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FOREWORD

Aalborg University has pleasure in welcoming you to The 12th International MITIP Conference on Information Technology & Innovation Processes of the Enterprises. The conference aims to enhance the successful work of the previous MITIP conferences by bringing together people from across the world within academia and industry and exchange their views and experience on the development within information technology and innovation processes of enterprises.

The proceedings cover a wide range of important issues to enterprises such as Operations Management, Logistics, Supply Chain Management, Performance Optimisation, Just-In-Time (including LEAN & TPS), Automation, RFID and Product Architectures. To encourage the participation of Danish manufacturing companies, invitations have been sent out to industry via the Danish Engineering Union (IDA). This has led to a satisfactory interest from industry. We would like to thank Siemens Wind Power Blades who have agreed to present their logistics and manufacturing challenges and host a physical visit to their manufacturing site in Aalborg.

Furthermore, we would like to thank all those, who have made an effort to bring this conference to reality: first of all the authors, the sponsors, the international programme committee, the keynote speaker, and last but not least our colleagues at Department of Mechanical and Manufacturing Engineering and the Centre for Logistics (CELOG).

It is our hope that the conference will stimulate exchange of research results and enhance collaboration among the participants.

You are very welcome.

Hans-Henrik Hvolby

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DEVELOPMENT OF A COOPERATION FRAMEWORK FOR HORIZONTAL LOGISTICS COLLABORATION

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Abstract:

Due to growing competition, companies are paying more and more attention to logistic costs. As limited shipment volumes impede the optimization of company-owned logistics structures and processes, cooperative approaches to logistics are a powerful tool to optimize cost structures and increase overall efficiency. This paper proposes a cooperation framework for horizontal logistics collaboration. Due to the variety of possible influencing factors and parameters of cooperation, the approach is divided into three strategies: joint tendering, cross-company bundling and coordination between logistics and production. The three approaches differ in the necessary degree of cooperation and in the resulting potential for consolidation. With regard to the company's characteristics its qualification for one of the three strategies can be identified and the possible potentials can be derived.

Keywords: Logistics, Cooperation, Coordination, Cross-company, Transport bundling.

1. INTRODUCTION

As a consequence of increasing competitive pressure and a changing market place driven by globalization, the speed of technological progress and the generally more dynamic nature of markets, today's business is more strongly driven by competitiveness than ever before [Zigmas & Benas], [Engelhardt-Nowitzki & Oberhofer]. Companies are forced to reorganize their business processes, to enable them to react quickly and cost effectively to fast changing market demands. Logistics has gained much attention by substantially increasing the efficiency and flexibility of organizations. As logistic costs make up a significant part of total production costs, individual companies with limited shipment volumes have no access to cost efficient and highly productive transport networks.

The optimization of a company's owned supply and distribution network or the utilization of a freight exchange only have limited impact on the efficiency of the resources. In the case of freight exchanges, an online, real time service where haulers search for freight as well as freight forwarders, which offer freight to be transported, a significant load factor increase is inhibited by the openness of the market. Too many service providers are interested in the acquisition of fluctuation transport loads. Thus a concentration of volumes on fewer resources cannot be achieved [Florian]. Business networking strategies and especially cooperation in logistics is one possibility to increase efficiency and collaboration between the different partners or stages of the supply chain is gaining even more momentum nowadays.

The objectives of this paper are the illustration and determination of the various possibilities in the field of horizontal logistics for individual companies and the possible identification of the optimal cooperation for each company. On the basis of the existing body of knowledge and different known approaches to increase efficiency a cooperation framework is developed and its main characteristics are described.

2. LITERATURE REVIEW

Both vertical cooperation in supply chains and lateral cooperation in supply networks have been the focus of various research efforts over the last decades. However, the literature on horizontal cooperation in logistics is still in its infancy, especially where operational consequences are concerned. Existing literature in the field of horizontals logistics cooperation is scarce and emphasizes the illustration or quantification of potential cost savings through cooperation by means of simulations studies and by reporting a limited number of successful implementations, as this type of cooperation is becoming more relevant in practice.

Horizontal relationships

In today's economy a common way to classify existing cooperation approaches is the differentiation with regard to the arrangement of the cooperative element in relation to the value chain. While the close cooperation between logistic service providers (LSP) and customer is known as vertical cooperation, concerted practices between companies operating at the same level(s) in the market or logistic chain is defined as horizontal cooperation by the European Union. These companies can be either competing or unrelated suppliers, manufacturers, retailers, receivers or LSPs, that share information, facilities or resources with the goal of reducing costs and/or improving service.

Depending on the degree of cooperation and competition Bengtsson and Kock identify four types of horizontal relationships: coexistence, cooperation, competition and coopetition [Bengtsson & Kock]. In both academic and professional literature the various types and designation of cooperation in horizontal logistics have been discussed. Although cooperation, collaboration, alliances and partnership are all used to refer to concerted practices on horizontal level, a high level of ambiguity exists between the definition and characteristics of these relationships [Mentzer et al], [Golicic et al]. To avoid confusion, from here on all these relationships will be summarized by the term cooperation.

Horizontal cooperation in transport and logistics

Whereas horizontal cooperation is well documented for maritime shipping as in [Shepperd & Seidman] and aviation industry as in [Fan et al], [Oum et al], the literature on horizontal cooperation in landside transport and logistics is fairly limited, although cooperation between logistic businesses is not new. Hauliers already started with freight alliances in the early 1930ies [Kleer] and later focused on regional traffic. These cooperation forms are used mainly in city logistic concepts. Within the city logistic concept cities strive for central optimization of transports, where already in 1999 analysis concerning the point of implementation showed that over 30 cities had at least started planning activities for such concepts [Weddewer].

The scarce relevant literature on horizontal cooperation in landside logistics mainly deals with cooperation on the level of LSPs and only few exceptions focus on the cooperation on the freight forwarder level. The most relevant are discussed in chronological order. Caputo and Mininno examine various policies such as standardized computerized document content, standardized pallets and cartons, multi-supplier warehouses and coordinated route planning in the Italian grocery industry and further discusses the aggregation of suppliers to the same

courier. Erdmann constructs a model to quantify the synergy potential of different forms of cooperation in the German consumer industry and elaborates guidelines and recommendations for cost allocation and design of horizontal cooperation. Bahrami develops an IT-supported model to define forms of cooperation leading to the desired results, to identify qualified cooperation partners and to evaluate the individual and overall benefit of a cooperation comparing the scenarios of individual transportation, joint distribution with current structures and joint distribution with optimized structures offering a real-life case study of two German consumer goods manufacturers. Hageback and Segerstedt study co-distribution in rural areas providing the example of the approximately twenty companies located in the small and remote municipality of Pajala in Northern Sweden. Further possible savings are estimated and the most important problems of launching co-distribution are stated. Cruijssen et al. study the potential benefits and impediments for horizontal cooperation between logistics service providers in Flanders and finally, Frisk et al. focus on the usage of cooperative game theory to allocate costs of joints transport in the Swedish forestry sector, proposing a new cost allocation method for how the costs can be distributed taking various properties of the planning problem into account.

3. DEVELOPMENT OF A COOPERATION FRAMEWORK FOR HORIZIONTAL LOGISTICS COLLABORATION

The existing research on horizontal cooperation on freight forwarder level mainly emphasizes the illustration of potential cost savings through transport bundling and the optimization of existing logistics processes and structures. However, further approaches to improve performance in horizontal logistics collaboration could not be found. Literature lacks a general conceptual classification to guide practitioners in setting up horizontal cooperation and as not all forms of horizontal cooperation are applicable to any given sector or companies, a general framework for horizontal logistics collaboration is needed. Thus, besides of the literature review the input-transformation-output model builds another basis for the development of the framework.

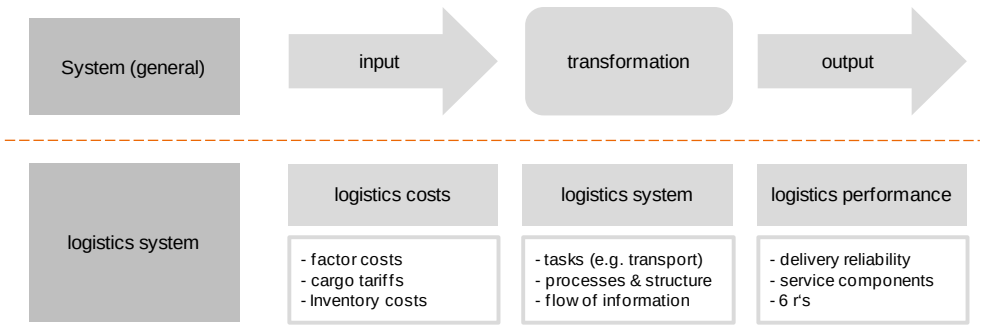

Figure 1: input-transformation-output model for logistics

By means of the input-transformation-output model the obstacles that hinder logistics systems from being efficient were analyzed. High transportation tariffs, inefficient transport processes and structures and interface problems between logistics and other planning tasks like production planning were the main obstacles that could be identified. These were further verified by conducting a survey among various automotive suppliers in the region of Times, Romania [TransAustria].

Especially for the specific needs of individual enterprises, the currently applied logistic processes do, from a holistic point of view, not appear optimal. As companies are assigning

transports individually to their preferred LSP, several service providers are operating within a specific region. Under consideration of its entire customer structure each service provider strives for the optimization of its specific sub-system. In some regions large service providers might have a sufficient customer base and contract volume in addition to flexible distribution systems and vehicle fleet to achieve high load factors by means of consolidation and optimized assignment of vehicles [ISL Baltic Consult].

Service providers generally struggle with the optimization of those sub-systems and cooperation on the level of service providers. As previously mentioned in the case of freight exchanges, such strategies are still not successfully employed and freight forwarders suffer from inefficient transports [Florian]. Deficits might emerge due to direct transport running far under capacity, use of small transportation carriers, less-than container load (LCL) with long running times or multiple handling steps as well as increased transportation tariffs due to small quantities. High stocks and capital tied up are results of these inefficiencies. Also flexibility is reduced since small changes of usual order cycles lead to additional trips. It is assumed that many companies within the same region have a similar source-sink-behavior. Especially in the automotive industry these source-sink relations are common [TransAustria].

Hence, potential savings by means of a horizontal cooperation on freight forwarder level in are high. Under consideration of the main obstacles mentioned above a framework could be developed, that offers companies different forms of horizontal cooperation to optimize transport efficiency. These are presented subsequently.

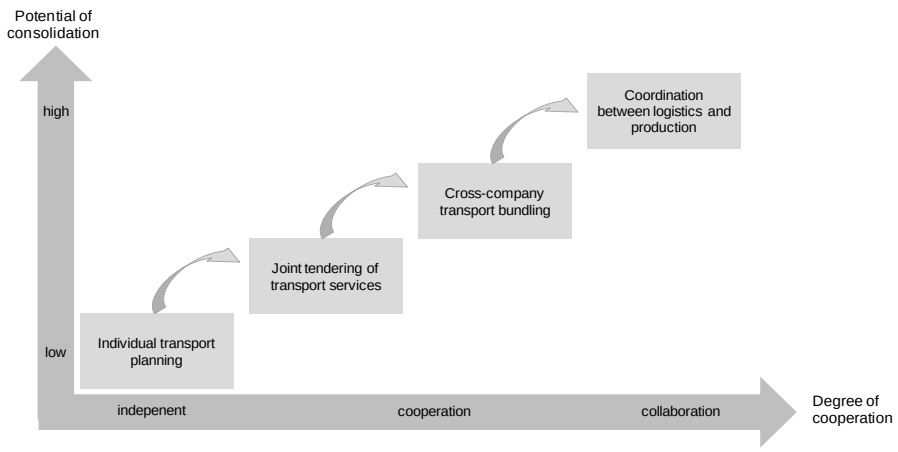

Figure 2: Cooperation framework for horizontal logistics collaboration

Joint tendering of transport services

As a first level of horizontal cooperation the joint tendering of transport services was identified. By tendering jointly and assigning the entire transport load of multiple companies to a single LSP the system load and stability in the transport network increases. The effects of larger quantities maximize the market and the bargaining power of the cooperating partners, when re-negotiating rates with the service providers. Besides suffering from lower tariffs, the LSP benefit from the economies of scale and are able to increase service level and efficiency of the employed resources.

With regard to the international commercial terms in effect between suppliers and their customers, the joint tendering may be initiated not only by the freight forwarding suppliers, but also by the customers, as they are able to identify easily which suppliers in a specific area uses a specific LSP. The low necessity of cooperation to successfully utilize synergies

makes this concept very interesting for a first cooperation experience. With this approach the typical problem of how to share costs and benefits within cooperation doesn't have to be addressed. The possibility of a growing dependency on the service provider has to be considered in the moment of tendering, where intelligent measures ensure a sustainable cooperation.

Cross-company transport bundling

In contrast to the joint tendering of transport services, where given transport orders of freight forwarders are the basis of a route planning optimization, the approach of cross-company transport bundling considers all the relevant transport information in order to generate possibilities to furthermore bundle transports within the cooperating network. The increase of transport efficiency and the related cost reduction due to cross-company transport bundling is influenced by many different factors. Depending on the amount of influencing factors considered and the companies' ability to adjust the own structures and processes in benefit of the whole network, cross-company transport bundling might have very different characteristics and further the potential of consolidation may vary extremely. Besides of transport structures and transport processes, the flow of information and the planning processes are also relevant for the design of cooperative transport bundling.

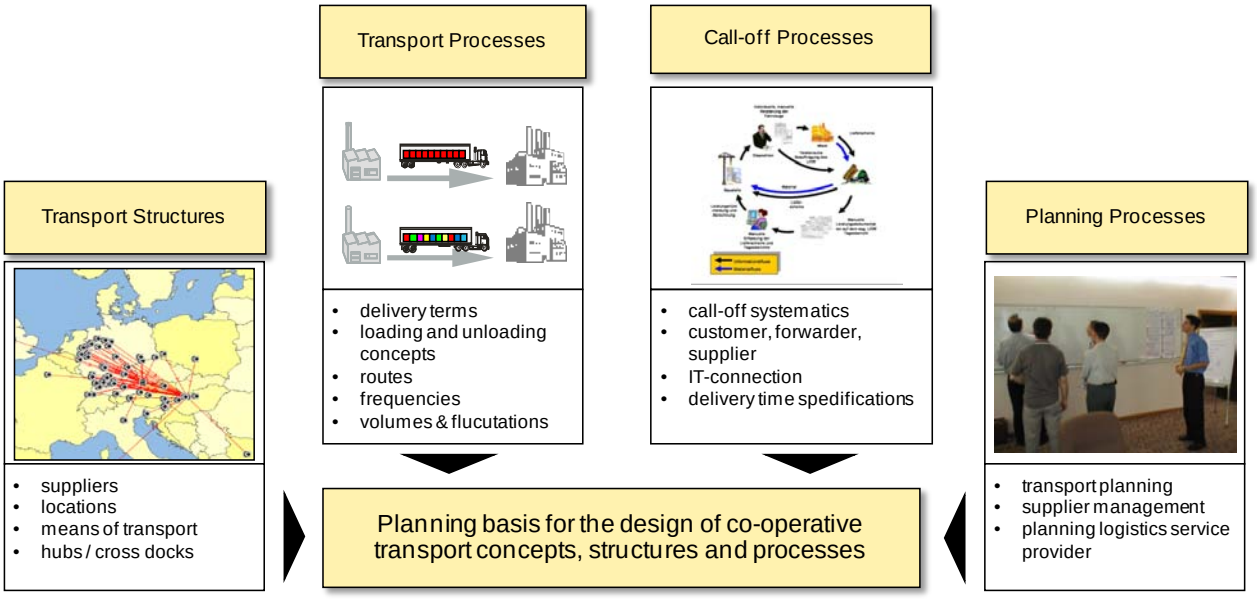

Figure 3: Influencing factors and planning basis of cooperative transport concepts

Collaborative approaches and the logistics models are mainly based on the following premises:

- Identification of route sections where transport volumes can be handled with efficient transport carriers
- Availability of adequate partners for transport bundling on route sections (legs)
- Possibility of individual businesses to efficient usage of carriers
- Distance from source to target of possible nodes considering impacts of variance from ideal path

- Prioritization from transport volumes given limited capacities of one carrier in the main run as a result of different impacts on target categories
- Possibility to change transport frequency

Determined by the number of possible cooperating partners and influencing factors considered, the definition and identification of a cross-company logistics networks requires simulation or optimization for more complex problems. Both the design and operations of the cross-company network requires a neutral coordinator that ensures the overall improvement of the logistics network as some decision might even lead to disadvantages for a single freight forwarder. As the holistic optimum is in focus, the distribution of costs and benefits within the cooperation is essential and therefore a challenging task that must be further detailed for the functioning of the cross-company logistics model.

Coordination between logistics and production

Coordination between the processes of production and logistics between all the involved partners (suppliers, customers, service providers) promises the highest potential of consolidation. As production planning and scheduling has a timely influence on inbound as well as outbound logistics, adjusting production scheduling offers an important possibility to increase efficiency in transportation.

Currently production scheduling is focusing mainly on production relevant criteria, like the planning restrictions of avoidance of overload in the assembly stations or cycle and delivery times [Boysen et al]. The consideration of logistical requirements and parameters as a part of a holistic production scheduling would lead to an increase of capacity utilization and to a reduction of fluctuating resource capacities. The reduction of cycle times and inventory would be further positive side-effects.

The coordination between logistics and production requires the highest degree of cooperation among the network partners and the desired combination of vertical and horizontal collaboration requires flexible network partners. The applicability depends on the planning processes and the requirements of production. Influencing production scheduling offers various possibilities to increase efficiency:

- **Considering transport time-tables** in case of fixed time slots. Besides influencing the load factor, particularly for efficient transport modes of high capacity like train and ship the adjustment of production scheduling to transport time-tables offers a potential to reduce inventory costs.
- **Smoothing of demand** and the resulting constant stock movement and flow of parts provide a basis for a steady transportation schedule.
- **Bundling of demand** allows higher shipment volumes, high utilization and low inventory costs. The parameters relevant for bundling that have to be considered in the production scheduling are: selection of suppliers and parts, determination of the bundling time period and of the bundling amount per part.

Although potentials are obvious this approach can hardly be found in the industry nowadays. Whilst big companies for example in the automotive industry already made attempts to consider logistical requirements in production planning, small and medium enterprises pursuing this approach are not known. The combination of vertical and horizontal collaboration requires a dynamic planning and adjusting of logistics and production within the network. Therefore processes and routines have to be agreed. As optimization within the network might lead to the waiving of economies of scales in the production for single companies, a method for the distribution of costs and benefits within the cooperation is essential.

4. CONCLUSIONS

Horizontal logistics collaborations help companies, which individually do not have access to highly productive transport networks, to activate cost cutting potential in logistics. As there are various possibilities to cooperate and not all forms of horizontal cooperation are applicable to any given company, this paper presents a general framework for horizontal logistics collaboration.

Due to the variety of parameters of cooperation and complexity in planning the approach is divided into three stages that differ in the necessary degree of cooperation and also in the resulting potential for consolidation. Whilst a jointly tendering of transport services only requires little cooperation and offers a reduced utilization of synergies, the approach of cross-company bundling states higher demands on the cooperation. As there are various factors that influence the overall result of transport efficiency, the potential of consolidation in cross-company bundling depends on the amount and the degree of influencing factors considered and adjusted. Coordination between logistics and production in horizontal networks represents the highest potential and further requires the strongest form of cooperation, as it considers horizontals as well as vertical collaboration.

As the overall goal of the cooperation is to realize optimum transport efficiency, the disadvantages of single cooperation partners have to be considered by a fair distribution of costs and benefits. Further organizational models that fit the different needs of the specific cooperation have to be developed in each single case in order to guarantee a sustainable success of the cooperation. With regard to the organizational models it has to be mentioned, that this approach has big implications for the future role of LSP. Most forms of horizontal collaboration require a neutral coordinator whose tasks and duties are similar to the current service offering of an LSP. In each of the proposed stages there is a different trade-off between managing the network by planning and scheduling transportation and forwarding the freight for service providers. Thus LSP might increase their important role to improve competitive abilities of manufacturing and distribution companies in the future.

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