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VARIETY IN TRANSPORT SERVICE SETTINGS AND THE CONDITIONS FOR VEHICLE MAINTENANCE

By

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ABSTRACT

Freight transport is featured by complexity since it relies on the business networks in which the firms that buy transport services are involved. To understand the conditions for vehicle maintenance, the variety of transport service settings and how these link with business networks needs to be uncovered. The aim of this paper is to explore the variety in transport service settings and how these in different ways affect the conditions for vehicle operations and in particular; maintenance activities. The paper relies empirically on highlights from an on-going case study featuring different conditions for, and approaches to, transport services from the perspectives of buyers and suppliers of transport services. The study relates to recent studies of transport service procurement (Dubois and Hulthén 2013, Lammgård et al. 2013, Rogerson et al. 2013) and theoretical suggestions of triads as units of analysis consisting of buyers and suppliers of goods and of transport services (Andersson et al. 2014). Features in transport service settings with an impact on vehicle operations are identified in three dimensions; (1) the buying firm's share of and influence on the utilisation of vehicles and vehicle fleets, (2) the division of labour with regard to the scope of coordination of vehicle operations, and (3) the nature of the transport needs.

There are two kinds of implications suggested. First, there are managerial implications for how firms in the network plan for and perform vehicle maintenance depending on the demands on the uses of the trucks. Second, there are research implications suggesting further research on transport service procurement and how buying firms may tackle the complexities of their business networks on the one hand and of the transport service networks on the other. Both direct and indirect relationships between transport service buyers and vehicle operators require further scrutiny.

Key words: transport service triads, business networks, maintenance activities

INTRODUCTION

Efficient use of vehicles is one of a set of issues that have become subject to increasing attention following the growing concerns of the climate effects of freight transport. All in all, road transport encompasses around 20 % of the total carbon dioxide emissions in Europe, and heavy duty vehicles stand for a quarter of these (EU Climate Action). In order to improve the utilisation of vehicle capacity it becomes essential to better understand the conditions for this utilisation. In this paper we take one such step by exploring the connection between vehicle utilisation and the network settings of transport services. In particular we focus on the conditions for maintenance activities in this context. However, in relation to efficient use of vehicles the study captures two related aspects; (1) how firms affect the efficiency by how they buy transport services (and thus the setting itself), and (2) how individual vehicles can be used as efficiently as possible in a 'given' setting.

By exploring variety in transport service settings we identify a set of factors that impact on vehicle maintenance activities. These settings include the business networks of the firms that are involved in buying and selling of transport services. Hence, the wider business setting of these firms is considered as of importance for the understanding of vehicle utilisation.

The aim of this paper is to explore the variety in transport service settings and how these in different ways affect the conditions for vehicle utilisation. The maintenance activities are of particular interest as these are vital to keep vehicles operational. The theoretical framework is grounded in the industrial network approach (see e.g. Håkansson and Snehota 1995, Håkansson et al. 2009) and especially the notion on triads in which buyers and suppliers of goods and of transport services are involved (Andersson et al. 2014). The paper is based on a case study of how three firms approach transport procurement in different ways, and how these approaches affect the conditions for vehicle operations.

In the next section we present the frame of reference followed by section three in which the method is described. In section four the three cases are presented. The cases are analysed in section five. The two last sections contain a concluding discussion and implications for research and practice.

FRAME OF REFERENCE

To capture the inter-organisational nature of service business and procurement, the IMP research tradition (Håkansson et al. 2009) forms the theoretical base of this study. The IMP research tradition emphasizes the importance of interaction and business relationships between firms over time. Business networks are analysed in three dimensions: activities, resources and actors (Håkansson 1987). In the IMP research tradition particular attention has been paid to interdependence across firm boundaries (see e.g. Araujo et al., 2003). Also, special attention has been paid to the functions and substances of business relationships (Håkansson and Snehota 1995), wherein activity links, resource ties and actor bonds are substance layers with a function for individual firms, relationships and third parties. What happens between two firms in a business relationship influences and is influenced by what happens in other relationships. This forms the basis for understanding the business market as a network (Johanson and Mattsson 1992).

Resources are activated by activities and thus; how activities and resources are organised among actors play a vital role for the performance of the firms involved. In this study we focus on the link between vehicle operations and transport service procurement. Vehicles are

activated by transport activities that are interdependent with other activities in the network. The key to understand these interdependencies, and how the firms involved handle them, is the activity patterns that, in turn, influence and are influenced by the firms' approaches to transport service procurement. Moreover, how the vehicles, as the focal resources, are tied to other resources and how these resources are organised among the firms is an additional aspect as well as the bonds among actors that may influence the other interdependencies and how these are handled.

In order to describe and analyse the network setting in which transport services are carried out, we take a starting point in transport service procurement (Andersson and Norrman 2002, Dubois and Hulthén 2013, Lammgård et al. 2013, Rogerson et al. 2013) and in the relationships between buyers and suppliers of transport services. This relationship, however, has a generic connection with the relationship between the buyer and supplier of the goods to be transported (regardless whom, the buyer or supplier of goods, is buying the transport service). We refer to this as the transport service triad.

Triads are the smallest possible network consisting of two (or three) connected relationships (Laage-Hellman 1989). When studies of transport services are concerned, a theoretical focus on triads as units of analysis consisting of buyers and suppliers of goods and of transport services has been suggested (Andersson et al. 2014). The triad relies on (1) the focal dyad between the transport buying company and the transport service provider, and (2) the third party who is the business counterpart to the transport buying company that either sells or buys the goods subject to the transport activities (see Figure 1). While this triad can be considered generic for the analysis of freight transport activities to capture their embeddedness in the exchange of goods, fourth parties of different kinds also need to be identified in specific settings when they impact on the conditions for the transport activities.

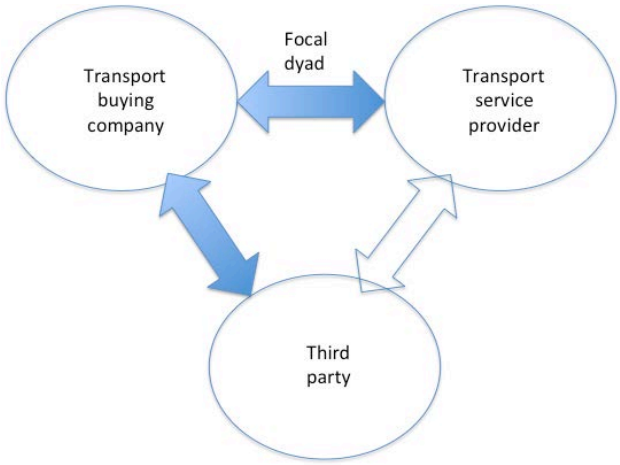

Figure 1. The transport service triad and the focal dyad (relationship between the buyer and supplier of the transport service) for analysing transport service settings (modified from Andersson et al., 2013). The two blue arrows illustrate business relationships.

Based on the notion of the (generic) triadic approach to how transport service providers are involved "in between" buyers and suppliers of goods to be transported we will address three broad research issues. The first deals with identifying and describing the relationships within the triads of concern for the transport operations. The triads set the terms for the focal dyads including the relationships between the transport buying firms and its transport service provider(s). The second research issue concerns analysis of the interdependencies among the activities, resources and actors involved in the identified triads. The third research issue

focuses on how the identified interdependencies impact on the uses of the focal resources, i.e. the vehicles. In addition, fourth parties that influence the specific triads need to be identified and analysed with regard to their influence on the vehicle use. Maintenance activities are considered as part of the activity structure within the triad and thus as linked with other activities.

METHOD

The study is based on a case research approach wherein three cases have been selected based on some similarities (*ex ante*) to identify variety in other dimensions (*ex post*). The three transport buying companies were selected based on that their operations were known to be heavily dependent on transport and on that they were known to be large buyers of transport services. Hence, the cases were selected based on that they were considered as particularly interesting with regard to purchasing of transport services and vehicle maintenance. When generalizations are concerned these rely on the analytical dimensions identified in the study and thus not to any other general categories of firms or settings. The three cases were found to display variety in several dimensions; (1) how the buying companies' transport needs were featured by time sensibility and resource specificity, (2) how the organising of the transport operations were handled both internally within the companies, and externally i.e. in relation to the transport service providers, (3) how the transport buying firms' approach make or buy issues when transport operations are concerned, (4) how the transport service buying firms approach the relationships with suppliers, and (5) how the transport buying companies approach the coordination of externally organised transport activities and resources. Most part of this variation was discovered as a result of the interviews, which also had an impact on the analytical framework developed during the study (Dubois and Gadde, 2002).

To collect data, four semi-structured interviews (Bryman and Bell, 2011) were carried out with representatives from companies related to the cases selected. In two of the cases, Dairy Products and the Retail Corporate Croup, the representatives are responsible for transport service procurement. In the third case, Forest Products, the interviewee is manager for the internal haulage company. The interviewee for Rapid Transports, supplier to Retail Corporate Group, is Business Area Manager for Retail. The interviews, with a length ranging from around one to one and a half hours, were recorded, further on transcribed and thereafter sent to the interviewees for respondent validation. The transcriptions, synthesizing the information gathered from the interviewees, together with supplementary company-related data from internet have been used as basis for the case descriptions below and as input to the case analysis performed.

THE CASES

Dairy Products (DP)

The company DP, based in Sweden and with a cooperative owner structure, is part of an international group with presence not only in Sweden but also in Denmark, Finland, Germany, Great Britain, The Netherlands, Luxembourg, and Belgium. The company group is owned by the milk-producing farmers, which currently are around 13.500 with over 3.000 of them in Sweden.

The operations of the Swedish company include production, marketing and retail sales of fresh milk, fermented products and other dairy based products. The products are refined and produced at 12 dairies spread geographically over Sweden. The company is also responsible for the in-bound logistics operation regarding fresh milk collection at the farms, transport

between dairies and out-bound transport of products to industrial customers as well as retailers. The logistics operation has been divided into two parts. One organisation is responsible for collection of fresh milk at the farms and transport of un-packed products between dairies and the other organisation manages transport of final products in the out-bound transportation flow. The case studied regards the in-bound part of the company's transport operations.

The logistics team that manages transports for collection of fresh milk at the farms and transport of un-packed products between dairies consists of eight persons. The group is responsible for transport planning, purchasing of transports and other administrational tasks related to the transports. Furthermore the team is responsible for management of bulk tank trailers and bulk tanks for the trucks used for haulage. DP owns all the bulk tanks and most of the bulk tank trailers, while the trucks used for hauling are owned by the hauliers. The bulk tanks for trucks are installed at the beginning of a contract and will not be exchanged during the length of the contract.

Transport plans are established and managed by the logistics group. The team strives to minimize the number of trucks that are required to meet the needs of the operations. There are two main drivers related to the needs of the operations; the needs related to the farmers producing fresh milk and the needs related to the production at the company's diaries. For the farmers it is crucial that the milk is collected every 48 hours, so the plans for this part of the logistics operations are more or less fixed cycles repeated every second day. For the receiving end of the transport chain, at the diaries of the company, there is more variation. The demands of the retail chains vary with respect to what specific products they require and in what amount and thus also the demands of the DP diaries vary over time. This variation is also reflected in the in-bound transports and the diary to which a haulier will deliver the milk may change from day to day. Of the milk collected from farmers about 35-40% is used for fresh dairy products and the rest for products like milk powder or cheese.

Currently 28 external hauliers carry out transports for DP. To secure that the transport demands are met, there are just over 70 vehicles being used in this 24/7 operation. The hauliers involved are not engaged in other transport operations but fully occupied by DP. DP prefers to purchase transports from smaller hauliers - most of them have one to seven vehicles in their fleets. The company claims that the type of assignment requires a very high level of efficiency, flexibility and commitment, something that according to DP is less often found in bigger haulage companies.

DP continuously monitors and revises its need for transport capacity and therefore the contracts with hauliers are re-negotiated every 8 months. DP aim at keeping the transport suppliers fully occupied and there is a very limited turnover of contracted hauliers. The conditions in the framework agreement regarding compensation for each specific activity in the transport chain are re-negotiated once every year, but for diesel costs the compensation is adjusted on a monthly basis. Demands on efficiency and cost reductions lead to that the number of hauliers contracted by DP has been reduced over time. The remaining hauliers working for the company have according to DP become more efficient and business minded.

DP does not include any requirements regarding vehicle maintenance in the contracts with hauliers. Nor does the company require that the hauliers sign maintenance contracts for their vehicles. There are also few requirements regarding vehicle specifications and the hauliers are free to choose vehicle brands and models themselves. However, as part of an on-going

environmental project, DP requires that the hauliers use Bio-Diesel as fuel, as long as there are suppliers within range. To help the hauliers improving efficiency, and to promote the use of Bio Diesel, DP offers the hauliers to fuel their vehicles with Bio Diesel at the Dairies where fuelling infrastructures have been set up. The same strategy for offering the hauliers improved efficiency and lower operation costs has been applied for tires. DP has co-ordinated purchases of tires for hauliers in Sweden, Denmark, Great Britain, Germany and Luxembourg. DP has looked into the possibility to arrange similar deals with Truck OEM's (Original Equipment Manufacturer), but according to DP it has not worked out well so far due to the fact that the hauliers have different preferences and also due to a weak interest from the OEMs'.

A milk-collection transport cycle includes a number of different activities performed in sequence. In addition to the actual transport the driver performs loading, un-loading and cleaning of tanks. For all assignments, the transport planner establishes a schedule including all required activities. For each 24 hours, approximately 23 of them are reserved for transport or transport-related activities. The transport plan makes it possible to calculate how long the haulier will drive and how much milk that the haulier will be able to collect from the farmers. The transport plan is revised at the yearly contract negotiation, but smaller adjustments due to variations in the milk production are made more frequently. A new plan is reviewed, and if required revised, when the driver has performed around three rounds following a new assignment plan.

Every 24 hours, milk is collected from 1.600 farms. The number of farms visited by a single vehicle during a cycle varies between one and 20, with an average of about 12 stops for a truck with trailer. The number of stops depends on how much milk that is collected at each farm. There are farms delivering only about 100 kilogram per visit, but an average quota is around 3,5 tons. Each stop takes around 3 minutes, excluding the time required for loading the milk using the pumping equipment. For the average amount of milk collected, i.e. 3,5 tons, the pumping time takes about 4 minutes. Most farmers milk their cows twice per day, one time in the morning and one in the afternoon. During the milking process, when the farmer's tank is being filled up, it is not possible for the haulier to collect milk from that farm. The assignment plan thus needs to take these restrictions into consideration.

There are no time-windows for milk collection defined for each farmer; instead there is a well-specified start-time for the first farm in the cycle. The assignment plan also includes information about expected milk loading times, times to drive between the farms, and how long it should take to drive to the dairy. Having unloaded the milk at the dairy, the driver then cleans the bulk tanks and pumping equipment. At each dairy, DP therefore provides special equipment to be used for cleaning. The pump equipment for each truck includes electronics that monitor the volume and weight of the milk being loaded. The aggregated weight is later on compared with the weighing systems at each dairy. The electronics does not contain any fault monitoring, but include a positioning system that provides information that can be used to monitor the position and route of the truck as well as the time spent at each farmer and at the dairy. The information gathered is used as input to the process of establishing and revising assignment plans.

The nature of the business, based on handling of fresh milk from farmers, makes it crucial that the transport chain from farmers to dairies is in continuous operation. A delay of only two hours may be critical and any disturbances must be immediately addressed and resolved. If there is a major issue with the truck, for example if a breakdown occurs, a replacement

vehicle needs to be put into operation. If the haulier does not have an emergency back-up solution, the transporter can switch to one of the 20 spare trucks that are owned by DP. Even if DP try to avoid using the spare vehicles, all trucks are seldom idle. For longer periods of vehicle standstill, hauliers must arrange for spare vehicles. As the replacement trucks owned by DP must be operational and ready to use, the company must secure that they are properly maintained. For maintenance, DP prefers branded workshops specialized on the truck make.

To be able to meet the uptime-related demands from DP, the hauliers themselves must put tough requirements on the trucks they operate. This includes maintenance, both preventive and corrective, on which the demands are high. To have the truck running almost around the clock, it is important to find flexible maintenance solutions adapted to the transport plans. Thus some hauliers perform maintenance themselves or divide the tasks of a required maintenance in parts that are performed separately when time can be allocated. In general, the hauliers rely on that the workshops they use for maintenance are both highly flexible, service minded and nearby.

Figure 2 summarises the main actors and relationships in the DP case.

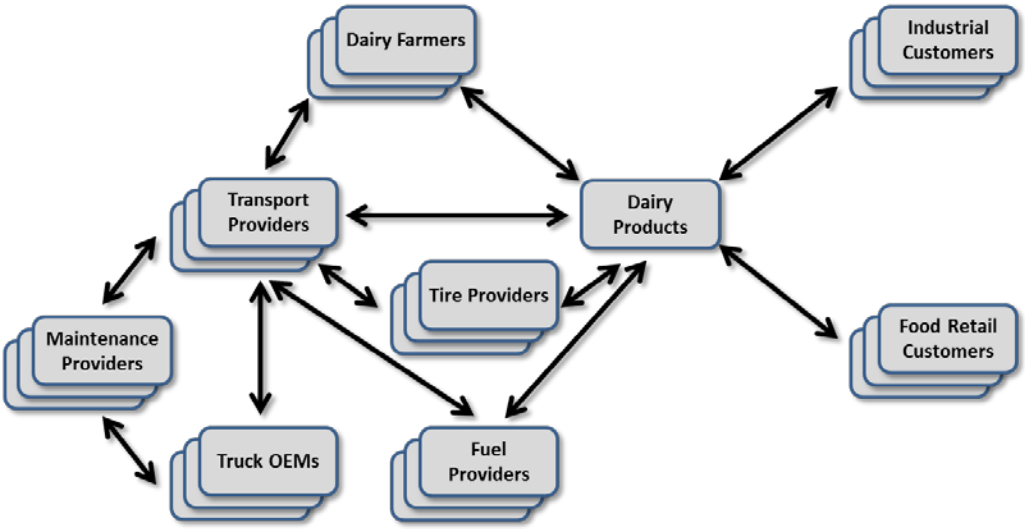

Figure 2. The main actors of the business network in the case involving Diary Products.

The retail corporate group (RCG)

The company group RCG is a public limited liability company with headquarters in Stockholm, Sweden. Grocery retail is the core business of the company group, but the organization also includes supplementary operations related to for example banking, real estate and pharmaceutical products. RCG is currently present with grocery retail operations in Sweden, Norway and the Baltic. In Sweden alone, the chain encompasses more than 1.300 grocery stores. The company's business model for grocery retail varies between countries and operations. In Sweden specifically, the business model is based on the concept of individual and independent retailers that cooperate with each other as well as the RCG company group. In this constellation, RCG's responsibilities relate to for example sourcing, logistics and marketing.

In 2013, a re-organization of the logistics operations in region South-West was initiated with a target to finalize implementation during 2015. Of the four warehouses in the region, the

operations will be centralised to two warehouses. In the new structure, one of the warehouses will focus on fresh foods and products like media and clothing while the other will handle fresh-food and other food-products.

The re-organization of warehouses and stocks in region South-West also results in new demands regarding the related logistics operations. The revised operations need to reflect altered needs with respect to transports in-between the warehouses as well as from the warehouses to the retailers. Also for the in-bound flow from suppliers to RCG the transport patterns will have to change. In parallel to the re-organization, RCG decided to revise the strategy regarding transport procurement in region South-West. RCG does not own any of the vehicles required for its logistics operation and thus rely fully on suppliers. Until now, RCG has been working with different suppliers at the four warehouses but the new strategy is based on the idea of having one common transport operator for the entire region. The procurement process started in June 2014 and October 1st the same year the new logistics operation was in place. The contract with the new supplier, Rapid Transports (RT), ranges over five years, a longer period compared to the previous standard contract-length of three years. RT now operates with more than 100 vehicles in the region in order to distribute to the 560 shops in the South-West region. All vehicles operating are from sub-suppliers contracted by RCG. The contracts between RT and its sub-suppliers are "transparent" and reflect both the length and the requirements set by the main customer RCG. The contracts include details about the number of vehicles that are to be allocated by the sub-contractor, the distance and time that the vehicles will cover in a year, as well as demands regarding how to meet needs for additional transport capacity during peaks.

Flexibility and simplicity have been the main drivers behind the revised logistics strategy of RCG. Instead of local contracts with several transport suppliers connected to each specific warehouse, there is now only one provider that RCG needs to interface and interact with. The new organization also eliminates previous problems concerning uncertainties regarding coordination of, and responsibility for, transports crossing district-borders. The set up furthermore also facilitates the possibility to balance transport capacity between different areas of the region when transport demands fluctuate due to for example summer vacation.

The contract and arrangement with RT lay the foundation for a new way of working with transport suppliers. The cooperation between RCG and its transport supplier will become closer than with previous transport suppliers and the ambition is to "open up" the internal processes of each company to provide visibility. A specific joint project team has been established in order to drive the improvement process. By learning from each other, making mutual adjustments, and create a common basis of trust, RCG hopes that the new relationship will lead to that both companies become more efficient and are able to reduce costs. One of the changes is that transport planning will be performed in cooperation between RCG and RT. Through close cooperation, the partners hope being able not only to achieve a good driver-scheduling but also to establish a transport plan that allows the transport supplier to perform vehicle maintenance, or use their vehicles for other customers, when RCG's logistics operations allow for it.

There are two main types of transport operations procured by RCG; one called "charter-traffic" and one called "free distribution". Charter-traffic concerns situations in which for example a major shop orders a full vehicle load. In these situations RCG is fully responsible for the transport planning. Free distribution is applied when a transport operator receives a load to be delivered during the day, and then the operator is in charge of the detailed transport

planning. In both cases, however, general requirements regarding delivery times and windows need to be met. In charter traffic, disturbances in the transport flow are easily observed by RCG, but for free distribution it is not always possible to monitor and identify deviations. To enable follow-up, the drivers are obliged to report delays and, by use of the GPS-based systems installed in the vehicles, it is also possible to see where the trucks are.

Planning of the logistic operations of RCG reflects the demands and needs of each specific cooperating grocery store, demands that in turn reflect the buying patterns and behaviours of the consumers. As buying patterns and volumes varies between shops and over time, demands with respect to the amount of products needed as well as delivery times fluctuate and make the logistics operation complex. For each delivery at a grocery store, a delivery time is defined. To allow for some flexibility, there is a window around each delivery time specified. The window is 1.5 hours, with 30 minutes before the delivery time set and 60 minutes after. It is important that the delivery time requirements are met, especially since the receiving shops adapt their staff with respect to expected deliveries. To follow-up on the actual performance, the delivery precision is measured on a weekly basis for each vehicle. For RCG the target is to meet the time limits set for at least 87% of the deliveries. The current delivery precision measured is 90%, and in some instances even better. RCG and RT follow up on the delivery precision on a weekly basis.

Delays in, or absence of, deliveries of groceries to a shop result in disturbances in the internal planning and logistics arrangement of the shop and may ultimately also lead to loss of sales. Also for the RCG warehouses a delay will impact on the operations due to that loads still not shipped will block space reserved for new loads. RCG therefore requires that the transport operator makes sure that a vehicle of the right specification is available when planned and agreed. If there is a problem, for example due to a vehicle breakdown, the operator is required to resolve the issue without causing disturbances. An operator may solve this in various ways and one of them, however costly, is to have reserve capacity available as back up.

To achieve flexibility, and at the same time also secure continuity and knowledge about the receiving shops, mostly more than one driver is assigned to each district. A driver that frequently performs the same transport assignment becomes familiar to the practical arrangements for each receiving shop and is by this able to improve efficiency with respect to unloading Another factor that is important to address is the driver scheduling, and for the operator it is critical from an economical perspective to avoid unnecessary gaps and waiting times through an optimal driver-planning.

For RCG, the vehicle specification is of great importance. The specific vehicle type, size and loading capacity need to match internal demands regarding for example volume and weight, load carriers and loading and un-loading infrastructure. Also from a transport-planning perspective it is favourable if differences between the vehicles utilized are limited with respect to specification and load capacity. Furthermore, it is also important that the vehicle specification maximises transport capacity within the limits of the current legal framework. The most common standard specification is an 18-pallet rigid truck combined with a regular or a double-floor trailer.

RCG has targeted a reduction of 30% in CO2 emissions to 2020, and one of the enabling factors is that all vehicles shall be driven by bio-fuels in 2018. This target has a major impact not only on truck procurement planning, around 110 trucks need to be replaced, but also on fuel availability. To engage in the development of related areas, as well as topics such as

alternative payment methods and vehicle design, RCG cooperate with both truck OEMs and fuel suppliers in research and development activities.

RCG has considered whether or not the company should be involved in vehicle maintenance, but based on the reasoning that the company buys transport services the conclusion was that vehicle maintenance is considered an activity for which the transport operator has sole responsibility. Neither does RT include any requirements regarding maintenance in the contracts with their sub-contractors.

To avoid negative impact on the transport assignments, maintenance is preferably performed during stand-by-time, for example during evenings or weekends. If this is not possible, the operator needs to provide a replacement vehicle that could either be owned by the company or rented for this purpose. Even if RCG does not include any specific requirements in the contract regarding maintenance of vehicles, coolers or other equipment, the company prefers that the transport operators who do not have their own workshops sign maintenance contracts for their vehicles. The amount of maintenance contracts or leasing contracts including maintenance agreements appears to increase, specifically at the larger operators. Even if there are advantages, such as flexibility, there is today far less operators that perform vehicle maintenance on their own.

Figure 3 illustrates the main actors and relationships in the RCG case.

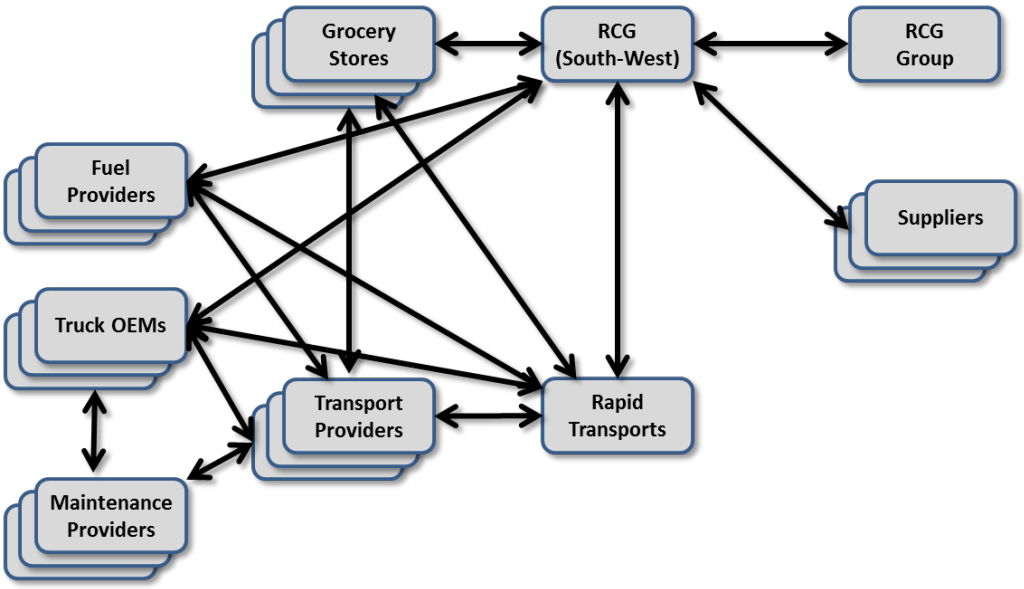

Figure 3. The main actors of the business network in the case involving the Retail Corporate Group.

Forest products (FP)

FP is an economic association formed by forest owners representing approximately 36.000 forest properties in Sweden. Not only do the forest owners themselves own about 50% of the forest in the region, but together they also own a group of companies related to forestry management, forestry services and forest-based products. The company group, with around 3.500 employees, encompass three business areas that offer forestry services and produce timber goods, paper pulp, biofuel and energy.

Forestry related management and services are bundled in a specific business area serving its members. The business area also purchase timber, both from members as well as other suppliers, and supply the production facilities of the company group with raw material required for further processing. Production and sales of solid biomass fuel, for example in the form of wood pellets, is another important part of the business area. Main products of the business area for timber goods are sawn and planed timber and interior fittings in wood. The business area operates 11 production facilities, i.e. sawmills, each of them specialized with respect to specific input raw material, products and markets. The business area for pulp production operates pulp mills and produces both soft- and hard-wood pulp using raw material originating from the forests of the owners as well as from imported raw material. In addition to the pulp itself, the business area also offers its customers a range of related services in areas such as logistics and support. Surplus energy and heat from the pulp process has also become part of the company's products.

FP also includes an internal transport operator who owns and operates 25 heavy vehicles; 18 for timber transport and 7 for transport of for example wood chips and pulp. The capacity provided by these vehicles is less than required in the company group, and transport capacity is thus also purchased from external hauliers. The haulier of FP, which only performs a limited part of the company group's transports, is internally looked upon as a transport-reference and transport-development company. Thus, an important part of the company's assignment is to operate vehicles in order to gather reference information regarding the cost of transportation. Furthermore, the company shall actively pursue and evaluate solutions that will further develop transport technologies. As the externally contracted hauliers very seldom have capacity enough to engage in technological development, they may instead leverage on the results from development activities managed by FP. Introduction of RME as an alternative fuel is an example of a result from this arrangement, where FP initially evaluated and proved the performance of the new fuel and then later the contracted hauliers were involved.

The geographical area covered by FP's operations is divided in three regions, and each region manages its own transport planning. Each region is responsible for planning both regarding the vehicles of the FP's own haulage company, but also for transports purchased from external hauliers.

For transport of timber to the mills, the regional transport planner establishes a weekly plan reflecting the raw-material needs defined for each mill. The plan includes information concerning where to pick up the load, type and age of the timber as well as each mill's specific quota for the week. FP manages and communicates the transport planning data using a dedicated IT-tool, and all vehicles transporting timber for FP are equipped with a mobile terminal. Having received the weekly plan for timber transports, the driver of the vehicle is then responsible for establishing the daily transport plan.

The transport of other raw materials and products looks slightly different, and there is no general IT tool as the one used for planning and management of timber transports. For wood chips, for example, the piles of chips are monitored with the use of cameras and transports are being planned based on the size and growth of the piles. To improve efficiency as well as avoid driving empty returns, FP collaborates with other companies performing similar transports in the region. As a result of this cooperation, loads are being exchanged with other hauliers in the region and thus the involved companies are able to jointly improve the vehicle utilization.

The vehicles used for transports are allocated in specific and separate locations spread over the geographical region covered by the FP operations. The FP vehicles are in operation from Sunday night to Saturday morning every week and three drivers working in two shifts are allocated for each vehicle. In average, the vehicles cover a distance of 250.000 kilometres every year. A vehicle is used in different ways depending on the nature of the assignment, where the vehicle is stationed and what kind of transport that is performed. For a vehicle stationed close to a pulp mill for instance, several turns between the loading site and the mill will be possible during a shift. For other vehicles, with longer distance between the loading site and the receiving mill, only one turn will be possible to complete during the shift of a driver.

To ensure continuity in the processes of the mills, it is vital that the delivery quotas of the mills are delivered every day. If there is an interruption in the delivery-chain to the mill, the mill may have to be closed down in the worst case. Even if there are other hauliers that could be approached if a problem is encountered, they may not have vehicles to put into immediate operation for FP. As a result of an unplanned vehicle standstill the FP haulage company, which competes with external hauliers, may risk to lose their contract with a mill. There are no specific delivery times or windows stipulated for supplies to the mills, it is the quota defined that steers the transport planning. Requirements regarding delivery-time windows would have been a difficult restriction as the drivers that pick up timber often meet unplanned and unknown obstacles in their daily work. There are however strict regulations regarding how long each specific type of timber may be stored in the forest before pick-up, which is something that needs to be addressed in the transport plans.

The vehicles are equipped differently depending on the type of transport assignment for which they are used. There are for example differences with respect to the locking-systems for timber transport, where one solution is adapted for short distances and frequent loading and unloading. The specifications are optimized for different types of transports which make it difficult to replace vehicles. As there are no replacement vehicles in stand-by, it becomes important that all vehicles are operational and capable to complete their specific assignments.
The FP haulage company competes with external hauliers, both with respect to contracts for mills external to the company but also for the timber-transport contracts signed for the internal FP mills. The FP mills order specific volumes to be delivered, and for them it is less important if it is an internal or external company that performs the transport.

It is the central purchasing department within FP that is responsible for contracts as well as negotiations with external hauliers, and the length of the contracts varies from one to three years. The size of the externally contracted transport companies vary between about 3 to 10 vehicles and FP prefers to cooperate with companies that have “muscles”, companies that they can grow together with. Twice every year, transport purchasers within FP and the external hauliers meet for discussions regarding the operations and related topics such as capacity and fuel. As FP wants to grow together with its contracted hauliers, and together protect the commercial brand, also the future perspective is part of the agenda for the meetings.

The contracts between Forest Products and external hauliers include no explicit requirements regarding vehicle availability or maintenance. In the contracts there are however implicit demands regarding uptime, or productivity, as FP states demands regarding the amount of load to be transported. FP has a long experience of using the OEM branded workshops for vehicle maintenance and the internal transport operator requires that the OEMs can offer high

quality service at service-points close to the company's vehicle depots, a demand that also steers the choice of OEM brand when purchasing new vehicles. First more recently the company has started to implement maintenance contracts and today FP signs maintenance contracts for most of their own vehicles The content of the contracts vary between vehicles depending on how each vehicle's drivers maintain and manage their vehicle. Some of the contracts are full contracts, for example Gold by Volvo and Green by Scania, while others only cover preventive maintenance. It is the FP's haulier managing director that decides upon which level that is appropriate for a vehicle in a dialogue with the drivers of the specific vehicle.

The transport operation of FP is sensitive and it is critical that all vehicles are operational. There are no spare vehicles in stand-by and thus a vehicle in standstill must be brought back into operation as quickly as possible. If there is risk for a longer standstill, FP and the concerned OEM work together in order to find a solution, and if necessary the OEM lends FP a replacement vehicle. A major reason for FP to sign maintenance contracts is the possibility to cooperate more closely with the OEM in order to find a solution during a standstill, and avoid having spare vehicles in standby.

The vehicles, most of them using RME fuel, are brought to the workshop for maintenance every second week. The maintenance intervals for vehicles using diesel are acceptable but the intervals for vehicles using RME would preferably be longer according to FP. Day and time for service is agreed with the workshop the week before, and the transport planning is adjusted accordingly. As the first shift starts at 04.00, it is often possible to complete a transport assignment before the scheduled maintenance.

To monitor the service or repair, the drivers frequently follow the vehicle to the workshop when maintenance is due. In this way, the drivers are also able to maintain a high level of technical knowledge regarding the vehicle, a competence that is critical if for example the vehicle has a breakdown in a remote location in the middle of the night. Even if it sometimes could be possible to schedule vehicle maintenance to evenings or weekends, this is not something that FP has required so far. A main reason for this is that the drivers follow their vehicles to the workshop, and as they are being paid also for this time it would be more costly to schedule the time to evenings or weekends.

Also the cranes of the vehicles need regular maintenance and occasionally repair due to breakdowns or malfunctions. Due to that FP strives for flexibility there is no single maintenance solution stipulated, and the solution preferred varies between vehicles and with respect to the specific and current needs. The drivers often perform some maintenance operations, such as greasing and replacement of hydraulic hoses, while the OEM workshops occasionally provide repair services in conjunction with vehicle maintenance. For problems requiring immediate attention, also third party workshops in the vicinity of the vehicle may be contracted for repair.

In the past, when the number of vehicles owned and operated by FP where less and not spread out geographically, the company operated a vehicle maintenance workshop on their own. Today, when the vehicles are distributed over a vast area, it would not be possible for FP to maintain a workshop operation. However, FP sees that external hauliers that operate workshops on their own gain benefits, primarily related to flexibility and cost advantages.

Figure 4 illustrates the main actors and relationships involved in the FP case.

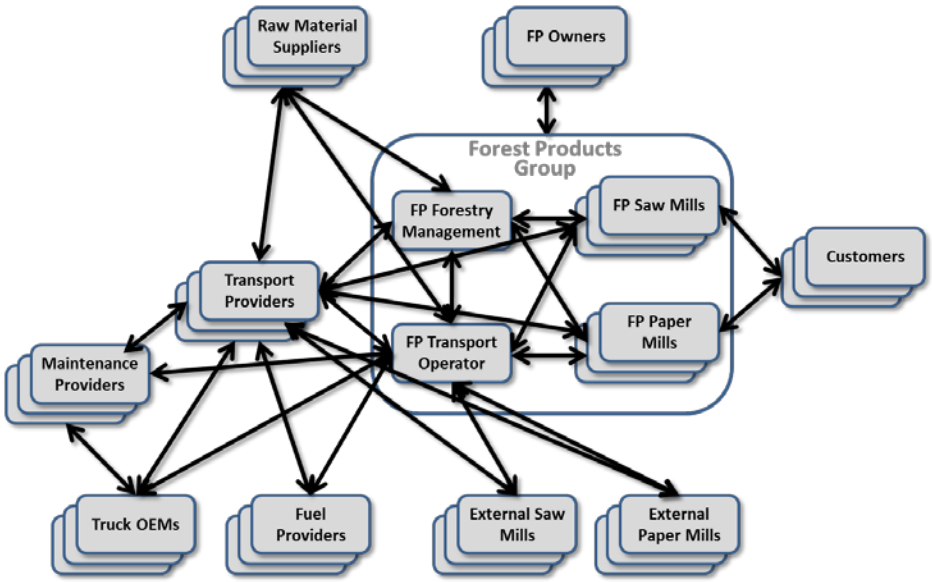

Figure 4. The main actors of the business network in the case involving Forest Products.

ANALYSIS

The DP case displays a triad with strong interdependencies among activities, resources and actors (see Figure 5). The chain of activities from milking at the farmers to the diaries' production is subject to sequential interdependence wherein DP, both in a short and long time perspective, coordinates the transport activities. No disturbances are accepted and therefore DP keeps 20 spare trucks for use when the hauliers' vehicles need unplanned repair. As the representative from DP put it; "… (the process) is ruled by biology … the cows will give milk all the time … and we can never pause …". Resource ties have been built into the structure e.g. the bulk tanks (owned by DP) that are fitted on the trucks (owned by the hauliers). Also, the bio diesel infrastructure installed at the diaries represents important resource ties. The strong bonds between DP and its hauliers are manifested in long term contracts and a low turn over of partners over time, and also in how DP leverage on their size and volume by e.g. buying tires for all its hauliers. The fourth party influence of the retailers whose demands entail adjustments of DP's production plans, and thus require adjustments also of the transport activities, is handled within the focal triad wherein the hauliers are carrying out their activities as part of DP's broad production plan. The hauliers all work exclusively for DP and thus do not share or tie their resources with any other buyers of transport services.

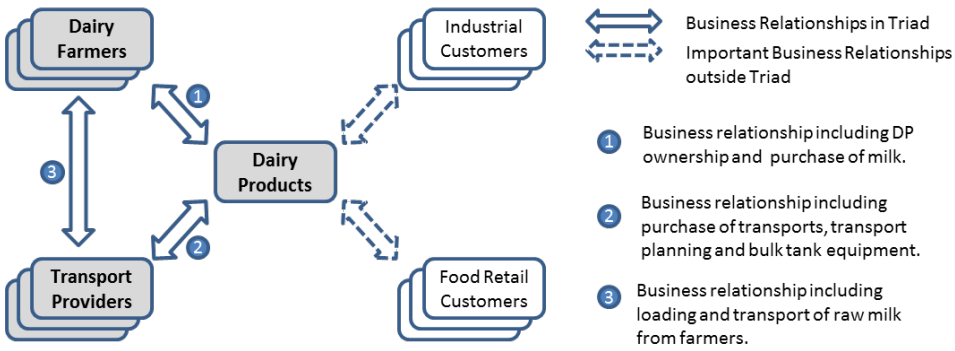

Figure 5. The key transport service triad in the case involving Diary Products.

The RCG case is also featured by strong interdependencies, in particular among activities and some of the actors (see Figure 6). This triad is heavily influenced by the focal dyad in which the strong relationship between RCG and RT (the single source of transport services) is extended to the transport operators as a set of fourth parties dealt with jointly by RCG and RT. The transport planning is also undertaken jointly by RCG and RT and is subject to high demands on flexibility of the transport operators and rigid time windows set by the needs (of capacity planning) of the grocery shops. If a truck is absent when loading is planned at the RCG warehouse there will be consequences for both stores and RCG. As the interviewee from RCG explain; "… there will be delays in the delivery to the grocery store which results in loss of sales … and we also need to empty the storage area in the warehouse …". Through the drivers the transport operators develop bonds with the grocery shop staff, which is perceived as important from a performance point of view. Apart from the end customers, the vehicle OEMs and fuel suppliers are involved as fourth parties. Through collaboration with these companies RCG develops long-term strategies for its (indirect) vehicle use. When the shorter-term vehicle use is concerned RCG and RT leaves this to the transport operators, i.e. maintenance activities are considered to be beyond the scope of these actors' concern. In contrast to the DP-case the transport operators do not work exclusively for RCG or RT but are expected to utilise their excess capacity for other customers. The transport operators' activity planning thus includes all aspects of vehicle utilisation including all maintenance activities.

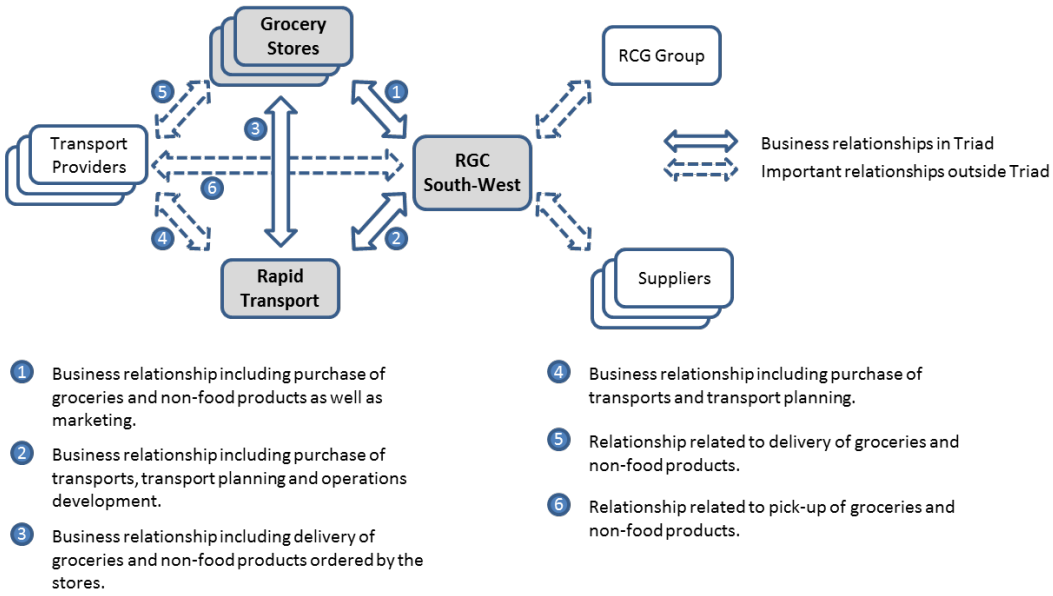

Figure 6. The key transport service triad in the case involving Retail Corporate Group.

In the FP case transport activities are embedded in yet another specific and complex chain of interdependent activities (see Figure 7). In this case the chain of activities starts in many different places to pick up timber and is determined by the mills' daily quotas. Although the daily deliveries are not subject to hourly time windows as in the case of RCG, any failure to deliver the required amount of timber to each mill may potentially result in costly production interruptions. "In the worst case, a mill may need to close … and (as a result of this) we may lose the contract", the manager from FP underlines. The vehicles are subject to resource ties both with regard to specific uses and to special equipment such as lifts and mobile terminals. Geography plays a key role in this case both for activity panning and vehicle use and for resources such as the workshops that are used for maintenance that in turn affects the vehicle brands used by the hauliers. The actor structure is complicated by the fact that several of the

key actors in (all roles of) the triad are parts of the same group of firms although organised into separate business units. Fourth party connections include external hauliers with whom FP exchanges transport assignments to maximise the use of vehicle capacity, as well as direct collaboration with vehicle OEMs to affect both short and long term conditions for the vehicle use. In contrast to the other cases, maintenance activities are in this case part of the overall activity planning in the focal triad.

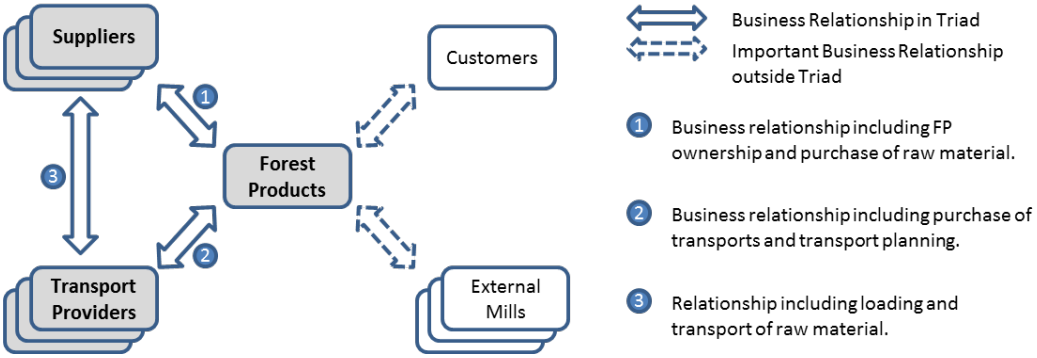

Figure 7. The key transport service triad in the case involving Forest Products.

The three cases all display triads with strong interdependencies among activities, resources and actors. However, the scope of control over activities, resources and actors exercised by the transport service buyers differ among the cases. As a result from the different approaches to transport service procurement the three cases illustrate different conditions for vehicle use. In the DP-case the hauliers work exclusively within the focal triad which entails that DP carries out all planning for the use of vehicles. While maintenance is not within the scope of this planning, DP keeps spare vehicles to safeguard for vehicle breakdowns. In the RCG case the vehicles are used also beyond the focal triad and maintenance is not considered as a concern for RCG or RT as the key actors involved in transport buying and planning. In the FP case vehicles are used also beyond the focal triad while vehicle maintenance activities are within the scope of FP's activity coordination.

In addition, the transport routes also affect the coordination and performance of the transport activities, and thus the use of the vehicles. In the DP and RCG cases the sites to and from which the transport activities are taking place are 'fixed' which facilitates the planning of transport activities although, especially in the RCG case, the short term planning depends on external demand factors and needs to be updated frequently. In the FP case, in contrast, the transport planning is complicated by the location of the timber to be transported to the mills since these pick up locations are varying and often remote.

From the vehicle operators (owners and drivers of the vehicles) the three settings provide different conditions. In the DP case they operate as resources within the wider production operation of DP. The hauliers' main concern is to keep their vehicles in a good condition by fitting maintenance activities into their tight schedules. However, if their vehicles break down there is a buffer in place. In the RCG case the vehicle operators need to sell their capacity and plan for the use and maintenance of their vehicles on their own since they do not work exclusively for RCG. Lastly, in the FP case the vehicle operators (external hauliers) work as an extension of the capacity of FP's own vehicle fleet. FP's planning include all activities including the vehicle maintenance required.

All three cases studied include transport operations which comprise explicit demands related to delivery times, delivery windows or delivery quotas. In the case of DP, the farmers rely on that the milk is picked-up according to the strict schedule and the dairies require supply of milk in order to meet productions plans. In the RCG case, the retail stores need to fill up their shelves and expect groceries to be delivered according to well defined delivery windows. The demands observed reflect interdependencies that exist between activities of the cases. It is noteworthy, however, that even if the cases show similarities with respect to demands regarding delivery times or quotas, the reasons behind these requirements differ. Even if all cases relates to transports, and the trucks used could be seen as fairly standardised tools or resources, the unique and dynamic setting of each case drives the development of highly context-specific sets of requirements.

To secure that delivery times and delivery quotas agreed are met, the transport assignments scheduled needs to be completed as planned and expected. A prerequisite for this is that the vehicles of the hauliers are operational and possible to use for their intended purpose. Even if it is possible to establish back-up solutions using spare vehicles that are kept in reserve, this is not common. Trucks are expensive resources, and investing in vehicles that are used mainly as stand-in in case of emergency is something that companies therefore strive to avoid as far as possible. To allow for that the vehicles are operational and available for use, vehicle maintenance thus becomes one of the most important enablers to address.

Maintenance is an activity that includes both regular and scheduled service as well as unplanned repair. The scope and aim of maintenance is to ensure that the vehicles are operational and may be used efficiently and safe for their specific purpose. Service, or preventive maintenance as it is also called, is performed on a regular basis according to a schedule that relates to how the vehicle is used, for example how long distance it is driven. Repair, or corrective maintenance, on the other hand is performed when there is a need for it due to vehicle or system malfunction or breakdown. Maintenance is performed by the haulier themselves or by an external maintenance provider. The external maintenance supplier may belong to a truck OEM or being a third party supplier, see figure 8. Even though vehicle maintenance not is seen as a core activity in the focal triads studied, the interdependencies observed in-between activities as well as resources of the three cases imply that it will be important to plan and coordinate vehicle maintenance activities well in order to avoid disturbances and additional costs.

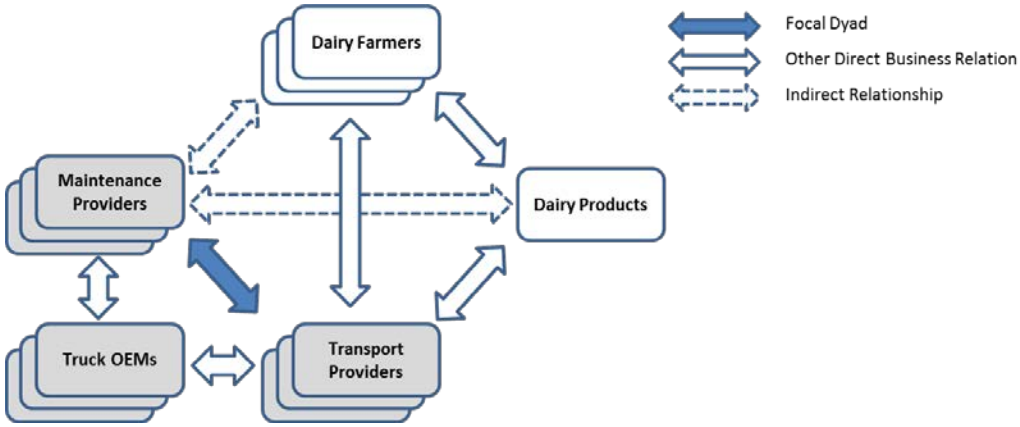

Figure 8. The main business relationships related to vehicle maintenance and how they relate to the key triad of the business network in the case of Dairy Products.

For service, a maintenance activity planned in advance, the hauliers strive to schedule the activity to a time when the vehicle not is engaged in assignments. If required, and when

possible, service may even be planned for evenings or weekends. Hauliers operating with a bigger fleet of vehicles could have a spare vehicle that will replace a truck being serviced. Vehicle repair, required due to malfunction or breakdown, is however due to its nature more difficult to prepare for. Even if new technologies introduced are used in order to predict failures, it is difficult to foresee and plan for vehicle repair. As unplanned stops risk to induce disturbances in the chain of interdependent activities, hauliers aim at reducing both risks and possible negative effects. The hauliers may for example sign maintenance contracts for their vehicles or have in-house competence for problem solving and repair. A close relationship with the preferred workshop is a prerequisite for the haulier. The haulier must be able to rely on that support is provided when required in order to have the vehicles in operation. For a haulier, being able to rely on the support from a workshop is of such an importance that it may guide the choice of vehicle brand.

As discussed above, the unique and dynamic setting of each case drives the development of highly context-specific sets of requirements. Also for demands and conditions for maintenance this is highly valid. For service as an example, the service schedule varies depending on the specific usage and specification of the vehicle. Furthermore, depending on the type of transport operation, the demands regarding preferred day and time of day for service would look different.

CONCLUDING DISCUSSION

Vehicle operation includes a set of activities, one of which is vehicle maintenance, which can be divided among and/or coordinated by different actors. In this paper we have looked into three cases of how large transport service buyers handle their transport needs and thus set the conditions for the settings in which transport services are carried out. The scope of their control and coordination within the focal triads involving the buyer and supplier of goods and transport services varies.

Based on the case analysis we distinguish three dimensions in which the network settings differ with regard to the uses of vehicles. First, the buying firms' share of and influence on the utilisation of the vehicles may differ. In one of the cases the transport operators work exclusively for the transport buying firm while in the other two cases the vehicles are also used for other customers and purposes. As illustrated by the cases this dimension is also affected by the extent of resource ties involved between the vehicles and other resources involved in the focal triads. Second, the division of labour with regard to the scope of coordination of vehicle operations may be handled in different ways. This dimension is related to the first one since transport operators working exclusively within one focal triad become an extension of the buying firm's resource constellation and thus the planning of the transport activities is part of the scope of this firm's wider production planning. Whether or not maintenance is made part of the transport buying firm's scope of planning or not may differ as well as how breakdowns are handled by the firms involved. Third, the nature of the transport needs, in terms of e.g. location of the pick ups or delivery points, plays an important role since this affects the conditions for the coordination of the transport activities and thus for the utilisation of the vehicles. Depending on how the first and second dimensions are handled, these matters fall either into the transport buyer's or the vehicle operator's scope of concern.

IMPLICATIONS

Managerial Implications

All three cases studied include transport operations that comprise explicit demands related to delivery times, delivery windows or delivery quotas. The demands observed reflect specific interdependencies that exist among resources and activities. Furthermore, the unique and dynamic setting of each case drives the development of highly context-specific sets of requirements. For managers involved in the process of transport purchasing, planning and operation it thus becomes critical to identify, understand and address the unique and specific demands of each setting.

As previously discussed, maintenance is an important factor in order to ensure that vehicles of the fleet are operational and that the transport service provider is able to complete the transport assignments as planned and expected. Hence, there are a number of maintenance related issues and challenges that need to be addressed by the firms involved. One of the issues that needs to be addressed early in the transport purchase and preparation phase relates to how the buyer and supplier plan for vehicle maintenance and whether this is subject to their joint plans or if it is a concern just for the transport service provider. The involved companies may want to clarify demands both related to how vehicle maintenance should be performed and monitored as well as how maintenance should be managed in relation to the long and short term transport planning. Furthermore, interdependencies between resources involved in the transport operations prompt that the resource owners investigate and agree on solutions regarding maintenance. In case, for example, that the trucks and trailers are owned by different companies there could be gains if vehicle and trailer maintenance could be synchronized.

An additional issue to address by the firms involved regards the share of the transport provider's capacity that is purchased by transport buyer. In case that the provider's full capacity is dedicated to one buyer, operation and planning will become more straight forward. If however the capacity is split between two or more buyers, buyers that may have different and divergent demands, both operation and planning will become more complex. This complexity also have an impact on vehicle maintenance and thus the firms engaged needs to agree on solutions that would lower risks for future problems.

For the vehicle operator, a fundamental question to resolve is whether maintenance should be performed in an internal workshop or by an external firm. This decision does not only have an impact on the vehicle operator's internal organization and resources but also have a major impact on the business relationships of the vehicle operator. As observed in the three cases, the relationship between a haulier and its maintenance provider is one of the most critical relations in the network of a vehicle operator.

Research implications

Based on this study, we formulate some implications for research. A first implication deals with the appropriateness of using a business network perspective in order to understand transport services and, in particular, using the triad as a unit of analysis. As we know, business relationships do not occur in vacuum but they both influence and are influenced by what happens in other business relationships (Håkansson and Snehota 1995, Anderson et al. 1994). The same argument applies to triads (Dubois, 2009). Extending the scope of analysis from a dyad to a triad may make it possible to better comprehend the substance and function of a dyad. However, "acknowledging that dyads are embedded in larger networks emphasises

their contingency on more than one third party" (Dubois 2009: 267). This means that a triad as a general unit of analysis in business networks is problematic. However, a triad may at the same time be relevant to focus on in order to capture to something specific since the relevance of any individual triad is likely to be more specifically related to one or a limited number of particular issues, tasks or situations than any dyad, since the latter is likely to harbour a multitude of such connections related to different sets of third parties (ibid.: 268).

Exchange of transport services always involves at least two types of business relationships: one between the buyer and seller of goods and one between the buyer and seller of the transport service. In addition, there are other related business relationships as seen in the three cases presented, for example with other transport operators, actors involved in maintenance operations and/or customers, impacting on the focal triad. Implications from this paper regard that transport services as well as vehicle operation issues may be instances of such particular issues, meaning that a triadic focus of the analysis make sense. Another implication is that any focal transport service triad is part of a wider network and thus a business network approach is necessary to understand transport services in their contexts or specific settings. Hence, in line with studies of transport service procurement (Dubois and Hulthén, 2013; Andersson et al. 2014), we see triads as useful analytical tools for analysing transport services in a business network perspective.

In the context of operations management research, Wynstra et al. (2015) recently presented a research agenda for further research on so called 'service triads' emphasizing that this kind of triad is featured by that "each actor has a direct connection with the other" and that "such connections may be constant or intermittent" (ibid.:1). The authors consider service triads as both a phenomenon and a research topic and argue that further research is needed; "rather than just extending theories of triads, we would suggest to extend theories in triads". As another point, they stress the need for more empirical studies on triads. In this vein, the generic type of triads that we have begun focusing on, i.e. transport service triads, seems promising to explore further. Hence, we suggest that further studies of and on triads in the empirical setting of transport services may be a fruitful way for continued empirical exploration and theorising on triads.

If we again turn our attention to the IMP research community, triads is not a new object of study but several essential empirical studies with a focus on triadic analysis have been carried out (see e.g. Laage-Hellman 1989, Holma 2009). What is important with triads as study objects is that they are embedded in wider network settings, as emphasized above. Recently, Harrison et al. (2012) draw attention to how triads have been used as a starting point for uncovering dynamics in business networks. They suggest three forms of scenarios for role dynamics in triads: the diamond (including a focal dyad and variations in the third part actor), aligned unitary (a triad in which the actor performs multiple interaction processes and activities simultaneously) and the timer (a focal actor playing different roles in several triads over time). It would be interesting to explore these roles further in continued studies of transport operations focusing on specific dimensions or activities, such as transport planning, maintenance or business development, to reveal patterns in network development in order to contribute both to IMP theorising as well as to transport research.

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