A FRAMEWORK FOR TRANSPORT PLANNING PROCESSES

A LOGISTICS SERVICE PROVIDER PERSPECTIVE

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ABSTRACT

Purpose - The purpose of this paper is to explore operational planning processes for road based long haul transportation and analyze the potentials for improvements. The point of departure is an Operations Management planning model used to build a frame of reference that is used to analyze transport planning processes.

Design/methodology/approach - A literature study was conducted to review models and theories from the Operations Management area. The outcome of that study was used to provide a theoretical foundation for analyzing transport planning processes. Following the literature study, empirical data was collected through two different case studies, one with focus on vehicle fill rate and the other with focus on transport planning processes.

Findings - The findings include evidence of poor fill rate in road based long haul transportation related to poor planning processes. Hence, a framework for transport planning based on Operations Management planning models is provided. By using that framework, the analysis reveals shortcomings in transport planning related to lack of information access but also time to allocate the right resources to various assignments.

Research limitations/implications – This paper is focused on road based transportation. It shows poor fill rate in long haul transport operations and consequently a need for improved transport operations planning. The provided transport planning framework constitutes a theoretical contribution and is beneficial for analyzing transport operations planning.

Practical implications – The fact that the fill rate in long haul road based transportation has potential to improve gives an opportunity for enhanced planning operations. The developed framework is useful in identifying opportunities for improvements in planning as well as what prerequisites needs to be fulfilled to enable better transport planning.

Originality/value – In addition to showing evidence of poor fill rate in road based transportation, this work provides a transport operations planning framework based on traditional Operations Management planning models and transport planning models.

Keywords: Transportation, Freight Transport Operations, Transport Planning, Fill rate, Logistics Service Provider.

1 INTRODUCTION

Road based logistics service providers are facing many challenges, both in their daily operations as well as in the planning activities. One of the reasons planning is difficult is the fact that the information is typically available at very short notice, often in less than 24 hours in advance. It is not uncommon that a service buyer can have their shipments picked up and shipped to their customer within hours of contacting a logistics service or transportation service provider. This leaves very little room for making informed decisions on scale and scope of capacity of the transport resources such as vehicles, trailers and personnel at terminals. The key concern is the inability to reliably plan transport operations mid- to long term, and to a great extent even short term.

Within the Operations Management field, typically dealing with production planning, the story is somewhat different. Manufacturing companies have traditionally put a lot of efforts into planning and control to increase efficiency and gain competitive advantages. Planning of material flows and production capacity are vital for effective and efficient operations. Without planning and forecasting the future would be too uncertain, which would have a serious impact on how the operations can be managed and controlled and that greatly affects profitability. It would be impossible to know how much material and production capacity needs to be available which could lead to a lot of wasted labor and material use. For this reason it is of importance that planning is conducted on short-, mid- and long terms. In a production context a solid manufacturing process and control (MPC) is vital for success (Jacobs et al, 2011).

In the transport research field a lot of effort has focused on aspects such as network balancing and design including last mile problems. Much of this is focused on mathematical solutions to quantitative problems such as location of facilities, shortest routes for distribution, selection of transportation modes and consolidation possibilities. The same is true for manufacturing, where researchers such as Wiers (2002), de Kok & Graves (2003) and Lin et al (2007) have described mathematical solutions to scheduling and planning problems. But unfortunately, this only solves a part of the equation. In the manufacturing industry the conversion ratio of theory and models to practical implementation is not perfect and research often ends up specifying specific software or ERP module functionality (Brown et al, 2001; Gupta et al, 2002, Fleischmann et al, 2006) to solve existing problems. In the transportation industry mathematical solutions are widely used for solving specific quantifiable problems, but on a larger scale the core issue remains unsolved. How much transportation resources that has to be available in the system has to be decided before the demand is known, which makes it a “guesstimation”.

The lack of reliable data input results in unreliable output data. And even if the data quality is reliable enough it is often attained too late, with no time to realize its benefits. In the transportation industry much of the information is available only shortly before the operations have to be conducted. Hence, the amount of resources, i.e. vehicles and trailers in the transportation system has to be based on historical data and rough estimates.

Unpredictable behavior of transport service buyers is resulting in less than optimal resource utilization of freight transportation resources resulting in poor fill rates (McKinnon, 2008). Not fully utilizing the available resources is a problem stemming from the planning aspects of the transport operations such as the dimensioning of the network. It is important how the operations are planned on a strategic, tactic and most importantly, an operational level. Incomplete or erroneous planning of operations is causing unnecessary costs in addition to the obvious environmental strains ((McKinnon, 2010).

After reviewing literature related to transport management processes a literature gap has been identified. Little has been written about transport planning processes and how transport planning affects resource utilization in road based transport operations. Furthermore, a framework for transport operations planning has not been identified and by using theories and models from production planning research in the operations management literature this article attempts to begin to bridge parts of that knowledge gap and put forward a framework for transport operations planning.

The outline of the paper includes a short description of the methodology applied, followed by an introduction to the relevant literature in chapter 3. That chapter ends by introducing a framework for transport operations planning based on the literature. This is central to this work as it is used for analyzing the data collected from the empirical work. This analysis is presented in chapter 4,

2 METHODOLOGY

The approach for this work has been based on two-step approach. First a literature study was carried out to find the relevant literature for planning in the field of operations management and the field of transport operations respectively. The result of the literature study was then used to develop a framework for transport operations planning. Finally, empirical data was collected through two different studies, one with focus on fill rate in transport operations and the other with focus on transport planning processes.

2.1 The fill rate study

By the end of 2011, empirical data was collected through a case study done at three of North Europe's leading logistics service providers. The purpose of the study was to investigate fill rates of vehicles leaving a consolidation terminal, more specifically the trucks and trailers in a long haul lines operation between terminals. A template for data collection based on the proposed factors from McKinnon (2010) and Lumsden (2006) was prepared to secure consistency.

For a period of one week (Monday through Friday), the load in 450 truck and trailer departures were measured and observed. Volumetric data was collected and later cross-referenced with data exported from the companies' information systems. This made it possible to create a profile for each departure that included volume, weight, and distance to destination. By having this data, it was possible to calculate metrics such as payload weight, average loading height, deck-area coverage, average volume, and more.

In 2013 this study was repeated using the same method and templates in order to be able to compare the fill rate under the same circumstances but at different points in time.

2.2 The transport operations planning study

In 2013, another study was conducted where qualitative data was collected with the same logistics service providers. The purpose of the study was to in detail investigate the planning process of their road based transport operations. In order to do so all activities and the information/data used and generated in the transport operation process was mapped. The process started when a supplier received a customer order and ended when it had been delivered to the customer. The reason for mapping the entire process was to gain a firm understanding of how the service consumers behave, how the network is structured, which stakeholders are involved in the process, and what their different roles are. This was essential in order to identify and understand what all the factors that affect the planning process are.

The empirical data was collected using semi-structured interviews and were documented using a tested and standardized case study template.

3 TRANSPORT PLANNING – LITERATURE REVIEW

In this chapter, the relevant literature is reviewed, manly from the operations management field in addition to the transport operations field. The purpose is twofold, to put this research into perspective, but furthermore, to put forward a frame of reference that is necessary for structuring and analyzing the transport operations planning processes.

3.1 Relevant literature

Complexity of freight transportation is related to the fact that demand for transportation is generated out of the complex world of supply chain activities and cannot be isolated from them. The complex interaction between decisions made at different levels in the supply chain has direct consequences on the freight transport operations where short decision turnover often result in ad-hoc solutions (McKinnon and Woodburn, 1996). Activities included in procurement operations, production operations, inventory management, warehousing and market operations have great impact on the efficiency of the associated freight transport network (McKinnon, 2008). The above is mainly affecting the daily transport operations, but even the strategic and tactical factors are influenced.

Fill rate of vehicles in freight transportation are to great extent affected by inter-functional relationships between transport and the core activities of the shippers. A collaborative supply chain and logistics management means that two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation (Simatupang and Sridharan, 2002; Stefansson, 2006). The business relationships between the firms affect the nature and the outcome of the firms' actions and their potential sources of efficiency and effectiveness (Håkansson & Snehota, 1995). Cross-functional integration within companies is a prerequisite for successful operations and necessary in order to capitalize on potential service improvements (Bowersox and Daugherty, 1995; Kahn & Mentzer, 1996; Croxton et al., 2001; Christopher, 1998). Such collaborative setups require adjustment of mutual processes and effective sharing of information between the business partners involved (Lee and Lim, 2005; Aviv, 2007; Stefansson and Russell, 2008)

Complexity of the supply chain contributes to planning difficulties, and to simplify the chain structure manufactures and retailers are reducing the number of suppliers in their supplier base (Sanchez and Perez, 2005; Paulraj and Chen, 2005; Sengupta et al., 2006). In addition, the buyers are developing closer relationships with their reduced number of suppliers of products (Corbett, et al., 1999; Kotabe et al., 2003). This does not have to be valid for service supply chains as many global supply chains include ever-increased number of service providers (Stefansson, 2006). This implies increased number of relations and relationships based on high-involvement are costly because coordination, adaptation, and interaction create expenses. Low-involvement relationships on the other hand, can be handled with limited coordination, adaptation and interaction costs (Gadde & Snehota, 2000, Håkansson & Ford, 2002).

Planning of operations is necessary for all organizations. The degree of planning needs and capabilities differs greatly between types of organizations, types of industries and size of companies (Jacobs et al., 2011). The individual stakeholders traditionally do planning of activities within different supply chains. These plans are as usually based on historical data in addition to existing orders. Unfortunately mismatches in planning due to lack of decent forecast capabilities are still today a huge challenge despite availability of sophisticated information systems on the market. The existence of the famous Bullwhip effect in inventory availability shows this clearly in physical supply chains (Lee et al., 1997, Cachon et al, 2007). Uncertainty of future demand is obviously a major contribution to forecasting failures in capacity needs and many attempts to improve accuracy fall short.

Traditionally operations management planning and scheduling is done in in several steps. Manufacturing planning and control (MPC) system includes management of materials, scheduling machines and people, and coordination of suppliers and key customers (Jacobs et al, 2011). The typical activities that are supported by MPC can be divided into three time horizons (ibid):

- In the long term, the sale and operations planning to provide information for making decisions on the appropriate amount of capacity to meet the market demands of the future.
- In the intermediate term, the fundamental issue is to match supply and demand in terms of both volume and product mix supporting detailed capacity and material planning.
- In the short term, the resource's detail schedule is required to meet production requirements and generate a detailed production planning.

A general MPC system is illustrated in Figure 1 below and structures the MPC system into three different phases: Front end, Engine, and Back end.

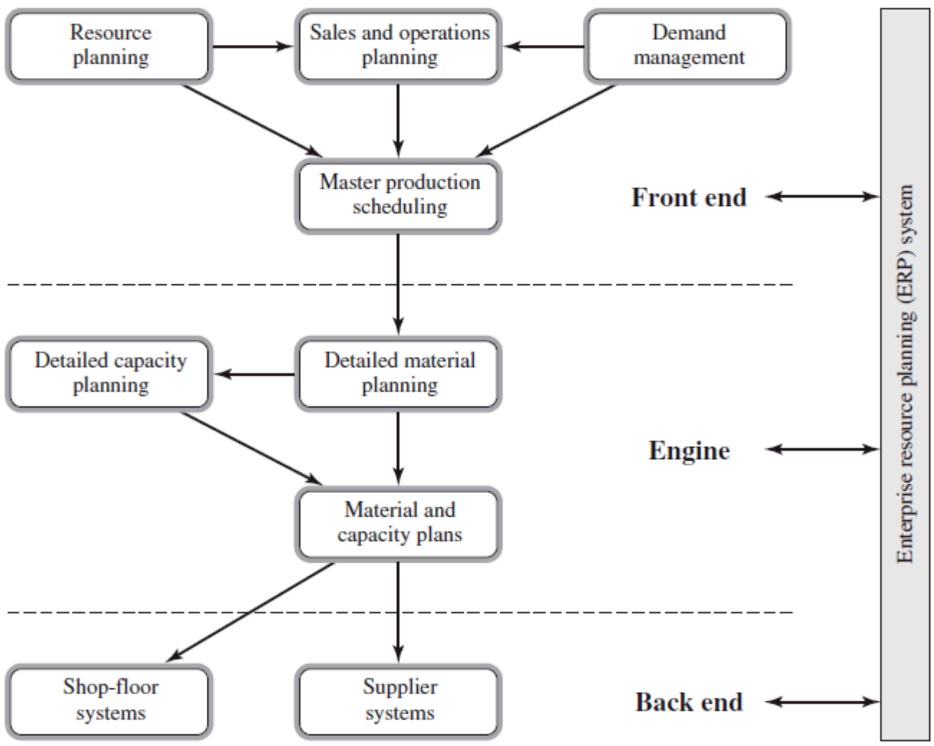

Figure 1 Manufacturing planning and control system (Jacobs et al., 2011)

The MPC system different phases: Front end, Engine, and Back end all have various purposes where the Front end builds up the overall company's direction of product sale bases on orders and forecasts, the Engine phase focuses on detailed material and capacity planning ands the Back end focuses on the execution of the plans, both in own production facility and also follow-up of vendor deliveries.

The literature presents a wide range of planning models for operations management and supply chain management (Narasihman and Santosh, 2004; Ma and Davidrajuh, 2005; Jacobs et al., 2011). Some examples of specific freight transport planning models have been developed (Roy and Delorme, 1989; Brown and Ronen, 1997; Crainic and Laporte, 1997; Crainic, 2000; Caputo et al., 2006) Despite the existence of the above planning models, no transport planning model is as established as the one for operations planning above. However, some similarities can be found where planning is divided into Strategic planning, Tactical planning and Operational planning. The division into these three areas have been widely applied in transport planning, not the least by Crainic (Crainic and Laporte, 1997) and work de and his team has done in recent decades.

Strategic planning is the one made for long term planning and typically involves the highest level of management. The decisions taken set the operations strategies for the company and often require large investments that need to be capital returned over long time horizons. Such decisions can relate to design or extended changes of the physical network including locations of facilities, both locally and globally, acquirement of resources to be used long terms, management of demand, etc.

Tactical is a medium term planning in aiming at improving the performance of the business operations. The available data is on a high aggregated level and the typical activities involve type of service to operate, allocation of assignments to the existing resources, both terminals and vehicles, reposition of resources, etc. The output of the tactical planning is a transportation plan that is used to guide the future operations. The tactical planning is important for the transport operators as they frequently apply consolidation operations that need advances coordination (Crainic, 2000).

Operational planning is a short term planning that involves the resources used in the services being offered. This includes routing of vehicles, crew allocation, dispatching of vehicles and crews as well as maintenance of the involved resources. The resource allocation is the most important operational decision made in all transport operations where the time plays an important role. It is also important to be able to feed back the status of various resources and activities.

Unfortunately, due to time constraints, business partners do not always take the necessary time to adequately plan all aspects of their business relationship (Hadaya and Cassivi, 2007). The time constrains are different in different industries and obviously companies within the process industry producing Make to Stock (M2S) products with long production runs in a certain demand market have completely different planning environment compared to a Make to Order (M2O) producers in a market with volatile demand structure (Fisher, 1998). Not only does this apply for the retail and manufacturing industry, but for the transport service industry as well.

3.2 Frame of reference

As stated before, a frame of reference for transport operations planning is needed, partially to structure the different requirement for transport operations planning but also to analyze the used planning setup. In this work the framework has been put forward to analyze the data collected in this work. It is based on the three level approach already introduced in the literature discussion above related to the MPC framework. The transport operations framework includes:

- The “Strategic planning” is used from the transport literature and represented by the “Front end” in the OM planning literature.
- The “Tactical planning” from the transport literature and represented by the “Engine” in the OM planning literature and,
- The “Operational planning” from the transport literature and represented by the “Back end” in the OM Planning literature.

4 EMPIRICAL DATA

In this chapter, the empirical data from the two different studies, the “Fill rate “ study and the “Transport operations planning “ study is presented.

4.1 The fill rate study

The fill rate study provided an overview of the resource utilization in the studied departures. Figure 2 compares the best and worst departures side by side, sorted by deck area utilization. The difference in utilized deck area does not vary a lot between the best and the worst examples. The main differences can be seen in volume and weight, which varies wildly. The reason for this is that the loading personnel maximize use of deck area because it is faster and easier than stacking pallets and goods. While it is positive that the deck area is utilized it simultaneously creates the illusion that a vehicle is “full”, when in reality there is unused capacity.

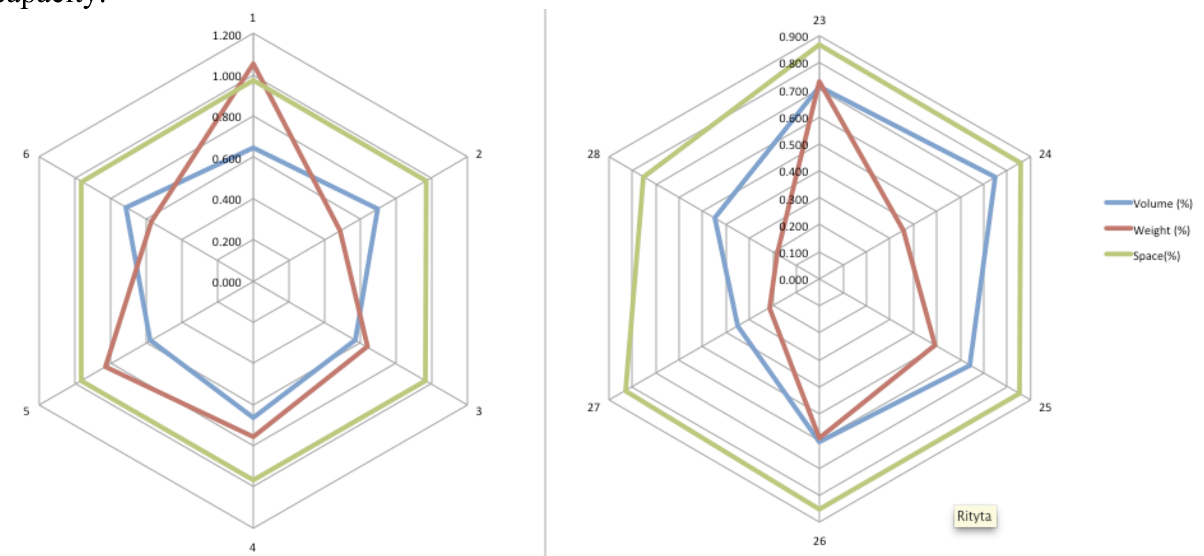

Figure 2 Comparison of best (1-6) and worst (23-28) examples of deck area utilization in %, and their weight/volume

A lot could be done in order to fully utilize the capacity. By using more detailed data in the planning process, which is almost fully automated, it could be possible to create more balanced load profiles. According to the interviewees exceeding weight limitations is very rarely any issue, and vehicles almost never come close to the maximum capacity. This means that weight would not be a big concern, and the focus could placed be on maximizing volume utilization as well as deck area.

It would be necessary would be to investigate what the actual costs of loading the vehicles differently. There is relatively little time to unload and load vehicles at the terminals due to time restraints in the transport network. This could be an issue when considering how to achieve higher overall resource utilization, as the extra handling might not be possible to conduct while still maintaining the fast terminal throughput times.

4.2 The transport operations planning study

The companies in the case study are large global logistics service providers and multi-modal freight forwarders. This study is limited to road based freight transport operations in Sweden, and the focus is on the planning processes and the related information, data and activities. The logistics service providers' purchase capacity or full truck loads from haulers and do not own the fleets of vehicles used in the operations.

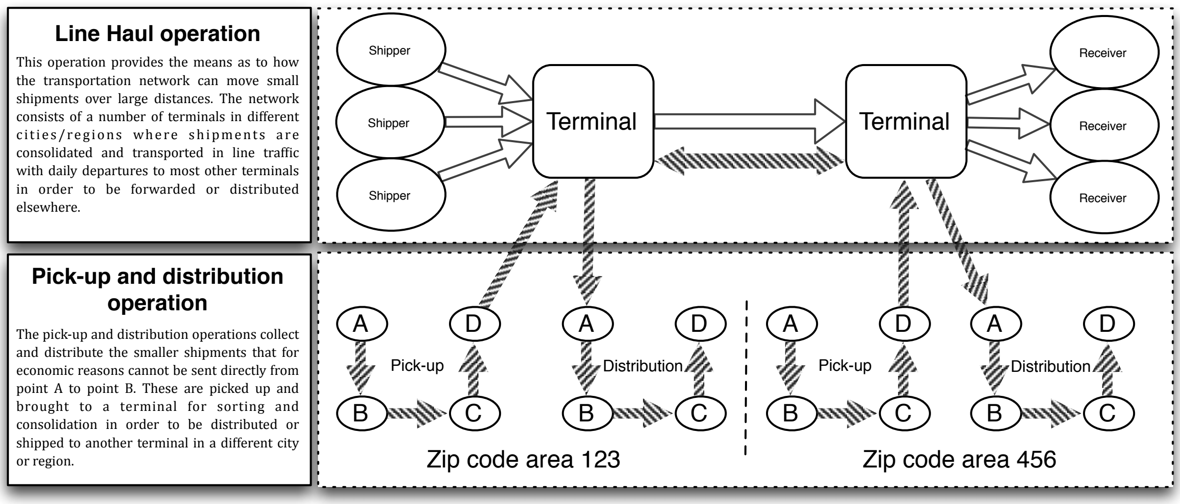

Figure 3 Logistics service provider network and operations structure

Within the frame of the study there are three areas of operations that have been studied, but only two are included in this paper. These are the three categories of operations that include road based freight transport operations, and they are **direct delivery services** (DDS), **pick-up and distribution** (PUD) services and **line haul** (terminal to terminal). The DDS are full truck loads (FTL) while PUD are less than full truck loads (LTF). Since the DDS are not of interest from a planning perspective in the context of the article they are not included. The other two are described more in detail above in Figure 3.

There are four different phases of the logistics service providers transport operations. Before anything is physically moved from the site of the service buyer pre-transportation activities such as receiving customer order and picking the orders are conducted. It is in this phase the logistics service provider is notified that there is one or more shipments that should be picked up. The next phase is pick-up when the logistics service provider, mainly through use of haulers, collect and deliver shipments to terminals. In the third phase the shipments are sorted to be distributed locally, or to be moved within the logistics service providers network of terminals if it is going to another region/country. The final phase is when the shipment leaves the terminal in order to be distributed in the receiving region where the receiver resides.

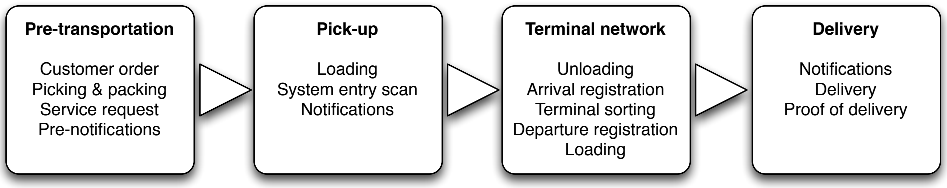

Figure 4 Transport operations system description

All the various activities, decisions, physical movements and the related information that is created, used or sent to different stakeholders are shown in the process mapping Figure 5 and Figure 6 below. The mapping depicts the entire process for all shipments passing through a terminal, presented in a chronological order.

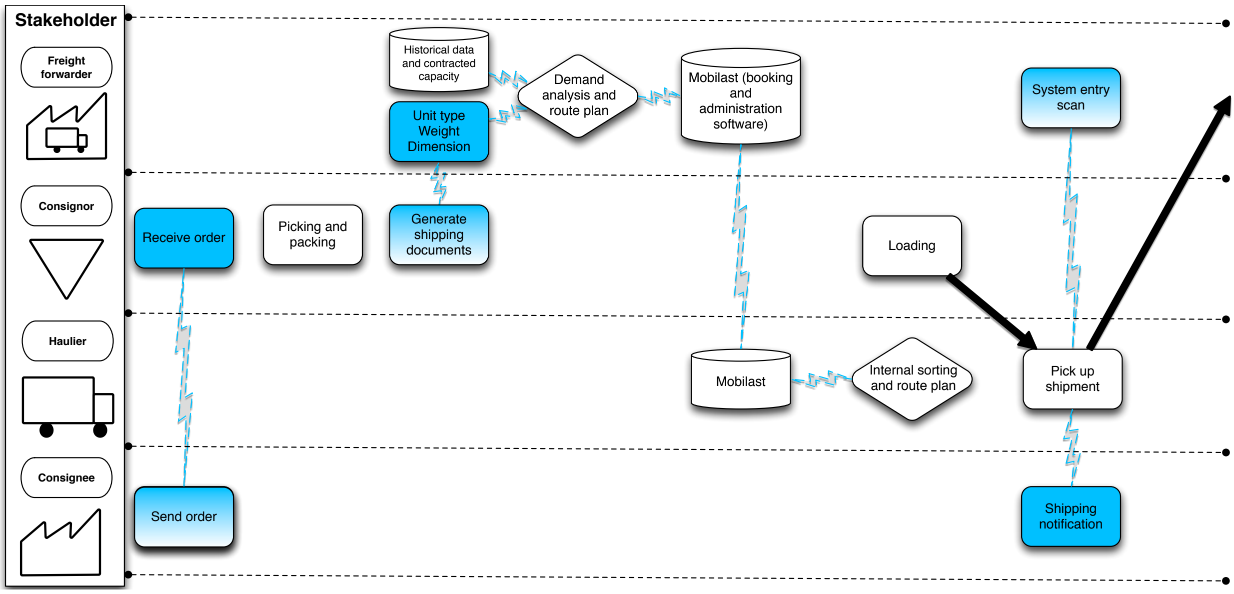

Figure 5 Logistics Service Provider operations mapping

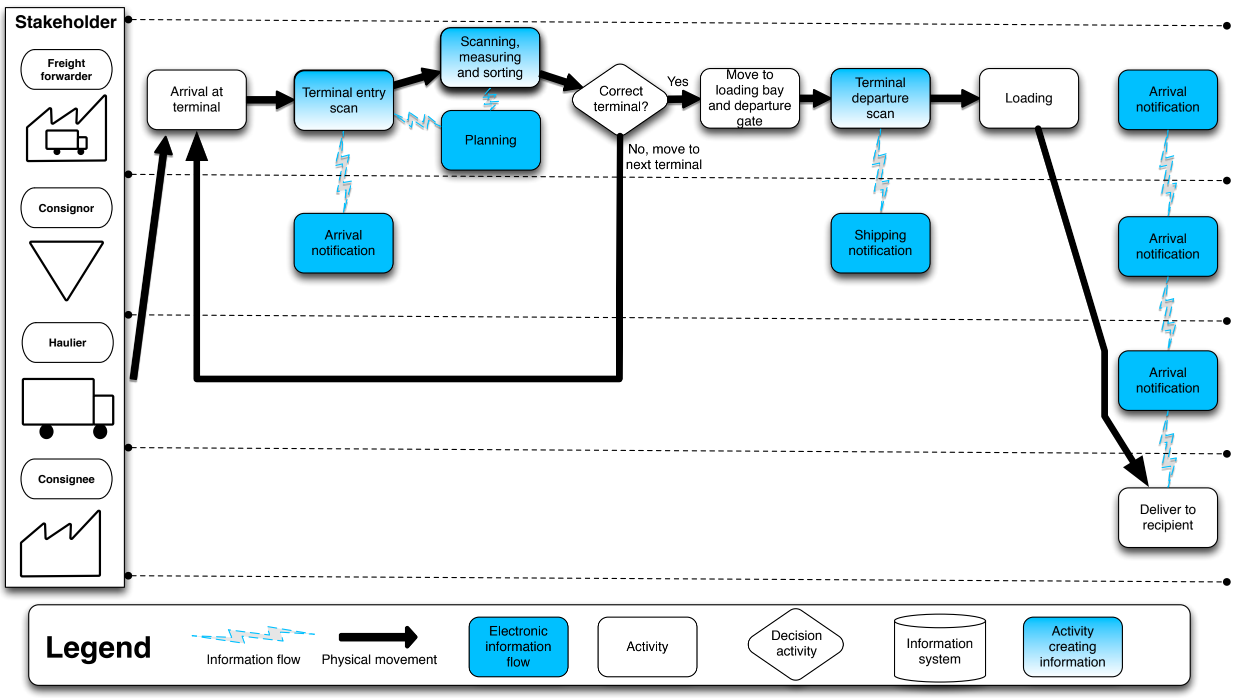

Figure 6 Logistics Service Provider operations mapping, cont.

The timeframe for each parcel or shipment may vary, and therefore no specific time indication is shown. For a typical regional or national shipment all these activities normally happen in less than 24 hours. Lateral connectivity indicates they happen simultaneously while horizontal indicates what happens as the next step in the process.

5 ANALYSIS AND RESULTS

In this section the empirical data is analyzed and results are presented. The framework used is a combination of the MPC and transportation frameworks. They were adapted to create a similar framework where the planning process data could be inserted. The different aspects of the planning process are depicted and analyzed.

5.1 The transport planning process

The frame of reference has been used to analyze the empirical data previously presented where the hierarchy of planning level is used; Strategic planning, Tactical planning and Operational planning. Based on the empirical data and MPC model, a new model for transportation planning has been developed and is shown in Figure 7. The different levels of the model are described in detail in the subheadings.

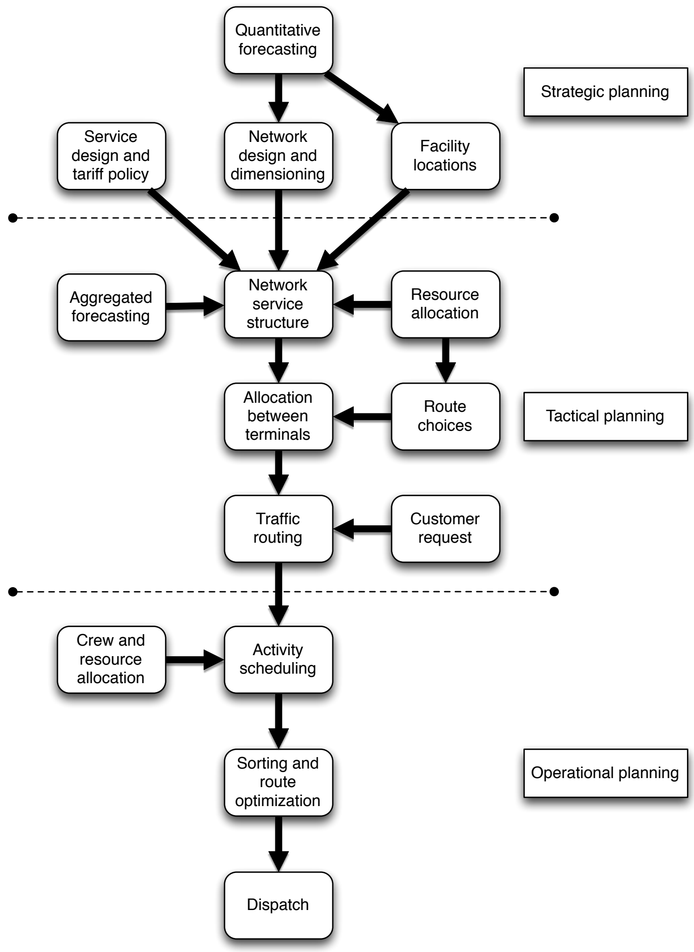

Figure 7 The Logistics Service Provider planning process

5.1.1 Strategic planning

Planning on the strategic level is based on quantitative historical data, and the decisions are based on predicted expected trends and variation. Decisions taken on this level are for example where facilities such as terminals should be located, how the network is designed and how much capacity and resources that should be made available in the network as a whole. Other important decisions taken are how their services are designed and how pricing is modeled. These decisions mainly have global and national impact.

5.1.2 Tactical planning

The tactical planning mainly focus on decisions that have national and/or regional level impact. The primary goal of the tactical planning is to efficiently and rationally allocate resources based on both the strategic plan and aggregated forecasting, combining quantitative and qualitative input. Planning decisions are taken based on forecasts. These planning decisions are for example which terminals and routes that should be used to connect different regions, what their areas of distribution and delivery are, and so forth. Also, it is decided how resources and shipments are allocated between terminals in order to balance and maximize use of resources. Additional input from customer's forecasts or requests is included and translated into a plan for how traffic is routed through the network.

5.1.3 Operational planning

As opposed to the other levels of planning the operational planning is focused on a local level, or more specifically, in a terminal. The transport resources are requested and allocated locally on a daily basis. When and where resources are needed depends on customer behavior, and there is variation in demand as different service buyers consume services based on their individual needs and requirements. The various activities are scheduled daily basis, and shipments are registered and sorted in order to use route optimization software to make efficient use of the resources. The output is a route planning with designated drop-off points for each and every shipment. This route planning is given to the hauler, which in turn decides whether to use it, or plan its own route.

5.2 Transport planning issues

There are a number of issues that create planning difficulties for logistics service providers. These are mainly related to two different categories of problems, information lead-times and communication. Both of these types of issues cause a troublesome environment for planning as they affect both quality and how far in advance planning can be conducted. The issues are described more in detail below.

5.2.1 Information lead-time issues

Some customers provide incomplete or erroneous input data when booking transport services. This is both intentional and unintentional, and it can create some issues. Examples can be defining the shipment as the wrong unit type i.e. declare a pallet as a parcel, declare wrong weight, or provide the wrong dimensions. Missing, or having incomplete or erroneous data about any one of these could lead to planning issues such as insufficient vehicle capacity or charging the wrong amount for the service.

Lack of transparency combined with incomplete data about actual customer needs leads to planned overcapacity in order to cope with a varying demand. This results in lower-than-optimal resource utilization. The logistics service provider pays for the allocated capacity whether they actually use it or not.

On the flipside the logistics service provider is not responsible for the resource utilization except what they have rented. This means that it is up to the hauler to fill any spare capacity, for example by searching for other assignments in the vicinity. Short-term benefits are likely gained by the logistics service provider, but the long-term implications are that the costs could increase as the haulers have fewer options as to how to maximize resource utilization compared to a logistics service provider.

There are a number of similarities between the production industry and the transportation industry. In both theory and practice the planning processes function mostly the same way, but the main difference is the information lead-time. The rapid operation cycles and lack of information in advance in the transportation industry creates a different planning environment. The first and foremost problem is the lack of proper lead-times on information transfers. This creates difficulties to somewhat reliably plan mid-term and especially in the long-term.

The lead-time problem stems from how the different stakeholders communicate and interact. Information is not shared or made available to the logistics service provider until the point when services are booked. With a different approach and model for sharing information it would be possible to plan differently than in the contemporary system. There are currently no incentives or demands for transport service buyer to operate differently. Finding these incentives are crucial in order to be able to re-structure how planning processes are conducted. If no incentives can be found then it might be necessary to use other tools, such as increasing prices of services for some customers that refuse. The dilemma is that unless other Logistics Service Providers change their models as well then the first one to do so likely price themselves out of contention and lose customers. These issues are on a system level, and individual companies are unable to change the system by itself.

Previous work by Crainic & Laporte (1997) indicates that transport planning operations would benefit from learning from Operations Management. So what happened? Did the research community then fail to convey the lessons and knowledge to the industry? Or were there were barriers hindering implementation of new planning tools and methods? One such barrier could be lack of data or information sharing and integration between different stakeholders. As technology and information systems are maturing and developed there should now be much better conditions for more advanced solutions than those that were previously possible to put into practice. Transparency and visibility in the needs, requirements and behavior of both customer and the customer's customer could greatly improve the planning capabilities, which would be a crucial part in achieving the highest possible resource utilization.

Service levels are overall excellent in the current system, which is in its own way a way a problem. Offering a wider range of transportation options with different lead-times to the consignee could be a way of getting information earlier about the actual need of the consignee and profit by using the information.

5.2.2 Communication issues

Generally there are two categories and methods to how customers purchase transport services. The first category is the customers that communicate their needs through EDI, directly from information system to information system. The second category consists of those that use a web booking system. In rare cases communication is conducted by phone or fax, but that only happens under special circumstances such as being unable to access the web based system. As such over 95% of the communication is digital. These two digital categories are generally split by different company sizes. Large organizations tend to favor using EDI booking while medium to small sized companies generally tend to use the web booking system. Regardless of method of communication the attributes of the consignment are always specified as unit type (i.e. pallet, bulk, parcel etc.) with weight and dimensions.

Historic data combined with contracted or explicitly implied capacity need is what provides the input for daily forecasts as to what each particular day, route and customer will require. The contracted or explicitly implied capacity functions as a sort of capacity allotment, and is estimated to generally be around 30% of the planned capacity. Due to inconsistent or incomplete data making accurate forecasting difficult there is normally extra capacity planned to avoid any ambulatory transports or unnecessary delays.

Users of the pick-up and distribution transport services normally communicate their needs the same day they want to ship. This is often as late as an hour or two before pick-up. Typical customers with this behavior pattern are often companies that have specific customer service goals such as promising to send shipments the same day, as long as they are purchased before a certain time. They normally indicate their daily capacity requirements in their contracts, and have to notify in advance if they differ a lot from their estimations. The contracted or implied capacity is estimated to be 30% of the daily orders, and 60% of the volume. This daily leaves a large swath of capacity uncertain.

Direct delivery service purchasers communicate their needs and requirements further in advance and in detail due to the nature of their more specific demands i.e. requiring entire vehicles, bulky goods etc. They normally book transportation 1-2 days in advance, and 60% of the volumes are booked 1 day in advance. Large shipments that require multiple vehicles it is booked further in advance, and the rule of thumb is that the larger the shipment is the further in advance it is booked.

6 CONCLUSIONS

The literature shows that successful collaboration in supply chains is built upon long-term relationships and trust between stakeholders. This applies especially to markets where competition is tough. The transportation industry does often not have such long-term relations, and is mainly based on relatively short-term, arms-length relations. Transport service buyers do not need to secure long-term transport capacity in most instances as transport services are highly commoditized. High expectations on availability and flexibility of the Logistics Service Providers create an environment where planning in advance is particularly troublesome. In addition, information sharing is vital for successful collaboration and long-term economic stability. Information availability is important for execution of processes and it is a prerequisite as input to forecasting activities and for successful planning.

In this paper, the purpose was to explore operational planning processes for road based long haul transportation and analyze the potential for improvements. A literature study was conducted to review models and theories from the Operations Management research area as well as the Transport Management research area. The study was used to provide a theoretical foundation for analyzing transport planning processes. Following the literature study, empirical data was collected through two different case studies, one with focus on vehicle fill rate and the other with focus on transport planning processes

The literature study, including the operations management planning models showed that there are many similarities with transport operations planning. The major similarity is the three level approaches of Strategic planning, Tactical planning and Operational planning.

The findings from the empirical studies include evidence of room for improvement of fill rates in road based long haul transportation. The fact that the fill rate in long haul road based transportation has potential for improvement creates an opportunity to enhance planning operations. The developed framework can be used to identify the opportunities for improvements in transport planning as well as to identify the prerequisites for enable better planning. By using that framework the analysis revealed shortcomings in transport planning that are mainly related to lack of information and a shortage of time to effectively and rationally allocate the right resources to the assignments.

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