

Outsourcing of heavy vehicle maintenance: the implications of embeddedness

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Abstract

The objective of this paper (in work) is to explore the outsourcing of heavy vehicle maintenance from an interorganizational perspective. Specifically, the paper aims to identify and analyze some of the implications resulting from the embeddedness of the maintenance solution, its provider and its buyer, and, how these implications influence a hauler's decision of make-or-buy. The paper draws on the results from an on-going case study focusing the marketing and purchasing of solutions in a business network context. The empirical data regards firms concerned by maintenance of vehicles in a road freight transport setting. While literature on outsourcing tend to focus on the supplier, the buyer, or the supplier-buyer dyad, the implications of this paper point to the need for applying an interorganizational perspective when outsourcing vehicle maintenance. The supplier-buyer dyad, as well as the maintenance solution in itself, is embedded in a wider network of firms. The maintenance solution therefore influences, and is influenced by, firms and activities in the wider network. Moreover, reflecting the heterogeneous needs of stakeholders of the business network, the value of the solution will be differently perceived by different stakeholders. Hence, for suppliers and buyers striving for improving value, effectiveness and efficiency of the maintenance solutions an aggregated view of the needs is crucial.

Introduction

Outsourcing of logistics and transport services is a common phenomenon in the industry (see e.g. Gadde and Hulthén 2009). Instead of performing the tasks internally, the Shippers, i.e. the buyers or suppliers of goods, purchase services involving, for example, warehousing and transports. Similarly, transport providers, or haulers, operating the vehicles used for transport often outsource parts, or the complete extent, of vehicle maintenance.

Heavy vehicle maintenance encompasses preventive maintenance (PM), also called service, and corrective maintenance (CM), or repair (e.g. Murthy et al. 2002; Basri et al. 2017). Vehicle maintenance is firmly grounded in the technical characteristics of the vehicle and the automotive industry retains a strong focus on preventive maintenance based on maintenance intervals (Murthy et al. 2002; Pintelon and Parodi-Herz 2008). Adding to the complexity, though, the solutions (see e.g. Brax and Jonsson 2009) offered by a maintenance provider must cater for more than the pure technical aspects of the asset to be maintained; maintenance solutions should be designed with a "value-centric approach" (Ali-Marttila et al. 2017) that address the buyer's operational and business needs. Therefore, at the one hand, firms that outsource maintenance should form their decisions about outsourcing in accordance with its operational strategies (Maley et al. 2015) and, at the other hand, providers of maintenance solutions should design their offering in accordance with the needs of each individual customer.

Reflecting the networked structure of the transport industry, it could be argued that value should be addressed from an interorganizational perspective (La Rocca and Snehota 2014). Value could be differently perceived by suppliers, buyers and other concerned actors part of the business network. Moreover, as firms' needs vary over time, also the perceived value of a solution may vary with the changing context. In addition, manufacturers with a global footprint must also address the challenges coming from that preconditions; expectations and needs that characterize each local market may differ. A maintenance solution developed for customers in the European market could be differently valued by customers in the US or China, for instance. The expectations of, and drivers for, the value of maintenance solutions thus becomes tightly interwoven with the transport industry network of the local market.

This paper (*in work*) applies an interorganizational perspective on the outsourcing of heavy vehicle maintenance in a transport industry setting. With a specific focus on the buyer-supplier dyad, the paper identifies some of the key implications resulting from the networked context. Drawing on the notions of the Industrial Network Approach (Håkansson et al. 2009), the paper discuss the initial results from an on-going case study focusing the marketing and purchasing of solutions in a business network context. The empirical data regards firms concerned by maintenance of vehicles in a road freight transport

setting. Next, the outsourcing of maintenance will be discussed. Thereafter, some of the methodological considerations will be addressed. Subsequently, the three sub-cases are presented together with a case analysis. Finally, some of the initial findings will be discussed.

The outsourcing of maintenance

Outsourcing is seen as a key business trend and is common in both manufacturing (e.g. Kaipia and Turkulainen 2017) and logistics and transports (e.g. Gadde and Hulthén 2009). Among the reasons for outsourcing, Kaipia and Turkulainen (2017) point to specialization, focus on core competencies, and releasing capital. In addition, Maley et al. (2015) argue that the principal drivers for outsourcing regards a strive for cost savings and a perceived financial advantage while Murthy et al. (2015) also point to the possibility of removing the need for the in-house specialist work and specific tools that otherwise are required.

Also for maintenance, outsourcing is an issue in focus for many firms (Toossi et al. 2013). Already in 1995, Campbell (1995, p. 19) claim that “maintenance activities are good candidates for outsourcing” due to that the activities usually are routine, well delineated, measureable, and can be managed at arm’s length. The view of Campbell (1995), though, appears to reflect the past view of maintenance were “maintenance was nothing more than an inevitable part of production” and “a necessary evil” (Pintelon and Parodi-Herz 2008, p. 26). Adding to this cost-centric view, Maley et al. (2015), for instance, argue that “[t]he maintenance costs are a significant portion of the operational expenditure for many asset-intensive industries and it is therefore not surprising that companies target maintenance for exigent cost savings.” (2015, p. 275). In the same vein, Murthy et al. (2015) state that maintenance traditionally was performed in-house by the owner of the asset, but “[o]ver the last few decades, there has been an increasing trend in the outsourcing of maintenance where some or all the maintenance is carried out by an external service agent under a maintenance service contract (MSC)” (2015, p. 100).

For a truck OEM offering maintenance solutions in the form of maintenance contracts (Stremersch et al. 2001) often involves a focus on internal efficiency. Oliva and Kallenberg (2003) explain that, “the move towards maintenance contracts is often triggered by a desire to make better use of the installed service organization. For the service provider, once the service organization is in place, it becomes a fixed cost and the main driver of profitability is capacity utilization” (2003, p. 168). Hence, for an OEM, offering maintenance contracts could lead to improved efficiency and lower costs. However, as Stremersch et al. (2001) argue: “industrial customers evaluate the value offered by a product or service rather than its price alone. Consequently, firms will not evaluate maintenance contracts solely on their (maintenance) costs, but on the entire value proposition” (2001, p. 6). Therefore, when offering maintenance solutions as maintenance contract, OEMs need to emphasize the value for customers and not only focus on internal costs and means of achieving internal efficiency. In the same vein, Toossi et al. (2013) point to the importance of providers understanding the value-in-use of the maintenance solutions offered and argue that “value-in-use needs to be assessed in a way that it can be used as an input to design and improve the value-adding services to boost customer satisfaction” (2013, p. 350).

Ali-Marttila et al. (2017) claim that firms have moved towards a more business-centered view and have recently argued that “maintenance management has moved from a cost-centric view toward a more value-centric perspective” (2017, p. 144). Moreover, Ali-Marttila et al. (2017) claim that “[t]he service aspect is now a common part of maintenance” (2017, p. 144). Maintenance thus aligns well with the trend of so-called ‘servitization’ that applies in many industries (Vandermerwe and Rada 1988). With servitization, producers aim to strengthen their offer and competitiveness through adding services to their products. According to Tukker (2004), maintenance belongs to the group of the product-oriented services, in which products continue to establish the core offering. Maintenance, as well as other services, has proven to be a strong, stable source of revenue for companies with a running population or installed base (Araujo and Spring 2006).

Even though researchers such as Tsang (2002) and Kelly (2006) have emphasized the value and strategic importance of maintenance, and truck OEMs expands their maintenance offering and applies strategies for servitization, the transport industries seem to exhibit the same state as many other industries. Murthy et al. (2002) explains that “[i]n most businesses, maintenance is viewed as being a non-core activity and the focus has been to outsource it completely” (Murthy et al. 2002, p. 297). In the same vein, Pinjala et al. (2006) argue that there is a “lack of understanding this relationship [between business and maintenance strategies] and only cutting down the costs of maintenance can influence the company’s

competitive strength equation and its ability to compete in the market” (2006, p. 215, Text between brackets added). As McIvor (2008), point to: “[i]n many cases, the choice of which parts of the business to outsource is based on ascertaining what will save most on overhead costs, rather than how the decision impacts upon the long-term capabilities of the organisation” (2008, p. 24). Hence, even though the value of maintenance has gained increasing attention, the outsourcing is still often price-oriented (Ali-Marttila et al. 2017). And as Ali-Marttila et al. (2017) point to, “[t]his often results in short-term decisions which can be quite problematic in maintenance, as many of the benefits are created over a long term” (2017, p. 145).

It thus appears that the transport industry would benefit from a more clear understanding of the value as well as costs of maintenance. Moreover, the costs resulting from the absence of maintenance or poorly performed maintenance have to be seen in relation to the actual cost of performing such maintenance (Salonen and Deleryd 2011). Murthy et al. (2002) have estimated the annual cost of maintenance per total operating cost to be approximately 20–30% for the transport industry, whereas ‘the indirect costs resulting from delay in delivery, customer dissatisfaction leading to loss of goodwill and customers is much higher’ (2002, p. 288). Thus, maintenance should be addressed from a broader perspective that considers the costs and benefits for all stakeholders involved, including transport providers and transport buyers.

Method

This paper draws on data collected through interviews (Bryman and Bell 2011) in an on-going qualitative case study (Maxwell 2013; Yin 2014). The study encompass three sub-cases involving transport buyers and transport providers. The three sub-cases all involve transport buyers known to be large buyers of transport services, operations strongly dependent on goods transport, and represent different types of industries. Thus, also the assumed variety with respect to the characteristics of each road transport operation was considered important (Eisenhardt and Graebner 2007). The interviews involved representatives from the transport buyer and the transport providers of each case. Moreover, interviews were also performed with representatives from maintenance providers, i.e. workshops. Analysis of the collected data was divided in three main steps. The first step, performed during transcription of the interviews and write-up of the case descriptions, resulted in a mapping of each transport operation with respect to actors, activities and resources (Håkansson 1987; Håkansson and Snehota 1995). In a second step, performed as a within- and cross-(sub-)case analysis, the organizing of - and interdependencies among - activities and resources were analyzed using concepts grounded in the Industrial Network Approach (Håkansson et al. 2009). Finally, in step three, features and pre-conditions influencing the vehicle maintenance solutions were identified and analyzed. Specifically, the analysis concerned haulers’ stance with respect to maintenance and maintenance outsourcing.

Case description

The study encompasses three sub-cases featuring different transport operations: the case of Dairy Products, the case of the Retail Corporate Group and the case of Forest Products. For the purpose of this paper, the brief case description that follows applies the perspective of the hauler (requiring maintenance for its vehicles).

The case of dairy products

For the inbound transport of fresh milk from farmers, the company Dairy Products (DP) relies fully on external haulers. About 30 haulers are currently involved, and most of them are small firms with fleets of one to seven vehicles. The haulers, which are fully occupied by DP, own and manage the trucks that are used, while DP owns and manages the bulk tanks and most of the trailers. Milk production involves critical biological processes and strict requirements regarding handling and hygiene, hence should the inbound flow of fresh milk never stop and disruptions must be immediately resolved. To ensure reliability of transports, vehicle maintenance is fundamental. The trucks are used 24/7 and cover long distances every year. Vehicle maintenance (preventive maintenance) therefore has to be performed between 10 to 15 times in a year. Planning of maintenance is a challenge. The split ownership of trucks, trailers and bulk tanks further increase the complexity with respect to maintenance planning. Most haulers outsource maintenance and also prefer to sign maintenance contracts for their vehicles.

The case of the Retail Corporate Group

The Retail Corporate Group (RCG) outsources all outbound transports to a logistics operator, the operator Rapid Transports (RT). RT does however not use any of its own vehicles for RCG, hence are all transport carried out by vehicles owned by (sub-) contracted haulers. In total, about 100 vehicles are used for distribution in the region. To improve vehicle utilization, the (sub-) contracted haulers offer their services also to other transport buyers. For RCG, timeliness of loading and un-loading is crucial. If a time-window for unloading is missed, for example, this will lead to a disruption in the store's planning and may ultimately lead to loss of sales. The haulers thus face tough demands with respect to timeliness and reliability of transports. As the vehicles are used during daytime mostly, the haulers prefer to have vehicle maintenance performed during evenings or at weekends. Some haulers prefer maintenance contracts while others perform most of the maintenance themselves.

The case of forest products

For timber transports, Forest Products (FP) owns and operates an internal transport provider with about 25 vehicles. The lion's share of the transport capacity is however provided by external haulers. The contracted haulers provide their services to other transport buyers in order to improve vehicle utilization and occasionally also use sub-contracted haulers for the transports related to FP. The saw mills require a steady and reliable flow of supply, and in the case of an interruption, the process may have to be shut down in a worst case scenario. Deviations from the transport plan therefore must be avoided and issues that occur must be resolved as quickly as possible. The vehicles used for timber transports are operated six days a week, from Sunday evening to Saturday morning. The vehicles cover long distances in a year, and vehicle maintenance is required about every two weeks. Also the timber cranes and load fixation systems require frequent maintenance in order to avoid breakdowns. The haulers themselves are responsible for planning and performing the maintenance required. Some haulers perform most of the maintenance themselves while others prefer to outsource the work.

Case analysis

All three sub-cases display large business networks involving numerous firms interconnected through an intricate web of business relationships. The two focal dyads established by 1) the transport buyer and the transport provider and 2) the transport provider and the maintenance provider, are embedded in a network involving, for instance, additional transport buyers, sub-contracted haulers, the customers of the transport buyers, and the truck manufacturers (OEMs). Observing the firms' operations, and the business relationships interconnecting them, it becomes clear that the transports performed influence, and are influenced by, what happens in other parts of the business network.

The three sub-cases presented all entail different types of transport operations. The transport concerns different types of goods, milk, groceries and timber, and display different characteristics with respect to issues such as transport planning, vehicle specifications and transport patterns. Moreover, the sub-cases show how the contractual agreements differ with respect to the haulers' possibilities to offer their services also to other customers, and outsource transports to third part haulers. A common feature, however, concerns the need for reliability and timeliness of the transports. Each of the operations concerned, such as the saw mills or the dairies, for instance, depends on a steady and robust supply of raw material. Hence, for all of the vehicles used, maintenance becomes essential in order to ensure vehicle uptime and transport reliability.

With respect to performing vehicle maintenance, though, the three sub-cases display a variety. While some of the haulers opt to perform the maintenance by themselves, others instead outsource the work to external maintenance providers. A complicating factor here, however, is that some of the equipment mounted on the vehicles, timber cranes and milk pumps for example, may require that additional firms, specialized in the equipment, have to be contracted for the job. Moreover, the case of Dairy Products provides an example of how the firms involved have chosen to split the ownership of vehicles, trailers and bulk tanks. As a result, the planning and performance of maintenance become a more complex task.

Discussion of initial findings

The objective of this paper (in work) is to investigate the outsourcing of heavy vehicle maintenance from an interorganizational perspective. Specifically, the paper aims to identify and analyze some of the implications resulting from the embeddedness of the maintenance solution, its provider and its buyer,

and, how these implications influence the act of outsourcing. As can be seen from the transport operations featured by the three sub-cases, the efficiency and effectiveness of vehicle maintenance depends on a number of different factors. Drawing on the argument that vehicle maintenance is firmly grounded in the technical characteristics and use patterns of the vehicle, maintenance solutions has to address three specific issues, see Table 1. As can be seen on the last row of Table 1, also the local regulation will strongly influence the vehicle maintenance. In some countries, for instance, the regulation for vehicle inspection influences the planning of the general vehicle maintenance.

Table 1: Four technical and usage-related factors influencing vehicle maintenance

Factors	Description of issues/questions involved
Technical specification of the vehicle	The technical specification of the vehicle (e.g. the type of engine, the type of cab, and the number of axles) corresponds to the needs defined by the expected use of the vehicle. The technical specification often differs between markets due to, for example, regulation, infrastructure, and customer demands.
Technical specification of the auxiliary equipment	The auxiliary systems of the vehicle (e.g. trailer, crane, rear lift, and cooler) correspond to the type of goods transported as well as infrastructure for loading and unloading.
Patterns of vehicle utilization	Utilization of the vehicles differs both between, and within, various types of transport operations. Important parameters here are e.g. distance, number of engine hours, weight of cargo and operation hours (e.g. 24/7).
Regulations & vehicle inspection	Regulations may differ between countries, for instance with respect to vehicle inspections, and could also influence the planning of regular vehicle maintenance.

Moreover, the case-study points to the importance of applying a network perspective for issues such as efficiency and effectiveness of maintenance solutions. Not only does the internal efficiency of a firm depend on other stakeholders in the business network – issues such as efficiency and effectiveness may also be differently perceived by different actors. Table 2 identifies three additional factors to consider when striving for efficient and effective maintenance solutions.

Table 2: Three network-oriented factors influencing vehicle maintenance

Factors	Description of issues/questions involved
Organization of transport capacity	Are all transports outsourced by the transport buyer or partly performed by an internal hauler for instance? Does the contracted hauler perform transports for other buyers as well or sub-contracting part of the transport work?
Ownership of vehicles and auxiliary equipment	Ownership of the vehicle (tractor/rigid, trailer, bulk tank, crane etc.) may be differently configured. Either one actor owns the complete vehicle, or the ownership is split among different actors.
Planning of vehicle maintenance	Is the hauler free to plan for vehicle maintenance according to internal needs only or does the planning also have to reflect the needs and demands of other firms?

Hence, for a hauler considering outsourcing of vehicle maintenance, there are a number of factors that have to be addressed and evaluated. Firstly, the technically- and usage-related factors have to be studied in order to identify the demands to be put on a maintenance solution. Secondly, the factors resulting from the embeddedness of the firm have to be evaluated. The needs and demands of the transport buyer as well as the sender and receiver of the goods should influence the characteristics of the solution sought for. Moreover, the limitations and capabilities of the maintenance provider's operation will strongly influence the possibilities of achieving effective and efficient maintenance solutions. The value

perceived by the stakeholders involved or influenced hence depends on several factors external to the supplier and buyer of the maintenance solution.

However, even though the importance of a value adding approach to maintenance solutions is increasingly emphasized in literature, it is mostly the supplier and/or buyer of the focal dyad that are in focus for the discussion (see e.g. Toossi et al. 2013; Murthy et al. 2015); the needs and perspectives of other stakeholders influencing, and influenced by, the maintenance solution remains unclear. As also argued by Ali-Marttila et al. (2017), the perception of the value created differs between individuals, functions and firms. Hence, acknowledging the heterogeneity of actors embedded in the business network, the same actors also displays variety with respect to the assessment of value.

With respect to the question of outsourcing, and the maintenance solution sought for, it is however also important to consider that many managerial decisions will influence the needs and preconditions. The choice of a specific truck OEM and the specification of a vehicle, for instance, will have a long term effect on when, how and where to perform maintenance. Similarly, the type of transport services sold to a customer will influence how and when maintenance may be planned and performed. Hence, when evaluating the different factors and preparing for a decision concerning outsourcing, short-term (operational), mid-term (tactical) and long-term (strategical) effects have to be assessed.

Moreover, outsourcing is not only about specialization and reducing costs; the literature on outsourcing also lists challenges, risks and downsides that need consideration. Maley et al. (2015) claim that “outsourcing engagements have been well documented as being associated with negative consequences such as the hollowing of corporations and the depreciation of firm capabilities” (2015, p.275), and Kaipia and Turkulainen (2017) point to the challenges involved in managing the outsourcing relationship. According to Campbell (1995), management also need to consider risks related to the loss of critical skills, loss of cross-functional communication and loss of control over a supplier.

Hence, a hauler considering outsourcing vehicle maintenance should look beyond the technical characteristics of the vehicle and the transport operations; a make-or-buy decision should also reflect the long term business and strategies of the firm. Table 3 summarizes a few of the questions that should inform a decision about outsourcing.

Table 3: Factors to consider by a hauler for the decision of outsourcing of maintenance

Factors	Description of issues/questions involved
Competencies and tools	Which are the short-/mid-/long-term pros and cons of outsourcing maintenance with respect to availability of competencies and tools?
Industry segment?	Choice of transport industry segment will strongly influence issues such as vehicle specifications and vehicle usage patterns.
Choice of truck make/OEM	The choice of truck make will influence the capabilities and limitations of the dealer/workshop network and the maintenance solutions offered.
Financing of vehicle maintenance	Concerns the type of business relation established between hauler and the workshop. Could for example be in the form of a Maintenance Contract or more of an ad-hoc nature.
OEM workshop or 3 rd Part	For maintenance outsourcing, the hauler can choose a workshop of the OEM or a third part company
Externally or on-site?	Should the outsourced maintenance be performed at the external workshop – or fully/partly at the site of the hauler?

While the preceding discussion of this chapter focus on the buyer-perspective, i.e. the perspective of the hauler, the same discussion also provides an indication of what a maintenance solution provider has to consider when defining, developing and deploying maintenance solutions for its customers. It is, however, crucial to emphasize the interactive nature of the outsourcing. In line with the discussion of Baraldi et al. (2014), the value is not depending on a unidirectional transaction but co-created by the supplier and the buyer involved in the outsourcing relationship. However, as both the buyer and the supplier are embedded in a wider network featuring business relationships and interdependencies among actors, activities and resources, the creation of value should be seen from a network perspective. Hence, the outsourcing of vehicle maintenance, i.e. the provision and procurement of a maintenance solution,

should thus not be seen as an isolated action but as an action influencing, and influenced by, a range of actors interconnected by business relationships. For the firms involved in the act of outsourcing, this results in the movement of firm-boundaries which also becomes blurred and multifaceted (Gadde 2013; Gadde 2014); the coordination of activities and interaction of resources becomes issues jointly managed by firms through interaction.

Hence, while Campbell (1995) sees maintenance as a good candidate for outsourcing due to that the maintenance activities usually are routine, well delineated, measureable, and can be managed at arm's length, this paper point to the embedded nature of the maintenance solution, the supplier and the buyer – an embeddedness resulting in a complex web of relationships and interdependencies. Moreover, while Maley et al. (2015) argue that the reduction of cost is a significant driver for outsourcing of maintenance, this paper point to the importance of addressing the aggregated needs and perspectives of multiple stakeholders when considering outsourcing vehicle maintenance. Being embedded in a wider business network, maintenance influence, and is influenced by, actors and operations of the network. Therefore, for buyers and suppliers of maintenance solutions, a network perspective is required when striving for improving value, effectiveness and efficiency of the solutions.

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