derived from how they are connected. Interdependencies occur because of adjustments of activities to improve efficiency and effectiveness. The efficient performance of activities is dependent on how they are matched with other activities and a key issue is how to manage the interdependencies that occur in this matching (Dubois et al., 2004). How to manage interdependencies is important as they occur both within and across companies. Freytag et al. (2017, p. 251) argue that '[b]y working creatively with interdependencies, a company can improve performance substantially. Consciously created interdependencies in terms of activity links, resources ties and actor bonds are strategic assets.' Interdependencies are managed through coordination, and adjustments of activities thus have to be made to reach the preferred direction (Håkansson et al., 2009). Activities have to be coordinated and adjusted in order to form both products and services. Interdependencies are defined in various ways to understand the efficiency and effectiveness of activities in, for instance, manufacturing and logistics (Richardson, 1972; Håkansson et al., 2009). There are different types of activity interdependences (see Table 1).

Table 1. Interdependencies discussed and analysed in this thesis (Richardsson, 1972)

Serial interdependencies	**Parallel interdependencies**
Complementary	Similar
Closely complementary	

Serial interdependence occurs when activities have to be performed in a certain sequence. Therefore, a specific activity's turn rests on the previous activity. Richardson (1972, p. 889) states that 'activities are complementary when they represent different phases of a process of production and require in some way or another to be co-ordinated.' Thus, the output of one activity stands as the input for the next. For example, the outputs of inbound logistics are the inputs to manufacturing. Closely complementary activities need more coordination than those of complementary activities. In other words, closely complementary activities demand a higher level of specification. Richardson (1972, p. 891) states that the characteristics of closely complementary activities rest upon a situation when a need exists to 'match not the aggregate output of a general-purpose input with the aggregate output for which it is needed, but of particular activities.' Closely complementary activities share the same characteristics as complementary, but with the difference that closely complementary activities are directed to certain counterparts; namely, closely complementary activities are limited in the sense that they cannot be used for other purposes.

Similar activities are those that require the same type of resources for their undertaking (Richardson, 1972). This means that a particular resource is used to perform more than one activity. Activities are performed by firms with the suitable skills and knowledge, and firms tend to specialise to certain activities for which they have some form of extended competence and competitive advantage. Similarity among activities enables standardisation. Standardised activities are necessary in logistics operations as such activities allow for integration that can increase their joint performance. Examples of such activities are order-picking and outsourced warehouse operations.

As discussed above, interdependence between activities are omnipresent in the network. Richardson (1972) shows that firms need to handle specific types of coordination for certain types of activity interdependencies to operate and manage in the network. For example, Håkansson et al. (2009, p. 113) state that 'sequential [complementary] activities are central to the logistics and supply-chain frameworks in the analysis of flow efficiency in activity configurations.' In addition, similar activities – those that make use of the same resources –

may contribute to better utilization of resources and, therefore, may enable firms to use their resources more efficiently (Håkansson et al., 2009).

Consider the following example (shown in Figure 6) illustrating the logic of complementary, close complementary, and similar activities. An incoming truck is loaded with goods to several destinations in the same geographical area. When the truck arrives at the terminal, the goods are split from their stillage cage, scanned on a conveyor belt and then repacked to a new stillage case (unloading). Then the goods are moved in place to their destination awaiting loading (rearrange), and in many cases also moved in place one more time due to a new or more detailed destination (rearrange repeated) (upper part in Figure 6) and then loaded onto a new truck for departure (loading).

The activities in the terminal are complementary to the activities that trigger the terminal activities, this is symbolised in Figure OP by the arrival of the truck with incoming deliveries. Likewise, the loading activities are complementary to both the rearranging and the unloading. The activities performed for truck A and truck C are standardised (in terms of terminal activities); thus, the activities for truck A and truck C are complementary, whereas the undertaking of activities for truck B are customised (in terms of terminal activities). The activities performed for truck B are directed towards a specific end-customer. Goods are also added from storing prior to the loading of truck B. Thus, the activities that result in the departure of truck B are not only complementary but they are closely complementary and only useful in relation to that specific end-customer.

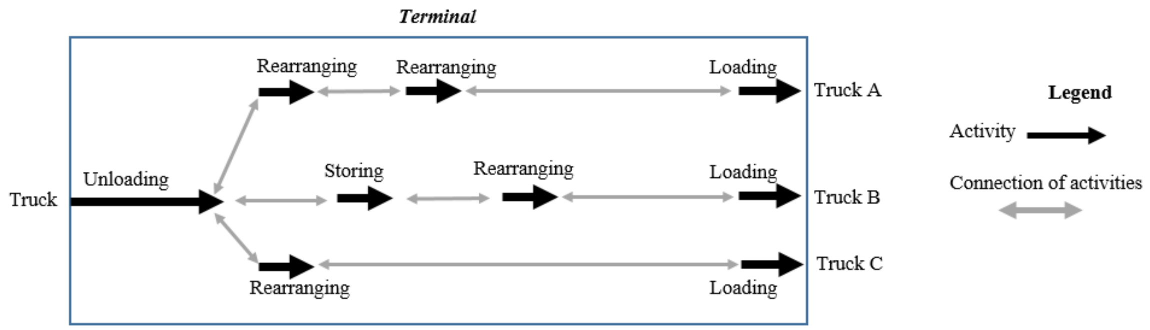

Figure 6. Serial and parallel interdependence in a terminal

Given the above example, activities need to be coordinated because one activity cannot be performed before the previous is completed. Similar activities are also apparent as several of the activities are performed by the same personnel and equipment even if the destination of the goods may vary.

2.3 Transport services from a resource perspective

This section deals with transport services from a resource perspective. The aspects connected to the resource layer most relevant for this study are discussed. The section starts with an outline of resources related to transport services in supply networks. This is followed by a description of the concepts for analysing resources. A particular focus is put on resource combining and resource adaptation.

2.3.1 Resources related to transport services in supply networks

Resources are considered to be related to logistics when they have implications for logistics operations (Jahre et al., 2006). Physical resources, such as warehouses, terminals, trucks and handling equipment, are all related to logistics. Non-physical resources are also related to logistics, such as information, competence, and knowledge about logistics operations, for example, specific knowledge about the intermodal, container, or long-haulage market. Also, one type of non-physical resource are organisational resources. Organisational resources include purchasing capabilities, workers' goods-handling skills, IT systems, and marketing/sales capabilities as well as logistics coordinators' ability to coordinate the flow of goods. These physical and non-physical resources are used by organisations for their own operations or by other organisations through business relationships. Resources important for logistics operations are also related to infrastructure, such as roads and ports. These resources are used by many organisations and individuals in society. Heskett et al. (1964, p. 43) provide one perspective of logistics by stating that 'There are two basic elements in the logistics system of a business firm. The first of these is a set of fixed points, or facilities, which may vary in number from two to several thousand. These points are connected by the second element of a logistics system, a transportation network.' Thus, in the first element the more or less fixed resources are those related to infrastructure, warehouses, and terminals. On the other hand, resources related to the logistics system are resources such as trucks, handling equipment, pallets, competence, and knowledge. Additional resources relevant to the logistics system can be the products flowing through the transportation network, different types of packaging, and load carriers.

Following the definition of a supply network given in the introduction, it becomes clear that resources are used in many different ways and that different types of resources are relevant in different situations. To coordinate all these activities, other resources (e.g. information systems), logistics personnel (e.g. logistics coordinators and purchasers), and other capabilities are needed. Thus, there are countless varieties of resources used in supply networks and their use depend on how companies work with each of them in order to elevate the use of a particular resource (Jahre et al., 2006). For example, trucks differ in how they are built and how they are used. Trucks are in many ways built to fit a particular operation to meet specific requirements. Specific requirements also connect to trucks' special uses, such as for municipality use, for regional delivery, for construction sites, or for long-haul operations, and the choice of the appropriate truck is therefore important when it comes to transport efficiency. In pursuit of transport efficiency, resources play a pivotal role, as they are essential for moving goods smoothly through and between different supply networks. In addition to the movement of goods, how resources are used has consequences on how different actors can perform their activities. To reach the goals of enhanced transport efficiency, resources have to be utilised in the best way possible.

2.3.2 Concepts for analysing resources and how they are combined

A resource is 'a relation between its provision and use' (Holmen, 2001, p. 148). The emphasis is on access to resources and the ability to influence them across the network (Holmen, 2001). Firms have to connect with other firms in their business network to get access to certain resources. Also, as no firm is self-contained, they are dependent on others to exploit their resources. Gadde et al. (2010, p. 261) state that 'in many cases these external resources may be more important to a company than their internal resources.' Hence, resources are pivotal for firms, contributing to their performance and specific characteristics. Firms are therefore more than merely an administrative unit; firms are collections of resources (Penrose, 1959). Penrose (1959) points out that resources are heterogeneous, that firms are made up of bundles of resources and that resources can achieve different outcomes when combined. Resource heterogeneity implies that the same resources generate different outcomes and values depending on how they are combined with other resources (Håkansson and Waluszewski, 2002). The combining of physical and non-physical resources is vital. This is further emphasised by Gadde and Håkansson (2008, p. 36) who state 'Resource combining and resource utilization call for organizational resources since both these processes are based on interaction, within and between firms.' A firm's resource collection is hence a set of physical and non-physical resources.

Resources are constantly evolving through interaction among actors who combine resources differently, all depending on how they are related within and across firm boundaries. Jahre et al. (2006, p. 212) state that 'resources always have untapped potential and the value of a single resource can be affected by alternative utilization – by becoming "better" combined with other resources.' Resource heterogeneity is therefore essential in efforts to utilize resources in different combinations as the lifecycle of a resource is full of potential for combining resources in new ways (Gadde et al., 2010). The concept of combining resources becomes imperative since resources are considered heterogeneous. Firms combine their resources with other firms in multiple ways (Jahre et al., 2006), and both internal and external resources are important Gadde et al. (2010, p. 261). For this reason, a firm should not consider its internal resources as isolated from others; instead the resources should be seen as a part of larger resource constellations in the network (Håkansson and Snehota, 1995). Drawing on the aforementioned notion of internal and external resource combinations, the performance of one company is linked to the ability to connect internal and external resources. Moreover, Holmen (2001) provides a distinction between resources being transformed into completely new resources and the ones that are being modified to fit their features better with the existing resources. Thus, the unknown characteristics of resources makes them subject to new combinations with existing or new resources (Baraldi et al., 2012). Effective resource development and resource utilisation are possible through joint adaptation of resources.

A successful combining of resources rests on the ability to adapt resources to one another, and the resources are developed as the parties interact and develop insights into each other's resources. Adaptations of resources are essential to the desire to reduce cost and to make the resources fit various contexts. Such adaptations are evident in business and can be seen in, for example, a business relationship between a producer and a buyer of goods when the buyer wants a specially designed product. An adaptation can take two forms: either it can be a one-sided adaptation or a more mutual adaptation between the two. In logistics, one example of adaptation could be that of production operations and delivery schedules (Jahre et al., 2006). Interaction is a prerequisite for adaptations and it is in the light of such interactions that firms learn about each other's operations which in turn enable mutual adaptation. That is, interaction enables the two firms to understand the context in which the resource is used. In addition, adaptations demand expenditure of resources both in time and over a period of time, thus contributing to gradual changes to a business relationship and its content (Ford et al., 2011).

Relationships are important resources as '[r]elationships are a company's most important assets, because without them it cannot gain access to the resources of others… A company's relationships are in many ways the assets that bind together all of its other assets and convert them into something of economic value for itself and for others' (Ford et al., 2011, p. 29). Jahre et al. (2006) show that business relationships are key resources in logistical settings, as in producer–distributor and logistics service provider–customer relationships. A relationship is an asset because relationships can be used to generate value through different processes, whether that be improvements of logistical operational efficiency or as a contributor to innovation. This is due to increased specialisation and outsourcing among actors. The resources required for the actor's entire operations are often located outside the actor's boundary. Hence, business relationships are essential because it is through business relationships that firms adapt their resources to each other. For example, Windahl and Lakemond (2006) point to the need to consider business relationships when developing integrated solutions. Moreover, Forsström (2005) shows that buyer–supplier relationships can excel and achieve more than a single entity can and points to a high degree of involvement and careful use of resources enabling value-creation initiatives in, for instance, procurement and logistics.

How resources are used has an impact on efficiency and effectiveness. Resources cannot be completely optimised in terms of efficiency and effectiveness as they always relate to other resources which are not fixed (Håkansson et al., 2009). Also, a collection of already existing resources that are difficult to change can be said to be more or less heavy in relation to their use. This means that the heavier the resource is, the more difficult it is to recombine (Håkansson and Waluszewski, 2002). Resources mobilised internally and through relationships affect how efficient a firm can be in regard to its utilisation of resources (Håkansson and Snehota, 1995). Utilisation of resources – that is, how activities activate resources – is pivotal to achieving efficiency. Similar activities Richardson (1972) and the idea of interplay between resources and activities are important to achieve efficiency (Penrose, 1959). Similarity among activities, a firm needs to allow for efficient utilisation of resources.

Penrose (1959) states that resources can be used in different ways depending on how they are activated by a service, implying that a service is an activity. Penrose (1959, p. 25) states that '[s]trictly speaking, it is never *resources* themselves that are the 'inputs' in the production process, but only the *services* that the resources can render. The services yielded by resources are a function of the way in which they are used–exactly the same resource when used for different purposes or in different ways and in combination with different types or amounts of other resources provides a different service or set of services.' Although heterogeneity of resources provides the possibility to create value and improve efficiency, there are also some concerns with them (Håkansson et al., 2009), especially those related to standardisation. Standardisation can be very cost efficient for some firms, but it can be troublesome for firms in the larger network due to the inability to adapt to the standardisations elsewhere. Thus, how resources are used and combined by firms in the network have implications regarding efficiency. Gadde et al. (2002) exemplify this through a logistics package and how it has to be integrated and adapted to other resources in the network for efficient utilisation. Changing such a package in terms of size or material could have effects on numerous other resources in the network, which in turn might require changes for others (Jahre and Fabbe-Costes, 2005).

2.4 Transport services from an actor's perspective

This section deals with how actors organise for transport efficiency in supply networks. The aspects connected to the actor layer most relevant for this study are discussed. The section starts with an outline of how actors organise to achieve transport efficiency in supply networks. This is followed by a discussion of concepts for analysing actors and business relationships.

2.4.1 Actors related to transport services in supply networks

From an IMP perspective, supply networks are analysed taking into account how different actors mobilise resources to perform different activities (Gadde et al., 2010). Several actors are involved in these supply networks. Supply networks have at any given point in time existing structures making the interrelatedness of actors important. Actors can, for example, be sellers of goods and services, buyers of goods and services, transport companies, or logistics companies operating terminals and warehouses. There are endless variations of how supply networks are organised in regard to activities, resources, and which actors are involved. In the aforementioned Transport Service Triad (TST), the transport service providers play a key role. There are many buyers and suppliers of goods in a supply network as well as many buyers and sellers of transport services. These companies provide many different offerings to their customers. Hertz (1993) highlights different categories of transport companies: (1) freight forwarders; (2) owners of the means of transportation, equipment, and terminals; and (3) freight carriers. Over time, these categories have converged into one term, logistics service provider (LSP), or third-party logistics provider (TPL), which is a common term in today's literature (Berglund et al., 1999). The term LSP is close to that of third-party logistics provider (TPL or 3PL). However, an LSP has an inbuilt notion of hierarchy based on how complex the offering is or how well problems are solved making the 3PL and the LSP slightly different.

The term LSP is defined by CSCMP[2] as 'any business which provides logistics services. [This] includes those businesses typically referred to as 3PL, 4P, LLP, etc.' 3PLs are defined as providers of services that are bundled together by the provider, including transport, warehousing, cross-docking, and packaging. In addition, 3PLs often have a business unit called freight forwarding. A 4PL is often a consultancy firm providing a single interface for the customer by organising the customer's logistics set-up using different LSPs. Freight forwarders are those that work as intermediaries between the actor who tenders goods to be transported (shipper), and the firm who transports goods (carrier). As such, freight forwarders, 3PLs, 4PLs, and LSPs provide many different solutions. Nevertheless, they do not themselves provide transport as they often do not own trucks, trains, vessels or airplanes. Instead, these activities are performed by freight carriers. Table 2 below gives an overview of different actors offering transport solutions and how the different actors relate to each other. Freight carriers are those that haul freight but do not provide any other large-scale services such as those provided by a 3PL. However, freight carriers may compete with 3PLs as freight carriers and can have specialised solutions and cutting-edge sustainability solutions as well as small terminal operations.

Table 2. Characteristics of different transport companies

Term	**Characteristics**
4PL	Organises a customer's logistics set-up using different LSPs. Generally, a 4PL does not own any transport equipment such as trucks, forklifts, and warehouses.
3PL	Providers of services that are bundled together by the provider, including undertakings such as transport, warehousing, cross-docking, and packaging.
Freight forwarder	Intermediary between the shipper and the carrier, often when it comes to import and export of goods.
Freight carrier	Freight carriers own the means of transportation and undertake transport; i.e., they haul freight.

[2] CSCMP. 2013. Supply Chain Management terms and glossary. Illinois Council of Supply Chain Management Professionals. Available: http://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms.aspx?hkey=60879588-f65f-4ab5-8c4b-6878815ef921.

Research focusing on 3PLs has increased dramatically over recent decades (Marasco, 2008; Leuschner et al., 2014). Nonetheless, a clear definition of third-party logistics is yet to be established. However, from the above outline it becomes clear that many actors contribute in different ways to both transport and logistics in the supply network.

2.4.2 Concepts for analysing actors and business relationships

Actors perform activities and control resources for specific purposes. Actors can be any type of organisation, a function in an organisation, or teams and individuals. No actor can function in isolation, nor can an actor enforce or achieve changes in isolation without directly or indirectly affecting other actors. However, it is difficult to distinguish where the influence from one actor ends and where another begins (De Boer and Andersen, 2016) . Interaction is a process that occurs between firms over time filling the business relationship between the two parties with substance, such as activity links, resource ties, and actor bonds. Interaction amongst actors unfolds in direct relation to those directly connected but also to those that are connected in the wider web of actors. How to interact with other actors and how to mobilise and influence other actors through business relationships becomes of utmost importance in order to achieve efficiency and innovation (Gadde et al., 2003) but also to gain access to resources as well as knowledge about, and influence on, the activities and resources of other actors (Håkansson et al., 2009).

Prajogo and Olhager (2012) have shown that long-term relationships can foster logistical performance and collaborative behaviours, and provide direct positive effects on performance. Aharonovitz et al. (2018) conclude that relationship history is the principal overarching contributor to collaboration as well as logistical performance. Collaboration could include activities such as materials handling, order processing, warehouse activities, and transport, while logistical performance includes time, cost, and reliability. Collaborative relationships have shown to often bring about positive effects, but they are also more costly to manage.

Organising in the supply network

Actors organise by combining resources and coordinating activities internally and between business relationships. Business relationships are thus changing and different adaptations are taking place. Change and adaptation exist because of the interaction taking place between actors but also because of the actors' ability to coordinate activities and combine resources in business relationships. According to Gadde et al. (2010), it is the actors who constitute the organising force because neither activities nor resources can adjust and adapt themselves. In this way, actors determine what is organised as they recognise opportunities related to the activity and resource layer (Håkansson et al., 2009). An important aspect of firms organising activities and resources is efficiency. To become more efficient, actors need to interact with others who can provide a potential for increased efficiency by adjustment of their activities and adaptation of their resources. As pointed out by Håkansson and Snehota (2006, p. 261), 'The distinctive capabilities of an organization are developed through its interactions in the relationships that it maintains with other parties.' Thus, it is important to consider the interactions in a business relationship, and the traces and content they leave behind, because they allow access to resources, impact on the activities performed, and affect the actors involved (Gadde et al., 2010). Actors can take on different identities as they have different business relationships in the network. One such case is when an actor has the role as buyer and supplier at the same time but with different counterparts in the network. Each actor has a position in the network, which is the result of the interactions with other actors. The opportunities faced by a single actor are related to its position in the network.

The position is dynamic and changes over time and a holistic overview of the network is a complex issue for an actor (Håkansson and Ford, 2002). Thus, it is impossible for actors to picture a complete view of its surrounding network. This means that actors have limited views as they tend to adhere to what they find relevant from their own perspective. Håkansson and Ford (2002, p. 138) state that '[a] network will look very different from the perspective of different companies, each with their own motivations, resources and understandings. A company that only sees the network from its own perspective will fail to understand its dynamics and the interface between the well-being of others and itself.'

Internal and relationship organising

Firms organise internally as well as in relationships. First, internal organising cuts across the entire firm, as many functions and business units are within the boundaries of the firm. For example, the purchasing department has to organise its activities and resources with other departments (see arrows in Figure 7).

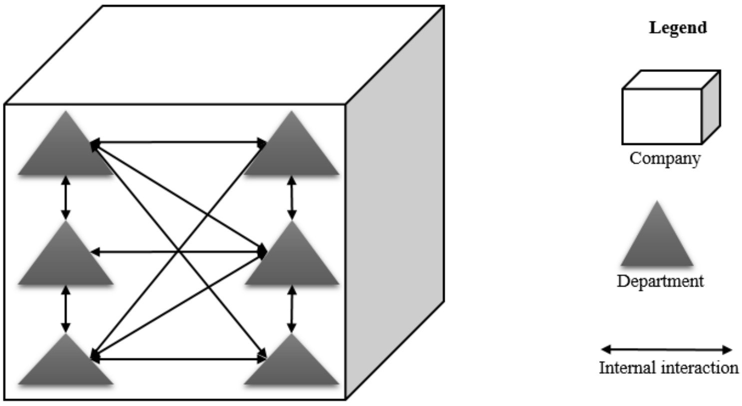

Figure 7. Interaction between departments in a firm. Adapted from Hessel (2014, p. 47)

The interaction is further complicated because the departments are specialised (e.g. logistics, sales, marketing, sustainability, and purchasing) and coexist with other departments. For example, the logistics department contributes to the purchasing department as well as the sales and sustainability department. The interplay between these departments contributes to the realisation of, for example, a firms' logistics operation. Thus, how different functions organise have effects on the activities they can carry out and how they prioritise (Hessel, 2014). Secondly, firms also organise in relationships which cut across firm boundaries (see Figure 8).

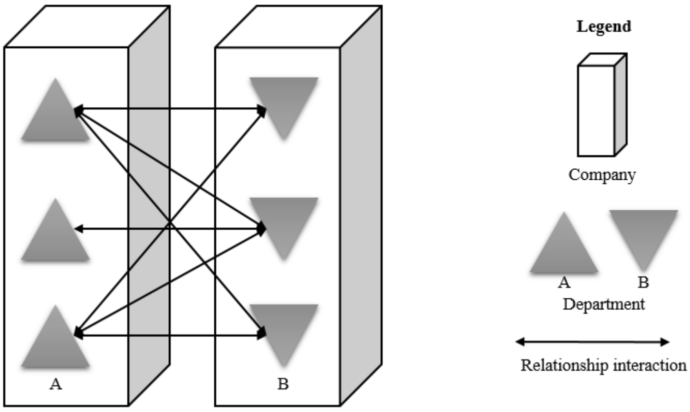

Figure 8. Interaction between firms in a relationship. Adapted from Hessel (2014, p. 55)

Organising relationships addresses the connections between the seller (A) and the buyer (B) connecting multiple departments and individuals. As seen in Figure 8, firms A and B are interconnected. In the relationships, the interactions take place between departments and between individuals in each of the two firms. This connectedness results in organising – whether internally within the firm or externally across firm boundaries – depends on other actors organising activities and resources.

Interaction

According to Håkansson et al. (2009, p. 28), interaction is described as a 'multidimensional process between companies that change and transform aspects of the resources and activities of those companies and the companies themselves.' The process of interaction deals simultaneously with the input and the outcome of the interaction, and the interaction changes through new ideas learnt as well as through new experiences (Håkansson et al., 2009). The interaction process transpires in space, in time, internally, and among business relationships (see Figure 9). Interaction in the space dimension deals with relatedness in a specific space, whereas interaction in the time dimension deals with the specific time-related aspects of the interaction.

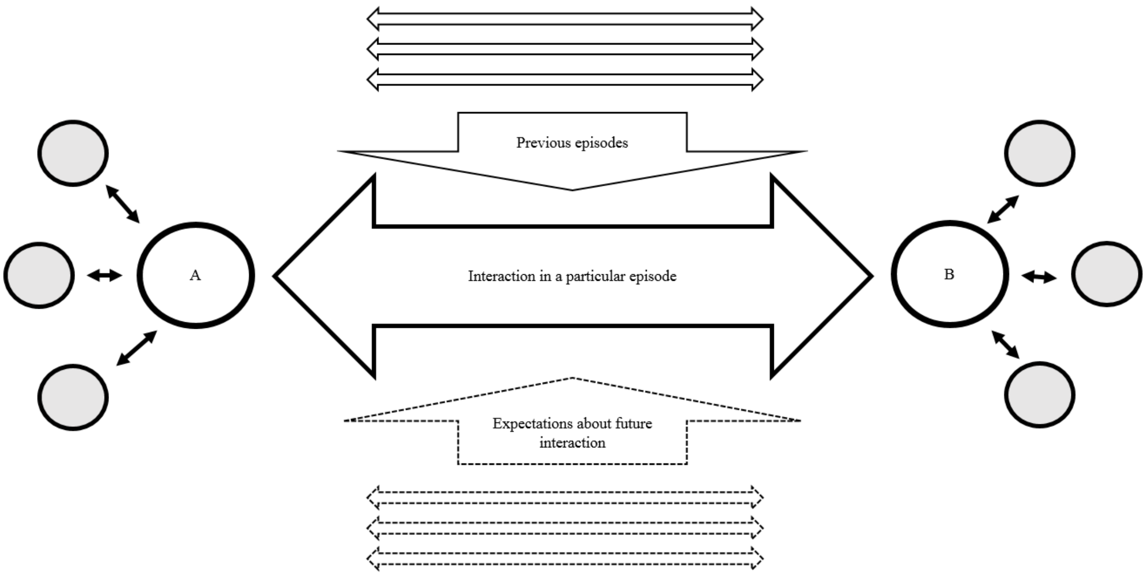

Figure 9. Interaction in time and space. Adapted from Gadde et al. (2010, p. 113)

The first dimension is space. Interaction is specific in space and generates different results in relation to the content of the interaction. Interaction in space and its content is related to activities, resources, and actors, which are also linked to each other. Figure 9 illustrates the interaction process between two firms, A, a supplier, and B, a buyer. Every interaction episode affects the content of the business relationship as both firms have relationships beyond their shared relationship (Gadde et al., 2010), so decisions made impact the others as well. For example, if A and B together decide to change some of their resources or activities, a previously unrelated business partner could as a consequence overtake and manage those resources and activities. This will impact the position of A and B since other actors are now involved. The content of such interaction will influence not only the changed relationships but also others since the interaction stretches within and across firm boundaries connecting other relationships through the wider network (Håkansson et al., 2009).

The second dimension is time. Time is important since the future is dependent on current and past interactions (Gadde et al., 2010). Past and current interactions and expectations of future interactions influence and create actors' memories. Through these interactions, actors systematically become accustomed to each other. The interaction process between the two firms depicted in Figure 9, supplier A and buyer B, is the result of previous interaction episodes, which also impact the current interaction episode. Hence, historic adjustment of activities and adaptation of resources have implications for the future. In addition, the time dimension is also important because of the continuous repositioning of actors as a consequence of past interactions. The actions and reactions in an interaction have specific effects on the specific relationship and cannot be controlled from only one side.

2.5 A triadic approach

A triadic approach highlights both the direct and indirect connections between firms and business relationships, and the triad can be regarded as the smallest possible network with at least two interconnected relationships (Andersson et al., 2014; Carter et al., 2015). Triads have been suggested to be the smallest unit of analysis to feasibly investigate connectedness between actors (Laage-Hellman, 1989; Halinen and Törnroos, 1998).

Business relationships are embedded with other business relationships, and changes in one impact the other. A central concept in research involving business relationships and triads is connectedness, which refers to a situation where an 'exchange between A and B[,] to some extent[,] affects exchange between B and C and vice versa' (Yamagishi et al., 1988, p. 835). Connectedness has been recognised as a significant factor in business relationships and the process of value creation (Laage-Hellman, 1989; Blankenburg and Johanson, 1992; Anderson et al., 1994; Vedel, 2016). Walter et al. (2001, p. 368) highlight the importance of indirect influences by stating that '[i]ndirect functions of business relationships capture connected effects in the future and/or in other relationships – the wider network… [and] indirect functions are important because they positively impact on exchange in other relationships.'

Triads have been researched for over a century, the German sociologist Georg Simmel's seminal work being among the first to discuss triads[3]. Simmel (1964) stresses the importance of relationships and the interaction taking place in these relationships. Furthermore, Turner (2013, p. 106) states that for Simmel, 'the external forms of interaction always open up conditions of possibility for individuals. Society therefore is never an objective determination

[3] Simmel originally used the German term *'Verbindung zu dreien'*, or 'association of three'.

but is a complex assembly of social interactions.' Moreover, Simmel discusses how dyads have certain special characteristics and how adding a third actor to the dyad changes its characteristics.

Simmel (1964) makes a distinction among the three possible roles and positions for the third actor and how these roles provide different group formations. The first role is the mediator. Simmel elaborates on two perspectives of this role. First, the mediator's role can be to establish agreement between the two conflicting actors. The mediator can also balance the contradictory claims made by the other two actors and by that eliminate their incompatibility. The second role is the rejoicing third (Tertius, or the interested third party). This role is similar to the role of the mediator, but with the difference that it involves gaining and benefiting from choosing one of the two actors. The choice can be direct or indirect and the purpose is to exploit the situation. The third role is the one who divides and rules (i.e. the one who brings conflict and divides the group in order to push its own interest). This role means that the third actor actively causes conflict between the other two and thereby attains a dominant position. These roles have been discussed previously in several studies (e.g. Adobor and McMullen, 2014; Vedel, 2016). Adobor and McMullen (2014) draw on new advancements related to the role of the rejoicing third. They state that this role takes on more of a constructive role, and thus has the role of fostering collaboration between the parties, as opposed to the third party benefiting and seeing an opportunity emerging from a conflict between the other two parties. The third actor functions as a bridge and mediator, and this actor can influence the dyad even if not directly involved. In addition, strong ties to a third party can be beneficial for reducing power asymmetry and minimizing companies' opportunistic behaviours, and for the development of supplier relationships. Vedel (2016) illustrates how triads profit from connectedness and how the structure of a set of relationships influences the processes taking place in each dyad. For example, how an actor benefits by acting in accordance with the role of the rejoicing third, but also showing different perspectives of connectedness in the same triad.

Triads have recently been studied both conceptually (e.g. in a paper addressing triads development in marketing Siltaloppi and Vargo (2017)) and in a literature review of service triads by Sengupta et al. (2018). Siltaloppi and Vargo (2017) identify three forms of triads: brokerage, mediation, and coalition. First, the focus in a brokerage triad is on how the third actor influences, manages, or facilitates interaction between the other two actors (Obstfeld et al., 2014). The broker can unite actors in a relationship even if they previously were disconnected from each other. Moreover, the broker can also distribute information to the other two actors regardless if they are directly connected or not. Siltaloppi and Vargo (2017) relate brokerage to *tertius gaudens* (Simmel, 1964) and *tertius iungens* (Adobor and McMullen, 2014). Brokerage with an orientation towards *tertius gaudens* entails keeping the other two actors apart, whereas a *tertius iungens* orientation entails uniting the two actors by forming a new connection between them for fostering collaboration (Ibid.).

Second, a mediation triad describes three mechanisms—dyadic influence, normative commitments, and cognitive dispositions—by which a dyadic relationship affects and is affected by a relationship with a third actor (Anderson et al., 1994)—that is, the embeddedness of dyads within triads (Krackhardt, 1998). A particular focus of the mediation triad is to understand how 'indirect relationships with third parties influence focal dyads' (Siltaloppi and Vargo, 2017, p. 401). Dyadic influence draws on how a third party can influence the focal dyad's current behaviour by providing information to either one of the two actors in the dyad. Normative commitments refer to mediation in which existing commitments to a third party constitute restrictions on activities in a focal business relationship. These commitments are valid regardless of being based on explicit agreements or implicit social norms. These norms are also important in the relationship atmosphere where control and influence occur (Gadde, 2004). Furthermore, it is the embeddedness of these actors that trigger, impose, and enforce the values and norms of the members. Simultaneously, the embeddedness of dyads in triads limits actors' freedom to act. Cognitive disposition is a mechanism of mediation characterised by the 'human tendency to adopt certain forms of activity unconsciously as a result of interactions in a particular context' (Siltaloppi and Vargo, 2017, p. 402). Hartmann and Herb (2015) show that an important coordination mechanism is common goals and shared assumptions as well as the expectations and requirements of the other actors.

Lastly, a coalition triad differs from the previous two because coalition results in three actors forming one unified system. This unified system acts as one entity with strong ties and a high degree of cohesiveness (Vedel et al., 2016). To reach such a system, the third actor works to sustain the relationship over time by acting as an intermediator and stabiliser. Such efforts of persistence over time results in direct connections among all three actors (Siltaloppi and Vargo, 2017). Thus, this type of triad and open triad structures move in the direction of eventually becoming a closed structure.

Triads can vary in form, and they have different characteristics. Vedel et al. (2016) distinguish between triadic contexts and triadic structures. First, a triadic context refers to a situation involving three actors where the unit of analysis is on a single actor or on a dyadic relationship. That is, the actors are seen through the eyes of the focal actor or a focal relationship. One study with a dyadic focus occurs in a study by Van Iwaarden and van der Valk (2013), where they examine how the buyer controls outsourced service deliveries in a triadic context. Second, Vedel et al. (2016, p. 142) define triadic structures in an interorganisational context saying that '[w]hen relationships between three directly or indirectly associated actors are connected, the structure constitutes an inter-organizational triad.' In triadic structures, actors take on the role of adjusting and coordinating activities (Vedel et al., 2016). The idea of reciprocity is present in triads affecting the manoeuvrability among the three actors, and Siltaloppi and Vargo (2017, p. 397) state that triads rely on the idea that 'each actor not only interacts directly and reciprocally with another actor, [but each] also operates as an intermediary between the other two.' The reciprocity becomes an important feature of triads because it changes the understanding of relationships and interdependencies among the actors. Hence, actors cannot plan a relationship but can only be a part of the development of it. In such a development, the surrounding actors shape and are shaped by the other actors. The interplay, its conceptualisation and the interdependence on a triadic level is important in one's endeavour to understand this 'small' network.

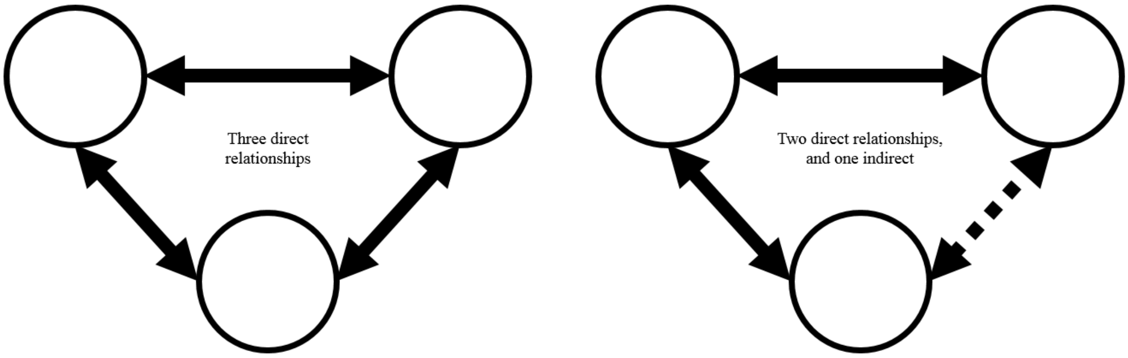

Figure 10. Two types of triadic structures

Triads can either have three direct exchange relationships or two direct exchange relationships and one indirect (see Figure 10). In the triad depicted on the left, direct connections exist among the three actors, and interactions among them can improve the utilisation of resources and facilitate quality improvements in the triad. In the triad depicted on the right, there are only two direct connections, while the third is indirect. Simmel states that '[T]he indirect relation does not only strengthen the direct one. It may also disturb it. No matter how close a triad may be, there is always the occasion on which two of the three members regard the third as an intruder' (Simmel, 1964, p. 135). Nevertheless, this type of triad can be filled with a significant amount of content, and it can be highly specialised and important in terms of resources and activities by providing a special service as well as connections to other business relationships. Business relationship characteristics as well as the substance are different among all actors. The substance is, as stated before, the activity links, resource ties, and actor bonds in a business relationship. Thus, the substance has implications for what can be achieved in business relationships (Håkansson and Snehota, 1995).

2.5.1 Triadic approaches in supply chains and logistics research

A triadic approach has been shown to be useful in purchasing and logistics in order to capture the interorganisational management of supply chains (Bask, 2001; Selviaridis and Spring, 2007; Choi and Wu, 2009b). A triadic approach can illuminate the connections among dyads, which is something that has not traditionally been a focus of supply (chain) management research (Choi and Wu, 2009a). Each actor in a triad – and the connections among the actors – affects the other actors in different ways that may lead to changes in the relationships. Studies in this area have been relatively scarce. However, there are studies of related areas, such as triads in supply networks (Choi and Wu, 2009b), interaction in business triads (Holma, 2012), matching logistics services to seller–buyer relationships in supply chains (Bask, 2001), and logistics innovation (Tanskanen et al., 2015). In addition, a triadic approach can augment research, complementing the one-sided buyer perspective that is often the norm in recent research (Chen et al., 2016). Today, networks are studied to a larger extent than before, and supply chains can be said to be interconnected in complex networks (Carter et al., 2015). Moreover, Bask (2001) takes a TPL perspective, suggesting that the term TPL implies a triadic approach, which makes the relationships among TPL providers and other members of the supply chain(s) interesting to study (Selviaridis and Spring, 2007). Selviaridis and Spring (2007) also propose that network research can capture indirect relationships, the interfaces between processes, and the relationships in the network. Most research on triads in SCM is concerned with manufacturing processes in triads comprising a buyer and its influence upon two suppliers (Wynstra et al., 2015). However, Wynstra et al. (2015) propose the concept of service triads, which they conceive as involving three parties and roles—a buyer, supplier, and a customer—in which the buyer contracts a supplier to deliver services directly to the buyer's customer. They have argued that service triads provide a critical context for understanding service processes in supply chains, as well as suggested some avenues for empirical studies *in* triads as opposed to *about* them (Wynstra et al., 2015).

Triads involve three interdependent parties. Thus, the relationships in the triad could be seen differently than those in the dyad. The difference is apparent because managing or changing anything between the buyer of goods and supplier of goods also affects the supplier of transport services. Thus, in order to understand the triad as a whole, the dyads within the triad and how they affect one another need to be understood (Wu and Choi, 2005). Supply networks are conjoined interorganisational relationships among several firms. Such networks are difficult to manage because of their unpredictability resulting from changes occurring in various parts of the supply network (Choi et al., 2001).

2.6 Transport efficiency in supply networks

The transport sector contributes immensely to CO_2 emissions. Transport efficiency in a broader sense, its meaning, and the ideas surrounding it have been discussed for decades (Moriarty and Honnery, 2012). Several authors argue that it is necessary to shift from a narrow view of transport efficiency – advancements that include technical aspects relating to types of fuels and engines – to a broader perspective (Baumann and Tillman, 2004; Léonardi and Baumgartner, 2004; Silva et al., 2006). Some studies have examined non-technical aspects of this problem; however, the scope has been limited. Aronsson and Huge Brodin (2006) argue that structural and organisational issues have only been addressed on a societal level, mostly concerning infrastructure. Therefore, a broader perspective is called for. Arvidsson (2013, p. 14) states that 'transport efficiency is not all about technical improvements, but also about behavioural and operational aspects'. Hence, several opportunities to decarbonise road freight transport exist in addition to those relating to technical advancements. One such opportunity is 'intra- and intercompany cooperation, which decreases the inefficiency caused by [the] geographical imbalance of goods flows and [the] lack of interfunctional coordination' Liimatainen et al. (2014, p. 379). Thus, transport efficiency concerns organising transport in the most suitable way possible. It does not consider the best or most effective way of doing this, only the most efficient approach. Firms have started to pay more attention to the environmental performance of surrounding partners, which can be regarded as one component of transport efficiency. Liimatainen et al. (2014, p. 386) state that '[the] literature shows that the shippers are increasingly interested in the environmental performance of the hauliers.' However, only a few firms are actively trying to reduce their carbon footprint from freight transport (Ellram and Golicic, 2016). In addition, Ellram and Murfield (2017) state that there is ample room to improve research on environmentally sustainable freight transportation, specifically transport-specific activities, partly in response to the lack of focus on transport due to a prevailing analytical focus on logistics in a broader sense.

The Swedish government have outlined its view on goods transport in Sweden's first national goods transport strategy document (Ministry of Enterprise and Innovation, 2018). Furthermore, the document is one part of an effort to join the directions of actors regarding the development of the Swedish goods transport system. In addition to the entire strategy, they provide their definition of transport efficiency. In their view, transport efficiency means that transport should be as efficient as possible from the perspectives of energy, environment, and economy in order to accomplish accessibility, sustainability, and competitiveness. To achieve this, it is necessary that accessibility can increase while the amount of traffic necessary to attain it decreases, that the vehicles used are energy efficient, and that the sources of energy employed are renewable and sustainable. They also state that there is great potential to increase transport efficiency, for example, by coordination of transport in order to increase load factor, reduce unloaded transport mileage, and improve the efficiency of routes (Ibid.).

2.6.1 Transport efficiency in relation to activities and resources

One way to address efficiency from a network perspective is by focusing on resource utilisation and activity coordination. Activity coordination can be handled in different ways, and this may call for require direct contact among the actors involved. In any case, specific coordination is always necessary to accommodate delivery frequencies, transport destinations, time specifications, and the types of goods to be transported. According to Rogerson (2016), the process of purchasing freight transport is especially important to capturing different demands in terms of logistic variables such as load factor, fuel efficiency, and empty running of trucks. For example, specific requirements related to time are particularly significant as factors of logistical variables and consequently affect a transport provider's ability to coordinate transport activities and utilise resources. Also worth consideration are the purchasing processes of buyers of transport services, which influence transport providers' decision-making ability about transport activities and resources (Rogerson, 2016).

These transport activities are part of the relationships among involved actors. The resources involved are those activated by the actual transport activity (e.g. trucks) and other resources needed to carry out the transport (e.g. terminals, IT systems, infrastructure, and road space). Resource utilisation – i.e. how activities activate resources – is fundamental in order to achieve efficiency. As stated in section 2.2, efficient resource utilisation is enabled by similarity among activities (Richardson, 1972). On the one hand, similarity among transport activities is needed in order to utilise the capacity limits of the truck (e.g. fill rate) in an efficient way for transporting goods from point A to point B. On the other hand, to fully utilise the truck as a resource – that is, to use the truck to also transport goods back from point B to point A – requires coordination among activities. As such, it is apparent that resource utilisation can be achieved by organising between firms.

In a recent study, Sagen and Ingemansson (2018) show how three actors are involved in a corporate sustainability initiative and how vital business relationships and interactions with other firms are in this effort. They emphasise how the embedded characteristics of corporate sustainability are overlooked, providing new insights in the matter by taking a network perspective instead of a single-firm perspective. From this backdrop, the efficiency of transport activities today is being given a higher priority than before because of the possible positive economic, environmental, and societal effects (Liimatainen et al., 2014; Montabon et al., 2016).

2.7 Research problem and research questions

To recapitulate, The aim of this thesis is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach. The triadic approach is the first analytical step towards a network analysis. Hence, the triad is the bridge between single relationships and the larger network. The Transport Service Triad as identified in this thesis involves three actors: (A) the seller of goods, (B) the buyer of goods, and (C) the seller of transport services. Furthermore, transport services involve several activities and resources related to transport and logistics. Hence, the triad involves three core business relationships, A–B, A–C, and C–B (see Figure 11). A first issue hence concerns the analysis of these three single relationships in the triad.

A model for analysis of relationships is presented by Håkansson and Snehota (1995), based on the three cornerstones activities, resources, and actors and its related concepts. First, in each relationship there are interdependencies and adjustments among activities, depicted in Figure 11 as arrows within each actor. Second, the relevant resources, depicted as boxes within each actor in Figure 11, are the ones activated by the means of the activities. These resources are combined in different ways by the actors and different resources are also adapted to one another. Third, the actors, depicted as circles, organise in networks and interact on different organisational levels as they are embedded and connected to other actors. Furthermore, issues related to transport efficiency from a relationship perspective is of special interest here.

The next step deals with transport efficiency seen from various levels and perspectives. Relating to Figure 11, a second issue is to discuss transport efficiency on four different levels: (1) firm level, (2) relationship level, (3) triadic level, and (4) fourth party level (external to, but influencing, the triad). Each of these levels of analysis can be discussed in terms of activities, resources, and actors. Depending on the level of analysis, transport efficiency can be higher on some levels while lower on other levels. Actors will also perceive transport efficiency in different ways. Hence, as the actors in the TST have different perspectives on efficiency in general and transport efficiency in particular, different challenges can emerge as a consequence. To identify such challenges is a starting point to understand transport efficiency in supply networks. A second issue hence concerns the analysis of transport efficiency on the four levels outlined above.

The importance of moving from an analytical focus on relationships to an analytical focus on triads in order to approach the network level was highlighted above as a key to understanding transport efficiency. One way to structure such an analysis is to scrutinise how one relationship in the TST—for example, between the seller (A) and the buyer of goods (B)—is affected by the third actor—the seller of transport services (C). Accordingly, a third issue is to discuss how transport efficiency is affected when a third actor is added to the analysis.

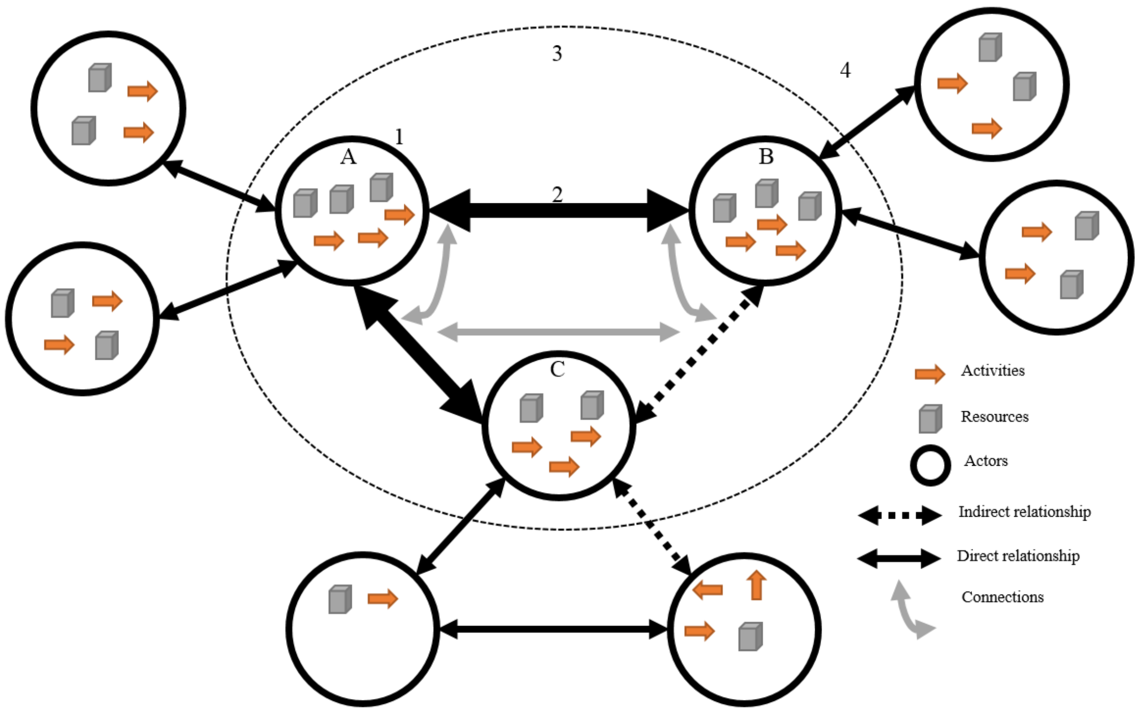

Figure 11. The focal Transport Service Triad embedded in a supply network

From the discussion above the following three research questions are formulated:

- RQ1: How can each of the three relationships in a TST be described and analysed regarding:
    - interdependencies and adjustments in the activity layer;
    - combining and adaptations in the resource layer;
    - organising and interaction in the actor layer; and
    - what are the effects on transport efficiency?

- RQ2: How can transport efficiency be analysed in the three network layers, activities, resources, and actors on:
    - the firm level;
    - the relationship level;
    - the triadic level; and
    - the fourth party level?

- RQ3: What does a triadic approach contribute to in contrast to a dyadic approach when analysing transport efficiency?

3. Methodological considerations

This chapter deals with how methodological considerations have been handled. The chapter starts with an overview of the research context in which this study was conducted and continues with a description of the research strategy, the case study design, the data collection and the performance of the analysis. This is followed by a discussion of how the approach 'systematic combining' was used, and a description and discussion of the research process. The chapter ends with a discussion of reflexivity and of the research quality of the study.

3.1 The research context

The study started in February 2016 with a project funded by the Swedish Energy Agency called 'Energy efficient freight – methods, actions and evaluation tools in logistics', henceforth referred to as ENERGO (from the Swedish abbreviation). The project involved researchers from Chalmers University of Technology, the Swedish Environmental Research Institute (IVL), the Centre for Environment and Sustainability (GMV), and the Network for Transport Measures (NTM). The aim of the project was to study and analyse how a change in the planning processes in production and logistics could accomplish more energy efficient freight transport. The project involved several companies across different industries and each of these companies focused on a specific part of their logistics activities in the project. The study mainly focuses on three actors forming a Transport Service Triad: *ProDist*, *Consgro,* and *Haulcom.*

3.2 Research strategy and design

This research employs a qualitative research design. The focus on qualitative research is to provide an insight into a problem, highlight issues, and provide possible explanations (Flick, 2014). Qualitative methods start from the perspective of the subject under study (Alvesson and Sköldberg, 2009), and Denzin and Lincoln (2011) emphasise the researcher's own participation and interpretations. It is a search for meaning from the evidence of what people do and say (Gillham, 2000), and 'why' and 'how' questions are often asked to capture this. One frequently used qualitative method in business research is the case study design (Eisenhardt and Graebner, 2007). The case study design is used in this thesis to close in on the Transport Service Triad as one entity. The case study design also allows for the inclusion and combination of multiple sources of evidence, and because a convincing, deep, and rich case description was deemed necessary (Ellram, 1996; Dubois and Araujo, 2007). In this study, a model proposed by Maxwell (2012) is used to illustrate the research design. The model involves five interacting elements in a qualitative study. This study's design is illustrated in Figure 12 below and further elaborated upon in section 3.6, whereas the current section presents the final research design.

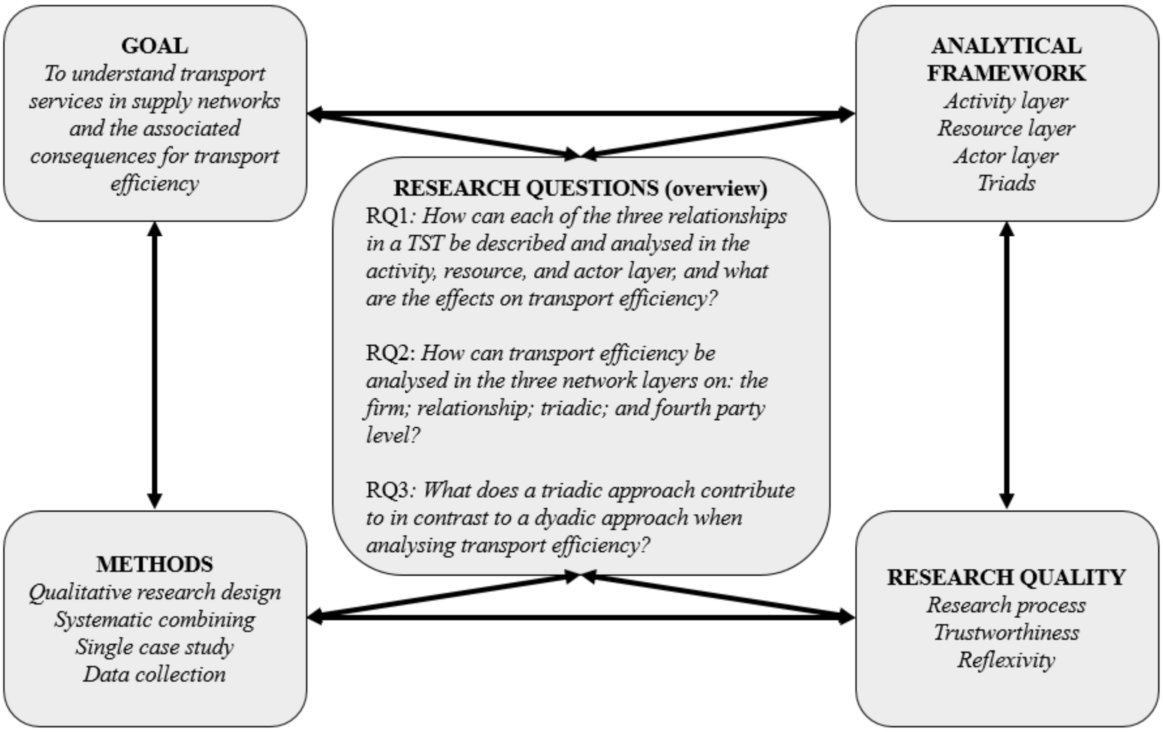

Figure 12. Interactive design process. Adapted from Maxwell (2012)

The first and central box in the model is the research question(s). Surrounding this, four more design elements are presented: goal, framework, methods, and research quality (note that Maxwell refers to validity). One key notion from the model is its interactive nature with the research question in the centre connecting and affecting all the other four elements. This makes the process everything but an 'off-the-shelf' process (Maxwell, 2012).

The goal of this study (upper-left box) is to understand the transport services in supply networks and the associated consequences for transport efficiency. The formulation of this study's goal was inspired by the need for firms to shift from solving environmental issues with technology and instead focus on how firms can organise both within and between firms. The analytical framework (upper-right box) is structured to be able to analyse single relationships, how they are embedded in a Transport Service Triad, and how transport efficiency is affected in regard to the activities, resources, and actors in the supply network. Moreover, the triadic concept provides an analytical starting point in the connectedness (Laage-Hellman, 1989; Halinen and Törnroos, 1998) among firms and how they relate to one another and how they can organise for efficiency. This formed the three research questions of the study (centre in Figure 12). The first question was developed with respect to the three network layers—activities, resources, and actors—whereas the second was formulated to highlight the consequences on different network levels. The third question was developed to understand how transport efficiency is affected when a third actor is added to the analysis of a dyad. All three questions are relevant to the purpose of studying how the (inter-)organising of transport services impact on transport efficiency by taking a triadic approach.

The research quality (lower-right box) in this study concerns the research process, the researcher's reflexivity together with a discussion on trustworthiness as a quality criterion (Lincoln and Guba, 1985; Halldórsson and Aastrup, 2003; Alvesson and Sköldberg, 2009). This will be further discussed in sections 3.6 and 3.7. In addition, Dubois and Gadde (2014) stress two important issues regarding research quality. The case presentation should not just be a long and rich description of events unfolding which later is put into predefined theoretical categories. The focus should instead be on the matching of the case and the theoretical framework (Dubois and Gadde, 2002). Therefore 'systematic combining' is an approach for scientific reasoning used in this thesis. The methods used in this thesis (lower-left box) as well as reflexivity (Piekkari et al., 2010) are highlighted, since they impact the strengths and weaknesses of this thesis and consequently the understanding of the findings. The case study approach and the data collection are described in sections 3.3 and 3.4, respectively.

3.3 Case studies and the single case approach

Case studies offer an opportunity to gain in-depth knowledge about the phenomenon in focus (Flyvbjerg, 2006). Flyvbjerg (2006, p. 235) states that 'the advantage of the case study is that it can "close in" on real-life situations and test views directly in relation to phenomena as they unfold in practice.' Case-based research is a well-established method in research dealing with business networks (Halinen and Törnroos, 2005; Easton, 2010; Piekkari et al., 2010) and Easton (1995, p. 371) argues that 'case research is perhaps the most appropriate methodology for research into Industrial Networks.' Case-based research can apply either a multiple case study approach or a single case study approach (Dubois and Gadde, 2002; Flyvbjerg, 2006; Siggelkow, 2007). The single case study approach is chosen in this study because of the researcher's ability to focus on a single Transport Service Triad where various contextual details can be studied. The single case study approach pays attention to the specific research context and enables the researcher to narrate a story and provide a powerful illustration (Siggelkow, 2007). Also, Dubois and Gadde (2002) and Flyvbjerg (2006) both argue that single case research is advantageous when aiming for depth and richness. In line with Siggelkow (2007), the case in this study has enabled a rich illustration of a Transport Service Triad and how the involved firms engage in organising for transport efficiency.

The single case study in this thesis focuses on a Transport Service Triad and the relationships among its three actors. The study tries to capture the research context in terms of the relationships and different logistical set-ups. It is important to get a comprehensive view of the surrounding network as well as to capture the adaptations and interactions within the network and among the relationships within the boundaries of the single case study. Boundary issues need to be addressed in all (single) case studies (Dubois and Gadde, 2002). The case takes as its point of departure the focal Transport Service Triad and the three involved business relationships and firms. However, in order to capture the relevant context of the focal TST, the case stretches beyond the focal TST. The boundary of the case was successively changed over time when new actors where confronted, when research questions were reformulated and as the analytical framework developed. Finally, when the researcher found that enough information was gathered to answer the research questions the case boundaries were 'locked'.

3.3.1 Case selection and the process of casing

Casing is defined as the process of 'making something into a case' (Ragin, 1992). This process means scrutinising material and carefully selecting empirical evidence which can help make vaguely defined theoretical ideas more explicit. To highlight empirical evidence, one needs to select cases. Case selection is one of the most important methodological aspects in case studies and qualitative research (Dubois and Araujo, 2007).

Through the ENERGO project, ProDist, a large technical wholesaler within heating and plumbing was identified as an interesting study object. To identify a Transport Service Triad to study further one of ProDist's main customers, the construction company Consgro was included in the study. A main reason for this was that Consgro and ProDist had recently initiated some initiatives which could be fruitful to study further. One such initiative involved the haulier Haulcom, which was therefore also chosen to be included in the study. Hence, the study mainly focuses on three actors forming a Transport Service Triad: ProDist, a wholesaler of technical equipment; Consgro, a construction company; and Haulcom, a transport service provider. Furthermore, to focus on the construction industry was not decided ex-ante. Instead, it developed in dialogue with the study's partners. ProDist first suggested Consgro, since they together had identified environmental challenges and challenges with both deliveries to the construction site and on-site logistics. This helped to anchor the case in this study. The interplay between making sense of the theory, in relation to the empirical evidence, as well as the problematisation of the research, is a result of the casing process.

3.4 Data collection and analysis

The data were collected between early 2016 and early 2018. The primary source of data was interviews with the officials from ProDist, Consgro and Haulcom, and a small number of participant observations from visits at each of the three companies. Moreover, data were acquired in project meetings in the ENERGO project. Data were also extracted from various company documents of the three companies and other relevant partners. In addition, files about the transport operations were extracted from the companies' business systems. In order to capture the respondents' roles in each company and their subsequent knowledge about procurement, marketing, transport, logistics and environmental problems, the data collection focused specifically on the relevant actors working with these topics. In addition, each of the three business relationships embedded in the triad has been analysed in the context of the other two dyads to which it is connected, and from both ends (Halinen and Törnroos, 1998).

3.4.1 Interviews

Interviews have been said to be an effective method for collecting data. In total, 14 data collection occasions (interviews, site visits, and project meetings) were held. Interviews were held with 11 unique respondents from different company functions. Interviews have been carried out with all three actors in the Transport Service Triad plus one additional logistics service provider. These interviews have been important to capture diverse perspectives and different business logics from each actor in the case (Eisenhardt and Graebner, 2007). A semi-structured interview format was used to avoid constraining the interviewees and encourage them to open up to provide additional information. This way of conducting interviews also helps to control the process in which the respondent gets to answer or discuss a topic and the interviewer directs the questions in relation to the interview guide, or spontaneously creates questions based on the topics discussed during the interviews. Semi-structured interviews enable follow-up questions and redirection of questions throughout the interviews (Creswell, 2014). The interviews were conducted, audio-recorded, and transcribed in Swedish. When writing the 'raw case', the information was translated into English. The length of the interviews varied from 30 to 150 minutes; however, several of the interviews lasted 90 minutes or longer. After the interviews, some of the respondents were approached via email for clarification and follow-up questions. In addition, field observations at Haulcom and ProDist were conducted. These field observations provided a good overview and elevated the understating of the processes in ProDist's warehouse and Haulcom's terminal. Notes were taken throughout the site visits and pictures were taken. Table 3 shows a summary of the interviews, project meetings, and observations at site visits.

Table 3. Overview of interviews and site visits

Company and data source	*Interviewee(s) and Sequence in Figure 13 (1-16)*	*Date (14 occasions)*	*Duration (in min.)*
ProDist			
Interview***	Head of Transport (1)	29/04/2016	***180
Telephone interview	Key Account Manager (2)	16/01/2017	*30
Interview	Key Account Manager (2)	24/01/2017	**90
Interview	Key Account Manager (5)	28/02/2017	90
Site visit and Interview***	Head of Transport (12) Transport Developer (13)	24/04/2017	***210
Interview	Transport Developer (15)	12/10/2017	150
Consgro			
Telephone interview	Category Manager (3)	16/01/2017	*30
Interview	Category Manager (3)	24/01/2017	**90
Interview	Category Manager (4)	10/02/2017	45
Interview	Sustainability Development Leader (6)	28/02/2017	90
Telephone interview	Logistics Manager (7)	27/03/2017	60
Haulcom			
Site visit and Interview	Transport Manager (8), Terminal Manager (9), Quality Manager (10), Vice President (11)	3/04/2017	240
Interview	Transport Manager (14)	24/05/2017	60
LSP			
Telephone interview	Network Engineer (16)	27/10/2017	30

* interviewed jointly (telephone) ** interviewed jointly *** project meeting

The sequence of the interviews is presented in Figure 13. The sequence is important as one interview inspired questions for the next, and thus the interview guide was developed as a result of the interactive process between the interviewees and the interviewer(s).

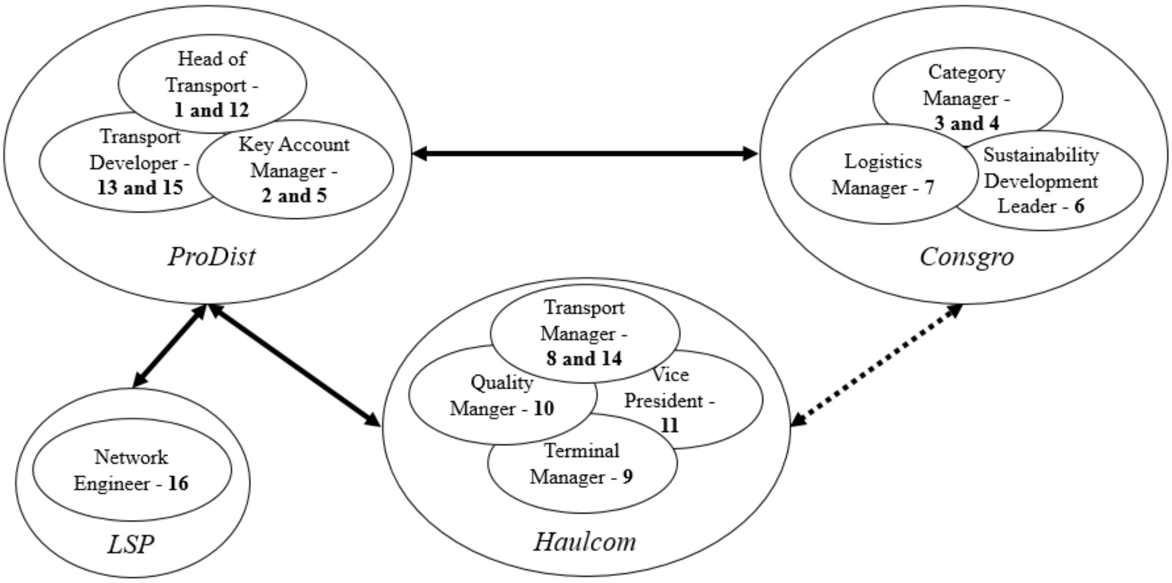

Figure 13. The sequence of interviews

Snowball sampling – the process in which a group of people propose other participants as being valid interview objects within a research process – proved to be an appropriate method for data collection. In practice, this implies that certain employees are selected by their own co-workers as being relevant to the research (Bryman and Bell, 2015). Representatives from the companies were therefore approached with regard to the ProDist–Consgro relationship and asked if they could propose interview participants. Respondents were chosen based on their knowledge within their specific field of work, with the aim being to identify people to interview who understood and could outline the respective firm's view.

Figure 13 illustrates the sequence of interviews being conducted during this case study. From the first interview with ProDist's *Head of Transport* (1), it became clear that the interviewee did not have all the details regarding the business relationship between ProDist and Consgro. This led to an interview with one of ProDist's *Key Account Managers* (2), who had a good understanding of the business relationship with Consgro. The interview with the *Key Account Manager* was held in conjunction with Consgro's *Category Manager* (3) to get a holistic and detailed view of the business relationship between the parties. A second interview was subsequently held with the *Category Manager* (4) to follow up on the previous interview, which led to a deeper discussion of buyer-specific issues.

After that interview, ProDist's *Key Account Manager* (5) was interviewed once more to capture the history and development of the business relationship with Consgro. Furthermore, the interview dealt with how the key account managers at ProDist worked with their most important customers on a day-to-day basis as well as on a strategic level. Finally, the possibilities and obstacles of initiating the development of a new transport solution from the key account manager's perspective were discussed. This was followed by two interviews with representatives from Consgro, the *Sustainability Development Leader* (6) and the *Logistics Manager* (7), both of whom had in-depth knowledge about specific issues.

After the seventh interview, a substantial amount of information had been collected from Consgro and ProDist and some information had also been collected about Haulcom. To gather more information on Haulcom's role in the TST, the following interviews focused on interviewees employed at Haulcom. The first interview was held with the *Transport Manager* (8) to gain a better understanding of new transport solutions and how these would affect Haulcom. To get a more in-depth understanding of Haulcom's terminal operations, the *Terminal Manager* (9) and *Quality Manager* (10) were interviewed. Strategic issues and the business relationship with ProDist were then discussed with the *Vice President* (11), with a focus on Haulcom's perspective. The managers at Haulcom supplied detailed information about their operations and how the relationship, especially with ProDist, had developed. An interview was then held with both ProDist's *Head of Transport* (12) and the *Transport Developer* (13). The interview provided a description of how ProDist had developed a general transport set-up for their customers. A second interview with the *Transport Manager* (14) was held to follow up on questions that had come up during other interviews and to discuss different transport scenarios. This was then followed by an interview with ProDist's *Transport Developer* (15) to acquire information about their environmental goals and strategic work. Lastly, an interview was held with a *Network Engineer* (16) at a large LSP operating in Europe, to acquire information about a specific transport flow from southern to northern Europe. All interviews were audio-recorded and subsequently transcribed. Over time, the transcriptions were grouped into themes. For example, general information about all three actors – ProDist, Consgro, and Haulcom – became one theme each. Other themes concerned environmental issues, information handling, purchasing, logistics, supplier management, and the business relationships. Each theme included material from all the respondents, regardless of affiliation. This was the base upon which the case narrative was constructed. All interviews, observations, and additional secondary data contributed to the case description that gradually evolved over time.

3.5 Systematic combining

The relationship between theory, empirical data, framework, and analysis in this study is best described as systematic combining (Dubois and Gadde, 2002). The logic behind this is called abduction and is defined by Kirkeby (1994, p. 147) as ‘an exploration of a set of facts, which are permitted to suggest a theory’. When an abductive approach is applied, the researcher is not able to identify all the relevant theory, since the empirical fieldwork parallels the theoretical conceptualisation. Hence, the need for theory is created during the research process. Systematic combining (see Figure 14) is a continuous process in which the theory is confronted with the empirical world, and in the same way the framework is confronted with the case (Dubois and Gadde, 2002).

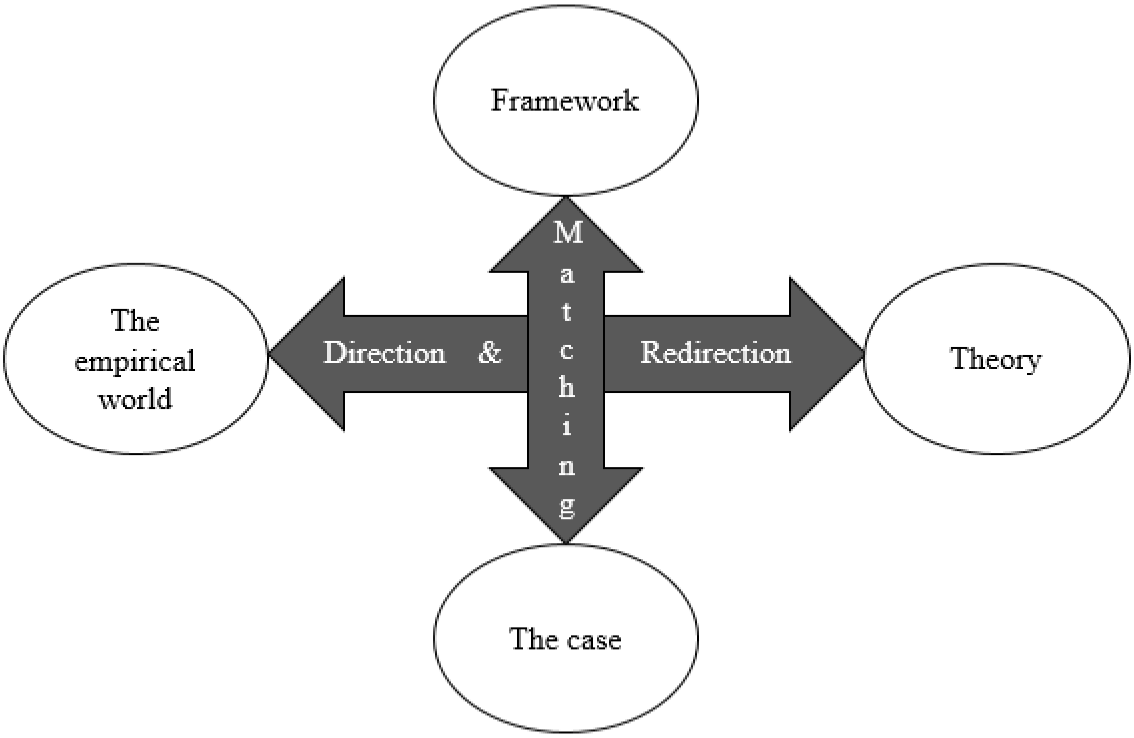

Figure 14. Systematic combining. Adapted from Dubois and Gadde (2002)

The horizontal part of Figure 14 illustrates the interaction process between theory and the empirical world when the researcher goes back and forth between these two, leading to redirections when discovering something new, be it in the empirical world or in theory. The vertical part of the figure illustrates the process of matching, i.e., matching the framework with the case description. The case-based research strategy and design employed in this study and the propriety for ‘how’ questions and rich case descriptions led to the use of systematic combing thought. Hence, the current study is based on this approach, with the next section providing a snapshot of minor and major changes in the process considered important for the final study.

3.6 The research process

According to Flick (2014) the research process should be seen in the light of the available resources, thereby making the process a matter of goals, research questions, theoretical frame of reference and the empirical material on which it is presented. When this research process started in 2016, the outset of the ENERGO project was to investigate how the business relationships and processes between the actors were organised and the project's aim was *to identify structures that enable or prevent more sustainable logistics*. The ENERGO project and the study in this thesis ran in parallel, but they had different foci. The following describes the study in this thesis.

After initial meetings with all the involved actors, the working aim of this study became *to identify how potentials in supply chains with regard to environmental effects can be realised through business relationships*. From this point in time, redirections were identified within the case. ProDist's customer Consgro initiated a change to reduce environmental impacts by reducing the number of deliveries (performed by Haulcom) to its construction sites in Stockholm. This led to a new aim of the study: *to investigate how supplier relationships can contribute to reorganising supply chains in order to reduce environmental impacts.* In the first quarter of 2017 the case developed further as the transport service provider Haulcom became a part of the case. Transport came into focus in light of the Green Month Project launched by Consgro and ProDist. Haulcom, as the seller of transport services, was an important actor in that project since it is the actor that makes the deliveries to customers. This led to a theoretical concept, namely triads, being explicitly anchored in the study's purpose and the working aim became *to investigate how environmental impacts in supply chains can be reduced taking a triadic approach*. However, sustainability (in this case environmental impacts) is an extremely complex concept and it became evident that this study is not about sustainability as a holistic, aggregated concept (e.g. the triple bottom line) or environmental impact per se, nor about efficiency, including a wide range of different typologies. The study advanced to be about transport services as embedded in a supply network. This led to a new aim which was *to understand transport services as embedded in supply networks*. The question of what a transport service is arose, which in turn triggered a need to go back to the literature for the definition of a transport service. Transport services include a wide variety of activities connected to the transport of goods, including activities in a warehouse, terminal, or construction site but also the physical movement of goods between two points. Transport services involve not isolated entities in networks but various interconnected firms in those networks. The ARA model (see Chapter 2.1) was introduced to clarify transport services in terms of the variety of activities involved, the resources used, and the actors performing the activities by using resources. As a result, the three layers revealed different aspects of the interaction in regards to the ARA model. The focus was initially on transport activities, though for actors to perform such activities, resources are needed, which required delving deeper into resources used in logistics. The ARA model thus served as a tool for explaining transport services in supply networks. At the same time, understanding transport services in supply and business networks (IMP) requires empirical material. As such, the IMP research tradition is a two-way process that facilitates the understanding of both the empirical world and the theoretical spectra.

The study positioned transport activities as embedded in supply networks in order to identify how firms, by way of the transport activities, can affect transport efficiency. Consequently, a new aim was *to explore how the embeddedness of transport activities impacts on transport efficiency*. That new aim required to further explore the theoretical framework, and a clear distinction between energy efficiency and transport efficiency was outlined to that end. Transport services were added because not only the activities but also the resources and actors involved and how they organise their transport services matter. Moreover, the embeddedness of transport services had to be specified to wherein it is embedded because it is not given and omnipresent based only on the context. This led to a new aim which was to *explore how the embeddedness of transport services in supply networks affects transport efficiency*. However, neither their embeddedness nor how it affects transport efficiency is as important as how transport services are organised and how organising activities and resources affects transport efficiency. Given the importance of the TST as a unit of analysis for understanding changes in the transport system and capturing each actor's perspective on efficiency, the final (and present) aim of this thesis is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach

The study presented in this thesis is the result of ample interactions with industry through the ENERGO project and with academia through seminars, conferences, and workshops. The study and earlier versions of this thesis have been presented at several conferences and workshops (see Table 4 for research proposal, conferences, and workshops).

Table 4. Workshops and Conferences

Nordic Workshop on Supplier Relationships	Research Proposal	Nordic Workshop on Interorganisational Research	IMP Conference and Doctoral Consortium
1st, Aalborg (DNK), May 2016 **Title:** *Towards more sustainable supply chains: Realising potentials through relationships*	Chalmers (SWE), December 2016 **Title:** *Contribution of supplier relationships through reorganising*		
2nd, Gothenburg (SWE), June 2017 **Title:** *Reducing environmental impact in supply chains: A triadic approach*		23rd, Stavanger (NOR), April 2017 **Title:** *Reducing environmental impact in supply chains: A triadic approach*	33rd, Kuala Lumpur (MYS), September 2017 **Title:** *Reducing environmental impact in supply chains: A triadic approach*
3rd,Trondheim (NOR), May 2018 **Title:** *Organising in the Transport Service Triad*		24th, Vaasa (FIN), April 2018 **Title:** *Organising in the Transport Service Triad*	

In addition to workshops and conferences, one academic paper (Andersson et al., 2019) was written during the project with a particular focus on the Transport Service Triad as a key unit of analysis. The first ideas to conceptualise the TST resulted from a study focusing on buyers of transport services in 2011. From that study, it became apparent that the transport set-up always includes an interplay between the three firms in the TST and that one or more of these firms may take initiatives to change the set-up and that all of them more or less influence how transport solutions develop over time. The TST thus became a starting point for the current study. The article uses excerpts from the case study presented in this thesis to illustrate a TST. The article has been accepted by the *Journal of Business and Industrial Marketing*, an academic journal focusing on business-to-business marketing.

3.7 Reflection on reflexivity and research quality

It is important to be able to show that the conducted research is of good quality and that the researcher is self-aware of the choices made. The quality of the research is motived by (1) the use of the systematic combining approach and the research process, as described above; (2) reflexivity, thereby showing self-awareness and transparency; and (3) a notion of trustworthiness as one evaluating mechanism of the research. Thus, the next sections deal with a reflection on reflexivity followed by a reflection on the research quality of the current study.

3.7.1 Reflexivity

One essential part of the research process is reflexivity, or self-awareness. Alvesson and Sköldberg (2009) state that the researcher should interpret and reflect carefully about the empirical material. This calls for an in-depth understanding of how it is interpreted, as the empirical material is a mirror of reality. It is important to show a sufficient amount of data – to be selective but not too selective. Hence, there is an endeavour to show data that is of interest to the study, the reader, and the researcher. Reflexivity also highlights the significant impact of the researcher on the study itself (Piekkari et al., 2010; Denzin and Lincoln, 2011; Bryman and Bell, 2015). Researchers learn continuously throughout the process. However, the documentation of what and how people learn is seldom discussed in a manuscript despite its importance (Dubois and Gadde, 2002, 2014). This research will hopefully shed some light on reflexivity and learning and provide a better understating by describing the underlying thought process. In addition, by describing the research process (section 3.6) as well as the researcher’s a priori knowledge about the context, quality will be assured.

The researcher’s a priori knowledge and the assumptions made in this research stem from both working and studying in the field of logistics and transportation for several years. In regard to work, the knowledge acquired comes from working in a warehouse for a large logistics service provider for eight months and in transport administration (coordination) for 12 months. In regard to studying, the knowledge acquired from studies at the university predominately revolved around logistics and maritime management. The main theoretical streams outlined in this thesis were mostly unfamiliar. The industrial network approach was more or less a completely new theoretical domain, as was the literature on triads. All in all, these studies have noticeably shaped the researcher, the learning process, and the research process. For example, knowledge about the context has helped in discussions with peers, on the one hand, to understand the respondents' immediate view, and on the other hand, to ask the interviewees industry-specific types of questions.

3.7.2 Research quality

The quality criterion of trustworthiness is used to discuss one aspect of the quality of this research. Trustworthiness includes four dimensions: credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985; Halldórsson and Aastrup, 2003). The first dimension, *credibility,* relates to the fact that it is necessary to accept the lack of one single objective reality, and instead accept that reality only exists in the minds of the participants (Erlandson et al., 1993). Thus, it should pervade the entire research process, as a continuous process of learning, and not just at one specific point in the process. Lincoln and Guba (1985) propose a set of credibility activities, including member checks, peer debriefing, prolonged engagement, and referential adequacy to reach credibility of the research. *Member checks* relates to activities in which data, interpretations, and conclusions are tested on those providing the data. Several interactions with the members have occurred throughout this research process. The interviews have provided many opportunities to check information gathered in previous interviews as have email correspondence throughout the research process. In addition, the project meetings have also provided opportunities to check data with the project members by commenting on the data collection and preliminary analyses. The ENERGO project report was sent to the involved firms to give them an opportunity to comment and clarify. *Peer debriefing* concerns the exposure of the research to peers. Throughout the research process, several debriefings occurred with peers at conferences, workshops, seminars, in different review processes, and with project partners. *Prolonged engagement* relates to the time spent in the empirical context of the research. The a priori understanding of the field and the duration of the research process have provided ample opportunities to develop a contextual understanding of what this thesis deals with. *Referential adequacy* refers to the degree to which parts of raw data are sufficiently archived for later analysis. This has been some was somewhat troublesome because the raw data have been interpreted in the process of writing to create a raw case to serve as the backbone of the case description. In the process, some data considered to be irrelevant to the study were excluded, whereas other data simply indicated the need for additional data. In line with what Dubois and Gadde (2002) propose, the excluded parts have been vital for the researcher's learning and understanding but can at the same time reduce the reader's overall comprehension of the case. The description above outlines how the work with this thesis has proceeded; and to secure that credibility has been achieved, the work has been performed as described.

The second of the four dimensions, *transferability,* deals with checking (and validating) the findings as well as providing rich and detailed descriptions of the data so that others can check it elsewhere (Schwandt et al., 2007). The thick-case description provided in this thesis of the operations of firms, their relationships and the larger context in which they are situated adds to the transferability. An additional dimension of transferability is generalisability, that is, the general application of the findings (Guba and Lincoln, 1989). Easton (1995, pp. 381-382) states that 'one case is enough to generalise: not generalising to any population but to a real world that has been discovered.' The Transport Service Triad is not only applicable within the scope of the firms presented in this case. Instead, the TST should be seen as an example of illustrating transport activities' embeddedness in supply networks, and a starting point in exploring the TST in other supply networks. Hence, each supply network context is unique, but the TST should be seen a generic conceptual tool to explore the uniqueness in such supply networks.

The third dimension, *dependability,* relates to the process itself and the logic behind the process, as well as to how decisions were made. Dependability is achieved when the researcher with clarity can show the logic behind the entire process and the decisions taken during the process (Halldórsson and Aastrup, 2003). Records were kept throughout the entire research process whenever the researcher was confronted with new empirical material and input from peers. The study's dependability was ensured by keeping those records, including the directions and redirections in the research process (Dubois and Gadde, 2002), as well as in the writing of this thesis.

The last dimension, *confirmability* (which is highly intertwined with dependability) means that the findings should be representative of the study and not a result of the researcher's bias. The data collection has to 'speak' for itself and the interpretations have to be grounded in the data. The collected data were matched with the main theoretical notions outlined in the framework. Moreover, one way to increase confirmability is to work with transcribed material. Transcriptions are important as they provide the researcher with a solid database for analysis and the ability to revisit the material (Flick, 2014). Thus, transcriptions are related to confirmability and, as a result, research quality. In addition, the data have been interpreted by several researchers during internal seminars as well as at international conferences and workshops prior to analysis but also on different occasions during the analysis. All in all, the emergent process of confronting theory and the empirical world throughout the entire study contributed to the study's confirmability.

4. Introduction to the case

The chapter starts with three sections describing each of the actors involved in the focal Transport Service Triad; ProDist, Consgro, and Haulcom. This is followed by an illustration of a product's path, involving the focal Transport Service Triad, ending up at the point of consumption.

Three Swedish firms – ProDist, Consgro, and Haulcom – compose the focal Transport Service Triad (TST). ProDist is the supplier of goods and buyer of transport services; Consgro is the buyer of goods; and Haulcom is the seller of transport services (see Figure 15 below).

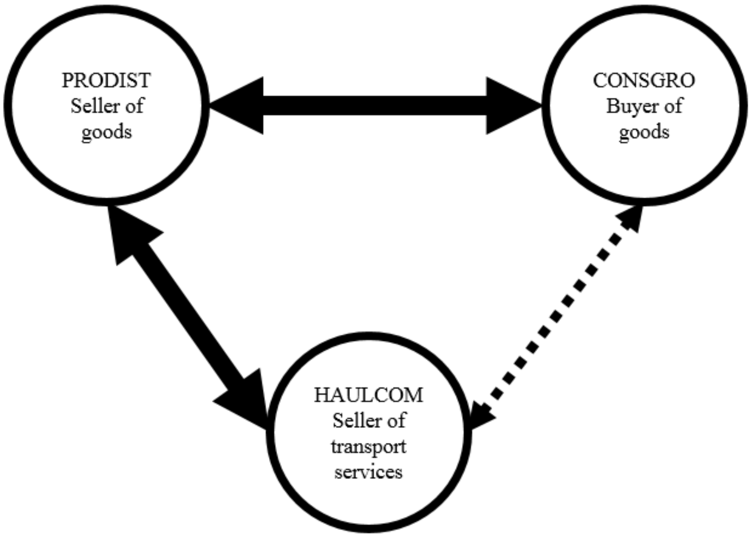

Figure 15. The focal Transport Service Triad

ProDist is a technical wholesaler supplying installation products to several industries, one being the construction industry which accounts for approximately 25% of ProDist's sales. One of its main customers in the segment is the construction firm Consgro. ProDist has been a supplier to Consgro for over three decades. Haulcom is a transport service provider and transports goods to ProDist's customers in the Stockholm area. ProDist has been a customer of Haulcom's for over three decades.

In the forthcoming three sections, each of these actors are described. In Chapters 5–7 the three relationships illustrated in Figure 15 are described and analysed. Chapter 5 deals with the ProDist-Consgro relationship, Chapter 6 with the relationship between ProDist and Haulcom, and Chapter 7 with the relationship between Haulcom and Consgro.

4.1 ProDist

ProDist is a Swedish technical wholesaler providing installation products to customers in the heating and plumbing segment. The company has an annual turnover of around SEK 20 billion and offers three broad product segments: (1) heating, ventilation, and air conditioning (HVAC); (2) electrical; and (3) tools and machinery. The construction industry, in which the products are used throughout the entire project cycle, is one of ProDist's most important segments. ProDist has customers in all the Nordic countries and in some countries in the Baltic area. In addition to selling products, they also provide logistics and transport services. The company strives to provide solutions in which the customer makes one purchase and receives one invoice and one delivery. They have about 80,000 items in their product assortment and they sell this assortment through approximately 120 physical stores and an e-commerce portal that accounts for 30% of sales in Sweden. They also have offices with internal sales forces in the eight regional areas of Sweden. Furthermore, the company can be reached via email and telephone to support customers and provide detailed information about products and solutions. Altogether, about 10+ million order lines are generated each year, resulting in the handling of around 50,000 order lines per working day. On the supply side, ProDist works with a large base consisting of approximately 3,000 suppliers.

4.1.1 ProDist's logistics and transport operations

ProDist's operations are focused around a central warehouse in the southern part of Sweden. Over 500 employees work at the warehouse, and every day 25,000 +/- 5000 packages are collected, sorted, and shipped. Approximately 75% of the products (in volume) are distributed through the warehouse. The remaining 25% (in volume) are bulky goods or goods with special attributes that are delivered directly from the suppliers to the end customers. Of the goods delivered from the warehouse, 75% are delivered directly to end customers through 35 cross-docking terminals, and the remaining 25% are delivered to one of the local stores (see Figure 16). In total, approximately 150 trucks are arriving or departing every day with goods from the warehouse. An average delivery consists of approximately four order lines, which relates to the fact that 44 order lines are loaded onto one loading meter[4] of a truck.

[4] One loading meter is one meter of loading space in a truck.

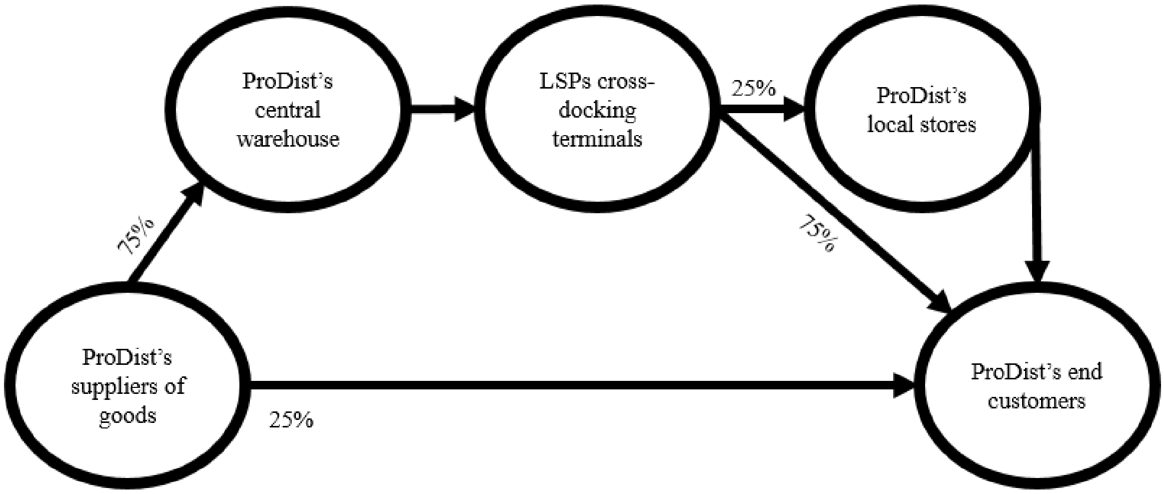

Figure 16. ProDist's flow of goods.

ProDist is a large purchaser of transport services in Sweden. They do not operate any trucks themselves; instead, all transport services are purchased from external transport service providers. ProDist uses either Logistical Service Providers (LSPs) or independent hauliers with different setups in various geographical areas. The transport service providers serve ProDist's local distribution network with a fleet of approximately 550 trucks. Transportation from the warehouse to the cross-docking terminals is performed by a small number of large LSPs. Every day, approximately 50 fully loaded trucks leave the central warehouse heading to one of the cross-docking terminals. The goods are then cross docked in one of the terminals and delivered to the end customers. However, in four geographical areas, the Gothenburg area, Skaraborg area, Stockholm area, and the Northern Norrland area, local hauliers are used to transport ProDist's goods from one of the cross-docking terminals to the end customers. All in all, ProDist has only a handful of transport providers that they work with on a daily basis to deliver goods to customers throughout Sweden. They have decided that goods with short transport distances should not be transported with trucks that are dedicated to only one or a few customers. Instead, goods transported short distances should be carried by distribution vehicles on existing routes. Dedicated trucks are only used in line haulage transports from ProDist's warehouse with minimal variation and often to the same destinations. The aim is to obtain the highest fill rates possible, something which is important for ProDist. Moreover, ProDist controls the goods in the warehouse as well as in the trucks departing from the central warehouse every day. When goods are transported with a distribution vehicle, it should done by an LSP's existing distribution system and not a separate dedicated transport.

Plastic storage boxes are used as the primary containers for parcels and deliveries. When a box is full (ranging between 50 and 100 packages) it is transferred to the outbound loading dock together with other boxes and delivered to one of the cross-docking terminals. The total number of boxes in the logistics system is about 80,000, and all boxes are equipped with an RFID tag for easy tracking and tracing upon arrival at the cross-docking terminal where the boxes are split up and sorted by area, municipality, and unique delivery address. If a customer orders goods amounting to more than four gross tonnes in total, the IT system sends a notification to the transport planner who makes a decision together with the customer whether the goods should be delivered directly to the end customer or not. The transport developer (TD) at ProDist states that the logistics function treats the local stores as highly prioritised customers. Thus, goods distributed to one of these stores have priority over goods that are delivered to other customers throughout the day. This is because it is important that the stores receive every order before opening at 7am so that they can serve their customers. Also, the goods need to be available in time for customers to collect the goods they have ordered as 'pick up in store'. For example, ProDist has 13 stores in Stockholm that serve customers situated in the vicinity of the city. Every store has its own customers, including local firms, small firms, and construction workers from construction projects near the store.

4.1.2 ProDist's work with sustainability

ProDist strives to become a leader in sustainability in its business sector, and they work in different ways to actively address this issue. They have decided to focus on four of the UN's sustainable development goals (SDG)[5], which are to 1) engage in society[6], 2) create sustainable innovations[7], 3) procure responsibly[8], and 4) reduce environmental impact[9]. ProDist endeavours to work actively with its supply chains to contribute to these goals: to steer towards central agreements, to encourage suppliers to intensify their work with sustainability, and, by 2020, to reduce CO_2 emissions from energy, waste, and transport by 20%. The TD has the overall responsibility for sustainability issues related to transport and logistics. The TD reports sustainability issues and progress regarding logistics and transport to the sustainability manager, who has the overarching responsibility for ProDist's work with sustainability issues. ProDist does not demand (by contract) that their transport providers perform better than the regulations of the country where they operate. However, they are considering introducing an award, diploma, or hallmark to customers who carefully plan their

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[5] Each number in brackets corresponds to UN's Sustainable Development Goals (SDGs) number
[6] (3) Good health and well-being
[7] (9) Industry, innovation, and infrastructure
[8] (12) Responsible consumption and production
[9] (13) Climate action

orders in a way that helps reduce the number of transports. Hence, ProDist wants to encourage customers to take a wider perspective on order planning. This diploma could be used internally or externally to promote the company's work with sustainability and could lead to customers deliberately contributing to the reduction of CO_2 emissions from transport. The TD points out that it is not only the sustainability of products that is important, but also the sustainability of the logistics operations related to the products. The TD illustrates this with the 'sustainable housing' concept, saying that it is not only the house itself that should be sustainable in terms of material used: the entire logistical system and logistical planning ought to be sustainable too.

ProDist's sustainability work with transport service providers

ProDist poses few concrete demands relating to sustainability in their contracts with transport providers. However, they have recently added a provision that states transport service providers should, to the best of their ability, propose and realise at least one sustainability improvement initiative every year. ProDist encourage initiatives based on their close collaboration with transport service providers, and they hope that this will open up possibilities for the development of new sustainable transport solutions. To what these initiatives should contribute is not specified, but the initiatives that have been realised so far are in the area of environmental improvements. For example, the transport provider for ProDist in Gothenburg has updated half its fleet with better engines and technology, and they have changed from diesel to HVO100 as the primary fuel. As a result, they have been able to reduce CO_2 emissions by 50% compared to the prior year.

4.2 Consgro

Consgro is a large Swedish construction and project development company with an annual turnover of about SEK 35 billion[10]. They are active in many projects throughout Sweden and employ approximately 10,000 people. Consgro has identified 'efficient logistics' both on and to site as a key area to help them operate more cost-effectively.

4.2.1 Logistics on and to site

On-site material handling is a substantial part of Consgro's operations. Construction sites are often crowded, which limits the possibilities for storing goods over long time periods. To manage the flow of goods to the construction sites, a logistics specialist function has been developed over the past few years that coordinates transport to construction sites. Consgro uses an IT system to manage pre-booked time slots for incoming deliveries to facilitate

[10] Business area Sweden

transport planning. Subcontractors working at the site and transport service providers hauling goods to the site can use the system to schedule and view their transports. The system works in three different ways: (1) the material supplier chooses an available time slot for delivery, (2) the material supplier gets a pre-defined time slot, or (3) a subcontractor gets an individual time slot for deliveries, either on a daily or weekly basis, depending on the project.

Consgro purchases transport to site mainly in two different ways: (1) full truck load (FTL) or bulk service transport from a single supplier in which, e.g., plasterboard or steel girders are managed by LSPa, their main logistics service provider; or (2) through joint loading in a logistics network using several logistic service providers. Consgro strives to buy as many products as possible from its suppliers without the transport being included in the cost, which has resulted in their always asking for the price excluding transport[11] (first way of buying). By doing so, they can arrange the transport themselves and use LSPa without involving the supplier (of goods). For example, products such as plasterboard that are bought in bulk from a large supplier are purchased directly from the supplier (excluding transport), and then Consgro arranges the transport with LSPa. The first way of buying is in stark contrast to how products are purchased from ProDist. When Consgro purchases from ProDist, they buy the whole solution with delivery of the products included in the price.

The construction industry is characterised by project-based work, thus adaptations to different project conditions are important to meeting requirements. The logistics manager (LM) at Consgro states that they have managed to reduce transport activity to the construction site by 80% in one of its housing projects, which now serves as a reference for other projects. Consgro managed this achievement by using consolidation centres operated by a large transport service provider in Sweden. The LM further elaborates that 'the construction sites become so much more capable when we know our inbound and outbound flows'. In addition to these consolidation centres, many IT solutions exist to enhance logistical efficiency. Nevertheless, Consgro's LM emphasises that logistics in the construction industry need to start from a business perspective and not from merely an IT or a systems support perspective and that a 'one-size-fits-all' standardised IT solution will not resolve specific issues related to the construction industry.

[11] HLS in Swedish. The following rules apply: (1) the seller makes the goods available; (2) the seller is responsible for loading and the buyer for discharge; (3) the buyer is responsible for the entire transport as well as for insuring the goods; and (4) the buyer bears all costs after the seller has loaded the goods.

4.2.2 Consgro's supplier structure

Consgro has a Nordic purchasing organisation with about 100 employees working in Sweden and 100 working in the other Nordic countries. Consgro works with over 50,000 suppliers, and the category manager (CM) states that they have many small suppliers and suppliers that are used only occasionally. Consgro divides its suppliers according to five levels in a 'supplier pyramid' (see Figure 17).

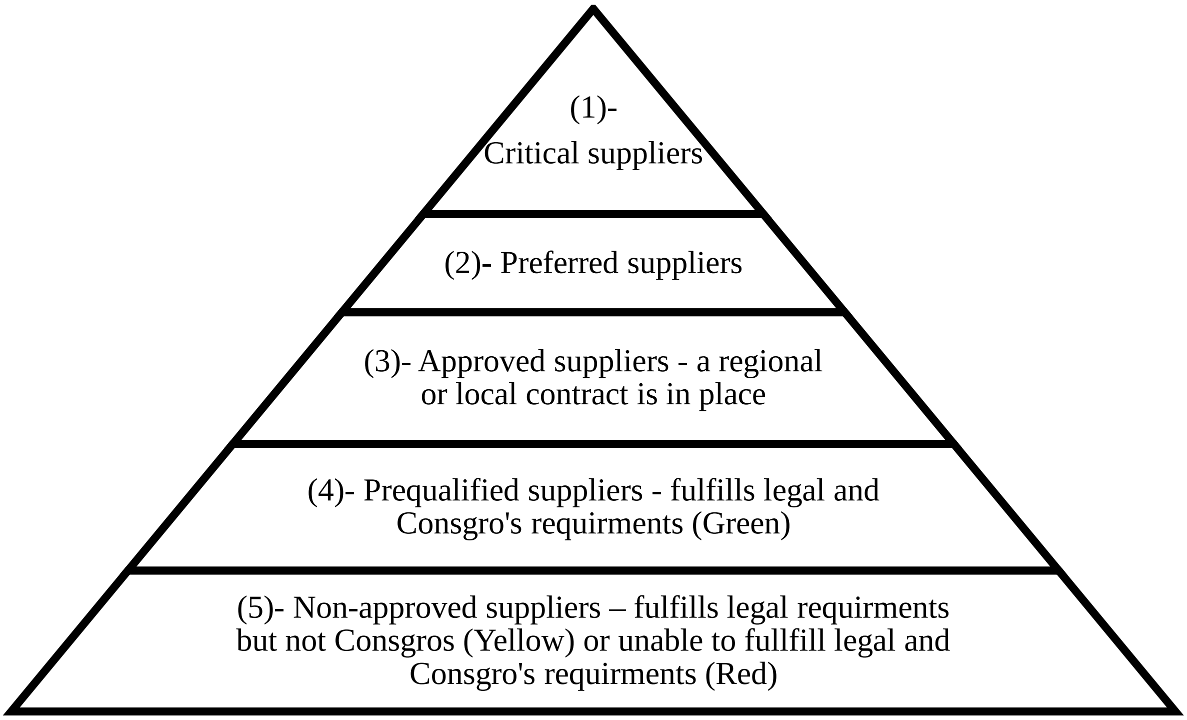

Figure 17. Consgro's supplier base categorisation

The first category consists of 'critical suppliers', of which there are 10, and as stated by the CM, *'critical suppliers are the ones that we cannot risk losing because all the projects will stop; they are vital, and nothing will work without them'*. The second category is 'preferred suppliers', of which there are about a hundred. They are important for the business even if other suppliers exist in the same segment. Moreover, Consgro collaborates closely with preferred suppliers, and a general rule is that each CM should pay extra attention to them. Consgro also has 'approved suppliers' who are approved by them either locally or regionally (third category in Figure 17). The contracts differ depending on what the suppliers can offer. Consgro carries out some projects with approved suppliers, however, not with the same details or as often as with the critical and preferred suppliers. The fourth category is 'prequalified suppliers', which are suppliers who have an account in Consgro's purchasing system and fulfil legal requirements as well as Consgro's internal requirements. Thus, they have a 'green' status. The fifth category is the 'non-approved suppliers', those who have not fulfilled Consgro's requirements, which means that they have 'yellow' status, or that they have not fulfilled legal requirements, which means that they have ‘red’ status. The third, fourth, and fifth categories together amount to over 50,000 suppliers, and the purchasing behaviour towards them is characterised by blanket orders/call-off agreements[12].

4.2.3 Sustainability initiatives

Consgro has initiated a yearly ’Green Week’ in an effort to increase awareness on issues of sustainability. The initiative allows suppliers to come together with Consgro to share information about what Consgro calls ‘green journeys’. During Green Week, many suppliers are invited to seminars to hear more about Consgro’s on-going green projects across Sweden. In addition to information about various projects, information about new, more environmentally friendly products is distributed and discussed. How services can fit better with suppliers’ and customers’ current environmental needs is also discussed. The sustainability development leader (SDL), states that the most common way of knowledge-sharing is through seminars where green journeys are illustrated and where suppliers discuss and share their views on sustainability issues. Internal issues at Consgro are also placed into focus. The sustainability department gives lectures and seminars about how Consgro’s internal processes can become more sustainable.

Working with suppliers, subcontractors, and customers

Consgro’s subcontractors must follow the same environmental standards as Consgro does. The environmental requirements are stipulated in several supplier documents. They contain, for example, provisions that require trucks to be fuelled with environmentally classified petrol or diesel class 1 including a minimum 5% fuel mix. Other fuel types can be used if they are as good as or better than what is required. In addition, drivers should be trained in energy-efficient driving[13]. The sustainability manager (SM) at Consgro states that, to reach the company’s sustainability goals, suppliers, subcontractors, and customers are required to engage in and commit to projects. Such commitment from suppliers and customers is vital to reaching the goals set for the years to come. For example, Consgro has discussed with one of its insulation and plasterboard suppliers how the transport contracts could be improved with regard to sustainability issues. This discussion focused on what demands Consgro should place on the supplier, for example which type of Euro-classification the vehicles should have. Consgro has also granted a project with the ‘Green Leaf’ certificate. The Green Leaf is a local initiative focusing on environmental issues that was created to facilitate co-loading in the housing project mentioned in Chapter 4.2.1. The certification is useful when Consgro’s

[12] Blanket release; i.e., order of goods firms issue against a blanket purchase agreement
[13] Eco-driving

logistics team tries to internally promote co-loading through the use of consolidation centres that are operated by LSPa, and Consgro tries to promote the use of the centres as much as possible when they buy products from suppliers.

4.3 Haulcom

Haulcom is a small Swedish transport service provider that has a fleet of roughly 50 trucks ranging from small physical distribution vehicles to larger crane trucks. The fleet handles and distributes approximately 1,200 shipments per day to ProDist's customers. Haulcom only operates in the Stockholm area, and their daily planning of routes is done manually down to the hour. Twenty-four different area codes are used for the terminal operation, mostly for sorting of inbound goods arriving from ProDist, but also for Haulcom's distribution operation. Haulcom states that there are uncertainties every day regarding the amount of goods coming in from ProDist and that the goods handled and transported are volume-demanding as opposed to demanding in terms of weight. These uncertainties stem from ProDist's desired service levels and promise of 'day-after-order-deliveries'. The promise provides ProDist's customers the capability to order goods the day before they are delivered. Orders can in some areas be placed at 8pm and be delivered at 7am the next day. Haulcom therefore has a high degree of flexibility so that they can meet daily demands. The volume shifts from one day to another, and so does the utilisation of the trucks. Generally, on Mondays and Fridays the utilisation is around 90%, and on Tuesdays, Wednesdays, and Thursdays the utilisation is close to 100%. The incoming volume and recipients determine how many trucks will be used each day.

Haulcom stresses the importance of being able to improve efficiency by planning their transport operations every day without any time restrictions. In line with this, Haulcom sees time-specific deliveries as one of the greatest impediments to efficient transport and especially to truck efficiency. As stated before, ProDist is Haulcom's only customer. With such a set-up, adaptations to ProDist's demands on customer service is important to securing future business. One example of time-specific deliveries is when Haulcom is required to transport goods to a destination in accordance with specific time slots. A possible consequence is that they might need to wait in order to arrive exactly in accordance with their time slot. Moreover, being a transport provider in an urban environment means that planning is of utmost importance because of fluctuations in volume, characteristics, traffic congestion, and destination. A truck might be stuck in congestion for between 20 to 180 minutes per day. In addition, goods with different properties/characteristics have different needs (e.g., the need for crane capacity) and should therefore be delivered in accordance with these characteristics. Concerning environmental improvements, Haulcom states that more work must be done on several levels, for example, creating better hybrid vehicles and cleaner diesel engines, reducing transport mileage by better planning to avoid the worst congestion zones, and increasing the volume of goods on the trucks.

Haulcom not only delivers goods to ProDist's customers, they also return goods and packaging to ProDist. First, goods which are not delivered to the customer are returned to Haulcom's terminal awaiting a new delivery or a return to ProDist's warehouse. On average, Haulcom fills one truck every week with goods to be returned to ProDist's warehouse. This truck with return goods is to be compared with the 40–45 trucks arriving at Haulcom's terminal with 'new' goods every week from ProDist's central warehouse. Second, goods require and generate vast amounts of packaging, both reusable and recyclable. ProDist has many reusable packaging solutions including plastic stillage, cardboard boxes, wooden and steel stillage, pallets, pallet collars, and steel racks. After Haulcom's sorting operation, approximately 12 loading meters of packaging are transported back to ProDist's warehouse.

4.3.1 Sustainability initiatives

Regarding environmental proactivity, Haulcom has actively worked with eco-driving to reduce CO_2 emissions and increase the durability of its trucks. Furthermore, Haulcom took part in a regional environmental project[14] initiated by Stockholm municipality called 'Clean Truck' between 2010–2014. This project aimed to reduce CO_2 emissions from heavy-duty trucks used for urban distribution through a rapid introduction of environmentally adapted technology—an electric hybrid.

The project was considered a success, and one conclusion reached was that '[l]ong-term agreements are beneficial for investments in clean trucks. The overall economy does not rest in the vehicle cost, but rather in the agreements of transportation'.[15] Furthermore, the project concludes that not every assignment taken by the transport service provider will fit their ordinary operations. Thus, being proactive when agreeing on what, when, and where the transport should take place will be beneficial for transport buyers, owners of goods, and transport providers.

[14] Österlund 2015: Clean Truck Project. Project number - LIFE08 ENV/S/000269. Stockholm: City of Stockholm, Environment and Health Administration.
[15] Österlund 2015. Page 47

4.4 A product's path through Europe

This section illustrates a product's path through the supply chain, moving from one of ProDist's suppliers in Italy to ProDist's customers and their construction sites Stockholm. This is done to highlight the complexity of a supply chain and to identify the many actors involved in moving a product from southern to northern Europe. The transport of goods, illustrated in Figure 16 in section 4.1.1, shows how products move through the latter part of the supply chain. However, a more specific illustration can shed light on the complexity of the chain involving ProDist, Consgro, and Haulcom. The illustration shows how the firms involved are part of a larger supply chain. The following section describes the product GeoForm and its different transport routes through the supply chain. GeoForm, a geotextile cloth, is a commonly used product in the construction industry. Geotextiles are used for infrastructure, for example, roads, railroads, canals, and other types of construction tasks involving heavy equipment (vehicles). The producer of the geotextile, GeoTex, Inc., is based in northern Italy, close to the city of Milan. The first section describes the route from the producer of the product to ProDist's warehouse. The second section illustrates the internal logistics operation in the warehouse. In the final section, the delivery of the GeoForm from the warehouse to the customer is described. ProDist places an order at the supplier (1 in Table 5), and the GeoForm is ready to be picked up by the haulier (2).

Table 5. GeoForm's transport checkpoints from Milan to the warehouse

#	Situation	Location from	Location to	Mode of Transport
1	ProDist orders the product			
2	GeoForm is ready for shipment	Milan (IT)		
3	Truck to intermodal terminal	Milan	Domodossola (IT)	Truck
4	Transhipment to train			
5	Train to intermodal terminal	Domodossola	Karlsruhe (DE)	Train
6	Transhipment to train (new route)			
7	Train to sea terminal	Karlsruhe	Rostock (DE)	Train
8	Transhipment to vessel			
9	Vessel to intermodal terminal	Rostock	Trelleborg (SE)	Vessel (ROPAX)
10	Transhipment to train			
11	Train to intermodal terminal	Trelleborg	Eskilstuna (SE)	Train
12	Transhipment to truck			
13	Truck to warehouse	Eskilstuna	Örebro (SE)	Truck
14	GeoForm arrives at warehouse	Örebro (SE)		

The haulier picks up the goods and can either pick up additional goods from other shippers to fill the truck to a minimum gross weight of 24 tonnes, or, if the initial pick-up results in a full trailer load (FTL), it can proceed directly to the intermodal terminal in Domodossola, Italy where the trailer is lifted onto a train wagon heading for Karlsruhe, Germany (4) and operated by a Swiss railway company. In Karlsruhe, the train wagon changes tracks to continue towards Rostock, Germany, operated now by a large transport service provider. In Rostock, the stevedores move the trailer from the train wagon to the vessel heading for Trelleborg, Sweden (8).

The sea shipment bound for Trelleborg is operated by Sweden's largest ferry operator (step 9 in Table 5). In Trelleborg, the stevedores lift the trailer to a new wagon, and the train, operated by a German railway company, departs from Trelleborg in the evening and arrives in Eskilstuna early the next day. The workers disconnect the trailer from the train wagon, and a logistics service provider, LSPb, picks up the trailer and delivers the goods to ProDist's warehouse in Örebro.

The TD states that ProDist tries to use trains for transport from a terminal to the warehouse as often as possible to reduce the use of trucks for final-mile transport and to make use of the train capacity of the nearby combi-terminal, which is located only one kilometre from the warehouse. However, it is difficult to use trains in this case because of the relatively short distance of approximately 100 kilometres.

Table 6. Inside ProDist's warehouse

#	*Situation*	*Context*
15	*GeoForm arrives at the warehouse*	*Inbound truck*
16	*GeoForm is awaiting quality control*	*Warehouse operation*
17	*GeoForm is placed in the warehouse*	*Warehouse operation*
18	*Incoming orders from customers*	*Orders (in)*
19	*Order is picked up*	*Warehouse operation*
20	*GeoForm is placed in the outbound area*	*Warehouse operation*
21	*The long-haul trucks are loaded*	*Outbound truck*

The trailer arrives at ProDist's warehouse and the product, GeoForm, is unloaded before terminal workers perform a quality check (step 15 in Table 6) and place the product on a shelf in the warehouse or at an assigned place in the outside yard. All trucks delivering goods to the terminal will receive a specific time-slot for unloading due to the large number of trucks arriving daily at the warehouse. When Consgro places an order of GeoForm and completes the purchase, ProDist receives a notification, and the GeoForm is picked up at its location in the warehouse and transported to the warehouse's outbound area for Stockholm.

Table 7. From ProDist's warehouse to Consgro's construction sites

#	Situation	Context
22	Truck arrives at the terminal	Inbound truck
23	Goods are scanned and checked	Terminal operation
24	Goods are sorted and placed in the terminal	Terminal operation
25	Goods are loaded onto the trucks	Terminal operation
26	Truck departs from the terminal	Local physical distribution
27	Goods are delivered to the customer	Local physical distribution

A large logistics service provider (LSPc) is responsible for the line haulage between ProDist's warehouse in Örebro and Haulcom's terminal in Stockholm (step 22 in Table 7). All incoming goods from ProDist are scanned and checked by Haulcom and compared to the digital notification that ProDist sent during the night. The GeoForm is then sorted and given a specific position (depending on the location of the customer) in the terminal. Haulcom's drivers then collect and load the product onto the truck headed to the corresponding area.

The GeoForm is then scanned and delivered to the construction site. When the delivery is completed, a digital receipt is issued and logged by Haulcom as proof of delivery (step 27 in Table 7). The product arrives at the customer site, and the driver can return to the terminal or continue to the next customer. The different routes for the goods (see Figure 18 below), exemplified by the transport of the product GeoForm, involve several steps of transportation, goods handling, transhipments, and coordination of information.

Figure 18. Illustration of the entire transport route from Milan to Stockholm

In Figure 18 above, the entire supply chain is illustrated on a map connecting all identified companies involved in taking the product from the supplier in Italy via several hubs and ProDist's central warehouse to Consgro, the final customer in Sweden.

5. The relationship between the seller and buyer of goods

Chapter 5 is divided into two sections. First, section 5.1 describes the relationship between ProDist and Consgro. Second, section 5.2 analyses the ProDist–Consgro relationship.

5.1 Empirical description of the ProDist–Consgro relationship

This section deals with the relationship between ProDist, as a supplier of goods, and Consgro, as a buyer of goods (see Figure 19 below).

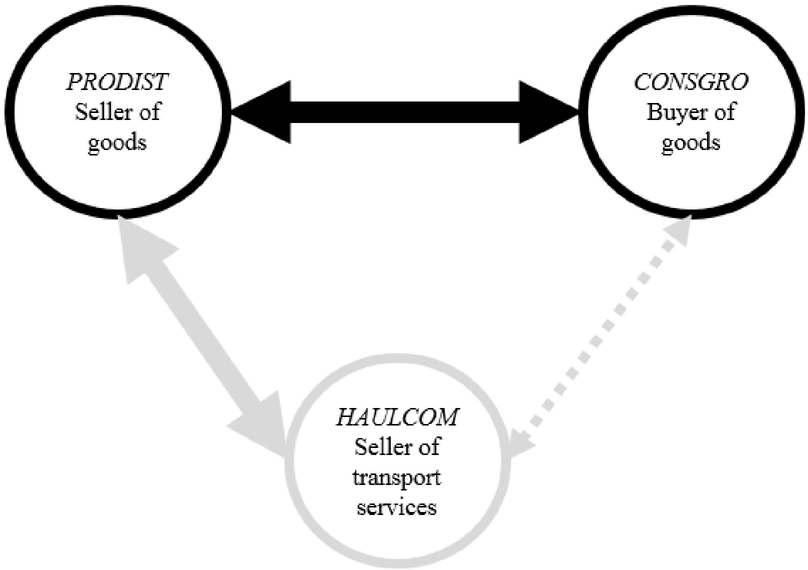

Figure 19. Relationship between ProDist and Consgro

ProDist has been a supplier to Consgro for over three decades, and ProDist is today a preferred supplier to Consgro. The preferred supplier status is evident mostly in terms of the volume of purchased goods but also in the progression of the relationship in recent years. Firstly, ProDist has a large assortment of products, which fosters the upscaled warehouse operations at ProDist, and which also gives ProDist ample opportunities to deliver goods with retained service levels. ProDist uses its sales force to manage the service levels, particularly in Stockholm[16], where ProDist has dedicated sales representatives for Consgro. ProDist has a 99% service level for Consgro's projects, which means that 99% of the orders are delivered in accordance with the current procedures, namely 'day-after-order deliveries'. Consgro, in turn, relies on ProDist's warehouse operations to quickly receive its purchased goods. Secondly, during recent years the relationship has become closer, with more engagement from both parties where they challenge each other in different ways; this is contrasted with how Consgro previously regarded ProDist as one supplier among many. ProDist's key account

[16] In other regions, one sales representative often handles a few larger customers and a dozen smaller customers.

manager (KAM) has played an important role in working towards a closer collaboration. The KAM has worked with Consgro's category manager (CM), and this partnership has resulted in some initiatives. Specifically, ProDist's KAM has been the driving force in the relationship since 2011, when the firms negotiated and signed a new contract. The CM states this about the relationship:

> I think it has a lot to do with the relationship between me and [the KAM]. The relationship works very well, since it is in that way you can try new things, often brand-new things. I need to give credit to [the KAM] for being very good at coming up with new things with a mindset that is very forward thinking as well as outside the box.

For example, in one of the "green week" sessions, ProDist identified an opportunity to reduce transport work to Consgro's construction sites in a distinct geographical area. This led to the beginning of the "green month" project, in which deliveries to Consgro's construction sites were reduced from five to two deliveries per week. The project ran as a pilot project for one month. In another project, Consgro initiated development of a new, more environmentally friendly spray paint to be used on concrete.

5.1.1 Purchasing in the relationship

Consgro's purchasing activities are standardised, and the main part of the purchases are handled through ProDist's e-commerce portal which is integrated into Consgro's ERP system with over 60,000 unique articles. The e-commerce portal handles approximately 70% of all purchases, while the remaining 30% is purchased from ProDist's local stores. First, when products are bought from one of ProDist's stores, it is the store who orders products from the warehouse on the basis of plans and forecasts of customer demand. Second, when products are bought from the e-commerce portal, the order goes directly to the warehouse, and pick and pack starts immediately. Thus, no adjustments are made specifically to Consgro's sites nor ProDist's stores, nor for the operations in the warehouse and transport operations from the warehouse. Instead, different ways of handling these orders exist at a later stage, which has implications for the IT system and Haulcom. Moreover, Consgro's purchasing department has an important function in the relationship since they handle the formal negotiations and contracts with ProDist's sales department. ProDist's warehouse operations are crucial for Consgro as a contractor and purchaser of goods, since the service levels, including handling of products and the following transport, impact the business with ProDist. Consgro's on-site buying procedure – that is, where (via the e-commerce portal or through one of ProDist's stores), what type of goods, and when in time they purchase goods – affect ProDist's business. However, Consgro as a purchaser does not, to a great extent, purchase bulky goods, but bulky goods are to a great extent delivered to its construction sites.

Purchasing and deliveries exemplified

A subcontracting company working at Consgro's construction site can make its purchases through either Consgro's or ProDist's e-commerce portal. It is the contract between the subcontractor and the main contractor that stipulates how products can and should be purchased. As many subcontractors are working at Consgro's construction sites, they are given a specific time slot at which they can receive goods from ProDist. Goods delivered from ProDist are often directed to many different subcontractors and not the construction site or project itself, meaning that a construction site can get multiple deliveries from ProDist every day (see Figure 20). This is due to Consgro having control over the logistics activities on-site, with every subcontractor allotted a specific time slot for deliveries from ProDist. Assigning one time slot per subcontractor makes consolidation of deliveries to sites problematic. Consgro appreciates having the incoming goods delivered at specific times of their choice to the construction site. However, this is not always possible because of difficulties in internal planning leading to projects sometimes disregarding planning because they know that the needed materials will arrive the next day.

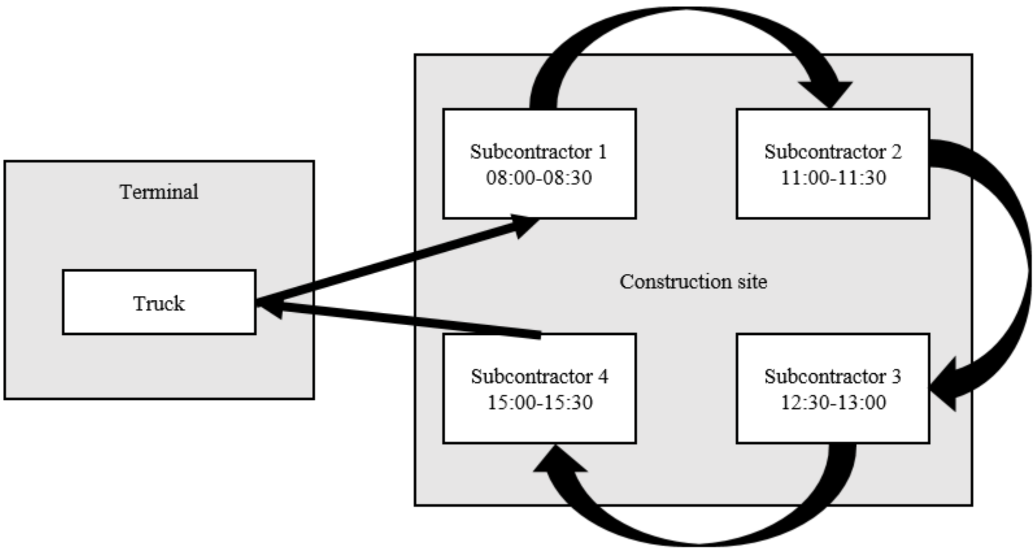

Figure 20. Deliveries to different subcontractors during one day

These types of time-slot booking arrangements occur regularly in the construction industry. One example of achieving on-site efficiency while still allowing coordination amongst the subcontractors is when the logistics arrangements on site are sequenced to different subcontractors' deliveries to reduce wait time on and around the construction site. Consgro's logistics manager (LM) states that, in the most favourable example, either every transport is booked through Consgro's transport booking system or ProDist books weekly deliveries. For example, on one site, ProDist's goods arrive at 10:00 every Thursday. This is in line with what Consgro wants as they aim for more and better planning to accomplish more controlled deliveries to their construction sites.

5.2 Analysis of the ProDist–Consgro relationship

This section analyses the relationship between ProDist and Consgro. The analysis begins with a discussion regarding activities and is followed by a discussion related to resources. Finally, the actors in the case will be discussed.

5.2.1 Activity analysis

A simplified illustration of the activity pattern in which the relationship between ProDist and Consgro is a part is depicted in Figure 21, which shows the activities as well as which actor performs each activity. The numbers and letters indicate the type of activity as well as the order of the activities. Information exchange are indicated by IE, whereas PF indicates goods' movement, the physical flow.

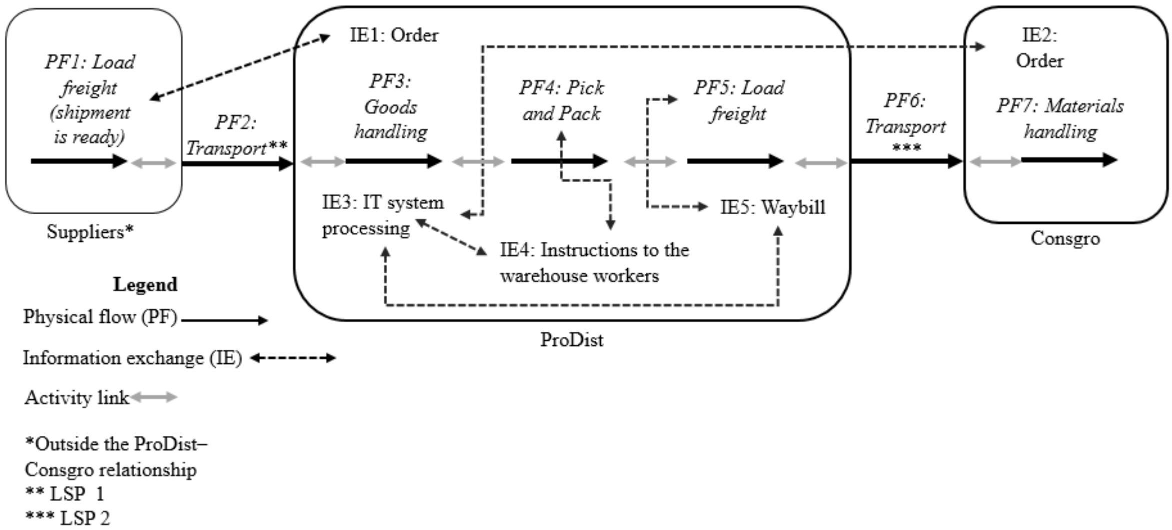

Figure 21. Activity pattern in the ProDist–Consgro relationship

As seen, all the activities are complementary. ProDist orders goods from its suppliers (IE1). These products are then picked by the supplier and loaded (PF1) onto a trailer to be transported (PF2) by a carrier and subsequently received and handled (PF3) in ProDist's warehouse. Consgro places an order to ProDist (IE2). ProDist's IT system processes the information (IE3) and information and a picking list is sent (IE4) to a warehouse worker who picks and packs (PF4) the goods. The warehouse worker puts the goods on ProDist's conveyor belt for further transport to the loading area. The goods are held at the loading area before they are loaded (PF5) onto the truck. After that, a waybill (IE5) is created. The loaded products are then transported (PF6) to Consgro's construction sites for handling at the site (PF7). Every transport activity in the relationship requires a need for specific coordination regarding, for instance, what to be transported (goods characteristics), destination (receiver address), if the goods need to be unloaded by a special truck, and time when the goods are to be delivered (specific or not). Hence, the adjustments and coordination of the transport activities are an important part of the substance – activity links – of the relationship between ProDist and Consgro. The information for coordination is made available through the order from Consgro (IE2). Furthermore, ProDist deals with multiple arrivals of incoming goods at their central warehouse every day. Inbound goods-handling activities are tightly scheduled, and they require coordination with the warehousing activities. The inbound goods are then placed as inventory in the warehouse and become a part of a range of standardised products which can be purchased by multiple customers. In ProDist's warehouse, the destination of the products purchased by Consgro is determined on a general regional geographic level, such as Stockholm. Consequently, ProDist's way of handling goods in the warehouse is standardised, hence not adjusted to specific customers, which means that the warehouse activities performed are adjusted for internal efficiency in order to reach efficient resource utilisation through the capturing of similarities among activities.

Interdependencies and adjustments in the relationship

The Consgro-ProDist relationship involves several complementary activities, for example loading of goods, transport, and delivery are complementary to other activities at both Consgro and ProDist. Since complementary activities between actors create serial interdependencies the relationship between ProDist and Consgro involves several serial interdependencies: ProDist's Order to Suppliers' Load freight (PF1-IE1), Suppliers' Load freight to ProDist's Goods handling (PF1-PF3), Consgro's Order to ProDist's IT system processing (IE2-IE3), and ProDist's Load freight to Consgro's Materials handling (PF5-PF7). Due to the serial interdependencies, the outbound transport activities need to be coordinated with activities in the warehouse. The serial interdependencies between ProDist and Consgro result in both actors' activity structures being linked. These activity links are important to understand if efficiency and effectiveness are to be addressed.

Consgro sends orders via the e-commerce portal, which are then handled by ProDist's IT system. Due to the standardised nature of the ordering process and ProDist's internal warehouse activities, no adjustments are made between the ordering and the pick and pack activity for the specific relationship. The consequences are that the serial interdependencies are low due to complementary but not closely complementary activities; because a single purchase of a product is not directly related to a specific procedure in ProDist's warehouse. Moreover, there are no adjustments vis-à-vis the activities of ProDist's other customers. That is, ProDist can capitalise on similarities among the internal warehouse activities. Furthermore, Consgro's purchases from ProDist are characterised by repeated low-volume and low-cost orders. Due to the standardised arrangements of ProDist's activities, the need for coordination is low. Nevertheless, in some cases, the need for coordination is higher, for example, when there are requirements for specific delivery times. The specific delivery times and issues related to the specific delivery times will be elaborated on in Chapter 7.

The relationship between ProDist and Consgro is characterised by standardisation in terms of day-to-day operations. ProDist's standardised activities, such as, sales and logistics and the conditions of the relationship do not allow for benefits linked to adjusted and customised operations. Instead, efficient resource utilisation of resources in the warehouse can be achieved due to similarity among activities. ProDist's warehouse activities rely on standardisation and similarities regarding pick and pack, and goods handling (see illustration in Figure 22). Consgro takes advantage of ProDist's assortment by purchasing all of its 'consumables' (repetitive purchases of low-cost and low-volume) goods from one supplier to achieve economies of scale and scope. This is beneficial for Consgro as the purchased goods stem from one warehouse, and the same procedures can be used regardless of both construction site location and goods purchased.

Activities within ProDist's warehouse

It is argued above that ProDist's warehouse is important and that the operation is standardised to accommodate for many customers. The reasons for focusing on the activities in ProDist's warehouse are twofold. First, it highlights how and in what sequence the activities are performed as well as their interdependence. Second, it provides to understanding of how these activities with both serial and parallel interdependencies are handled in the warehouse depending on the characteristics of the goods. Figure 22 below illustrates a situation in ProDist's warehouse when an order of copper pipes and pipe clips is placed in the e-commerce portal. The orders (a) are processed in the IT system, and three different collection orders are created, two for the pipe clips, and one for the copper pipes. One of ProDist's order collectors gets the orders on its display and collects the two order lines. The collection activity (b) is similar since the same resource, that is the same personnel and equipment, is used to perform the pipe clip's collection. The pipe clips are then packaged (c) and then sorted and placed on its outbound position (d) by scanning the final destination (regions). The last activity is loading the goods onto the outbound truck (g). In each activity (b-g), both pipe clip orders are undertaken by the same resource, which allows for higher capacity utilisation. This also contributes to joint resource utilisation since other customer's orders are collected and not only Consgro's orders.

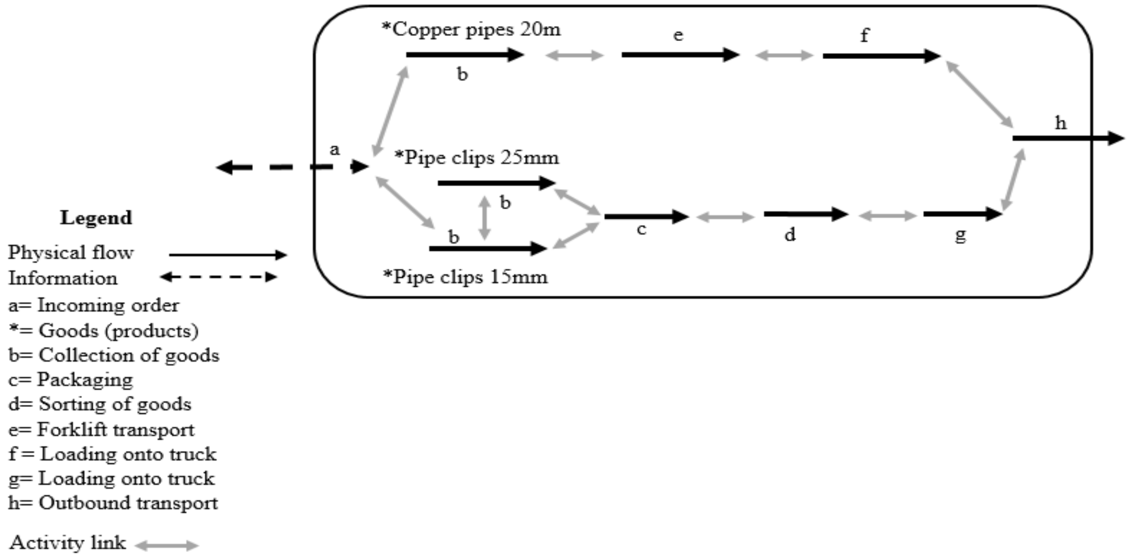

Figure 22. Activities within ProDist's warehouse

Another worker collects the copper pipes outside in the warehouse's yard. After collection, the copper pipes are transported (e) by a forklift operating outside awaiting further loading to the outbound truck. The copper pipes are then loaded (f) onto the Stockholm-bound truck (h). The collection of the orders show how activities in the warehouse are complementary and similar. They are complementary as they represent different phases of a process within the warehouse, and similar as some activates are undertaken by the same resources.

5.2.2 Resource analysis

Central resources in the relationship between ProDist and Consgro are portrayed in Table 8. The focal resources in this relationship are related to ProDist's different goods-handling activities as well as sales activities and Consgro's handling of incoming goods to its sites, and the purchasing department's activities. The resources shown in Table 8 are also related to the processes in the relationship, that is, sales, logistics and transport activities. The physical and organisational resources are summarised in Table 8 and discussed in detail below.

Table 8. Identified central resources in the relationship between ProDist and Consgro

	Physical	Organisational
ProDist	Assortment	Sales department (business unit) (KAM)
	Central warehouse	Warehouse operations knowledge
	IT system (for order processing)	
	Online stores	
Consgro	Construction equipment at site	Purchasing department (business unit)
	IT system (for purchasing)	

Physical resources

The IT system for order processing and purchasing is an important resource in the relationship. It is key for the overall function of handling all purchases made by Consgro and an important physical resource for all of ProDist's sales, logistics, and transport activities. ProDist's IT system is integrated into Consgro's ERP system, which allows for standardised purchasing activities and requires only minor adaptations of the two IT systems. The online store functions as a one-stop shop for Consgro and is therefore central in the relationship as 70% of all purchases are performed via the online store. Furthermore, Consgro's on-site purchasers can order products from the assortment at the click of a button via the online store. This feature is important for the business between ProDist and Consgro. Thus, the IT system and the online store are important physical resources for the coordination of Consgro's on-site purchasing from Consgro's different projects as well as for ProDist's warehousing, the outbound transport activities, and the contract between them. The central warehouse is an important resource, a hub, and a prerequisite for the physical handling and storing of products. The shelf space, handling equipment, trucks, yard, and loading docks are necessary for receiving, storing and delivering products to Consgro. Likewise, Consgro's construction equipment at site is important in handling the incoming goods. The assortment of products is a significant physical resource in the relationship between ProDist and Consgro. The basis of the relationship is built on ProDist's large assortment of products available for Consgro as Consgro purchases goods with low value, low volume, and high repetitiveness. The warehouse is the hub for the variety of products purchased by Consgro.

Organisational resources

Organisational resources are the foundation for many of the activities performed in the relationship. For example, ProDist's competence of sourcing products from several sources and delivering a quality logistics service is key for being attractive to contractors like

Consgro. Further, ProDist's sales department (KAM) and Consgro's purchasing department (CM) have increased their interactions over the years. The KAM and the CM are important resources in the relationship. They have paved the way for ProDist's higher status in Consgro's supplier pyramid. In addition, in Stockholm, ProDist has dedicated resources for handling the local contact and contracts with Consgro.

The importance of the warehouse was described above. However, the warehouse is in one sense only a scaffold for the important organisational resource – the competence of warehouse operations. Warehouse operation competence is at the heart of ProDist's way of conducting its business, which is centred on physical resources such as the shelf space, handling equipment, workforce, facility, and loading docks inside the warehouse. For example, consider the illustration of copper pipes and pipe clips in the previous section. If goods are ordered multiple times from one purchaser or several purchasers connected to the same project, the IT system does not give ProDist instructions on combined orders. Instead, the person collecting the order from the shelves treats each order separately. This is because a person collecting goods collects from a specific area in the warehouse and does not cross several areas. For example, if an order consists of five order lines, three of which are the same product – say, copper pipes and two compression fittings – the copper pipes and compression fittings are collected, labelled and loaded onto the outbound truck separately. The explained procedure allows for internal efficiency gains. The gains stem from similarities among activities as the same worker collects goods in a specific area of the warehouse. Each part of the warehouse is utilised in the same manner, meaning that each worker stays in the same area (see e.g., the example about pipe clips and copper pipes in section 5.2.1).

The handling of the goods from ProDist's warehouse and the way the goods are transported to Consgro are handled by other firms connecting the resources of ProDist with Consgro. Thus, these resources are necessary for sorting, storing, and delivering products to customers. The fact that ProDist delivers on a day-after basis from its warehouse is problematic in terms of generating similarities in the ProDist–Consgro relationship and in achieving higher utilisation of resources for actors outside of the relationship.

Resource combining and adaptation

In this relationship, huge volumes of goods are distributed to Consgro in their role as a purchaser of goods but also to Consgro as the main contractor. In both instances, there is a need to adapt to different conditions. The conditions differ since Consgro purchases low-value, high-volume goods, but they also organise bulky goods on their sites. These features provide specific requirements on the resources for delivering and handling the goods. For bulky goods, Consgro does not need to adapt its resources to manage the goods' delivery operation, since ProDist promise to deliver the goods to the site and unload it. However, adaptation is required to orchestrate the actual situation on the construction site post-delivery. Consgro's physical resources are adapted to the high volumes they purchase. For example, Consgro has ProDist's IT system integrated into their IT system and it is easy for them to order via the e-commerce portal and the order is delivered the day after it was purchased. Thus, the adaptations made to the IT resources have improved the arrangements between ProDist and Consgro, for example by allowing easy and extensive access to ProDist's assortment and easy purchasing procedures.

The adaptations of organisational resources are important in this relationship and have, like the IT system, improved the relationship between ProDist and Consgro. These adaptations include both the purchasing capabilities at Consgro and sales and marketing at ProDist. For example, these business units have had scheduled meetings on a regular basis. These adaptations have been ongoing for a long time as ProDist has climbed in Consgro's supplier pyramid and Consgro has managed to become one of the most important customers for ProDist. This has led to incremental adaptations in their ways of working with each other with elevated communication and a willingness to participate in development projects, such as the Green Month Project, which will be elaborated on in Chapter 8. In addition, ProDist delivers its goods with high service levels. This has also helped in developing the relationship further.

Some resources in this relationship are heavy and thus more difficult to adapt to specific situations, that is, the difficulties of changing an already established set of resources within a firm. For example, ProDist's warehouse is designed to manage large volumes of goods so as to be able to keep a large number of products in stock. The warehouse operation follows a standardised setup regardless of customer. The resources involved are hard to change because they are adapted to a specific logic which has been in place at ProDist for a long period. Likewise, Consgro's construction sites follow a logic anchored in the actual construction process and is not adapted to ProDist's supply of goods, such as the inbound deliveries of goods.

5.2.3 Actor analysis

This section proceeds as follows. First, relationship organising on a strategic and operational level is analysed. Second, an example of interaction in the relationship between ProDist and Consgro is provided. In addition to the interaction between the two, an example is provided to illustrate how both ProDist and Consgro are connected to other firms in the network.

Relationship organising

The relationship between ProDist and Consgro involves several actors who organise activities across firm boundaries. On a strategic level, this organising occurs mostly with regard to negotiation activities. The actors organise their activities differently depending on what function they represent and with whom they are interacting. Consgro's way of conducting its on-site buying does not per se impact on how ProDist organises its logistics activities. ProDist organises its activities in the same way for every customer although they have different ways of handling different types of products, depending on their character. The standardised nature of ProDist's logistics activities makes them difficult to modify. Thus, if Consgro buys products which are small, for example pipe clips, or other small-sized goods, they are handled by ProDist as parcels, and if Consgro buys large pipes, they are handled as bulky goods. The consequence of this is a large-scale operation in the relationship when it comes to the terminal and logistics activities. Moreover, ProDist's sales activities influence how Consgro purchases goods and services from ProDist.

Consgro's CM and ProDist's KAM are both important resources for nurturing communication and coordinating between other departments and representatives at their respective firms. The coordinating roles of Consgro's CM and ProDist's KAM help when functional representatives from each firm worked together on jointly developed projects since these projects include members of both firms participating in meetings to finalise the projects. The character of the interaction concerning the projects between ProDist and Consgro differs depending on which actors are involved. For example, ProDist's KAM and Consgro's CM interact to improve the relationship in different ways with projects related to logistics, and tests related to products. However, since ProDist's ordering process, warehouse operations, and logistics operations are standardised towards all customers, the possibilities to improve in certain directions are limited. For example, Consgro's different projects can either conform to that the orders arrive the day after they were placed or they can reduce their ordering to fewer orders per day and coordinate their purchases with other firms (e.g. subcontractors) working on the construction site. Alternatively, they can try to influence ProDist to offer more customised delivery solutions which are more in line with Consgro's needs for each construction site. This puts more pressure on ProDist to further expand its offering to deliver goods to Consgro 'when needed'.

The construction site is project based and it would be possible for Consgro to implement a uniform purchasing interface for all subcontractors connected to the specific project. However, subcontractors mostly purchase goods separately because they want to handle it on their account towards Consgro. This creates problems for transport because of the scattered order structure it generates. Nevertheless, one such interface could assist in the planning of the incoming deliveries thereby avoiding a situation where ProDist delivers goods to the same construction site several times per day, which in turn would reduce the number of transport visits to each site. Consgro's ambition to steer towards a situation where all purchases are processed via the e-commerce portal is another area which has improvement potential. The relationship between ProDist and Consgro involves several actors who organise activities across firm boundaries. On an operational level, this occurs mostly with regard to daily sales and handling orders from customers. At ProDist, the sales department manages the local contract, and after that the logistics department delivers according to the demands negotiated between the sales department and the customer. Hence, much emphasis is put on the agreement with the customer and the customers' needs, and not necessarily on logistical possibilities and needs. This mean that other needs are more important, such as, to establish and maintain a customer contract and to deliver products in the right time and at the right place when the customer needs it.

On an operational level, the ordering and logistical activities require organising across firm boundaries involving multiple actors within each firm but also actors outside of the relationship. For example, 3PLs and freight carriers taking care of the transport of goods from ProDist's warehouse to Consgro's construction sites are affected by ProDist's demands on service levels and Consgro's demands for time-slot deliveries. The 3PLs and freight carriers thus have to conform to the demands of both parties, even if they only have a direct business relationship with one of them. Furthermore, in this relationship, Consgro's way of buying goods on site – i.e. several people buying small quantities throughout the day – impacts on how deliveries are directed. This impacts the logistics activities as well as transport activities of ProDist and, to some extent, limits the room for manoeuvrability for ProDist and other actors outside of the relationship.

Example of interaction in the relationship between ProDist and Consgro

Figure 23 below provides one example of how ProDist's sales organisation interacts with Consgro's purchasing organisation, from an overarching management level to the local level.

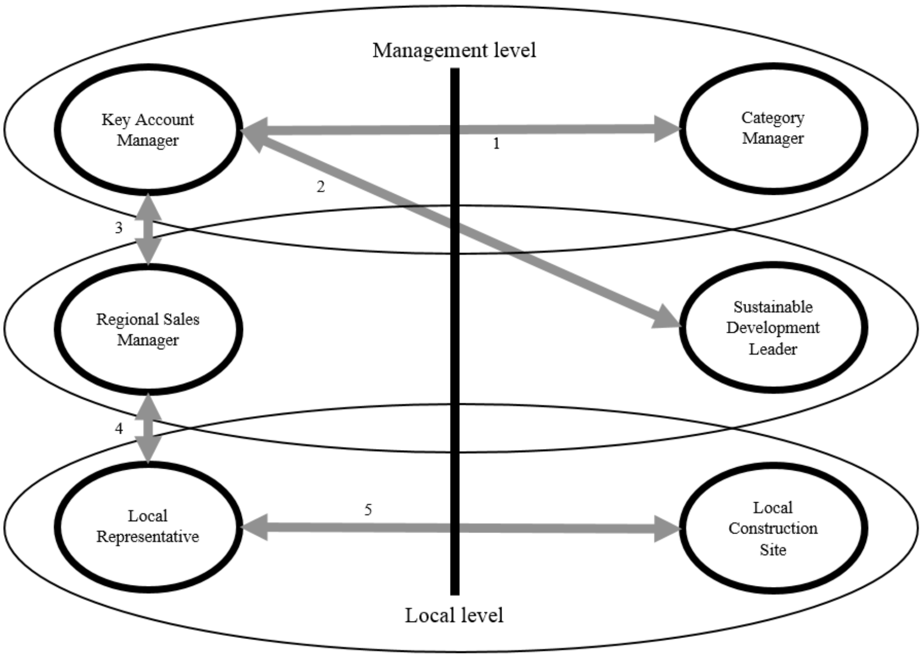

Figure 23. Cross-functional interaction between ProDist and Consgro

ProDist's KAM is responsible for negotiating, building relationships, and signing formal contracts. Consgro's representative and contact for ProDist is the CM. ProDist's KAM and Consgro's CM frequently interact (1) with one another. The interaction has increased over the years as a result of ProDist moving from being an approved supplier to one of Consgro's preferred suppliers. This has also led to the willingness to launch different projects together, one being the Green Month Project. Furthermore, in projects having a focus on sustainability issues the KAM interacts (2) with Consgro's sustainable development leader. This type of interaction is the result of the relationship commitment the parties have developed over time. The KAM assists and interacts (3) with the regional sales managers in their daily work; these managers are the bridge between the KAMs and the local sales representatives (4) within ProDist. On a local level, ProDist's sales force interacts with Consgro's local construction site representatives, and it is between ProDist's local sales representative and the site's representative that the daily interaction unfolds (5).

The relationship in a network of embedded relationships

ProDist and Consgro are both large actors in their respective segments and thus have business relationships with other firms. For example, many of ProDist's customers are subcontractors to Consgro. This is particularly important when it comes to ordering goods. On the one hand, Consgro is a purchaser of high-volume and low-cost goods. On the other hand, they have the role of the main contractor, in which they provide IT system support for subcontractors' order handling and incoming goods deliveries. As seen in Figure 24, there are connections between the relationship between ProDist and Consgro and other relationships.

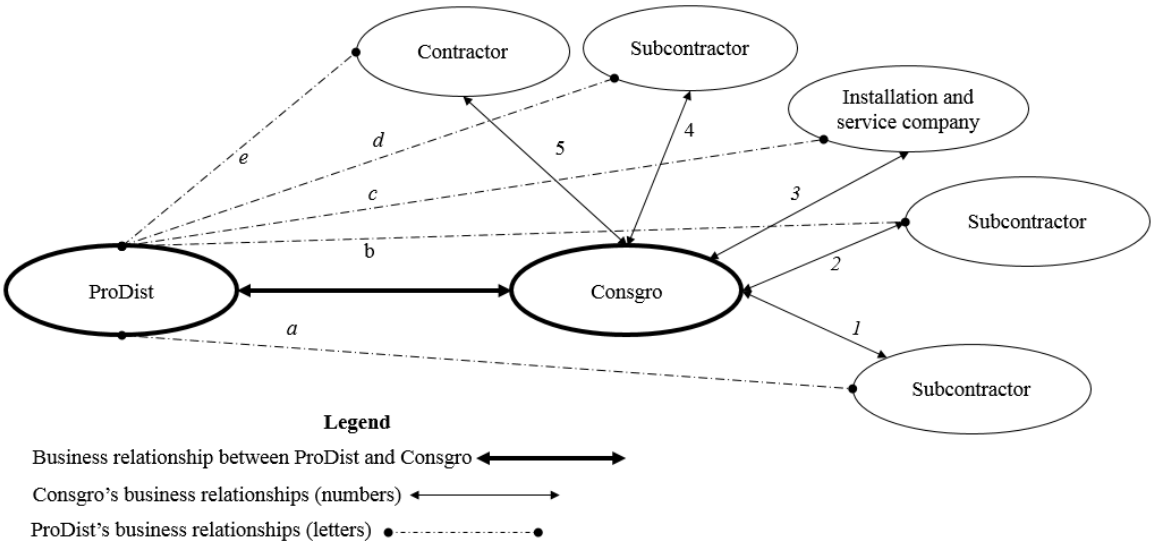

Figure 24. Relationships connected to the ProDist–Consgro relationship

ProDist has business relationships with several firms that are of particular importance since they affect the relationship between ProDist and Consgro (a-e). These firms regularly work on projects where Consgro is the main contractor. Consgro, in turn, has its own relationships with the same firms (1-5) regardless if they order from ProDist or not. When the subcontractors work on one of Consgro's sites and order goods from ProDist (a, b, and d), the transport is arranged to the site, often via Consgro's IT system. The subcontractors (1, 2, and 4) often have their own time slots for receiving goods from ProDist.

With regard to the business relationship with Consgro and the other (main) contactor (5). Consgro and the other contractor can be involved in the same project where they both order goods from ProDist (e) and not coordinate goods deliveries which result in separate deliveries to the construction site. The installation and service company also has a relationship with ProDist (c) and works at Consgro's site (3). However, they have their own procedure and purchase and collect their goods from ProDist's local stores and thus never have goods delivered by ProDist to the site. Thus, the connectedness among the relationships depicted in Figure 24 affects the possibilities to adjust activities and adapt resources to improve efficiency. Hence, interaction is of the utmost importance if the actors want to improve efficiency. All in all, the above illustration shows how embedded the relationship between ProDist and Consgro is with other relationships.

5.2.4 Transport efficiency in the ProDist–Consgro relationship

Because the relationship between ProDist and Consgro has lasted for decades, the way in which Consgro purchases products has become standardised and more than 70% of its purchases made via the purchasing tool integrated into the ERP system. Since ProDist receives orders and processes them in its warehouse in a standardised way, it enjoys an effective utilisation of resources in its operations and serves far more customers than merely Consgro, which allows high capacity utilisation and efficient activity coordination. The last activity in the warehouse is loading of the products onto the Stockholm-bound trucks, all of which have a high load factor (in terms of volume) and are thus highly utilised. The items are then delivered to the construction site within a day of the order being placed. Thus, the service level in this relationship is perceived to be very high and satisfactory. All the firms involved in the TST also corroborate this. The utilisation of resources in the transport of products to Consgro's different sites is important for the overall efficiency in the supply of products. ProDist uses its distribution network, and this means from Consgro's perspective that they buy products (and services) from ProDist where co-loading of the products is the norm, and the deliveries commence within a day. ProDist thus exploits its central warehouse and the other terminal(s) for co-loading, where all products can be loaded with other products to other customers in the same region. Seen from the ProDist–Consgro relationship perspective, this increases ProDist’s utilisation of transport resources and provides high service levels to Consgro with, for instance, room for adaptations regarding specific delivery times. The two companies are involved on different levels of their organisations. The management level signs contracts and rolls out different projects. In Stockholm, ProDist has a high salesforce presence and can quickly deal with possible problems occurring for Consgro. Regarding transport, ProDist-branded trucks have daily contact with different people working at Consgro’s sites. Because improvements in performance require specialisation, over time purchasing, warehouse, and transport activities have been tuned in relation to each other in order to function together with high efficiency. However, specific activities such as the handling and transport of goods with special characteristics and deliveries with time requirements require more resources for coordination. Overall, how resources are exploited in the coordination and performance of activities affects the conditions for transport efficiency. In that sense, ProDist’s high level of service for Consgro is critical, for it stems from the ease of purchasing goods, the accuracy of the number of orders delivered, and the punctuality and speed of deliveries. As a result, Consgro is satisfied with ProDist’s way of distributing the goods that it purchases to its construction sites.

6. The relationship between the seller of goods and seller of transport services

Chapter 6 is divided into two sections. First, section 6.1 describes the relationship between ProDist and Haulcom. Second, section 6.2 analyses the ProDist–Haulcom relationship.

6.1 Empirical description of the ProDist–Haulcom relationship

This section deals with the relationship between ProDist, the buyer of transport services, and Haulcom, the seller of transport services (see Figure 25 below).

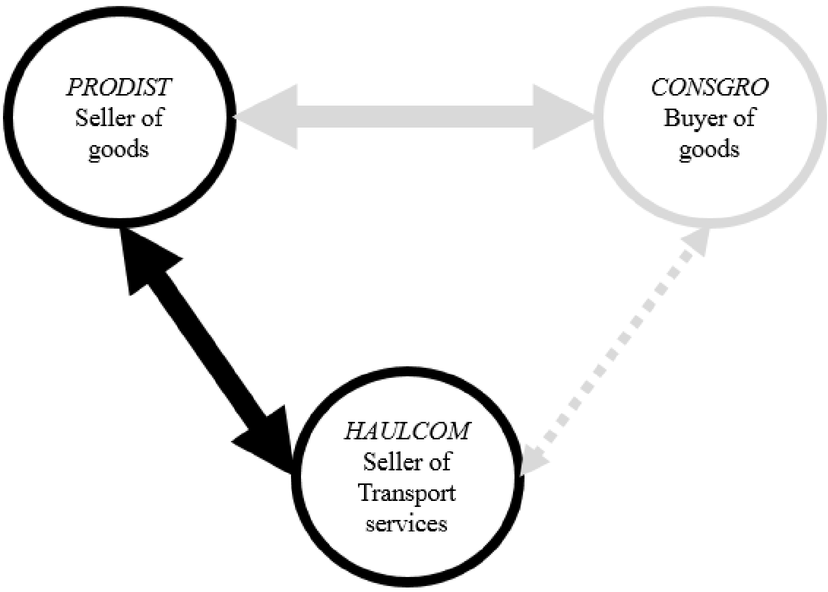

Figure 25. Relationship between ProDist and Haulcom

ProDist and Haulcom have been working together for more than three decades, and Haulcom is the only supplier of transport services for ProDist in the Stockholm area. Likewise, ProDist is Haulcom's only customer. Haulcom is hence dependent on ProDist's business. Thus, when the number of orders declines at ProDist, it declines also for Haulcom. Around the year 1999, the daily operation procedure changed for both ProDist and Haulcom. Prior to 1999, all aspects of transport planning were performed by ProDist. By 1997, Haulcom started to plan every aspect of the transport they later performed as a way to secure a good service and adequate control of the entire operation. Although this routine was not official at first, it became the official method in 1999.

As a consequence, after 1999 Haulcom controlled every aspect of the transport planning and logistics operation, including returns from its terminal. In addition, Haulcom invested in and moved to a larger terminal in 2008. The move enabled Haulcom to develop its terminal operations further with increased capacity. Today, ProDist's demands on delivery frequencies and attained service levels are a result of ProDist's ambitions to be an outstanding provider of customer service. For example, ProDist promises that Haulcom can take care of everything regarding the delivery; thus, a construction site is not required to assist with equipment to discharge goods. The responsibility for discharging goods at the customer's premises lies with Haulcom. Haulcom's trucks are branded with ProDist's logotype, but they are fully owned and operated by Haulcom.

ProDist sends between 70 and 100 shipments to Consgro's construction sites in Stockholm daily. Consgro places orders in its 'purchasing tool', which, in turn, is connected to ProDist's e-commerce portal. In Stockholm, if orders are placed on working days before 8 pm, the goods are delivered on the next working day. When a purchase is completed, an order line will be created in ProDist's IT system. This order line generates a collection of the goods in the warehouse either automatically by the automatized small goods picking system or by a warehouse worker. The goods are packed, and the package gets an address with a postal code. Depending on the postal code, the package is moved to the loading dock to be loaded onto a truck that will transport the cargo to a cross-docking terminal situated in or near the postal code area, for example, Stockholm. The trucks leave the warehouse one by one as they are fully loaded[17]. The transport from the warehouse to Haulcom's terminal is carried out by a large logistics service provider.

The first of eight or nine trucks from ProDist's central warehouse arrives at Haulcom's terminal in Stockholm before midnight and the last arrives in the early morning. As stated previously, the packages are not sorted to specific addresses when they arrive at Haulcom's terminal. Sorting of the goods to specific addresses starts when the first truck arrives just before midnight and continues until 5 am in the morning. Sorting of the goods and transport planning of the trucks are done manually. The number of incoming shipments to Haulcom's terminal from ProDist's warehouse fluctuates between 1000 and 1300 a day, which affects both sorting and transport planning of each shipment. Each shipment has a waybill connected to it. The waybills for each customer are generated via ProDist's IT system. The waybills are generated after 8 pm every day when ProDist's IT-system closes its approval of incoming orders for that day. The waybills are then printed out one-by-one during the night at Haulcom's terminal.

[17] 'Fully loaded' means that the truck has a fill rate of 90–95% in terms of volume.

Haulcom starts pre-loading their crane trucks during the night. This means that the trucks' routes are set during the night depending on the amount of goods and the location of the receiver. The crane trucks carry goods that are long, heavy and bulky, and the first truck departs from Haulcom at 5 am. The trucks return to the terminal after the first round of deliveries to pick up more goods. The goods are sorted and loaded onto Haulcom's remaining trucks during the morning and deliveries are ongoing throughout Stockholm until 4 pm. Goods with one of ProDist's stores as the destination are loaded onto trucks as early as possible. This is because ProDist's stores are prioritised, and Haulcom has to deliver to those stores before they open for customers at 7 am. In addition, the waybills for the stores are bypassed as they are handled internally and separately in ProDist's IT system. The last trucks leaving Haulcom's terminal are those with small parcels and pallet goods.

Haulcom's trucks generally deliver goods in two turns per postal code, per day. Hence, trucks that, in the morning, deliver goods to one of ProDist's stores return to the terminal to load new goods onto the truck. Trucks delivering only parcels have until 9 am to deliver goods which have been ordered as 'express delivery'. In addition to the regular deliveries, Haulcom has to account for time-specific deliveries to certain customers of ProDist. However, Haulcom sees it as untenable to make multiple deliveries to the same construction site several times per day instead of once. This is especially infeasible when the goods are ready for delivery already in the morning, prior to the first delivery. To change this, Haulcom sought to discuss this with Consgro's respective project managers on site in order to get a daily time slot for every delivery to a specific construction site. These types of arrangements can be site- or project-specific, but they are not possible with every site or project as different sites and projects have different logistical arrangements. In some cases, Haulcom can arrange deliveries once per day but in others not; a deciding factor in these cases is the possibility to conduct informal, project-specific negotiations.

Such a situation is illustrated by the following example. During the construction of a new hospital in Stockholm, deliveries were made to the construction site every day to both the main contractor and subcontractors. Haulcom remained on the construction site for a whole working day during the initial and more intensive faces of the construction project to deliver goods to ProDist's customers. Haulcom thus delivered goods to all firms ordering from ProDist, contractor and subcontractors alike. For Haulcom, deliveries to the construction site consisted of roughly 40 individual shipments[18] spread out over approximately 30 stops per trip. The most common receiver of goods was Consgro, with 10–15 shipments per trip.

A further example from a construction site shows that the contractor had an agreement with another logistics service provider in charge of on-site logistics. In this project, Haulcom delivered goods to three subcontractors separately, but they agreed with the on-site logistics provider to set up a fixed time for delivery of all the goods. This meant that Haulcom could load all the goods every morning on one of its trucks and make a single delivery at the same time to the site.

Haulcom has to work in accordance with ProDist's customer offering in every part of its transport and logistical operations. For example, a customer could place an order at 8 pm and receive the order at 7 am the following day. Moreover, ProDist offers customers their delivery at a specific time and place. However, if every customer wants their delivery on specific weekdays, Haulcom's entire operation will fail. Also, quite a lot of the goods sold have special characteristics; namely, they can be heavy, wide, and long or a combination of all three. This puts pressure on Haulcom and how they can best utilise its fleet. To achieve higher logistical performance, ProDist's KAM sees a scenario with an even closer dialogue with Haulcom concerning new ways of moving goods to the end customers. In such a scenario, Haulcom could take a more central role by using its expertise in developing transport solutions. ProDist's KAM stresses the importance of Haulcom's perspective for future undertakings to make ProDist's logistical operation more effective and efficient. According to Haulcom's transport manager, Haulcom has an advantage in comparison to other logistics service providers because of its limited geographical focus with swift and quick support.

6.2 Analysis of the ProDist–Haulcom relationship

This section analyses the relationship between ProDist and Haulcom. The analysis begins with a discussion regarding activities and is followed by a discussion related to resources. Finally, the actors in the case will be discussed.

6.2.1 Activity analysis

The activity pattern of the relationship between ProDist and Haulcom is depicted in Figure 26, which shows the actors involved and the crucial activities they perform. The numbers and

[18] One shipment can include several order lines.

letters indicate the type of activity as well as the order of the activities. Information exchange are indicated by IE, whereas PF indicates goods' movement, the physical flow.

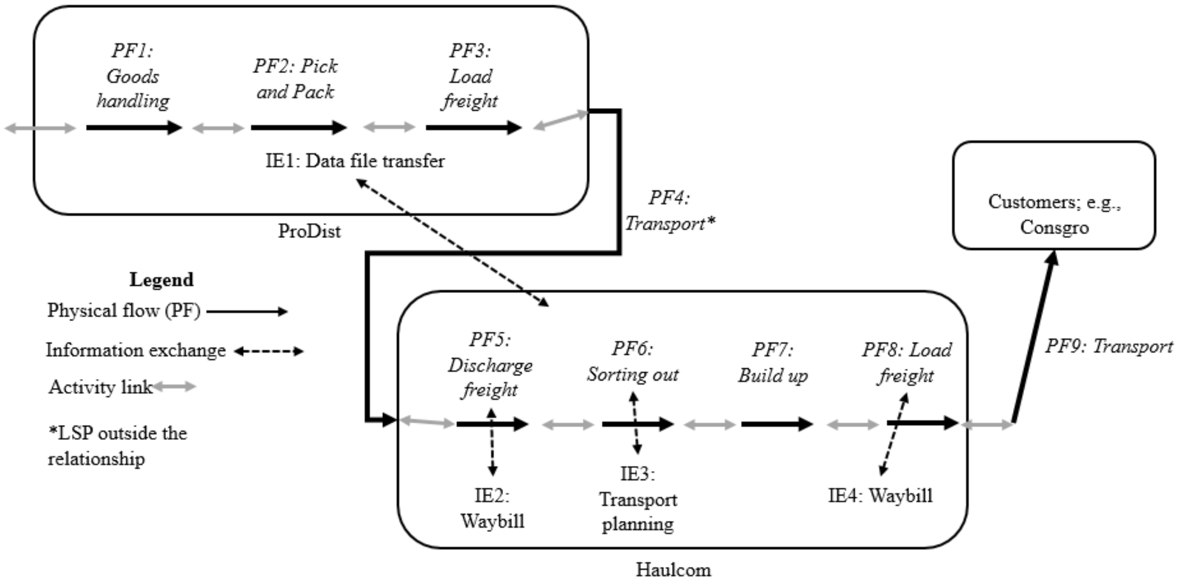

Figure 26. Activity pattern in the ProDist–Haulcom relationship

Figure 26 starts with ProDist's handling of the goods (PF1) to the last transport to ProDist's customers (PF9). The relationship between ProDist and Haulcom focuses on logistics and transport activities. ProDist's internal warehouse activities were discussed in the previous section. The starting point of the relationship between the two is the transport activity from ProDist's central warehouse to Haulcom's terminal (PF4). This outbound transport activity from ProDist's warehouse depends on activities (PF1-PF3) which are performed in a predetermined order. ProDist has chosen to buy all its transport from external LSPs, which acknowledges that this activity chain also requires coordination across firm boundaries and outside of the dyadic relationship between ProDist and Haulcom. In other words, a third actor manages the transport of goods between ProDist's warehouse and Haulcom's terminal (PF4) and is thus not considered as a part of their relationship. Nevertheless, the relationship is important as it connects ProDist's outbound goods and Haulcom's inbound logistics operation.

As the goods are transported to Haulcom's terminal (PF4 and IE2), a file containing information about the recipients is transferred (IE1) to Haulcom's IT system and processed. Haulcom then plans the transport activities (IE3). Activities PF5-PF8 described in Figure 26 are complementary, hence all activities are performed in a specific sequence. Haulcom's materials-handling process includes unloading (PF5), sorting out (PF6), build up (PF7) which means to bring together an order, and loading (PF8 and IE4). In addition, the movement of goods within the terminal area is also dependent on the delivery schedule to Consgro. This means that the goods' delivery is based on the transport planning activities and thus must be loaded on trucks in accordance. The goods are then transported to the customer (PF9).

Interdependencies and adjustments in the relationship

The activities involved in the transport of goods from ProDist's warehouse to the delivery of the goods to the customers are complementary (see Figure 26). The trigger activating the warehouse activities starts upon the purchase of the goods. ProDist is deploying goods from its warehouse based on geographical regions, and goods-handling activities at Haulcom's terminal are interdependent with how the incoming goods are sorted. ProDist does not sort after its customer's final delivery address or if the customer has any special arrangements, such as a specific delivery time when deploying goods from its warehouse. Instead, ProDist's sorting activities for outbound transport revolves around larger regions like Gothenburg or Stockholm. Thus, the goods purchased from ProDist's customers affect the goods-handling activity both in ProDist's warehouse and Haulcom's terminal, especially if the customers need special resources, like a special truck, or if they have specific delivery times.

The activities related to logistics and transport in the ProDist–Haulcom relationship are complementary as well as similar. They are complementary in the sense that they are required to be performed in a specific order and similar as they use the same set of resources (consider the example about pipe clips in Chapter 5). In addition, transport activities are not adjusted for any customer at ProDist's warehouse because the planning and fine-tuned sorting are coordinated by Haulcom after receiving the goods from ProDist. Thus, ProDist's outbound loading activities are standardised. This standardisation means that the LSP moving goods from ProDist's warehouse to Haulcom's terminal must adjust for the arrival time at Haulcom's terminal.

To complete the delivery process, the activities performed by Haulcom are all focused on the handling and delivery of goods to ProDist's customers. The data file (IE1) in Figure 26 with the order information is sent to Haulcom during the night. This file allows Haulcom to start its transport planning activity (IE3). This in turn aids in determining specific activities within the terminal and where the goods are placed in the terminal which; for example, whether the goods are placed outside in the yard or inside in the terminal which activates different personnel, and for which postal code area. ProDist's warehouse operations represent one important part of the activity pattern in delivering goods to its customers. Next, the transport of goods linking ProDist's warehouse and Haulcom's terminal is performed by an LSP, who has a formal business relationship with ProDist. This aspect of the entire transport pattern is outside of the ProDist–Haulcom relationship. Nevertheless, it is an important link between ProDist and Haulcom. The transport is standardised and follows a specific schedule from the warehouse to the terminal, making it complementary to other activities in the activity chain.

As stated previously, Haulcom specialises in a limited set of activities related to transport in this relationship, while ProDist is responsible for all other activities related to the customers near Stockholm. Consequently, there is a need for coordination between ProDist and Haulcom. ProDist and Haulcom have in turn their activity structures which need to be coordinated, especially when the goods vary in terms of their characteristics. For example, when there are demands on goods which are bulky and require a special crane truck thus the coordination of certain activities becomes more crucial than other activities. In cases of bulky and special goods, the materials handling activities have to be adjusted in relation to delivery time to facilitate the loading of the trucks carrying such goods. The time aspect is important because goods with special characteristics often require loading in the terminal yard with the help of a forklift truck and are thus prioritised over pallet goods and parcels. In addition, goods with special requirements also affect other parts of the transport, since such goods often take a longer time to unload. The absence of fine-tuned sorting from ProDist’s warehouse could result in goods that require early transport arriving last at Haulcom’s terminal. Goods with a time-specific delivery arriving late could be challenging as it restricts Haulcom’s ability to complete the loading of its trucks. Thus, the later the goods arrive, the harder it is to adjust the materials-handling activities in Haulcom's terminal.

Many products in ProDist's assortment are heavy, long, and wide. These bulky goods require a dedicated section inside the warehouse and outside in the yard, necessarily requiring adjustments related to their handling in the warehouse. A scenario in which all goods for a crane truck are among the first trucks from ProDist’s warehouse to arrive at Haulcom’s terminal is desirable. Haulcom’s activities related to the terminal and the transport are dependent on a steady supply of goods from ProDist’s warehouse. ProDist and Haulcom must adjust and coordinate the goods and information to secure the reliability of the transport activities and use of the resources involved. For example, an increase in deliveries which require specific resources or time-specific deliveries will impact the possibility of adjusting transport activities and the resources used for transport.

6.2.2 Resource analysis

The central resources identified in the relationship between ProDist and Haulcom are portrayed in Table 9. The focal resources in this relationship are related to ProDist's different goods handling activities and Haulcom's transport and logistics activities. The physical and organisational resources are summarised in Table 9 and discussed in detail below.

Table 9. Resources in the relationship between ProDist and Haulcom

	Physical	**Organisational**
ProDist	Central warehouse	Transport department (business unit)
	IT system (order processing)	Warehouse operations knowledge
	Materials-handling equipment	
	Online stores	
Haulcom	IT system (transport file processing)	Logistics planning (daily and manual)
	Materials-handling equipment	Terminal operations knowledge
	Terminal	
	Trucks	

Physical resources

The resources shown in Table 9 are related to Haulcom's processes in the relationship, namely logistics and transport activities for local physical distribution for ProDist. The IT system for transport file processing and order processing is an important resource in this relationship. It is key for the overall function of Haulcom's processes as the system provides information about forthcoming deliveries to the recipients and is, therefore, the start of Haulcom's transport planning process. That is, the IT systems are an important physical resource for all of Haulcom's activities, including the receiving of goods and subsequent terminal activities as well as the transport activity. The terminal is used for activities related to the unloading, sorting out, storing, building up, and loading of goods. Thus, the terminal is a prerequisite for the physical handling activities. The terminal space, forklifts, pallet pumps, racks, and loading docks are necessary for receiving and delivering ProDist's customers' goods. In addition, the trucks are used for Haulcom's main task, transporting goods to ProDist's customers. ProDist's central warehouse is a core and heavy resource in the relationship. It is from this warehouse and the operation within that all of ProDist's goods are shipped from.

ProDist's online store is key as it is through this portal that the goods are ordered. After the order is processed, the IT system generates a request for collection in the warehouse. The request is the start of ProDist's warehouse operation. Materials-handling equipment in the warehouse is a central resource used to collect and sort customers' goods. For instance, the forklifts, the automated small parcel lifts, and the long conveyor belt for easy transport of goods from the different collection areas are all important in moving the goods in the warehouse to the different loading bays where trucks are waiting to load the outbound goods. Moreover, ProDist has many resources allowing for easy handling of its goods. One particular important resource is the plastic load carriers carrying much of ProDist's parcel shipments.

Organisational resources

Organisational resources are the foundation for many of the activities performed in the relationship. The transport department's competence is an important resource in the relationship. ProDist's transport department has the overall responsibility for purchasing, sustainability issues related to transport, and following up on transport service providers, Haulcom included. Haulcom's logistical planning ability is an important organisational resource for several reasons. First, it provides the backbone for planning the daily transport activities. Second, it is in ProDist's interest to be close to its customers, and ProDist has thus deliberately outsourced the detailed planning for transport in Stockholm to Haulcom since ProDist wants to have specific area knowledge with local anchoring in certain regions. Hence, the division of activities between ProDist and Haulcom means that each actor is reliant on the resources of the other. In addition, Haulcom's daily logistics plan not only reflects the available resources in terms of trucks and drivers, but it must also be adapted to the amount of goods arriving each day at the terminal for further delivery to the customer. Warehouse and terminal operations know-how are essential for both ProDist and Haulcom for their control and coordination of the resources used in the business relationship. For ProDist, the knowledge of how to manage the large-scaled warehouse has accumulated over time with vast expansion. Thus, the skill-sets that are important to turn around the large volumes in the warehouse provide the basis for the numerous activity chains. Likewise, Haulcom's personnel have had to learn the processes for controlling and coordinating ProDist's goods in the terminal, since the fine-tuned sorting occurs within Haulcom's terminal. In addition, the procedure of returning ProDist's plastic boxes is vital as those plastic boxes – physical resources – are of great importance to track goods from ProDist's warehouse.

Resource combining and adaptation

Haulcom's trucks and the goods are combined when the goods are loaded onto the truck. The loading of goods occurs in two ways, either through the terminal loading docks or outside in the yard. The trucks used for pallets and parcels require different resources (pallet pumps or powered stackers) than do the trucks used for heavy and bulky goods. For bulky goods handled in the yard, a counterbalance forklift truck is used. The trucks are used in the logistics planning process. Haulcom has four different types of trucks with different capacities to choose from. The trucks are used depending on the goods' characteristics, which in turn also require the truck's daily capacity to be known in advance, the combining of goods and trucks are therefore important. Haulcom relies fully on ProDist's ability to sell goods and to provide a steady supply of goods from the central warehouse; ProDist relies on the logistical planning and terminal activities of Haulcom to ensure that the products it sells end up in the hands of the customer.

ProDist combines goods defined as parcels with the plastic load carriers which later, in Haulcom's terminal, have to be handled in a way which allows for a direct return. The boxes are a part of ProDist's standardised operation, and they allow for easy monitoring, tracking and tracing of ProDist's parcels. This resource is fully owned by ProDist and put into a cycle between ProDist's warehouse and Haulcom's terminal. The boxes are returned after being emptied and folded together by Haulcom. These load carriers have created a lock-in effect for how incoming parcels are handled and returned at the terminal. Furthermore, Haulcom has invested in new resources over time, for instance, a new terminal and new trucks, to adapt better to the needs of ProDist which Haulcom is reliant on. Thus, Haulcom's resources are adapted toward the logistical and transport needs of ProDist.

Haulcom is completely dependent on ProDist's ability to sell goods to its customers in Stockholm since ProDist is Haulcom's only customer. The physical handling and the transport activities of Haulcom are local. This means that Haulcom works on a smaller scale than ProDist, which has many more suppliers and customers and sells to a larger geographical area. Thus, rather than investing in resources for terminal activities and transport handling close to the customer, ProDist relies on access to Haulcom's resources, which include one terminal, fifty trucks, and organisational resources, such as transport planning and terminal operations knowledge, as well as knowledge regarding the local area. ProDist influences which resources Haulcom should use as they sell goods and services with different characteristics. For example, when ProDist's customers purchase goods that are bulky, they generate the need for Haulcom to use one of its crane trucks (see Figure 27 below).

Figure 27. A loaded crane truck used by Haulcom

The setup between ProDist and Haulcom illustrates some of the advantages that can be obtained when outsourcing a key service, for example, providing a fast and reliable logistics service to customers. The division of work allows both actors to focus on a limited set of activities, achieve increasing scale in their operations, and better exploit their resources. Both firms have their own resource collection, and Haulcom's resources are adapted to ProDist's existing resource collection. The fact that Haulcom is a mid-size firm with a less heavy resource structure than ProDist makes them more flexible and keener in adapting its own resources to ProDist's. This, in turn, allows for organising for higher efficiency in the ProDist–Haulcom relationship.

6.2.3 Actor analysis

This section analyses what is organised and who organises it in the relationship between ProDist and Haulcom. One example from the business relationship between ProDist and Haulcom is provided before analysing organising from an internal as well as a relationship perspective. Around three decades ago, ProDist decided to outsource all its transport activities to Haulcom. In the beginning, the relationship was transactional in its nature, hence, characterised by low involvement from both Haulcom's and ProDist's perspective. However, over the years the relationship has developed to become closer with a higher degree of involvement. This has been accomplished by various joint initiatives which led to more of the responsibilities for transport planning being transferred over time to Haulcom, so that as of today, ProDist has outsourced the entire transport setup to Haulcom. Haulcom owns its own transport and terminal equipment and solely undertakes the needed terminal activities to perform the transport activity. Haulcom is exclusively transporting ProDist's goods which makes Haulcom fully dependent on the volume of goods ProDist can generate through its sales. The dependence has led to ample interaction and close collaboration from both actors over a long time.

ProDist engaged in the relationship with Haulcom for strategic reasons when it deliberately chose to outsource its transport activities to only one transport provider in the Stockholm area. The stability provided by the long-term relationship is instrumental for both actors, and the interaction between ProDist and Haulcom is also important for the development of ProDist's relationships with customers in the Stockholm area. Being a dedicated transport provider for ProDist, Haulcom, with its ProDist-branded trucks, works as an 'ambassador' when delivering goods to all the customers in the area. By doing so, they make the first contact with the customers and get direct feedback, even if they are not handling any claims. Claims are handled by the local sales representatives.

Transport activities and terminal activities are organised across firm boundaries in the relationship between ProDist and Haulcom. These activities refer to the connections between ProDist's logistical activities and Haulcom's transport activities, which are interdependent. The analysis reveals that ProDist's logistical offerings require planning and effort for Haulcom to achieve efficient use of its resources. This involves the different demands for time-specific deliveries as well as deliveries that require special trucks. Resources are organised within the two firms and across firm boundaries in the ProDist–Haulcom relationship (see Figure 28). The trucks are all owned by Haulcom and are used solely for Haulcom's transport of ProDist's goods. However, the goods sold by ProDist require special trucks. These trucks are thus adapted to the characteristics of the goods as well as to the way they are used. For example, ProDist promises that goods purchased from them can be delivered without the customer deploying any special resources, such as a crane or truck. Furthermore, much of the goods Haulcom receives from ProDist are loaded in special plastic pallet boxes. These boxes are adapted for easy and efficient use in the warehouse as well as in the terminal, and they are RFID tagged for easy identification of where the box is and what is in it. In addition, the boxes are used only between ProDist and Haulcom, to go from warehouse to terminal.

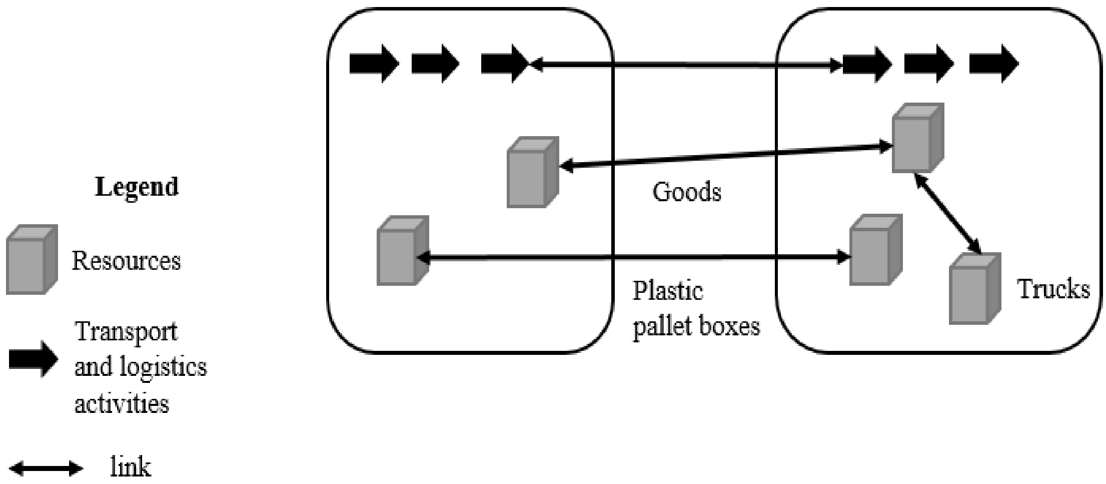

Figure 28. Organisation of resources in the ProDist–Haulcom relationship

Moreover, the analysis identified interaction patterns between ProDist and Haulcom that allow for organising of transport activities and resources. The standardised nature of ProDist's logistical activities makes it difficult to modify and to adjust current activity patterns as well as resource constellations. The analysis shows that ProDist's high service levels, inflexible (warehouse) procedures, and flexible offerings impact Haulcom's ability to organise resources and activities.

Internal and relationship organising

ProDist's firm internal organisation is designed for standardisation, which affects how the logistics are set up as well as how customers are dealt with. ProDist's logistics department manages the contract and has frequent contact with Haulcom. The focus of ProDist's logistics department in the relationship has gradually shifted toward a heavier emphasis on more formal contracts and the need for Haulcom to more thoroughly discuss transport quality and price aspects in detail and how they work with initiatives related to sustainability. Haulcom's internal organising is centred on the terminal, involving the managers, terminal workers, and drivers. The terminal manager has the overarching responsibility for transport planning and the contact with ProDist's logistics manager. Internally at ProDist, there is a low level of coordination between the commercial and transport aspects. Both aspects are discussed within ProDist, but the commercial side is heavier in terms of management attention. Thus, the commercial department more often than not gets its new ideas approved, and they then hand those ideas over to the logistics department for implementation. For example, there is a discussion around even more time-specific deliveries to satisfy customer needs. Such deliveries could, from a logistics perspective, be costly when the activities are adjusted and resources adapted as they currently are. Much of the work processes in the relationship are standardised, for both the logistics and transport activities. However, due to the lack of coordination in the relationship regarding the connection between commercial and transport matters, the needs of the customer and the transport providers are not always met and accounted for. This is exemplified by the transport manager who decided to communicate directly with one of Consgro's projects in Stockholm to change the delivery sequence and schedule and by doing so bypassed the transport agreement between ProDist and Consgro.

ProDist and Haulcom are both heavily involved with one another, with high involvement and far-reaching interdependencies. ProDist has, in its role as a purchaser of transport services, a certain power position in the relationship. The fact that the relationship has been ongoing for a long time and has evolved from being small in terms of scale to cover the greater Stockholm area indicates that incremental steps have been taken in the relationship where expectations and norms have developed over time.

6.2.4 Transport efficiency in the ProDist–Haulcom relationship

Transport efficiency in the relationship between ProDist and Haulcom has developed over time as a result of their long-term relationship, along with the development of terminal and transport activities. Prior to 2000, ProDist handled all transport planning, and Haulcom worked with a small-scale operation, albeit one that enjoyed steadily rising volumes of goods. Since that time, all transport planning has been performed by Haulcom, and the scale of the operation has expanded such that the terminal is now open throughout the night instead of beginning only in the early morning. The fact that all planning is performed by Haulcom has allowed both companies to allocate resources where they are most useful and it has also allowed both firms to adjust their adjoining sequential activities. This process has allowed effective resource utilisation in various operations. For example, ProDist needs only to sort goods in the warehouse according to general delivery regions without sorting for specific delivery addresses. The sequence in which goods are delivered to Haulcom's terminal is also of importance because available resources in the terminal operation have to be taken into account as well as the outbound goods from ProDist's warehouse. The transfer and specialisation of the transport planning activities thus allow Haulcom to plan by its available resources and in what order the goods should be delivered, which has helped to increase transport efficiency in the relationship. These changes and the changes in the offerings to customers have allowed the activity coordination change to include more adaptations and has increased interorganisational interactions.

Haulcom’s push for efficiency contra the efficiency of other actors is a major factor in this case. This stems from different logics on how to achieve higher efficiency. On the one hand, Haulcom tries to utilise its trucks as much as possible to reduce the number of trucks, increase the load factor, and thus reduce fuel consumption and cost. On the other hand, ProDist’s logic is based on fast and reliable logistics and transport of goods within a day with, to a great extent, time-specific deliveries, which is also diligently pushed from the management team. The consequences with more specific deliveries are that more and more resources are allocated to handle fewer customers because each customer requires more time for delivery, partly because of the waiting times in between time slots. The volume of goods transported has increased over the years and is fairly steady throughout the course of the year. The amount of goods handled by Haulcom is linked to its logistics and transport resources and adapted to the needs of ProDist. The number of trucks, terminal resources, and ProDist’s volume of goods are adapted to each other to secure the customer's goods deliveries. Some flexibility is included and needed although neither overcapacity nor undercapacity is desirable. The situation has implications for transport efficiency since Haulcom’s entire operation revolves around delivering goods to ProDist’s customers.

7. The relationship between the seller of transport services and buyer of goods

Chapter 7 is divided into two sections. First, section 7.1 describes the relationship between Haulcom and Consgro. Second, section 7.2 analyses the Haulcom–Consgro *relationship.*

7.1 Empirical description of the Haulcom–Consgro relationship

This section deals with the relationship between Haulcom, the transport service provider, and Consgro, ProDist's customer (see Figure 29 below).

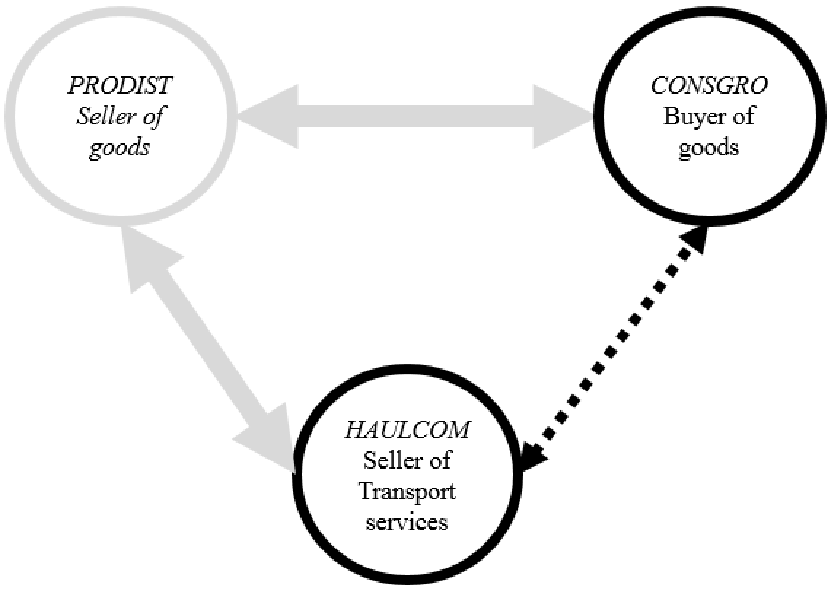

Figure 29. Relationship between Haulcom and Consgro

The relationship between Haulcom and Consgro is indirect since there is no formal business relationship between Haulcom and Consgro. Haulcom delivers goods to Consgro every day. Every month, roughly 1800 consignments, containing 5000 individual packages, spread out over some 140 unique receiver addresses are delivered to Consgro. As stated before, Haulcom's trucks are branded with ProDist's logotype, and therefore Consgro perceives Haulcom as representing ProDist. Haulcom's drivers are the ones who deliver ProDist's goods every day to the customers in Stockholm representing ProDist. Haulcom's transport manager says that the drivers communicate as if they were ProDist.

Over the years, Haulcom has developed relationships with many of ProDist's customers as they deliver goods to many of them on a weekly basis. The fact that Haulcom is the only transport provider for ProDist has given Haulcom time to develop these relationships. For example, Haulcom tries to have a dialogue with Consgro's project managers in striving to plan for daily, instead of multiple, deliveries to some projects. This is because Haulcom sees it as infeasible from a business point of view to deliver goods to the same customer several times a day instead of once, especially when the goods are already available for delivery in the morning. For example, when it comes to time-sensitive deliveries, Haulcom had in one case a time slot at 15:00 Monday–Friday at one of Consgro's construction sites in Stockholm. Loading the truck with goods destined for other customers is no longer possible due to the need to match the time slot at Consgro's construction site. From Haulcom's point of view, this was not a good setup, because Haulcom has to dedicate one truck for that time slot.

7.2 Analysis of the Haulcom–Consgro relationship

This section analyses the relationship between Haulcom and Consgro. The analysis begins with a discussion regarding activities and is followed by a discussion related to resources. Finally, the organising and interaction in the relationship will be discussed.

7.2.1 Activity analysis

The activity pattern of the relationship between Haulcom and Consgro is depicted in Figure 30, which shows the activities and actors involved. The numbers and letters indicate the type of activity as well as the order of the activities. Information exchange are indicated by IE, whereas PF indicates goods' movement, the physical flow.

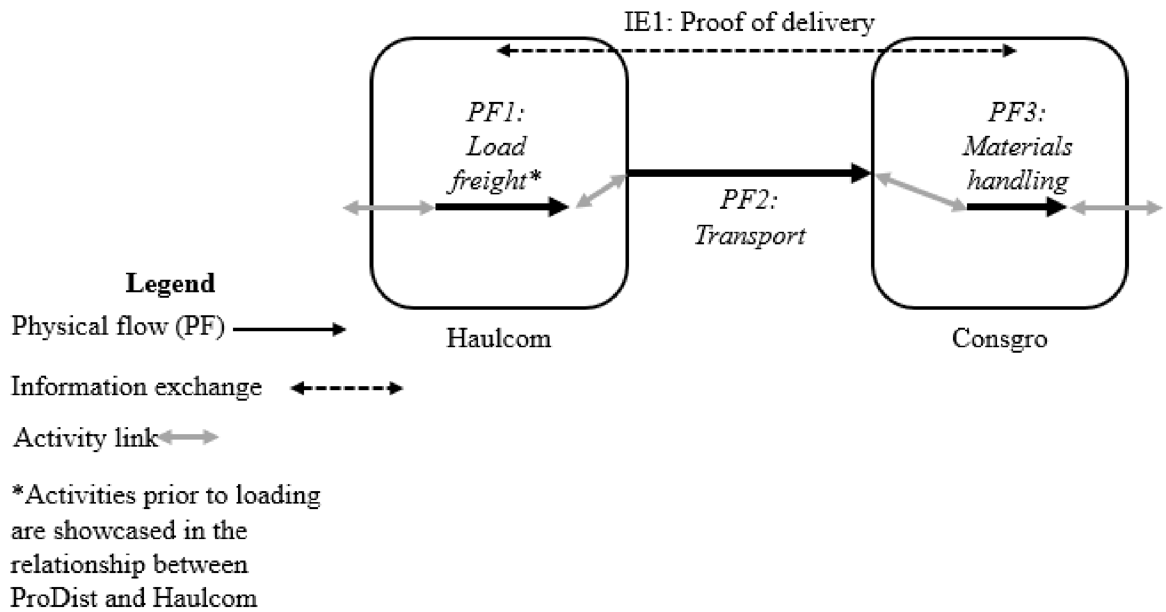

Figure 30. Activities in the Haulcom–Consgro relationship

The relationship between Haulcom and ProDist is indirect since no formal business relationship exists. Nevertheless, it is an important indirect relationship because Haulcom delivers ProDist's goods and Consgro receives the goods. Figure 30 starts with Haulcom's goods handling (PF1), continues with the transport (PF2) to Consgro, and ends with Consgro's materials handling on site (PF3) and the subsequent signing of the proof of delivery (IE1). The activities involved in the transport of goods from Haulcom's terminal to Consgro's construction sites are similar. As seen in Figure 30, activities prior to loading were explained in section 6.2.1. Therefore, the starting point is from the final stages of loading at Haulcom's terminal.

There are two separate activity chains in the final stages of loading, depending on the characteristics of the goods and the receiver of the goods. First, for example, the trucks that haul goods which are (a) bulky or (b) time sensitive depart from the terminal first. Thus, the preloading activities of the trucks are performed during the night. Deliveries of this kind can impact the truck's route and, in turn, the truck's utilisation, especially since the planning horizon is tight. The terminal activities where some restrictions are involved are prioritised over the standardised activities. Hence, Haulcom has to adjust its terminal and transport activities differently since the terminal activities with restrictions (bulky or time sensitive) are separated from the standard activity chain without these restrictions.

The standard activity chain involves goods which are loaded and sorted based on daily transport planning, without the restrictions mentioned. Hence, if standardised activities are the norm in the system, then every deviation from the standard may have an impact on other activities, both inside the terminal and in regard to transport. Moreover, to improve truck utilisation and thereby the efficiency of the whole transport operation, Haulcom must manage the interdependencies between Consgro's orders and ProDist's other customers.

Three conditions affecting the two activity chains

Three conditions can be identified as having implications for the transport activity between Haulcom and Consgro: standard, time and place, and goods with special characteristics (see Figure 31).

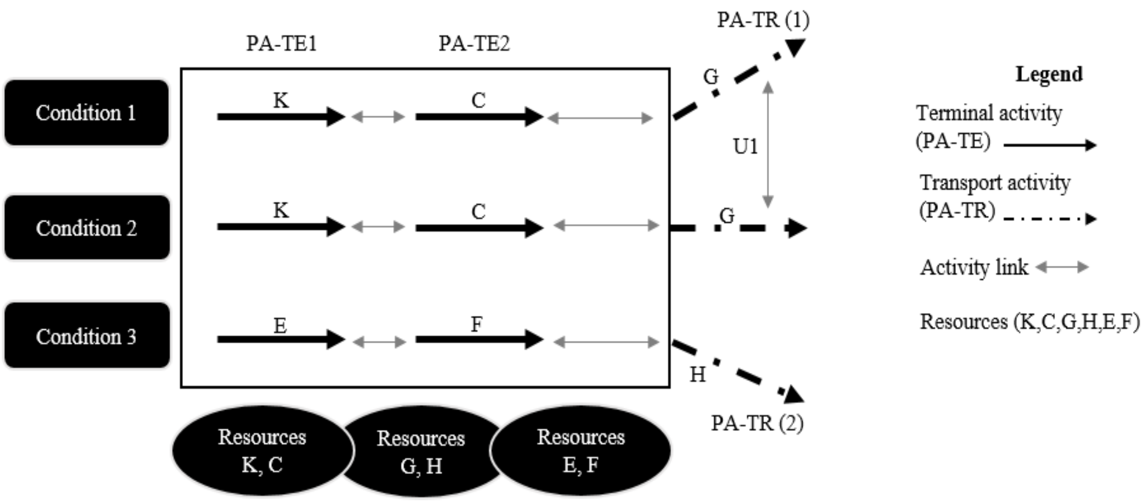

Figure 31. The impact of three conditions on activities

Under the first condition, the standard terminal activities in the activity chain (for Condition 1) results in transport activity (PA-TR1), which has no restrictions based on time and place or special goods characteristics. In this activity chain, terminal activities sorting (PA-TE1) and loading (PA-TE2) use the same resources: terminal equipment such as pallet-pumps and handheld computers to scan goods (Resources K and C). When the second condition pertains, goods with restrictions in terms of time and place are paired with activities in the first condition, as the same resources (K and C) are used for both conditions. The addition is that the goods are to be delivered at a specific time and place and require coordination with the transport activity for Condition 1. This is represented by the double arrow U1 in Figure 31. The coordination with the first condition makes it possible to share resources in the terminal (Resources K and C) as well as when it comes to the physical transport of the goods using a truck (Resource G). The sharing of resources (K, C and G) for both activities results in one united transport activity (PA-TR1).

For the third condition, goods with special characteristics have to be sorted and loaded first (in time) as they require special resources for handling goods such as counterbalanced trucks for loading (Resources E and F) and a crane truck for transport (Resource H) and take a longer time to unload. Activities PA-TE1 and PA-TE2 use a different set of resources (E and F) for the third condition compared to the other two conditions. The effect of this is prioritisation for the third condition, and activities which activate Resources E and F are therefore undertaken first. In addition, the transport activity (PA-TR2) is also undertaken first.

In summary, the transport activities are similar and complementary. The transport activities are similar in the sense that they require the same set of resources. The transport activities are complementary as prior activities, like sorting out and building up, need to be consolidated before the physical transport can follow. The result of this is that Haulcom's terminal (PA-TE) and transport activities (PA-TR) in Figure 31) have little room for manoeuvrability. Moreover, to meet the service level demands, time is a critical issue. Thus, Haulcom faces challenges when it comes to managing and coordinating transport activities, especially under the second and third condition.

7.2.2 Resource analysis

Central resources in the relationship between ProDist and Consgro are portrayed in Table 10. The resources in focus in this relationship are related to Haulcom's transport activities and Consgro's construction site activities. The physical and organisational resources are summarised in Table 10 and discussed in detail below.

Table 10. Resources in the relationship between Haulcom and Consgro

<table>
<tr><th></th><th>Physical</th><th>Organisational</th></tr>
<tr><td rowspan="4">Haulcom</td><td>Trucks</td><td rowspan="4">Drivers</td></tr>
<tr><td>Handheld computers</td></tr>
<tr><td>Terminal</td></tr>
<tr><td>Terminal equipment</td></tr>
<tr><td>Consgro</td><td>Equipment for inbound logistics</td><td></td></tr>
</table>

Physical resources, such as the terminal, trucks, construction sites, and equipment for inbound logistics, are important resources in this relationship. The terminal and the terminal equipment function as a prerequisite for the physical handling of goods, making both necessary for transport of Consgro's goods. Haulcom's trucks are key resources in this relationship as they are used for delivering goods to Consgro. Equipment at the construction sites is necessary for handling the inbound goods and as goods need to be moved around the construction site. Trucks loaded in the yard often have goods with special characteristics (e.g., goods that might be especially heavy, long, or wide) that require special forklifts or a crane, for instance. ProDist offers delivery of bulky goods to Consgro's sites and commits to lift off the goods from the truck themselves. Although Haulcom's drivers handle every aspect of unloading, they occasionally use the equipment for inbound logistics available on site. Hence, resources do not need to be allocated for the delivery. In regard to organisational resources, the drivers and their handheld computers are important resources for securing the delivery of Consgro’s goods, to maintain service levels, and to secure the transfer of ownership.

Resource combining and adaptation

Haulcom indirectly relies on Consgro for utilising its terminal capacity, while Consgro relies on Haulcom’s transport activities to ensure that the goods it purchases arrive at its construction sites. These conditions affect the coordination of activities and the resource adaptations required. Owing to the similarity in the structure of activities discussed above for the transport of goods intended for Consgro, Haulcom can use the same resources for ProDist’s other customers. There are interdependencies in the final stages of loading, which are related to resource allocation and how to commence the daily transport planning. Goods that are subject to transport and have special characteristics – e.g., weight, length, and width – impact how Haulcom can coordinate and plan its resources. In these instances, the goods have to be allocated to special trucks with the ability to handle them. These types of goods are often bulky, which means that the utilisation can be maximum in terms of weight but not in volume and vice versa. The characteristics thus impact the way Haulcom handles terminal activities, resources within the terminal, and the trucks used.

7.2.3 Actor analysis

Actors’ involvement and which activities they perform depend on the actors’ respective position in the network and which relationship the actors are involved in. Even though the relationship between Consgro and Haulcom is indirect, it affects both the relationship between Consgro and ProDist as well as the relationship between ProDist and Haulcom. On a strategic level, there is not much organising which affects the overarching service levels between Haulcom and Consgro as their relationship is indirect and no other management interactions exist. Haulcom’s transport activities are organised within the ProDist–Haulcom relationship. However, Consgro sets the conditions for what and how Haulcom organises, which impacts the Haulcom–Consgro relationship. Given ProDist's offerings and the transport conditions, Haulcom needs to coordinate its transport activities in a way that allows them to deliver the goods in accordance with these conditions. However, the activities are organised with the objective of achieving a high resource utilisation for Haulcom and a reliable logistics service in accordance with all of ProDist’s customers’ needs.

Interaction on a daily operational and individual relationship level is more prevalent in the relationship, and multiple actors organise on a day-to-day basis. For example, the terminal workers – the people who plan and manage the goods – and the drivers at Haulcom all contribute to the firm's internal organising, but they also contribute to organising within the frame of the relationship. The drivers are the ones delivering goods to Consgro and thus are the Haulcom employees in daily contact with Consgro's construction sites in Stockholm. Likewise, Consgro's construction site personnel are the ones communicating with the drivers when they receive the goods. The drivers' role with regards to organising is important for several reasons. First, the drivers load the goods at the terminal, so the transport operation depends on the drivers having good knowledge of the routes when they load and deliver the goods. Second, they interact with every customer when they deliver the goods, so they are the first to get both positive and negative feedback from the customers. They function as ProDist's extended arm in the interface with the customers. Third, all drivers are involved in the physical distribution, serving ProDist's stores and Consgro's construction sites, as well as other customers of ProDist. The drivers establish relationships with the receiving parties over time. Specifically, the drivers gain knowledge about the specific demands of each customer. Lastly, the interactions are often informal and do not reach ProDist. Instead, the customers interact directly with the driver to solve issues and to arrange future delivery specificities, such as a special gate on the premises or specific delivery time, none of which is stipulated in the business arrangement.

7.2.4 Transport efficiency in the Haulcom–Consgro relationship

In this relationship, transport efficiency is linked with the three conditions specified in the previous section (7.2.1). Transport efficiency in the relationship of ProDist and Consgro has been high due to the high levels of service and swift deliveries. In particular, Haulcom perceives transport efficiency to be high when trucks are not constrained by time-specific deliveries, which allows it to employ its own logic to organise transport services and ensure that the trucks are used in a way befitting them. As such, it is imperative for Haulcom to utilise its trucks to the greatest extent possible in order to reduce costs by avoiding the excessive use of its trucks. However, in the relationship with Consgro that is not always possible because of the different time slots and the booking arrangements made at the various construction sites. In addition to the booking arrangements, the way goods are purchased affects how Haulcom utilises its transport resources. Another factor affecting transport efficiency is the characteristics of the goods. Bulky goods influence the way Haulcom handles its terminal activities and utilises its resources in relation to Consgro's construction sites. Not being constrained by time specificities allows more independence in terms of resource use, especially from Haulcom's perspective. Also, transport efficiency is linked to the delivery of the goods at the right time, in the right quantities and at the right place, especially from Consgro's perspective. Consgro's handling of inbound transport is adjusted to the capacity and needs of their construction sites. If there is a change in the construction process, the transport plans may need to be adjusted accordingly, thus affecting Haulcom's deliveries to Consgro's sites.

Consgro's construction sites are scattered around the larger Stockholm area, with Haulcom's deliveries characterised as local distribution. Transport efficiency concerns not only resource utilisation; it also concerns to most suitably organising the transport activities in relation to other activities. The most suitable way to organise transport thus depends on the different actors' perspectives and logics. The actors' different logics and perspectives decide what is considered high or low transport efficiency given the actors involved and resources used. The Haulcom–Consgro is not recognised from Consgro's perspective because Haulcom delivers goods in trucks branded as ProDist and are therefore perceived to belong to, and be a part of, ProDist. Also, Consgro primarily communicates with ProDist in regards to transport, and seldom with Haulcom directly. Hence, the Haulcom–Consgro relationship is dependent on both the ProDist–Consgro relationship and the ProDist–Haulcom relationship. The ProDist–Consgro relationship is, concerning transport, organised in a way where Consgro gets deliveries the day after the order is placed. Also, the activities Haulcom performs and the resources used are adjusted and adapted to the needs of ProDist. Thus, it is difficult to extract transport efficiency from the isolated Haulcom–Consgro relationship because it is the connection between the other two relationships that activates the transport and the transport efficiency thereof. As such, isolated relationships are not always the best unit of analysis to capture transport efficiency or for doing anything to increase it (see Figure 32).

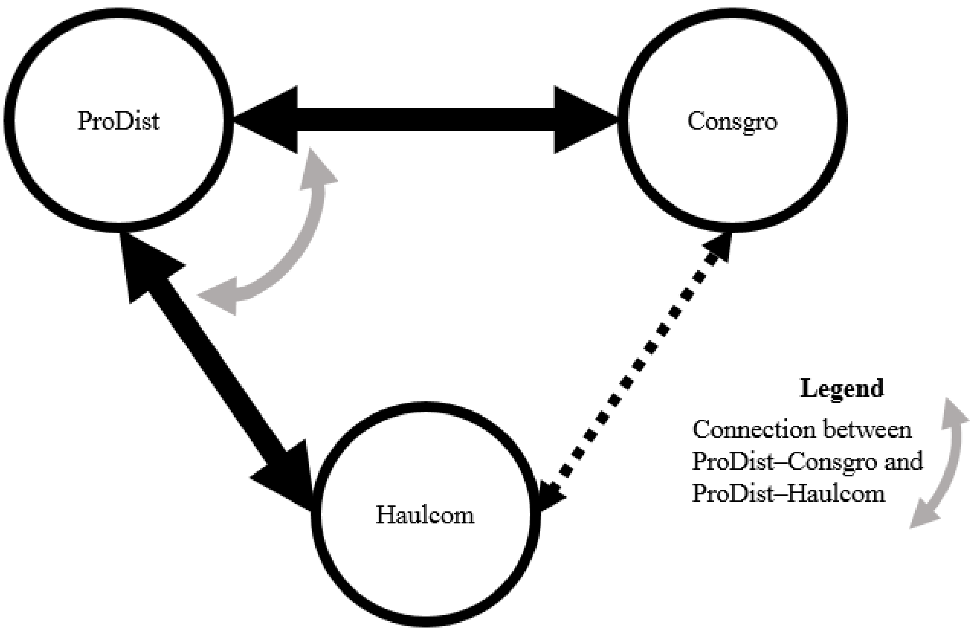

Figure 32. Connections affecting transport efficiency

Transport efficiency measures and actual deliveries come to light in the business relationship between Haulcom and Consgro since the actual transport take place in this relationship. If transport efficiency is limited to only measures of CO_2 and resource utilisation for the Haulcom–Consgro relationship, modifications in transport planning could increase transport efficiency only by focusing on Consgro's deliveries. However, the relationship between Haulcom and Consgro is an outcome of the ProDist–Consgro and ProDist–Haulcom relationships. Thus, what is decided in the two latter has vast implications on how Haulcom can perform its activities and use its resources. Both Haulcom and Consgro can increase as well as decrease transport efficiency in their relationship on a construction site and project level. The ability to operationally change delivery frequencies and routes is possible due to their informal business relationship. The ability to change and optimise transport efficiency on a systems level is harder for Haulcom since they are not involved in discussing Consgro's needs nor the development of ProDist's offerings.

In conclusion, to understand the dynamics of the Haulcom–Consgro relationship, the other two relationships have to be taken into account. Thus, the next chapter is devoted to the triad as one cohesive unit and, to further show the need of a triadic approach, a situation where ProDist and Consgro tried to accomplish a change in the number of weekly deliveries is described.

8. The Transport Service Triad

This chapter describes and analyses the Transport Service Triad in relation to transport efficiency. The chapter is divided into two sections. Section 8.1 provides an overview of the Green Month Project. Section 8.2 analyses the focal Transport Service Triad.

The three previous chapters analysed the three relationships involved in the focal TST (see Figure 33). This chapter analyses the TST as one entity to highlight how transport efficiency is affected when adding a third actor to the analysis.

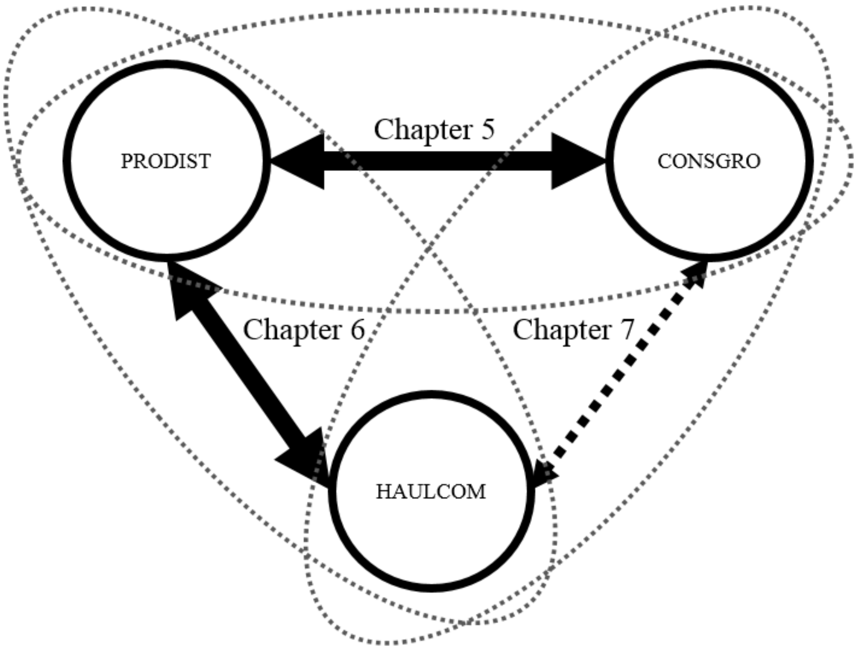

Figure 33. Each dyadic relationship in the triad

The analysis takes its starting point in the Green Month Project, an initiative aimed at reducing the number of transports to construction sites in Stockholm. The next section provides a description of the Green Month Project.

8.1 The Green Month Project

In the late 2000s, in an effort to increase awareness of sustainability issues, Consgro began to dedicate one week every year to focusing on these issues. One aspect of this annual week was to meet customers and suppliers to jointly discuss sustainability issues in order to identify some common projects within this area. One such example is the Green Month Project, which was initiated through discussions between Consgro and ProDist in late 2015 and realised in September/October 2016. The idea of the Green Month Project came from ProDist's KAM and head of transport (HT), who wanted to work with customers to find new delivery routines to jointly be able to reduce CO_2 emissions. The project had the goal of tracking CO_2 emissions and ton-kilometres from trucks during one month (in this case September 2016) of regular daily deliveries in the Stockholm area. The results of the project should serve as a reference point for future ambition to reduce deliveries from daily deliveries to twice a week in the Stockholm area. The CM at Consgro states:

> It is of course easier to work with a supplier that has their own thoughts and ideas. It was easier to proceed with a project like the Green Month Project, because ProDist initiated it. Otherwise, we would probably never have carried it out. If ProDist had not raised this problem, it would be very much up to what a supplier wanted to do and then we would decide on our end if we wanted to put time and energy into it, or if we would say 'No, this is not something we will do right now'.

The scope of the project was to include all of Consgro's construction sites in Stockholm. However, no subcontractors were connected to the project, something that turned out to be a huge limitation for the project. This will be further discussed in chapter 8.1.2.

8.1.1 Description of the Green Month Project

To recapitulate, the status quo is that Consgro orders goods from ProDist on day 0 and receives delivery of the goods on day 1. Haulcom, who delivers all of ProDist's goods in the Stockholm area, performs the deliveries. The new situation meant going from daily (Monday to Friday) deliveries to deliveries twice a week (Mondays and Thursdays). This, in turn, had some implications for the involved firms. First, to make the desired changes, ProDist postponed the processing of Consgro's orders until the day before the agreed delivery date, regardless of when the order was placed. This adjustment was made by adding a special feature in the IT system. Second, for ProDist, the project meant that they only needed to process Consgro's orders twice a week instead of five times a week. Third, for Haulcom this meant that they delivered goods to Consgro on only two days a week instead of five.

The Green Month Project is summarised in Figure 34 and Table 11 below. The process starts by Consgro's buyers placing orders on ProDist's purchasing portal. During the Green Month Project, 2,460 items were sent to Consgro's construction sites spread over 794[19] orders and 160 individual receiver addresses. The number of items delivered to a construction site could differ a lot from one delivery to the next. For example, on October 21, a 62-order delivery

[19] Bear in mind that orders and items are not equivalent; one order can contain several items.

contained 164 items. Out of the total 794 orders during the project, 667 were delivered in accordance with the terms of the Green Month Project, which in Figure 34 is symbolised by 'green delivery days'. Green delivery days occurred eight times during the month. The remaining 127 orders were not sent in accordance with the agreed-upon delivery schedule, which in Figure 34 is symbolised by 'red delivery days'. These kinds of orders occurred on ten days during the project.

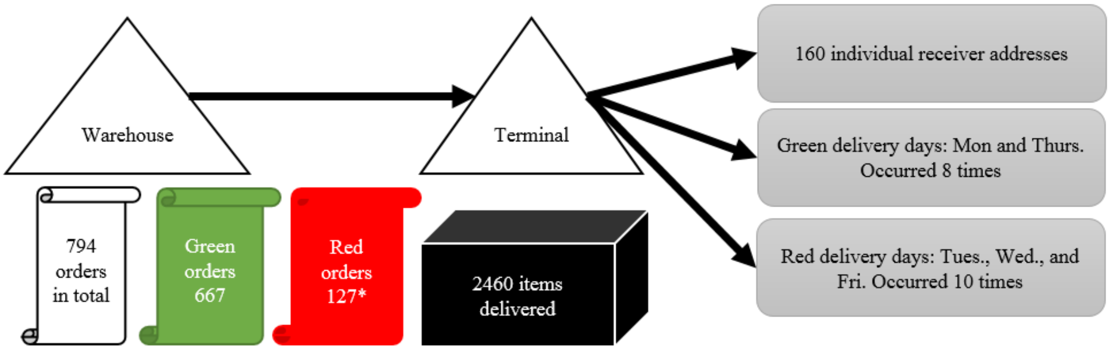

Figure 34. Overview of the Green Month Project (October 5–October 28)

Table 11 illustrates the deliveries during one week of the project. During this Friday-to-Friday period, Haulcom distributed goods on three 'green days' and three 'red days' (see * in Table 11). In total, 30 orders involving 48 items were placed outside the agreed-upon delivery schedule because of the urgent need of certain products, whereas 239 orders of 711 items were in accordance with the agreed-upon delivery schedule, that is, on green delivery days.

Table 11. Example from the Green Month Project - goods ordered and deliveries made

Goods sent from warehouse	Consgro receives the goods	No. of 'Green' and '**Red***' orders	No. of items
October 14 - Fri.	October 17 - Mon.	69	190
October 17 - Mon.	**October 18 - Tues.**	**7***	**18**
October 18 - Tues.	**October 19 - Wed.**	**10***	**11**
October 19 - Wed.	October 20 - Thurs.	108	357
October 20 - Thurs.	**October 21 - Fri.**	**13***	**19**
October 21 - Fri.	October 24 - Mon.	62	164

During the project the number of orders per day changed from approximately 43 per day for the month before the change (September) to approximately 80 per day after the change (October). This was in line with what both Consgro and ProDist anticipated. However, the orders made because of bad planning due to that some projects did not receive the information about the project, that is, on ‘red days’ were not desirable although they were deemed to be necessary from both Consgro's and ProDist's perspectives. The reason for orders being placed ‘in panic’ was that it proved to be difficult to get everyone involved in the project informed. This, in turn, created some challenges, which will be discussed next.

8.1.2 Challenges and how they were handled

The Green Month Project was confronted with some challenges, which will be discussed in the following sections. One challenge concerned the lack of information sharing in Consgro’s organisation regarding the Green Month Project. Other challenges were related to purchasing behaviour and ProDist’s IT system. Still another challenge was related to the fact that subcontractors were not involved in the project.

Information sharing difficulties

The original decision to launch the Green Month Project was made on a central management level at Consgro. This information was then disseminated to the regional level at Consgro. The regional managers disseminate a lot of information every day and it is easy to miss or overlook certain information. The district manager then had to disseminate the information to every construction site manager in the district. The site managers then had to disseminate the information to the persons at the construction site who actually purchase goods from ProDist’s portal. Consgro’s category manager states the following about disseminating information in the organisation: ‘It is not only from the purchasing department that they get the information, but it is also from the sustainability department, from those who work with the working environment. It is a lot of information we want to share, so it is hard’. The difficulties of getting information disseminated to every construction project led to it taking two weeks for projects to fully realise that the Green Month Project was ongoing. All in all, this together led to many people in the organisation missing information about the project and its goal and aim, which, in turn, created an unwillingness to follow the procedure outlined for the project.

Progression of the project – IT system and purchasing behaviour

The IT system was only adapted on ProDist’s end. In practice, this necessitated a manual queue (buffering scheme) with the purpose of queuing goods purchased during the ‘wrong’ days, that is, red orders in Figure 34 and Table 11. Since ProDist usually delivers goods the day after their purchase[20], the buffering scheme made it possible to hold goods so that they remained in the system until the day before the agreed-upon delivery, regardless of when the order was placed. This approach was easier and less costly for both parties compared to changing the pick and pack, storing, and loading operations in the warehouse. Changing the warehouse operation would have required adjustments to the activities performed in the warehouse because the goods would have to be sorted out from the standard operation in ProDist's warehouse and then stored until the day prior to delivery. Another alternative could have been to store the goods in Haulcom's terminal; either way it would require unnecessary storing for 2-3 days at ProDist or Haulcom, which would in turn require special handling of the goods when allocating the orders to the trucks.

The project meant that ProDist should process Consgro's goods only two times a week instead of five. Consgro's on-site buyers were instructed to purchase products only on the day prior to delivery. However, when they did not follow these instructions, ProDist's IT buffering scheme queued the goods. Thus, it was easier to change ProDist's IT system than to enforce a new, provisional, purchasing behaviour at Consgro's construction sites.

Subcontractors' lack of participation

The fact that subcontractors that bought from ProDist were not included in the scheme resulted in ProDist still sending goods from its warehouse to the sites almost every day. The main problem with subcontractors' lack of participation in the Green Month Project was that they could order goods every day and have them delivered the next day; i.e., ProDist's day-after delivery applied for all subcontractors, but not for Consgro. This resulted in reduction of the load factor for the trucks delivering goods to the concerned sites. That is, instead of having a steady flow (normal fluctuations accounted for) of goods to all recipients on the sites the trucks delivered only to subcontractors, which resulted in deliveries with less volume of goods but with the same frequency. This also created a situation where both ProDist and Haulcom had to process goods in the same way as before. Hence, since Haulcom still needed to deliver to the subcontractors on Consgro's sites the project had no impact on Haulcom's day-to-day business. Haulcom's transport manager (TM) elaborates on this in the following way: 'Because subcontractors did not take part, the entire project was meaningless as we still had to deliver goods to every subcontractor working at Consgro's constriction sites'. However, Haulcom could have made some changes in their operation if subcontractors had been included. For example, by allocating trucks and personnel for the increase in goods

[20] Order placed day 0; goods delivered day 1.

volume on the two delivery days, and the planning of the truck routes, thereby avoiding delivery of only subcontractors' goods those days.

8.2 Analysis of the Transport Service Triad

The forthcoming analysis discusses the effects on transport efficiency when the third actor is accounted for. Transport efficiency relates to how resources are utilised, how (transport) activities are coordinated, and how actors interact. Two scenarios are illustrated in Figure 35. The first concerns transport efficiency in the dyad (Scenario 1) which was discussed in Chapters 5–7. The second concerns transport efficiency in the triad as one unit (Scenario 2).

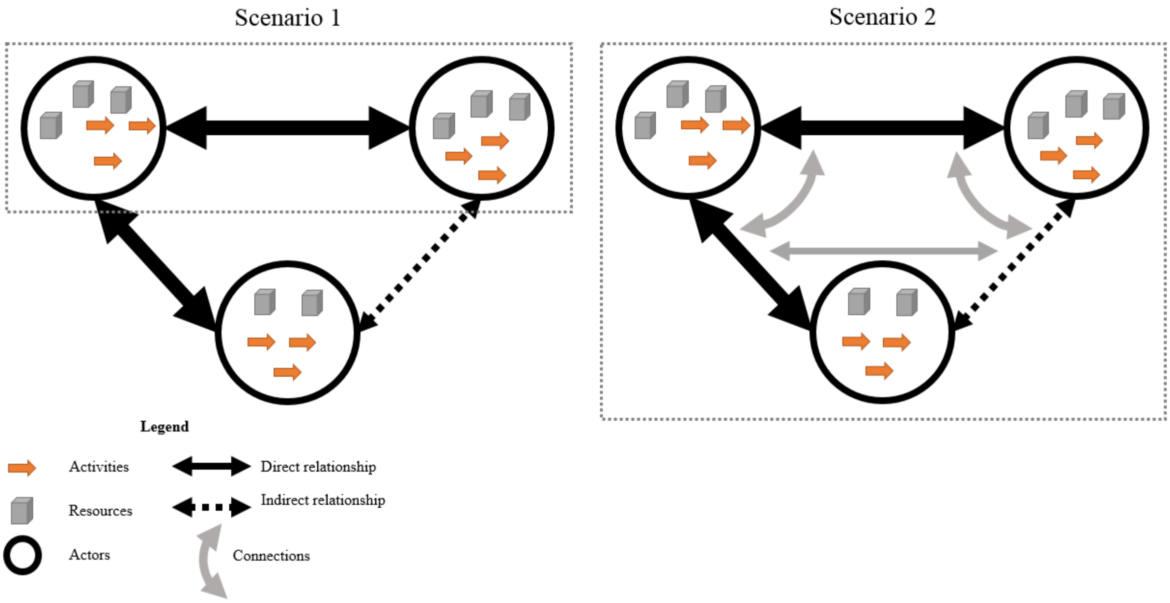

Figure 35. Analysing the effects of adding a third actor

8.2.1 Analysing two principal issues with the Green Month Project

In the following section two issues related to the Green Month Project are discussed: (1) Consgro's internal communication of the project and (2) the fact that subcontractors were not part of the project. First, internally disseminating the information about the project from the purchasing department to the sites took longer than expected due to the many organisation levels existing between the purchasing department and the site managers and on-site purchasers. Hence, Consgro's organisational structures hindered the information to reach the relevant actors before the start of the project. Due to a lack of information, the on-site purchasing activities did not at once change on all sites to twice a week. At some construction sites the project directives were followed directly while it took two weeks for others, which created confusion on the construction sites in regard to the whole project and how to commence the on-site purchasing. Orders were also placed 'in panic' from sites following the initiative since on-site purchasing is performed on an ad-hoc basis with little to no planning, and such orders could still be requested within the terms of the project. Thus, the (lack of) coordination of the purchasing activities at Consgro's sites contributed to making it difficult for Haulcom and ProDist to reduce the number of deliveries to the sites. They could have reduced the number of deliveries to the construction sites had they only received orders two days a week. In order to manage Consgro's scattered purchasing activities ProDist adapted its IT system to buffer Consgro's orders to the day before delivery; by changing the IT system, they neither changed its warehouse nor logistics activities for the Green Month Project. ProDist and Haulcom proceeded with business as usual. Yet, if ProDist's other customers start to interpose their needs in other ways, for example, if other customers started with their own specific delivery days, then ProDist would have to handle its activities and utilisation of resources differently as well as the effects thereof.

The second issue to be discussed is the lack of participation from subcontractors. Subcontractors working on Consgro's sites were not obligated to follow Consgro in how to purchase goods from ProDist. As the subcontractors ordered goods every day the demand for transport to site did not change. The result was that the project did not reduce the number of deliveries to site. Several of the subcontractors working on Consgro's sites have their own business relationship with ProDist. This meant that ProDist got separate orders from Consgro and the subcontractors. These orders were not coordinated either in ProDist's warehouse or Haulcom's terminal. In Haulcom's terminal the orders were sorted based on location and route. Haulcom's terminal activities and the demand for transport to site did not change as the subcontractors ordered goods more or less every day. Thus, Haulcom delivered goods to Consgro's sites every day, oftentimes with less quantity than usual since much of the goods to Consgro were queued and only delivered on two days (except for the 'red orders'), resulting in a central and key role for fourth parties (i.e., subcontractors). The result was that the Green Moth Project did not help in reducing the number of times a truck delivered goods to the sites; sometimes a lot of orders were delivered and sometimes only a few (see for example Table 11). Nor did it account for the connections between subcontractors and Consgro's orders and ProDist's way of handling those orders. Such connections are important for addressing efficiency and what is possible to capture or not with a restricted and narrow analysis. Thus, the next section analyses different aspects of efficiency in the TST in relation to what is possible to capture.

8.2.2 Analysing different aspects of efficiency

Transport efficiency in the three relationships was discussed in Chapters 5–7. However, transport efficiency is not the only aspect of efficiency for firms. Other aspects of efficiency are important for firms and can be contradictory. Thus, how other activities are performed and how other resources are utilised are important for firms. That is, other aspects of efficiency that are not specifically related to transport. Hence, in this section, different aspects of efficiency are analysed from the perspective of the focal TST. Figure 36 illustrates different aspects of efficiency in the TST. The section is divided into smaller sub-sections with each section discussing one aspect of efficiency.

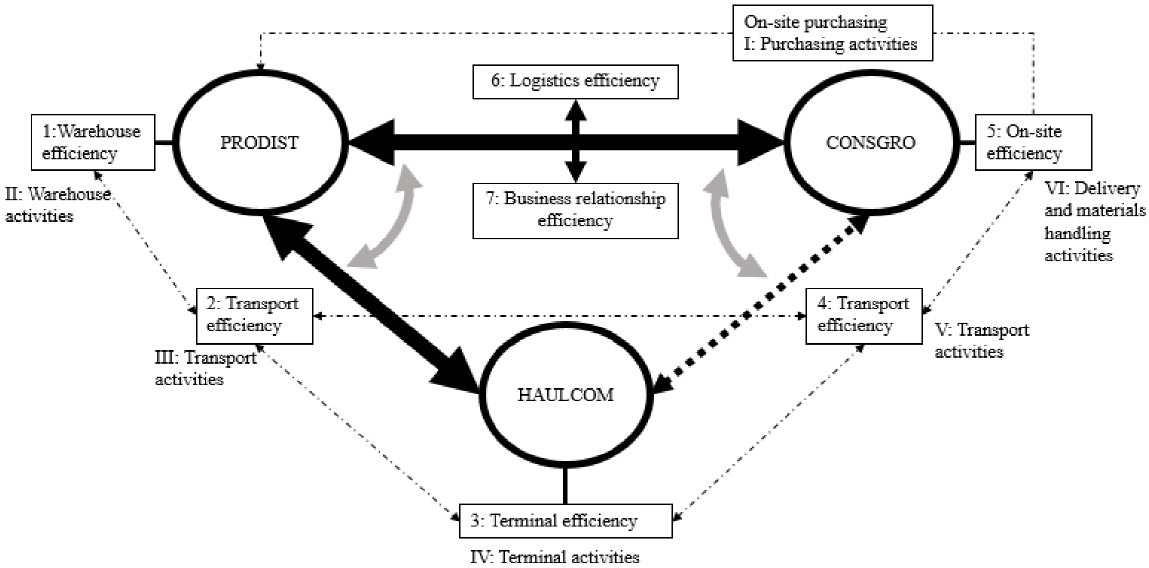

Figure 36. Analysing different aspects of efficiency in the TST

On-site purchasing

The activities identified in the TST involve ProDist, Consgro, and Haulcom. Consgro's purchasing of products (I) triggers ProDist's warehouse activities (II) and is thus the start of a series of complementary activities. Purchasing from the sites is separated with respect to the actor undertaking the actual purchase. Likewise, the orders are processed separately in ProDist's IT system, warehouse operation, and Haulcom's terminal and transport operation. For example, when Consgro's on-site personnel purchase products they often purchase low-volume and low-cost products. The subcontractors purchase products in their own right (with high fluctuations in volumes and type of goods depending on the subcontractor) and do not coordinate their purchasing activities with other subcontractors, nor the purchases made by Consgro. The lack of coordination of these actors generates separate deliveries at separate times because of the time-slots at Consgro's sites.

Warehouse efficiency

The warehouse activities affect the forthcoming transport activity (III) and Haulcom's terminal activities (IV) because the goods are not sorted more than by geographical location. With regard to efficiency in the warehouse, ProDist picks its customers' goods based on goods characteristics and sorts them based on overarching geographical location and then sends them to Haulcom's terminal. The warehouse efficiency (1) is important since they handle large amounts of goods each day and the efficiency is pertained because ProDist enjoys efficient resource utilisation in its warehouse operation due to similarities among activities (II) within the warehouse.

Transport activities and transport efficiency

Two transport activities are embedded and linked in the TST. Transport activities are performed between ProDist's warehouse and Haulcom's terminal (III) as well as between Haulcom's terminal and Consgro's construction site (V). The outbound transport activity (III) from ProDist's warehouse is adjusted to Haulcom's terminal activities (IV) and their ability to handle the incoming trucks since Haulcom cannot handle all trucks at the same time. Thus, when one truck is fully loaded the truck departs from the warehouse and arrives in sequence to Haulcom's terminal. This also means that goods ordered by Consgro can be spread out on eight trucks as one order most often contains several items, making it hard for Haulcom to know in advance if they can complete an order before goods from all eight trucks are scanned and sorted (an order can only be completed if all items are accounted for). The outbound transport activity (V) from Haulcom's terminal is of particular importance as it encompasses Haulcom's delivery to Consgro's sites. For Haulcom to perform these activities and allocate resources in the way they see fit it allows them to plan each transport each day based on customers' location, avoiding congestion as much as possible, and deploying fewer trucks for delivering goods to Consgro's sites, which would result in increased transport efficiency (4) from their perspective. However, from Haulcom's perspective, the excessive use of time slots hampers the utilisation and planning of transport resources in the most efficient way.

Terminal efficiency

The incoming goods from ProDist's warehouse set the condition for how Haulcom's terminal activities (IV) are performed. For example, the most favourable situation is when goods with special characteristics or goods that are ordered as express arrive first to the terminal. In turn, the terminal activities affect both the transport activity from the terminal as well as the delivery and materials handling activities. How and when goods are sent from ProDist's warehouse to Haulcom's terminal affects Haulcom's terminal efficiency. The terminal efficiency (3) is affected in part because the terminal activities cannot start before the transport has arrived from ProDist, but more importantly, the transport planning activities start when the information is sent from ProDist's IT system. These interdependencies set the conditions for how Haulcom manages its transport activities (V). As stated before, the goods are only sorted on an overarching level in ProDist's warehouse, which can result in 50% of the orders arriving at 1am and the rest at 4am. If these orders are to be delivered to Consgro at a specific time or if they require a crane truck, problems arise because then Haulcom has to devote resources to 'catch up' in order to be able to deliver the goods within ProDist's time frame. Moreover, if the incoming goods from ProDist (II-III) were sorted based on receiver or special requirements (time, length, width), Haulcom could more easily sort the goods in the terminal and allocate goods to the correct outbound transport (V). These features affect the possibility for delivering goods to Consgro as well as subcontractors.

On-site efficiency

ProDist's offerings to its customers affect how Haulcom can utilise its resources. For example, unloading at site is included in ProDist's offering, which means that Haulcom uses its crane trucks when unloading goods with special characteristics to Consgro's sites. Thus, Consgro does not need to do use the resources on the site when the goods are unloaded. The efficiency with regard to delivery and materials handling (VI) is dependent on Haulcom's ability to sort the incoming goods as well as how to plan the delivery routes for each truck. Also, the urban environment in Stockholm is exposed to a lot traffic waiting time, which can lower Haulcom's ability to deliver goods in the way agreed upon with ProDist, thus affecting the on-site efficiency (5). Also, on-site efficiency is affected when the purchased goods arrive in accordance to how they organise the construction project and the materials handling activities (VI) of the projects.

Logistics and business relationship efficiency

The actors in the TST value different aspects when it comes to efficiency (1-7). For Consgro, utilising ProDist's offerings with time-specific deliveries improves Consgro's materials handling (VI) and on-site efficiency (5) and also the satisfaction of the relationship or relationship efficiency (7). It is essential for ProDist to deliver goods in accordance with customers' expectations, meaning that the goods are delivered in the right time, at the right place, and with the right quantity. The routines for delivering goods are characterised by high logistics efficiency (6) for ProDist, resulting in high customer satisfaction for ProDist's customers, including Consgro. The overall efficiency in the business relationship (7) between ProDist and Consgro is high since ProDist offers fast and reliable deliveries to its customers. However, the high efficiency in the relationship (7) negatively affected Haulcom's transport efficiency (4) in the Green Month Project due to time slots and the fact that Haulcom still had to transport goods to the sites every day, making it difficult to take advantage of the possible reduction of stops to Consgro's sites.

Discussion about the original intent of Green Month Project and its effects on efficiency

The following section discusses the original intent of the Green Month Project and the possible effect had it been a success. If the project had turned out a success, Consgro's on-site purchasers would have purchased goods on Fridays and Wednesdays only, and without placing any 'panic orders'. This procedure would not have had any major impact on ProDist's warehouse activities per se or on the transport activities from ProDist to Haulcom's terminal. It would, however, have impacted Haulcom's terminal activities because they would have had to focus their terminal activities and goods deliveries to Consgro's goods volumes on two days instead of five. Furthermore, if subcontractors would have participated, large volumes of goods would have been allocated to only two days, thereby affecting Haulcom's terminal and transport activities. Haulcom would in such a case deliver goods to all subcontractors working on Consgro's sites, which would allow Haulcom to focus its resources for those two days only, and it would also result in more goods being handled during those two days. In addition, it would affect Haulcom's transport efficiency (4) by allowing the number of transports to the construction sites to be reduced and thereby concentrating the deliveries to Consgro's sites. In spite of that, ProDist's and Haulcom's efforts to increase transport efficiency (2 and 4) by using the transport resources better require involvement from Consgro since they set the terms for the deliveries to the construction site. Consgro has two separate roles in the Green Month Project, the first role being a purchaser of goods and the second role being a (main) contractor. In the Green Month Project the first role was evident and it was from Consgro's first role the project unfolded, since the starting point with the project was how Consgro purchased goods to its sites in Stockholm and the frequencies of deliveries of those purchases. However, Consgro's second role, which would have included subcontractors, would have been required for the project to succeed. This is because Consgro as a contractor decides how a site is organised, for instance, in regard to subcontractors' time slots.

8.2.3 Different logics and perspectives on transport efficiency

In conclusion, chapter eight deals with a triadic analysis. For transport efficiency, a narrow perspective covering only ProDist, Consgro, or Haulcom is not adequate due to the fact that transport in itself is not an isolated within-firm activity. Nor is a dyadic perspective involving only ProDist and Consgro since it would not address the actual transport to Consgro. To address the question of increased transport efficiency, a wider perspective, preferably a TST, and supply network perspective ought to be applied. Transport is one integrated part linked to other activities in Haulcom's activity structure as well as to the activity structures of ProDist and Consgro. Even if a broader perspective is needed they all have different perspectives on transport efficiency. First, for Haulcom, transport efficiency is the ability to perform their activities and allocate their resources in the way they see fit. This means that Haulcom can plan each transport each day based on customers' location, avoiding congestion as much as possible, and deploying fewer trucks for delivering goods to Consgro's sites. For example, time slots disrupt Haulcom's transport planning because they have to account for the time-specific deliveries when they plan the trucks' daily routes. In addition, the current organisation of terminal activities impacts how the trucks can be deployed. If the incoming goods from ProDist were sorted based on receiver or special requirements (time, length, width) Haulcom could more easily sort the goods in the terminal and allocate goods to the correct outbound trucks. Second, for ProDist, transport efficiency is when the goods are delivered in accordance with customers' expectations. This means that the goods are delivered in the right time, at the right place, and with the right quantity. Third, for Consgro, transport efficiency is when the purchased goods arrive when they need it, that is, in accordance with how they organise the construction project and the on-site logistics of the projects. Consgro does not want too many deliveries to the site at the same time and they use time slots to manage this. Hence, the incoming goods should be sequenced based on Consgro's needs in order for them to perform their activities and use their resources in the best way possible on site.

Finally, adding Haulcom to the analysis highlights the possibilities to look beyond the ProDist–Consgro relationship. For example, transport efficiency was improved as a result of Haulcom's interaction with Consgro's site managers, resulting in Haulcom reducing the number of deliveries to the construction sites at the same time the fill-rates of the trucks increased. This solution could have been improved by further activity adjustments in interaction with Consgro and the subcontractors working on the site so that the trucks also could deliver all goods in one instance. If the firms involved in this particular triad strive to plan for and perform efficient transport activities, the notion and the different logics of efficiency have to be clearly understood, discussed, and agreed upon by all parties in the TST, especially since the actors' different logics and perspectives on efficiency collide with each other. Transport efficiency in the Haulcom–Consgro relationship is dependent on how it is connected to the two other relationships. Transport efficiency in one relationship is thus difficult to specify in isolation from the other two relationships. What is specified in the

ProDist–Consgro relationship and the ProDist-Haulcom relationship due to their connectedness thus affects the possibilities for what can be achieved in the Haulcom–Consgro relationship. Hence, embeddedness of transport activities is one network feature that has to be both understood and addressed from different viewpoints as they influence how transport activities are performed. Transport as one separate activity and the resources involved are embedded with other logistics activities and resources. First, the transport activity is embedded in the activity structure of the seller of transport services (Haulcom) as well as in the activity pattern of the TST. Second, and in a similar way, the resources used to perform the activities are also part of a firm's resource collection as well as the resource constellation of the TST. Therefore, both transport activities and resources should be seen in the light of their embeddedness in the TST.

9. Transport efficiency in supply networks

Building on the case analysis of transport efficiency presented in chapters 5-8, this chapter discusses transport efficiency in supply networks. The chapter is divided into three sections; each section discusses one network layer each.

The Transport Service Triad (TST) is put forward as a key unit of analysis to understand the connections between the exchange of goods between a seller and a buyer of goods and the exchange of transport services between the seller and buyer of transport services. This research shows how transport activities depend on other activities in supply networks. This thesis highlights transport activities in supply networks by exploring the embeddedness of transport activities vis-à-vis other activities and explores the inherent dilemmas of transport efficiency in supply networks. Transport efficiency has different meanings for the actors involved in a TST due to their different business logics. The different logics comprise one piece of the challenge that affects firms' transport efficiency. The chapter proceeds as follows. The first section deals with transport efficiency in supply networks and how transport efficiency is affected through adjusting activities, adapting resources, and interaction among actors. The second section deals with how the TST is a part of the supply network.

The TST is, in this case, illustrated by the business relationships between ProDist, Consgro, and Haulcom. Within the frame of the TST, multiple types of activities are performed. For example, Consgro's orders generate a need for ProDist to perform a set of warehouse activities. When the warehouse activities are performed, Haulcom begins its terminal activities and later its transport activities to Consgro's construction sites. Consgro receives the goods and signs the proof of delivery, thus completing the activity chain from order to delivery. These activities, from order to delivery, may seem trivial; however, from the previous analysis, it is evident that the chain of activities from order to delivery involves a number of challenges. These challenges are, for example: how firms' activities interplay and how they are coordinated; how resources are used and adapted; and how actors interact with each other. These challenges are all part of the difficulties in organising transport activities. Each of the three relationships in the triad was analysed separately, focusing on the activities, resources, actors, and transport efficiency in Chapters 5–7. In addition, the triad was analysed as one entity in relation to the Green Month Project in Chapter 8. This chapter takes the starting point in the three network layers on four levels: the firm, relationship, triad, and network level. This provides an increased understanding of the impact of embeddedness and connectedness in business networks.

9.1 Transport efficiency and the activity layer

Firm level

Firms in supply networks have different activity structures. A firm's activity structure can be adjusted to increase efficiency within a firm. For ProDist, handling incoming orders and collecting goods in the warehouse are key activities to ensure the completion of customer orders. The activities are adjusted and performed by ProDist so that ProDist can achieve high internal resource utilisation. Consgro adjusts its construction project activities for the different projects as they impose different constraints on activity coordination depending on which actors that are involved in each project. Consgro's purchasing activities are performed based on Consgro's perspective of a given project and its needs. The time slots are one way for Consgro to coordinate the project's activities based on its needs, accounting for available space on site and Consgro's construction logic. For Haulcom to increase the utilisation of certain resources, they need to adjust the activities and increase the similarities among activities. For example, similarity among loading activities allows Haulcom to better utilise their resources. In this study, similarity among activities is evident in several cases, e.g., order picking in ProDist's warehouse, sorting in Haulcom's terminal, and loading and unloading at ProDist's warehouse and Haulcom's terminal, respectively.

Relationship level

The loading activities and how the resources are utilised depend on the sequence in which the incoming goods arrive at the terminal, which, in turn, requires coordination among relationships. Haulcom's internal terminal activities are part of its internal activity structure and connected to other firms through activity links. Adjusting the purchasing activities may not directly increase transport efficiency from Consgro's perspective, but it could help ProDist and Haulcom to ship the goods to the customers in a different sequence and thus increase transport efficiency from their perspective. Complementarity among activities affects transport efficiency within both the ProDist-Haulcom and Haulcom-Consgro relationships. For example, the terminal activities are complementary to the transport activities. Thus, disruptions in the terminal activities, such as if incoming goods arrive late or order lines are missing, affect Haulcom's ability to sort and load the goods on its trucks. Situations like these are particularly apparent for goods with delivery restrictions. Therefore, depending on what Consgro purchases, Haulcom must adjust its terminal and transport activities accordingly since the terminal activities with restrictions, such as those related to bulky or time-sensitive goods, are separated from the standard activity chain. Furthermore, Consgro's use of delivery time slots to sites results in adjustments of activities in the

Haulcom–Consgro relationship by which Haulcom has to account for several time slots when delivering goods. This illustrates how activity coordination is influenced by the actors in the relationship and their attempt to utilize their resources as efficiently as possible, which in turn affects transport efficiency in the relationship.

Within the ProDist–Haulcom relationship, Haulcom's focus is to deliver goods to ProDist's customers in Stockholm. The scope of the agreement between ProDist and Haulcom regarding deliveries in Stockholm has affected the business relationship, increased interorganisational interaction, and over time led to the integration of business processes. Activities, such as planning, final sorting, and the delivery of goods, have been allocated to Haulcom to enhance ProDist's logistics offering to its customers. Haulcom's drivers are involved in the physical distribution and serve Consgro's construction sites. The drivers hence establish relationships over time with the personnel at Consgro who receive the goods. Specifically, the drivers gain knowledge about the customers' specific demands, solve issues, and arrange delivery specificities. This means that they are involved in adjustments of activities in the relationship. Consgro's demand on time slots affects the activity links between ProDist and Haulcom. The activities performed on the construction site are adjusted to Consgro's logic for a particular site, whereas Haulcom's transport activities are performed from Haulcom's logic of efficient resource utilisation (trucks). However, for the Green Month specifically, the activity links did not change between ProDist and Haulcom, nor between Haulcom and Consgro. Consgro's demand on time slots affects the activity links between ProDist and Haulcom.

Triadic level

The conditions for Haulcom to deliver goods to Consgro are project specific, even though the same resources, such as IT systems, warehouses, terminals, goods, and trucks, are activated in all projects. However, Haulcom has to activate different resources for different deliveries to various sites. The analysis in Chapter 7 identified three conditions for how goods are handled and delivered to the construction sites that depend on the goods' characteristics. For example, one situation is when deliveries only contain parcels (first condition), which means that a truck is needed. In addition, adding time-specific deliveries to the first condition yields the second condition. In another situation, a crane truck is needed (third condition). The specialisation of activities is apparent in the TST. For example, the specialisation of activities concerning more time-specific deliveries would impact Consgro's on-site efficiency and thereby increase their ability to better coordinate their internal construction projects; however, this would require that Haulcom coordinates its trucks to a greater extent and allocates more resources for transport. If Haulcom had no time restrictions, they could plan and execute their terminal and transport activities and utilise their trucks more efficiently, thus reaching high efficiency in their operations. However, at the same time, ProDist's logistics efficiency and customer satisfaction would be lowered with this scenario. Hence, Haulcom's perspective of resource utilisation would, in such a scenario, be in focus and ProDist's and their customers' needs would not be taken into account. This means that the offering and demands on prioritised goods, express deliveries, and time-slot deliveries would not be prioritised. In addition, the utilisation of transport resources in the TST depends on the activity coordination among the two direct business relationships in the TST - ProDist-Consgro and ProDist-Haulcom. Furthermore, the coordination among the two business relationships relies on ProDist's IT system combined with Haulcom's transport planning system, goods characteristics, and individual construction project agreements for how goods are to be delivered, i.e., on the activity coordination at each construction site.

Fourth party level

Connectedness among business relationships affects the possible adjustments that can improve efficiency. Activities need to be adjusted in relation to fourth parties as the conditions from the parties outside of the TST affect the TST, e.g., project-specific business agreements between ProDist and Consgro relate to both Consgro's relationship with subcontractors as well as to ProDist's relationship with the same subcontractor. The subcontractor also buys goods from ProDist which are later transported by Haulcom, but the orders from subcontractors and Consgro are not fully coordinated from ProDist. This lack of coordination requires that Haulcom deliver goods multiple times each day to Consgro's construction sites. One way to coordinate Consgro's and the subcontractors' purchasing activities on site is through consolidation, which means that the purchasing activities are aggregated to one order towards the supplier of goods. This is in direct contrast to how the majority of the products are purchased since the majority of the purchases are performed independently by each actor at the construction site. This lack of coordination results in scattered delivery procedures and affects Haulcom's handling and delivery of goods. Hence, conditions external to the TST, i.e., conditions relation to fourth parties, affect which activities are performed; depending on these conditions, transport efficiency may (or may not) be reduced.

9.2 Transport efficiency and the resource layer

Firm level

ProDist's resources for enabling efficient logistics activities are, for example, physical resources such as the central warehouse, materials handling equipment and the IT system. Furthermore, an important organisational resource is the knowledge about warehouse operations. ProDist uses the same resource collection to all customers. Hence, no adaptations of resources are made to specific customers. The terminal for handling ProDist's goods and the trucks used for delivery are important physical resources in Haulcom's resource collection. Moreover, knowledge about logistics planning and terminal operations are important organisational resources. Since ProDist is Haulcom's only customer Haulcom's resource collection has been adapted to the needs of ProDist. Haulcom strives to utilise its transport resources as efficiently as possible, but the possibilities for accomplishing this depend on ProDist's offering towards its customers and the customers' demands on ProDist. Consgro's equipment at the construction site for handling inbound logistics and the IT systems which they use to purchase goods and manage the on-site time slots are important physical resources. These on-site resources are important for Consgro's construction site operations. The Category Manager's purchasing knowledge and the purchasing department's knowledge are important organisational resources when dealing with new initiatives such as the Green Month Project.

Relationship level

ProDist's IT system is an important resource in the ProDist-Consgro relationship for handling orders, but also in the ProDist-Haulcom relationship as a source of delivery information. Thus, the IT system is an important part of the resource ties in these relationships and the adaptations made to the IT system have improved the purchasing routines between ProDist and Consgro. The resource ties are also related to specificity and standardisation. Specificity entails specific adaptations of resources to Consgro; e.g., time restricted deliveries, whereas standardisation entails that the resources activated have high utilisation because they are used in a standardised manner. The resources are used in a standardised manner when, for example, Haulcom's trucks are used to deliver goods without special characteristics and no restrictions in terms of time. In the Green Month Project, ProDist adapted its IT system to comply with the new conditions. An alternative to changing the IT system would have been to adapt how Consgro ordered goods but this was not found to be a viable option due to the short time period of the project. Another option would have been to adapt the way ProDist organises its warehouse and logistics resources but this was considered too much adaptations and something that would create unwanted effects beyond the focal TST.

Triadic level

The utilisation of physical resources such as trucks and the terminal at Haulcom, ProDist's warehouse, and Consgro's material handling equipment can all be improved through adaptations of organisational resources. For example, changing Consgro's way of purchasing, away from ad-hoc purchases, could make the warehouse as well as terminal activities more efficient which in turn could make the transport activities more efficient since the orders would only contain goods that are needed at that specific time and place. In addition, the purchasing routines, warehouse routines and transport planning affect the utilisation for all the firms in the TST. For example, the purchasing routines at Consgro trigger ProDist's warehouse operations as well as how Haulcom plans the daily transports. Some resources in the triad are more difficult to adapt than others because of their heaviness. For example, ProDist's warehouse is designed to manage large volumes of goods and follows a standardised setup regardless of customer. Similarly, Haulcom's terminal is designed to only handle ProDist's goods and Haulcom's resources are adapted towards the logistical and transport needs of ProDist. Consgro's construction sites follow a logic anchored in the actual construction process and is not adapted to ProDist's supply of goods. Hence, these resources are hard to change since they are adapted to specific logics that have been developed during a long period of time.

Fourth party level

There are numerous important physical and organisational resources used for the exchange of goods in the TST, for example, Haulcom's trucks, the knowledge of drivers, and knowledge on transport planning, Consgro's ability and equipment to handle different types of incoming trucks, and the three actors' IT systems. The way in which goods are ordered, who orders them, and if the goods have special characteristics affect how these resources are utilised. For example, if small and standardised products are ordered high resource utilisation can be obtained due to economies of scale and scope. However, if bulky goods are ordered ProDist needs to use a special type of equipment for collecting goods and loading trucks. Likewise, Haulcom's handling of bulky goods requires special forklifts and trucks. How resources are utilised are influenced by actors in the TST but also by fourth parties and their attempts to utilise their resources as efficiently as possible. Moreover, the requirements on time-slot deliveries resulting from the agreements between ProDist, Consgro and their subcontractors affect Haulcom's utilisation of transport resources. This is due to that Haulcom has to use more transport capacity to deliver in accordance with these agreements than if no such time constraints would have been set. Finally, connections with fourth parties may be exploited to develop new routines among firms in the TST. A logistics specialist is an example of a fourth party involved in on-site logistics at a construction site. As such, they typically set conditions for on-site handling. These conditions can range from deliveries to a single specified address, or deliveries on specific times during a day. These conditions affect the utilisation of transport resources, meaning that the resource utilisation can be higher or lower if fourth parties have special requirements on how to deliver goods to a specific project.

9.3 Transport efficiency and the actor layer

Firm level

ProDist's organisational structure encompasses several departments. The sales and logistics departments are key actors in organising transport activities because the logistics department is responsible for organising the outbound flows from the central warehouse as well as transport procurement. The sales department is responsible for selling goods and establishing contracts and relationships with customers. How these two departments act and interact affects transport efficiency since they interact with customers in two different ways and have two different (and sometimes colliding) perspectives on how to work with customers. The sales department is responsible for the configuration of the customer offering, hence accounting for the needs of the customer. The logistics department is responsible for transport and logistics activities from the warehouse to the customer, e.g., Consgro. Therefore, how these two departments act and interact sets the terms of how to best utilise resources and activities and do not always concur with, for example, sustainability targets to reduce their environmental impact.

Consgro's organisational structure encompasses several departments. The purchasing department is responsible for the suppliers and negotiates the contracts. The logistics and sustainability departments are responsible for promoting and helping the projects with logistics and sustainability issues. Moreover, the sustainability department has the overarching responsibility for the 'green week'. The interaction patterns among these departments affect the strategic direction in terms of transport. For example, it was the purchasing department who anchored the Green Month Project in the organisation. The daily decision making processes are, however, taken on a project level, where purchasing of goods in terms of what, when, how, and to where affect the transport operation to the site. For example, decisions to use a consolidation centre for a project can positively affect the single project's ability to handle incoming transports and positively affect transport efficiency, whereas several time slots on a project can lower it. Hence, how different departments (and project organisations) act and interact affect the probability of increasing transport efficiency.

Haulcom's organisational structure is less complex, if compared to ProDist and Consgro, since Haulcom is a smaller firm. The truck drivers and transport manager constitute the key actors in organising terminal and transport activities. The daily planning and actual transport of goods to the customers affect transport efficiency with regards to how Haulcom can utilise its resources and perform the transport activities.

Relationship level

Interactions in the ProDist-Consgro relationship occur at two levels. Both firms’ management teams have intensified the interaction over the years, which has resulted in ProDist becoming one of Consgro's preferred suppliers. Consgro's specific sites, ProDist's sales force, and the logistics unit at the central warehouse interact regarding the supply of goods to the construction sites. One way to realise the identified potential beneficial outcomes in the ProDist–Consgro relationship, such as reducing the number of transports and new transport set-ups with more time-specific deliveries to construction sites, is with increased interaction and exchange of perspectives. However, this must come about not only at the management level, but also at the regional, local, and project levels, i.e., the operational level. Moreover, the daily interactions among Haulcom's drivers and Consgro's sites provide the drivers with knowledge about the sites' demands and specific needs. Also, Haulcom’s transport manager interacts with Consgro’s site managers regarding goods deliveries. Thus, interaction is present in the relationship between Consgro and Haulcom, although it is an indirect business relationship. The interaction allows for changes in the coordination of transport activities through activity adjustment.

Triadic level

There are two direct business relationships in the case, ProDist–Consgro and ProDist–Haulcom, whereas Haulcom’s relationship with Consgro is indirect. The indirect relationship with Consgro may be a factor that hampers Haulcom’s ability to influence the conditions that would allow for increased transport efficiency. This is because Haulcom is neither able to influence Consgro on a management level nor to influence activity adjustments and resource adaptations in Consgro’s relationships with its subcontractors. Consgro works on two different fronts regarding the strategical and operational issues affecting transport. On the one hand, they deal with strategic issues towards ProDist, and on the other hand, they deal on an operational level with both ProDist and Haulcom. There is a need for interaction and idea exchange at different levels between all three firms to address the aspects and perspectives of efficiency.

Fourth party level

The surrounding network of an actor is important because achieving transport efficiency requires information from and about other actors. Thus, interaction between the three actors in the TST alone is not sufficient to further improve transport efficiency; it would have required interaction with fourth parties, such as subcontractors in the network. Networks are a result of actors’ past decisions as well as future expectations. Thus, achieving transport efficiency relies on both the past and future decisions of different actors. Relationships with actors evolve through interaction and interdependencies are changed as a result. Over time, both activities and resources are mutually adjusted and adapted. ProDist's direct counterparts (e.g., Consgro and subcontractors) order goods separately and with different demands on delivery times and characteristics of goods. The characteristics of the goods subject to transport direct which resources (trucks) Haulcom can use. This can be traced back to the business agreements of the specific project, but also to the relationships with subcontractors and other actors in the triad and other fourth parties. Thus, Consgro's business logic in terms of, for example, how they organise activities and resources on the construction site is based on several other direct and indirect counterparts, such as municipalities, subcontractors, logistics specialists, and suppliers. For example, the demand on a logistic hub in one project came from the municipality, which also affected Haulcom's order deliveries since they only had to deliver to one address for both Consgro and the subcontractors. The Green Month Project was initiated by the actors in the TST through interaction. The solution was developed by the actors in the TST and could be tested in other situations. It would, however, require investments in, and development of, activity links, resource ties, and actor bonds. Hence, the connections between the actors affect activities, resources, and how actors interact and are thus imperative to affect transport efficiency, either positively or negatively.

10. Transport services and the Transport Service Triad

This chapter discusses transport services and the Transport Service Triad. The chapter is divided into two sections. The first section discusses each of the three business relationships in a TST and the implications for transport efficiency when the third actor is incorporated into the analysis of a business relationship. The second section discusses the different roles of actors in a TST.

There are many stakeholders involved in supply networks, and meeting the expectations of all of the stakeholders regarding transport efficiency requires a holistic perspective. Such a holistic perspective can shed light on the embeddedness of transport services within and outside a TST. The connection between two actors involved in a business relationship (i.e. a dyad) is a starting point for understanding the network, since the exchange of goods or transport services takes place between the two parties in a dyad. However, a triadic approach is necessary to bridge one relationship and its connections to other relationships in the network, because the relationship involving the exchange of transport services needs to be understood in light of the relationship involving the exchange of goods.

A starting point for dealing with the difficulties of managing different actors' needs and demands regarding efficiency, recognising what those needs and demands mean for each actor, and understanding them in relation to their business logics can be to use a triadic approach. Since a triad is the smallest network, triads have been suggested to be useful for investigating the connectedness of actors (Laage-Hellman, 1989; Halinen and Törnroos, 1998). In particular, taking a third actor into account in the analysis of a business relationship can illuminate the other two actors' differences concerning transport efficiency (Anderson et al., 1994; Krackhardt, 1998; Siltaloppi and Vargo, 2017).

Triadic structures originate in situations in which a third actor not only interacts directly with another but also operates as an intermediary between the two. It has previously been argued that there are two types of triadic structures (Vedel et al., 2016). The first encompasses three direct relationships, whereas the second encompasses one indirect and two direct relationships. The focal TST in this thesis can be characterised by a triadic structure involving one indirect and two direct relationships. In order to understand different aspects of transport efficiency, as well as how actors' different perspectives influence transport efficiency, the dyads within the triad and how one actor influences the relationship among the other two need to be understood and analysed.

10.1. The third actor's influence on a relationship in the TST

The following discussion revolves around transport efficiency when the influence of a third actor is taken into consideration. Each relationship in the focal TST is scrutinised considering the third actor and efficiency discussed from the perspectives of activities, resources, and actors.

The focal relationship in the TST can be said to be the relationship between the buyer and seller of transport services. The first section thus deals with that relationship and how it is influenced by the third actor in the TST, in this case, the buyer of goods. That section is followed by a similar discussion of the relationship between the buyer and seller of goods as well as the buyer of goods and seller of transport services.

10.1.1 The buyer of good's influence on the relationship between the buyer and seller of transport services

The relationship between the buyer of transport services and the seller of transport services is scrutinised in light of the influence of the buyer of goods (see Figure 37). Such scrutiny provides an increased understanding of how the influence of a third actor affects what happens between the other two actors regarding transport efficiency in the TST. That situation is exemplified by the case involving ProDist as the buyer of transport services, Haulcom as the seller of transport services, and Consgro as the buyer of goods.

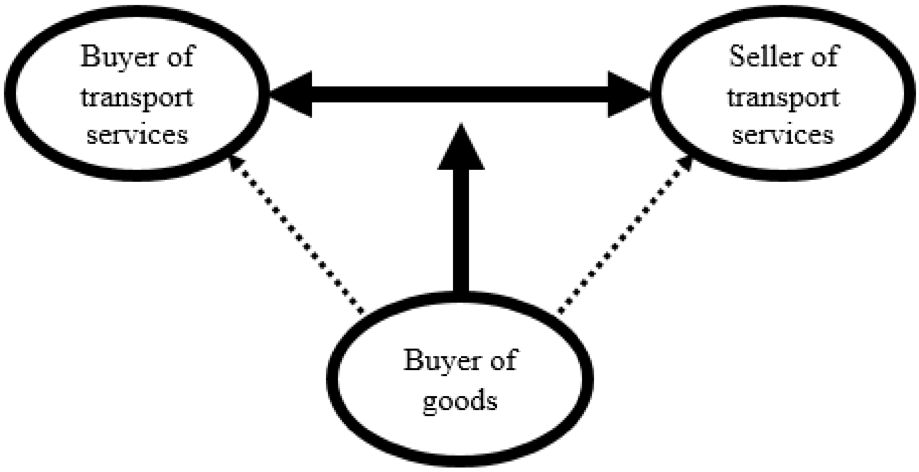

Figure 37. Consgro's influence on the relationship between ProDist and Haulcom

Transport efficiency between ProDist and Haulcom was analysed in Chapter 6. In short, transport efficiency in their relationship has developed over time. Haulcom tries to utilise its trucks to reduce the number of trucks that it needs, increase the load factor, and thus reduce fuel consumption and the cost of deliveries to ProDist's customers. ProDist requires reliable logistics and fast transport of goods, typically within a day's time, and the amount of goods handled by Haulcom is directly associated with the needs of ProDist. Thus, Haulcom's goods handling activities are linked to its logistics and transport resources and adapted to the needs of ProDist. That dynamic has implications for transport efficiency since Haulcom's entire operation revolves around transporting goods to ProDist's customers. Transport efficiency in the ProDist–Haulcom relationship is characterised as high since the actors in the relationship manage to deliver the goods in accordance with the terms of the agreements within that business relationship.

Consgro sets the terms for the deliveries of goods to its different construction sites. Consgro thus influences the ProDist–Haulcom relationship in ProDist's and Haulcom's endeavour to use the transport resources better and increase transport efficiency. Consgro requires that the goods arrive in accordance with their needs. Those needs are directly related to the organisation of construction projects, particularly to onsite logistics activities. Consgro uses time slots to manage the inflow of goods because it does not want to allocate resources to handle too many deliveries to the site at the same time. Furthermore, Consgro's organisation of its construction sites considers the needs and demands of its suppliers, subcontractors, and customers involved in specific construction projects. Accordingly, to increase the transport efficiency of deliveries to the construction sites, Consgro's relationships with fourth parties should be taken into account; not only do they influence the way in which goods are delivered to sites, but the subcontractors in particular have their own ways of purchasing goods and their own ideas of how to best utilise their resources (e.g. equipment and personnel) as well. Therefore, how they organise their purchasing and their part of construction activities also influences the conditions for ProDist's and Haulcom's ability to transport goods to Consgro's construction sites. For example, subcontractors were not included in the Green Month Project, which resulted in business as usual when actors in the triad dealt with them. It also meant that both ProDist and Haulcom had to process and deliver the subcontractors' orders every day, irrespective of construction site, day of the week, and how Consgro had purchased its goods. Consequently, no significant change occurred in the number of site visits for Haulcom.

10.1.2 The seller of transport service's influence on the relationship between the seller and buyer of goods

The exchange of goods between the seller and buyer of goods necessitates transport services. Therefore, the relationship between the seller of goods and the buyer of goods is scrutinised in light of the influence of the seller of transport services (see Figure 38). Such scrutiny adds to the understanding of how the influence of a third actor—in this case, the seller of transport services—affects what happens between the other two actors in terms of transport efficiency in the TST. That situation is exemplified by the case involving ProDist as the seller of goods, Consgro as the buyer of goods, and Haulcom as the seller of transport services.

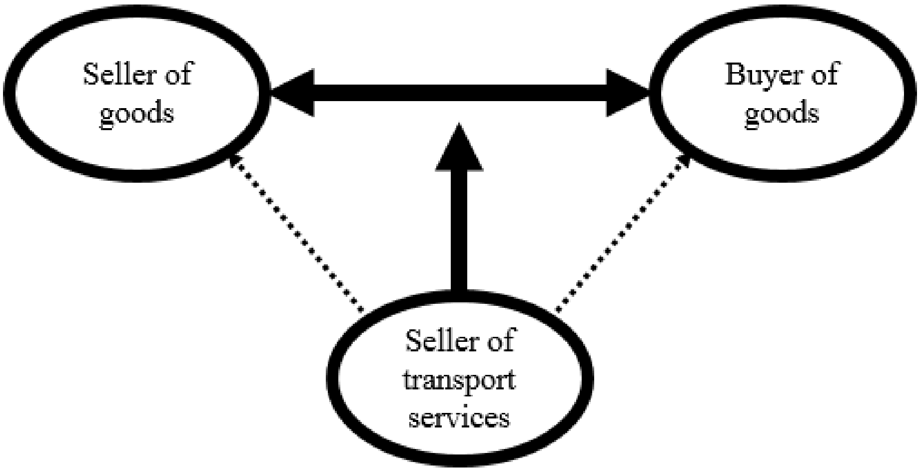

Figure 38. Haulcom's influence on the relationship between ProDist and Consgro

Transport efficiency in the ProDist–Consgro relationship was analysed in Chapter 5. Consgro purchases orders via its ERP system, and ProDist processes them in a standardised manner in its warehouse. ProDist's high resource utilisation in its warehouse operations is important since those operations serve far more customers than merely Consgro. This allows for high capacity utilisation and the possibility to increase similarities between activities and exploit them in a better way. ProDist uses its distribution network to achieve a high utilisation of resources in the transport of products to Consgro's different sites, which is important for the overall efficiency of the supply of products, because the way in which activities are organised in relation to resources in the ProDist–Consgro relationship leads to transport efficiency. As such, ProDist's distribution network for co-loading increases ProDist's utilisation of transport resources and provides high levels of service for Consgro. Consgro wants its purchased goods to arrive when they need them. That is, the goods need to be delivered at the right time, to the right place, and in the right quantity. This notion is furthermore based on how Consgro organises its activities and resources for the different construction projects at the various construction sites. As a result, the service level of transport services in the ProDist–Consgro relationship is perceived to be high and satisfactory from both actors' perspectives.

Haulcom is the seller of transport services and the firm that transports goods to Consgro's sites. The activities that Haulcom performs and the resources used are adjusted and adapted to the needs of ProDist. Thus, Haulcom connects ProDist and Consgro with each other and, in doing so, secures transport efficiency in the ProDist–Consgro relationship. For example, Haulcom's drivers and transport manager interact with Consgro to manage deliveries to

Consgro's construction sites. They do that to develop special agreements regarding deliveries and aspects of co-loading that are imperative to sustain transport efficiency. In that sense, the ability to change delivery frequencies and routes is possible due to Haulcom and Consgro's indirect business relationship.

10.1.3 The buyer of transport service's influence on the relationship between the seller of transport services and buyer of goods

It is in the indirect relationship between the seller of transport services and buyer of goods that the physical transport of goods takes place. Therefore, the relationship between the seller of transport services and the buyer of goods is scrutinised in light of the influence of the buyer of transport services (see Figure 39). Such scrutiny adds to the understanding of how the influence of a third actor—in this case, the buyer of transport services—affects what happens between the other two actors in terms of transport efficiency in the TST. That situation is exemplified by the case involving Haulcom as the seller of transport services, Consgro as the buyer of goods, and ProDist as the buyer of transport services.

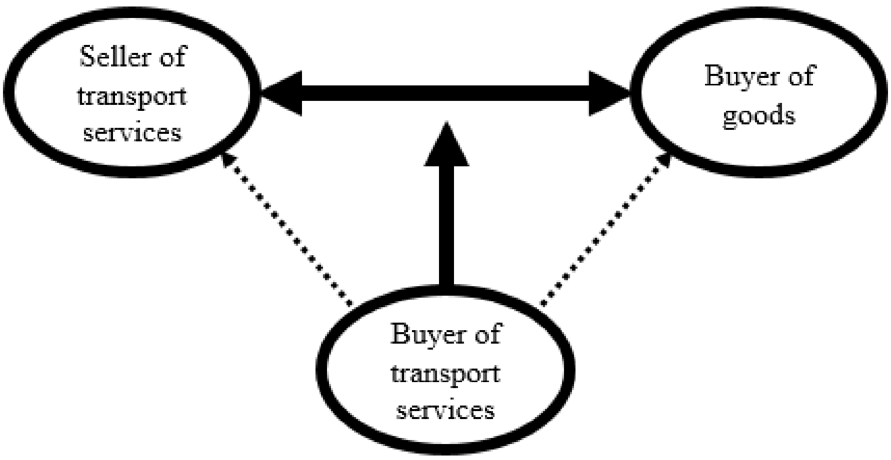

Figure 39. ProDist's influence on the relationship between Haulcom and Consgro

Transport efficiency in the Haulcom–Consgro relationship was analysed in Chapter 7. Transport efficiency can be seen as high due to the high levels of service and swift deliveries, even though such efficiency depends upon both the ProDist–Consgro relationship and the ProDist–Haulcom relationship. One factor affecting transport efficiency is the set of characteristics of the goods being transported. Bulky goods influence the way in which Haulcom handles its terminal activities and utilises its resources in relation to deliveries at Consgro's construction sites. Transport efficiency measures (e.g. resource utilisation) and how the transport activities are organised in relation to other activities originates in the Haulcom–Consgro relationship as the transport of goods takes place in this indirect business relationship. Even though it is an indirect business relationship, the ability to change delivery frequencies and routes is possible and has led to the consolidation of deliveries to certain sites, which has in turn allowed higher utilisation of trucks while at the same time maintained satisfactory levels of service.

ProDist’s internal warehouse logic influences how flexible Haulcom can be in its transport operations. The operations at ProDist’s warehouse are arranged to handle lots of goods on a daily basis. Goods are sorted by region only to accommodate gains in efficiency at the warehouse. ProDist has decided to specialise on some activities by delegating the final sorting to Haulcom. In doing so, it has freed up warehouse resources and transport capacity. However, Haulcom could have greater possibilities to better utilise its terminal resources if ProDist would initiate a finer-tuned sorting operation in its warehouse. Haulcom would then be able to allocate more resources to, for instance, the pre-loading of trucks and planning for goods arriving late. As a result, the daily transport planning would benefit since the planning horizon would be longer and knowledge about which goods arrive to the terminal at what time would be greater. ProDist also influences the Haulcom–Consgro relationship by enforcing new demands, including tighter delivery routines, by passing on those demands from its customer (i.e. the buyer of goods), which can allow more time-specific deliveries. Because Haulcom delivers goods to Consgro based solely on what it has negotiated with ProDist, ProDist’s influence on the relationship between Haulcom and Consgro is high but nevertheless dependent upon the other two relationships is the TST.

10.1.4 Transport efficiency and the Transport Service Triad

This section discusses transport efficiency from the perspective of the Transport Service Triad. The focus in the following discussion is on how transport efficiency is manifested by the actors in the TST (see Figure 40).

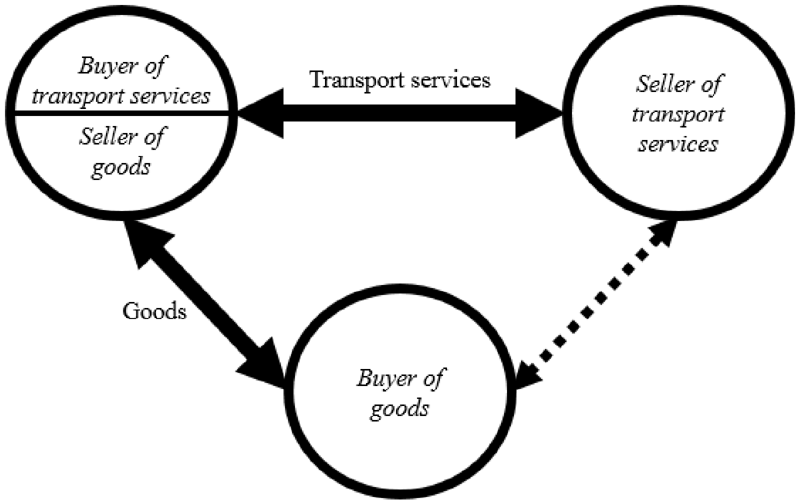

Figure 40. A generic perspective on transport efficiency in the Transport Service Triad

Imminent pressure to reduce CO_2 emissions from transport, together with an enhanced understanding of the specific conditions influencing the transport efficiency of sellers of transport services, might result in different adjustments in exchanges between buyers and sellers of goods in relation to transport in general and more sustainable transport solutions in particular. For example, such adjustments might allow sellers of transport services to be better equipped to meet the demands of other actors and thus move away from standard exchanges in which transport is treated purely as a commodity. In that sense, there are ample opportunities to positively influence transport efficiency by involving all three types of actors in a TST in the development of transport services. At the same time, the different aspects of efficiency among the three actors in general and of transport efficiency in particular call for the elevated exchange of perspectives among the three actors in the TST. That need was shown in the analysis of the third actor's influence on the relationships in the TST. Consequently, it is not appropriate to limit the analysis of transport efficiency to a specific relationship. As an alternative approach, the TST is a suitable unit of analysis for analysing transport efficiency related to transport services. Last, it is suggested to take relevant fourth parties into consideration since other activities and resources in the network have to be adjusted and adapted to increase transport efficiency in any given relationship.

10.2 Roles in the Transport Service Triad

In this discussion, the findings from the case study are presented as examples of different roles in the TST. The first four sections discuss the roles of the seller of transport services, the seller of goods, the buyer of transport services, and the buyer of goods in the TST, respectively (see Table 12), with examples from the case to illustrate the roles in the TST. It should be noted that, in the case, one actor plays the roles of both the seller of goods and the buyer of transport services. Later, the fifth section analyses generic roles of actors in TSTs. The focus in the following discussion is on how the three types of actors in the TST relate to each other and how they influence efficiency.

Table 12. Four different roles in the TST

	ProDist	Consgro	Haulcom
Seller of transport services			X
Seller of goods	X		
Buyer of transport services	X		
Buyer of goods		X	

10.2.1 The role of the seller of transport services

Haulcom is the provider of transport services in the TST, in which it mediates the exchange of goods between ProDist and Consgro. Haulcom thus provides transport services in accordance with the demands of the ProDist–Consgro relationship. In that role, Haulcom affects the relationship via *dyadic influence* (Siltaloppi and Vargo, 2017), with which Haulcom shapes the behaviour between ProDist and Consgro by providing information to either ProDist or Consgro. For example, in one project, Haulcom recognised that it could not feasibly perform eight deliveries to the same site in a single day. Haulcom solved that problem by notifying Consgro of its predicament and managed to change the delivery arrangements so that it could deliver all goods to the construction site in one visit. ProDist had not demanded that arrangement, which shows how Haulcom influences the ProDist–Consgro relationship.

10.2.2 The role of the seller of goods

ProDist, as the seller of goods, plays a meditating role that involves what Siltaloppi and Vargo (2017) refer to as *normative commitment* in the relationship—that is, existing commitments to a third party, explicit or implicit, that impose limitations on activities in a business relationship. ProDist, as both the buyer of transport services and the seller of goods, is involved in business exchanges with both Haulcom and Consgro. Consequently, ProDist has a direct relationship with Haulcom that involves normative commitments between both actors. ProDist is thus involved in two dyads in the TST: one with Consgro and another with Haulcom. Moreover, its embeddedness in the third dyad (i.e. the Haulcom–Consgro relationship) somewhat limits how the actors involved may pursue their own interests, because the TST imposes and enforces values and norms on the triad that stem from each dyadic relationship in the triad. For example, ProDist's business arrangements with Consgro allowing for more time-specific deliveries. However, that dynamic also limits Haulcom's ability to pursue higher resources utilisation since it has to devote more resources to manage those time-specific deliveries.

10.2.3 The role of the buyer of transport services

ProDist, as the buyer of transport services in the TST, plays the role of a broker (Obstfeld et al., 2014; Siltaloppi and Vargo, 2017), in which it influences the interaction between the other two actors. On the one hand, ProDist has an interface with Consgro by selling goods and collecting orders; on the other, it has another interface with Haulcom in which the terms of transport activities are negotiated and established. Although the dual role of being a seller of goods and a buyer of transport services may be difficult to disentangle due to interlocking obligations, the role of broker also allows the integration of knowledge and solutions between the other two actors.

10.2.4 The role of the buyer of goods

Consgro, as the buyer of goods, sets the conditions and terms for deliveries to its construction sites. Arguably, the buyer in this case is the one who *divides and rules*—that is, the one who introduces conflict and divides the triad in order to pursue its own interests (Simmel, 1964). Taking this role, Consgro advances not only its own agenda but also its customers' demands, based solely on Consgro's logic towards ProDist. In turn, ProDist forwards Consgro's interests and demands to Haulcom, which has to deliver in accordance with ProDist's demands. At the same time, Consgro's interests and demands are also defined by the need to plan each project according to the project's internal logic—for example, by arranging for deliveries to sites that promote onsite efficiency. Also as the buyer of goods, Consgro coordinates subcontractors (i.e. fourth parties) in the role as the main contractor. Within that role, Consgro has to take into account the fourth parties, as clearly shown in the Green Month Project. Last, in the role of the buyer of goods in the TST, Consgro also assumes another, more constructive role: that of *tertius iungens* (Adobor and McMullen, 2014). In the role of *tertius iungens*, Consgro, as the buyer of goods, tries to foster direct collaboration with ProDist and indirect collaboration with Haulcom. That dynamic became apparent in the Green Month Project, in which Consgro's and ProDist's efforts towards sustainability by reducing the number of transports to construction sites in Stockholm prompted a change towards more sustainable freight transport.

10.2.5 Generic roles in the Transport Service Triad

This section discusses the generic roles in the TST. The focus is on the roles identified in the TST and how they relate to each other. Figure 41 shows the TST and the three actors with their four roles: the buyer of transport services, the seller of transport services, the seller of goods, and the buyer of goods. The starting point in the following discussion is the exchange of transport services in a TST since any TST is defined by transport services.

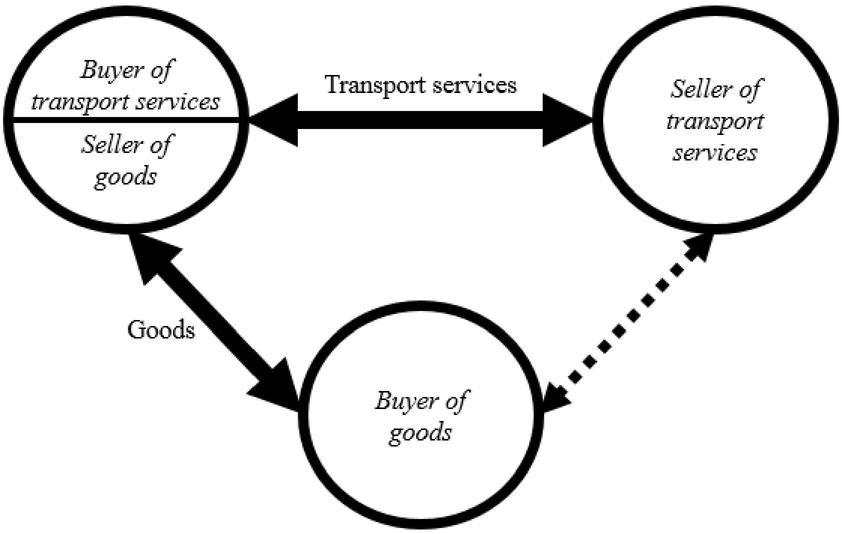

Figure 41. Generic roles in the Transport Service Triad

Generally, the development of the roles of the seller of goods and the buyer of transport services builds upon elevated interactions with business partners in the network, including the buyer of goods, the seller of transport services, and other buyers of goods (i.e. fourth parties). The dual role is important in connecting the transport services and goods. For example, the wholesaler examined in this thesis takes the dual role and is thus central in connecting other actors in the network. That development of elevated interaction also requires a shift from arm's-length relationships towards ones involving closer collaboration (Ford et al., 2011). However, the role of the buyer of transport services could also fall to the buyer of goods, who would then play two roles by connecting transport services and goods. In any case, the dual role is generic in TSTs, for one actor always has to play two roles.

The connections between the actors of the TST form a triad with two directly connected actors and an indirectly connected one. The triad is thus characterised as a triadic structure Vedel et al. (2016) since the seller of transport services has no formal business relationship with the buyer of goods. Relating to Wynstra et al. (2015) and their notion of service triads, which they argued entail a supplier (e.g. of products) who uses a third party to mediate exchanges with its customer, the third-party role is not valid in the TST examined in this thesis since the seller of transport services does not mediate or establish an agreement between the other two actors or balance out contradictory claims (Simmel, 1964). In that sense, the focal TST does not include the mediating role of the seller of services in 3PL and 4PL settings (Bask, 2001; Selviaridis and Spring, 2007). Although that role differs in such settings, it generally involves some combination of serving both the seller and buyer of goods, consolidating goods for a plethora of customers, bundling several logistics services, and providing a single interface for several transport needs. Regardless of the presence of role of the seller of transport services, be it a freight carrier or a 3PL, the importance and implications of the indirect link between the roles of the seller of transport and the buyer of goods has been brought to the fore in the analysis presented in this thesis (Selviaridis and Spring, 2007).

The seller of transport services can affect transport efficiency via mediation (Simmel, 1964*;* Siltaloppi and Vargo, 2017), which underscores the third actors' willingness to make adaptations due to interactions with other actors in a specific context. Interacting and agreeing on common goals and shared assumptions with the buyer of goods and other actors in the construction industry could foster the needed collaboration between the parties. For example, the lack of coordination between orders placed by the buyer of goods with subcontractors, as well as their different time slots, causes the need for multiple deliveries on given days. As a result, the seller of transport services experiences excessive transport capacity. In a mediating role, by contrast, the seller of transport services could coordinate transport more efficiently between the parties and develop common goals for transport. However, such a mediating role cannot be fully exploited owing to the lack of interaction between the higher organisational echelons of the buyer of goods and the seller of transport services (Bask, 2001). According to Bask (2001), many relationships are contractually restricted and managed only between either the 3PL and the buyer or the 3PL and the seller. At the same time, not only formal contracts but also implicit social norms influence the behaviour in a triad (Siltaloppi and Vargo, 2017). In their study of service triads, Hartmann and Herb (2015) found that shared norms, trust, and gratitude can function as mechanisms of coordination for efforts towards reaching common goals. The seller of goods and buyer of transport services could thus engage in normative commitments since the dual role implies business exchanges with both the seller of transport services and the buyer of goods.

The interaction between all roles within the TST allows the possibility to achieve adjustments of activities in order to promote efficient resource utilisation in terms of transport. However, the focus on various aspects of efficiency, especially transport efficiency, among the actors differs. Siltaloppi and Vargo (2017) state that *coalition* as a triadic relationship is one way to balance out the contradictory logics of actors by necessitating intensified collaboration and coordination. The four different roles in the TST are essential since they illuminate the different attitudes of the actors. Coalition entails a unified system with a high degree of cohesiveness, which can result in direct connections involving direct business exchanges among all three actors and their four roles. For example, the buyer of transport and seller of goods might see an opportunity to involve the seller of transport more in future transport operations. Consequently, if the seller of transport services was directly involved with both the buyer of goods and the buyer of transport services, then the seller of transport services could discuss new opportunities and exchange experiences, which may lead to increased transport efficiency. From a service triad perspective, it could also be that the service provider influences the other two actors by way of its role between the supplier and the customer (Wynstra et al., 2015).

In conclusion, each of the three firms play a different role—sometimes two roles—and applies a different business logic in allocating resources and perform activities. If the business logics of the actors in the TST were better understood by the other parties, then tensions resulting from conflicting business logics could be reduced, because every exchange of transport services involves the four roles illustrated in Figure 41. In addition, their different business logics concerning their needs for transport services could be taken into account, as could the different roles and logics of fourth-party actors relevant to the TST.

11. Concluding discussion

This chapter starts with a section discussing the theoretical implications of a Transport Service Triad (TST) approach, followed by a section discussing the managerial implications of the study. The third and final section of this chapter discusses some suggestions for future research on transport efficiency in supply networks.

To recapitulate, the aim of this thesis, as stated in the Introduction (Chapter 1) is to study how the organising of transport services impacts on transport efficiency by taking a triadic approach. To achieve that aim, a case of a Transport Service Triad (TST) involving three firms was studied. The TST as a key unit of analysis was used to explore the embeddedness and connections of activities, resources, and actors among the involved firms and their business relationships. Because transport services are embedded in business networks, they interact with other activities and resources that are not directly related to transport but nevertheless influence the ability to increase transport efficiency. Consequently, possibilities for influencing transport efficiency can increase in relation to how actors participate in developing transport services.

11.1 Implications of a Transport Service Triad approach

The following discussion revolves around three implications of the TST approach. The implications of adopting a broader analytical scope and of how the explanatory properties change are first discussed. This is followed by the implications of the different roles and business logics of the firms involved, as well as implications concerning transport efficiency and how it relates to other aspects of efficiency in general.

11.1.1 Analytical scope

The study shows that the TST approach provides a broader scope of analysis than a firm or dyadic perspective. The TST captures all relevant parties and their relationships to clarify the exchange of transport services, including the connections of those services to the exchange of goods. A TST analysis also captures the different business logics of the firms involved. In line with Simmel (1964, p. 141), the TST and other triads entail ‘a structure completely different from the dyad but not, on the other hand, specifically distinguished from groups of four or more members’. Accordingly, incorporating the influence of a third actor into the analysis of a dyad changes the explanatory properties and understanding of the interaction among the actors in the relationship and how they relate to each other. In doing so, this thesis adds to the current scarcity of research on how firms organise transport services in networks

(Johnsen et al., 2000; Selviaridis and Spring, 2007; Carter et al., 2015; Vedel, 2016; Johnsen, 2018). Triads can be used in systematic analyses of change processes, and the TST in particular can be used as an analytical tool for such analyses focused on transport services. This thesis advances several arguments regarding why a triadic approach is suitable when analysing transport services in supply networks. However, for such an inquiry to fully capture the properties in the triad, the analysis of each separate dyad is also necessary. Håkansson and Snehota (1995) emphasise the necessity and importance of understanding the individual business relationships (i.e. dyads) in order to expand knowledge at the network level. The relationships and their connections, as well as parties involved in a specific TST, are by their own right exclusive. It is thus vital to first identify and analyse each of them in each specific case.

11.1.2 Roles, business logics, and aspects of efficiency in the TST

This thesis suggests that the TST can be used to capture aspects of transport services in complex supply networks of connected relationships involving all relevant parties. It furthermore highlights the roles in the TST, their characteristics, and each role's different business logic regarding transport efficiency. For the seller of goods, that logic is based on the fast, highly reliable transport of its goods; for the buyer of goods, that logic concerns receiving goods suitable for its business processes; and for the seller of transport services, it concerns the high utilisation of transport resources and reduced costs for transport mileages. Although the three logics do not necessarily conflict, when one actor behaves to accommodate its business logic and that logic conflicts with another actor's logic, there is a risk of tension. An example of such tension is the difficulty of implementing changes that one actor perceives to be more efficient for transport but that another actor does not. Those tensions can be partly avoided and managed, however, by analysing not only the behaviours of the three actors in the triad, regardless of its type of triadic structure, but also by analysing the relationships and connections in the triad instead of focusing merely on the dyadic relationships therein.

Based on the exchange of goods and transport services that take place in the TST, four generic roles can be identified: those of the buyer of transport services, the seller of transport services, the buyer of goods, and the seller of goods. Each role takes a different perspective on transport efficiency. For the seller of transport services, that perspective encompasses the performance of activities and allocation of resources in a way that the seller sees fit; for the seller of goods and buyer of transport services, it encompasses high resource utilisation without compromising customers' expectations; and last, for the buyer of goods, it encompasses the timely arrivals of the goods purchased in order to increase its internal efficiency. Taken together, perspectives on improving transport efficiency can hamper other aspects of efficiency for the firms involved in a TST, because various aspects of efficiency and their relative importance to the firms involved can conflict. Although it is important to take the actors' different views on efficiency into account, it is also important to satisfy the various needs of the actors in the TST. For example, improving transport efficiency from one actor's perspective might not align with other actors' views on improved transport efficiency or might conflict with other aspects of efficiency. In that sense, the thesis contributes insights into actors' different concerns and priorities, which highlights that aspects of efficiency can be expressed in numerous ways depending on the perspective of the actors involved.

Although the roles in the TST are generic in terms of the exchanges in which they are involved, actors playing those roles assume other roles in the TST that are not connected to those exchanges. The seller of transport services tries to influence the other two actors by way of dyadic influence—that is, by providing information to either of the other actors—while the buyer of transport services plays the role of broker, which entails influencing the interaction between the other two actors by facilitating their interaction. By contrast, the role of the seller of goods involves making normative commitments—that is, when existing commitments to a third party, whether explicit or implicit, impose limitations on activities in a focal business relationship. Last, an identified role of the buyer of goods is that of *tertius iungens*, which allows the buyer to foster collaboration directly with the seller of goods and indirectly with the seller of transport services.

As stated previously, triads are the smallest network. However, each TST is also embedded within a supply network involving other TSTs as well as fourth parties. Since a large share of transport activities are outsourced to transport providers, collaboration and interaction among firms in the network are necessary to manage the adjustments and adaptations of activities and resources needed to accomplish increased transport efficiency. The TST is thus a suitable starting point for analysing networks because it takes into account several actors in a network, which is necessary to positively affect environmentally outcomes of transport services.

11.2 Managerial Implications

Any transport system is likely to be subject to major changes in the coming decades as freight transport increases, especially transport with trucks (Ellram and Murfield, 2017). That likelihood not only makes transport a particular area of concern for industries and societies at large but also requires its effects to be addressed at global, national, and local levels, which makes transport a concern for industry managers as well. Increased transport efficiency is especially imperative to combat climate-related challenges, in response to which managers play a vital role. This thesis thus stresses the importance of managers' jointly addressing how to increase the utilisation of resources in order to increase transport efficiency. Such an increase can be realised through coordination of customers' goods, for example by similarities of activities or by activities which supplement each other. Similarities entail, for example, coordination of several firms' goods in a joint delivery while the meaning of 'supplement' entails deliveries that complement each other, such as one delivery of goods complemented by the return of other goods. In that sense, if the buyers and sellers of goods address the embeddedness of the transport services that they use, then they can identify and act upon the interdependencies among activities, resources, and actors and, in turn, pinpoint both hindrances to and ways of supporting initiatives related to transport efficiency. Since increasing transport efficiency involves the actions of many actors, it is important that the actors involved in the exchange of goods take into account resource utilisation from the transport service provider's perspective. In particular, the buyers of transport services need to understand how their requirements for time-specific deliveries, for example, affect the transport service provider's possibilities of achieving efficient transport solutions.

For transport service providers, opportunities can arise if they are aware of and alert to changes in the exchange of goods between the buyer and supplier of goods, particularly when they discuss new business content with customers, such as the consequences of different demands and other requirements for transport services. Further opportunities might surface if they are actively involved in the interactions of the buyer and supplier of goods. All in all, elevated interaction between the actors in the TST can unlock latent potential; however, since different firms prioritise different logics of transport efficiency differently, the exchange of perspectives is also necessary. In that sense, transport services and the efficiency thereof should be not only the transport provider's concern but a concern shared and addressed by all actors in the TST.

Regarding purchasing of transport, Rogerson (2016) discusses the disconnection between purchasing activities and the planning of transport activities made by the buyer of transport services. That disconnection necessitates internal coordination among different levels, such as the tactical and operational levels. Hence, Rogerson's focus is partly on efforts related to coordination within a firm, to achieve high load factor. Although this thesis also deals with the firm internal issues, it moreover addresses inter-firm issues by discussing the other firms' different perspectives on transport efficiency and how their actions and perspectives can increase or decrease transport resource utilisation.

11.3 Future research

A goal of writing this licentiate thesis was to introduce and examine the potential of using the TST as an analytical tool for analysing transport efficiency as a means to provide some starting point for future research. Even though the thesis has partly taken fourth parties into consideration, its primary focus has been the analysis of a single TST. In compensation, future research could focus more on how TSTs are embedded in supply networks, both regarding the connectedness of various TSTs as well as their connectedness to other relevant actors in a network. That focus would be interesting for several reasons, one being the requirements of back-and-forth adjustments of activities and adaptations of resources in order to increase transport efficiency.

Although this thesis touches upon a context within the construction industry, further research could delve into other context-specific issues—for example, how a third actor organises transport and logistics activities within its broader network. A different context would most likely involve other issues, and examining it would thus highlight different aspects of transport efficiency. Moreover, in addition to the four generic roles identified in the TST, other roles with different functions have been identified in this thesis but not fully explored. Therefore, opportunities are ample for pursuing those other roles while studying the TST in the context of broader networks.

Last, future research could also delve into the area of action research highlighted by Ellram and Murfield (2017), in which academics, in liaison with industry partners, try to develop a method or work procedure in order to support concerted efforts to increase transport efficiency in any number of focal TSTs. Such research could help firms to form a shared understanding of issues faced while trying to increase transport efficiency, as well as to make strides towards their implementation. From another angle, using mixed methods can be a novel way to develop participants' understandings of factors propelling transport services and efficiency in order to better understand which aspects of transport affect sustainability. Action research can also be a way forward in contexts with abundant opportunities to increase transport efficiency. One such example is the construction industry, given its organisation of projects and decentralised decision-making processes involving several firms.

All of those suggestions for future research not only mark the end of this licentiate thesis on transport efficiency in the TST but also open doors for future endeavours. Altogether, the TST is a useful analytical tool for elucidating transport services in supply networks and increasing transport efficiency in transport systems, which is no doubt a complex undertaking. In response to such complexity for the various interconnected actors in those systems, despite their conflicting interests, increasing transport efficiency rests upon the united efforts of all of them.

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