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Critical success factors of synchromodality: results from a case study and literature review

Sarah Pfoser [a,]*, Horst Treiblmaier [a], Oliver Schauer [a]

[a]*University of Applied Sciences Upper Austria, Wehrgrabengasse 1-3, 4400 Steyr, Austria*

Abstract

Even though synchromodality is a promising new concept to promote modal shift, it is virtually unknown in Europe except for the Benelux countries. In synchromodal transport chains, real-time switching between transport modes enables efficient supply chains in which shippers book their transport service “mode-free”. In this paper we use a literature review and an expert panel to identify critical success factors which ensure the effective implementation of synchromodality. Our results suggest that there is quite uniform agreement upon importance and feasibility of various success factors with cooperation being the most crucial success factor.

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1. Introduction

The transport sector is fundamental to our economies and societies, but it is also responsible for a multitude of negative side effects including emissions, noise and congestion (European Commission, 2011; 2014). This calls for a modal shift toward a more efficient and effective reorganization of the whole transport system. Synchromodality is

* Corresponding author. Tel.: +43 5 0804 33261; fax: +43 5 0804 33299.
E-mail address: sarah.pfoser@fh-steyr.at

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a logistics concept which strives to increase the share of rail and inland waterway transport. Switching smoothly between these two modes and road transport takes place in near real-time, which is made possible since shippers book their transport service “mode-free”, i.e., without any need of specifying their transport mode in advance. The transport company is thus able to bundle the flows of goods from different customers and optimizes the cargo. Close cooperation between all stakeholders along the transport chain allows moving goods in a flexible and resource-efficient way.

Synchromodality is defined as an “evolution of inter- and co-modal transport concepts, where stakeholders of the transport chain actively interact within a cooperative network to flexibly plan transport processes and to be able to switch in real-time between transport modes tailored to available resources. The shipper determines in advance only basic requirements of the transport such as costs, duration and sustainability aspects. Thus, transport processes can be optimized and available resources sustainably and fully utilized” (Haller et al., 2015).

In spite of being a promising new idea, synchromodality is almost unknown in most of Europe, except for the Benelux countries. In the Netherlands several successful pilot projects exist which demonstrate its viability. The best-known is the implementation of the synchromodality network between Rotterdam, Moerdijk and Tilburg (Lucassen and Dogger, 2012). This pilot project included a trimodal network with mode-free bookings by shippers. For each container the best transport route has been selected and all parties worked together in optimizing the whole transport chain. In this way, a stable modal split was achieved at the Rotterdam Maasvlakte terminal with 19% truck transport, 46% ship transport and 35% rail transport. This already exceeds the port’s overall goals for 2033 which amount to 35% truck share, 45 % ship share and 20% rail share (ECT, 2012).

This business case bears the potential to serve as a role model for related projects and thus it is crucial to thoroughly investigate it in order to be able to fully understand why it turned into a success story. This will help to avoid pitfalls in the future and build a theoretic foundation for academics interested in this field of research (Treiblmaier, 2015). In this paper we therefore carefully analyze this best practice example in order to systematically identify those critical success factors which ensure the effective implementation of synchromodality.

2. Methodology

We used the critical success factor method in order to identify the key enablers for synchromodality. This method was mainly popularized in 1979 by John Rockart of MIT’s Sloan School of Management (Rockart, 1979; Bullen and Rockart, 1981). It is based on the work of Daniel (1961), who originally proposed the concept of success factors. In the present study we apply the refined version of Caralli et al. (2004). They adapted the method to be useful outside of the information technology field and described the single steps that need to be taken, which includes guidelines on how to conduct and analyze interviews and how to derive success factors from the data.

According to Bullen and Rockart (1981), critical success factors (CSFs) stand for "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization. CSFs are the few key areas where 'things must go right' for the business to flourish and for the manager's goals to be attained." (p.7). Caralli et al. (2004) define critical success factors as “key areas of performance that are essential for the organization to accomplish its mission” (p. 2). Critical success factors are therefore those critical factors or activities which are required to ensure the success of a business or a project. In the case study at hand the success of synchromodality constitutes the mission and the areas of performance represent success factors which are necessary for a functioning synchromodal transport chain. Identifying CSFs is important as it allows focusing one’s efforts on building the necessary capabilities to meet the relevant success factors. If objectives associated with these factors are not achieved, synchromodality will fail.

Following Caralli et al. (2004), the most important activity is the careful identification and collection of relevant data. In our study, we gathered data in two steps. First, an extensive literature research was performed in order to identify CSFs for synchromodality. Second, expert interviews were conducted with Dutch practitioners who were involved in the pilot study and other successful pioneer projects. Finally, the data was analyzed from which critical success factors were derived. The list of collected CSFs was verified, classified and evaluated. The literature research had been carried out between January and March 2015. We used the data bases EBSCO Business Source Premier, Emerald and Google Scholar. The main search term was “synchromodality” and also the related concept of “comodality”. Other terms such as “transport modes optimization” emerged during the review process and were

incorporated into our search strategy. Finally, some of the Dutch experts recommended papers which turned out to be highly relevant for the study at hand.

For the expert interviews, the proposed interview questions of Bullen and Rockart (1981) were selected and modified to match the goals of our study.

Table 1. Interview Questions.

Proposed questions of Bullen and Rockart (1981)	Adapted version for synchromodality
What is your personal mission and role in the organization?	What is your position and/or function in the organization?
What are the critical success factors in your job right now?	What are the critical success factors for synchromodality (in whatever order they come to your mind)?
What are your three greatest business problems or obstacles?	What are the three greatest barriers regarding synchromodality?
(Not available)	Please evaluate the importance and the feasibility of the following critical success factors (1=low, 5=high)!

The last question complements Bullen and Rockart's research to verify, classify and evaluate the CSFs. The critical success factors which have been identified from the literature were listed and the experts were asked to estimate the importance and the feasibility of each one. The importance of a CSF describes its relevance, whereas the feasibility of a CSF describes the extent to which it is viable to implement this CSF. To assess the importance and the feasibility there was a scale of 1 (=low) to 5 (=high) as well as the option "not applicable". The first, open question ("What are the critical success factors for synchromodality") allows respondents to name new success factors they consider to be especially relevant and which were not explicitly mentioned in the literature. The second question provides explicit CSFs in order to set a basic framework and receive comparable answers.

Between April 27 and April 30 2015 we conducted nine expert interviews in the Netherlands, the leading country for synchromodality. The experts included researchers as well practitioners in order to ensure a diversity of opinions. Among others, the interview partners included the General Business Manager from the ECT Terminal in Rotterdam as well as the project manager from Railport Brabant in Tilburg and several professors in the field of transport and planning from TU Delft, Erasmus University Rotterdam and Wageningen University and Research Centre as well as from TNO, Netherlands Organization for Applied Scientific Research. The interviews were conducted on site in the synchromodal pilot corridor: From the ECT Terminal at the Port of Rotterdam to the hinterland ports of Brabant Intermodal, operator of rail terminals as well as inland waterway terminals. Beside critical success factors, some other aspects of synchromodality have been discussed in the interviews, for example its definition, its future and the possibility of implementing it in Austria. The interviews took between and one-and-a-half hours each and they have been recorded. The interviewees were just informed about the basic topics that have been discussed but they did not receive the detailed questionnaire

After gathering all the information needed, the collected data had to be organized. This means that theoretical and empirical results have been listed and clustered. The findings of the literature review have been summarized in a table. All of the mentioned success factors have been condensed to seven conclusive groups. The number of references has been counted for each group to assess its relevance. The results of the expert interviews have also been listed in a table. Each statement has been analyzed and, if possible, assigned to one of the defined group of key CSFs to prove empirical evidence for the developed critical success factor groups. In agreement with Caralli et al. (2004), the final activity is to analyze the defined success factors. This will be done in coordination with important stakeholders within a workshop in October 2015. There, the occurrence of the identified CSFs in Austria will be reviewed and the viability of introducing synchromodality in this country will be examined.

3. Findings and Discussion

3.1. Identification of Critical Success Factors

Relevant CSFs for synchromodality were identified based on an extensive literature review which was based upon fifteen papers. We clustered critical success factors that are mentioned in the reviewed articles and formed seven groups of homogenous CSFs. In a later step, we defined three main categories to summarize similar critical success factors, namely transport-related ones, external conditions and customer related CSFs. Table 2 shows these results: The groups of potential CSFs for a successful implementation of synchromodal transport chains and the main categories they belong to. The literature is listed according to the year of publication. Critical success factors are ranked in regard to the number of times they are mentioned in the reviewed sources. The following paragraphs elaborate on each group of CSFs.

Table 2. Critical Success Factors of Synchromodality based on Literature Review.

	Transport-Related			External Conditions		Customer-Related	
Reference	Network/ Cooperation/ Trust	Sophisticated Planning	ICT/ITS Technologies	Physical Infrastructure	Legal/ Political Framework	Awareness/ Mental Shift	Pricing/ Cost/ Service
Pomponi et al., 2015	X						X
Tavasszy et al., 2015	X	X	X	X	X	X	X
ALICE Corridors, Hubs and Synchro-modality WG2, 2014	X	X	X	X		X	
Behdani et al., 2014	X	X	X	X	X	X	X
Oonk, 2014	X	X	X	X			
van Wee, 2014	X	X	X	X	X		
van Riessen, 2013		X					
Pleszko, 2012	X	X	X	X	X	X	
Simina et al., 2012		X	X	X	X		
Verweij, 2011	X	X			X		
Caris et al., 2008	X	X		X			
Mason et al., 2007	X		X				X
Groothedde et al., 2005	X	X		X		X	
Bontekoning et al., 2004			X		X		
Trip, Bontekoning, 2002		X	X	X			X
Total (15)	**11**	**12**	**10**	**10**	**7**	**5**	**5**

- Network, Collaboration and Trust

The generation of a network based on mutual trust and collaboration is one important prerequisite for synchromodal transport processes. Since many companies are reluctant to cooperate with competitors, a rethinking process is required to generate a network which is characterized by trust and awareness of the advantages of cooperation instead of competition. The coordination between highly diverse players along the transport chain is a highly difficult task but it comprises the potential of a win-win situation for all of them. The issue of collaboration often involves problems of risk sharing.

- Sophisticated Planning

Sophisticated dynamic planning and simulation of transport routes and transport patterns are essential to create a functioning synchromodal transport network. Customer preferences, busy routes and available resources of hubs and transport modes have to be evaluated and examined. Forecasts and simulations are essential to learn about repeated connections and to be able to optimize transport performances. Thus, a core freight network has to be identified using demand mapping and forecasting tools. A comprehensive supply framework to efficiently utilize available container capacity in intermodal transport services is needed for well-organized synchromodal processes. Following the Physical Internet paradigm and being induced by potential cost savings, transport operators and infrastructure managers will be motivated to collaborate (Rossi, 2012) and consequently more data will become available for analysis. As capacity data of transport operators is becoming increasingly available, it is getting easier to efficiently fill up of free capacity. Additionally, a better collaboration of fragmented transport flows, required to make them economically viable, can facilitate new transport solutions (Jacobs et. al, 2013).

- ICT/ITS Technologies

Providing high quality and standardized data as well as sharing and mutually exchanging information (open data) are key to creating new and innovative services. Data pipelines combining information from different stakeholders (port data, vessel data, terminal data…) have to be available in a way such that all stakeholders within the transport chain are able to properly use them. Furthermore, it is essential to implement ITS and ICT systems in order to dynamically provide data and to be able to optimize transport planning. Long-term and automated planning need to take into account the crucial role which data and information play in a synchromodal supply chain. Additionally, issues dealing with data security and data protection must be solved.

- Physical Infrastructure

Different aspects of terminal and port infrastructure were mentioned quite often within the reviewed literature. The basic prerequisite is that smart hubs must exist and they must be connected by smart corridors. The location of the ports and production sites influences the infrastructure network configuration and its efficiency. The terminal design is relevant as well. The overall aim is to obtain an attractive utilization of this infrastructure which is realized by bundling transport flows to synchromodal transport streams.

- Legal and Political Framework

The legal and political conditions constitute the basic framework for most of the other critical success factors. Harmonized transport regulations are indispensable for a functioning synchromodal network. Another important legal question is the one of liability for the transport, especially for any delay, loss or damage, which might not always be clear when the mode is switched spontaneously. Concluding unambiguous service level agreements is therefore highly recommended. Boundary conditions for data sharing are also vital with regard to the necessary collaboration between the stakeholders. Basically, legal security must be ensured for all involved parties.

- Awareness and Mental Shift

Another key success factor is the willingness of the customer to concentrate just on the core elements of the transport such as price, destination and duration of the transport and to leave the decision which transport modes to use up to the logistics service provider. Thus, it is important to raise awareness on the advantages of synchromodal transport and to generate a mental shift among customers. If customers insist on booking specific modes on specific transport routes, the logistics service provider lacks the necessary freedom to optimize his transport flows in a synchromodal way. The mental shift also includes that all players must be aware that not the preparation of the

transport is the primary feature of the service performance but rather the capability to respond to certain incidents and choose the right alternative in this case.

- Pricing/Cost/Service

Pricing, cost and service are important aspects within a synchromodal transport network. Transports must be provided at a lower or at least at the same price. Quality and the offered service (such as on-time delivery, reliability and flexibility) must also fit customer's needs, otherwise synchromodality is no competitive logistics concept. Unplanned waiting times for examples must be penalized. The pricing of synchromodal services is quite complex due to the amodal transports. Since the transport mode and the specific route are not determined in advance, it is difficult to set a price. On the other hand, customers require security to know the price in advance. Similar problems arise in terms of insuring the transport.

3.2. Validation and Classification of Critical Success Factors

The interview results suggest that empirical evidence supports the applicability of the identified groups of critical success factors. All statements that we received for the open-ended question (what are the critical success factors) have been clustered and assigned to the seven categories that have been developed based on the literature review (Table 3). Each identified group of success factors has been assigned several different statements of the respondents. For the most part, the experts agreed on the basic conditions which ensure the success of synchromodal transport chains and they had consistent understanding about the critical success factors. Only three responses have not been matched with a group of CSFs since they did not unambiguously fit into a category. Two of them are efficiency and flexibility, characteristics which are obviously necessary for each functional transport system. The third one is the claim for sufficient volumes, which is definitely a valuable extension of the selected critical success factors based on literature review. Indeed, the shipped freight volumes must be high enough to ensure that real time switching and bundling of goods work within the synchromodal network.

It turned out that the stakeholders widely agreed on the major prerequisites of synchromodality since their statements indicate a coherent estimation of CSFs. The major question remains whether it is possible to realize these CSFs and how this can be achieved. Thus, the respondents had to estimate the feasibility of the selected CSFs. In addition they were asked to assess the importance of each critical success factor that we proposed. To determine the degree of feasibility and importance, a scale from 1 (=low) to 5 (=high) was given. The mean of the nine expert's estimations was used to classify the CSFs into four categories. Depending on this value, each success factor is located in a quadrant with particular attributes (see Fig. 1).

The most critical success factors are those which are very important but not very feasible (lower right corner in Fig. 1). These CSFs must be managed closely in order to attain their accomplishment. As can be seen, the most crucial factor is cooperation because it is rated as the least feasible subject. Respondents frequently doubted that companies are willing to cooperate in such an intensive way that they are able synchronize their transport streams. Several other CSFs are also located within this segment, but they are more feasible, namely pricing strategy, legal and political framework as well as mental shift.

The factors in the upper right corner are less problematic since they are viable success factors: they are important, but their feasibility is high. Sophisticated planning as well as ICT/ITS and other information systems have been rated as viable CSFs, the experts partly mentioned that some of these systems already exist and are ready for being used to coordinate synchromodal transports.

The lower left corner represents negligible success factors. These CSFs are less imperative due to their low importance and low feasibility. Nevertheless, their development should be monitored as they can become more important one day and then their implementation might become relevant. The only factor located in this segment, physical infrastructure, is already very close to the upper left corner, the practicable success factors, therefore it can be assumed that this CSF is also quite viable to implement. The practicable success factors are those that are not so much important but easy to realize. They should be kept in readiness in case they become more relevant at some point.

Table 3. Critical Success Factors of Synchromodality based on Expert Interviews.

Transport-related	External conditions	Customer-related
Network/Cooperation/Trust • "Organizational issues: align interest of multiple stakeholders, organize relations, `gain and pain sharing´" • "Need for other players: you are reliant on other players in the supply chain" • "Administrative processes to allow to cooperate between nodes" • "Other way of negotiation" • "Trust of shipper" "How much competition is there in the synchromodal market? How much cooperation is needed to be successful?" **Sophisticated Planning** • "Integrated planning" • "Standardization of the transport itself" • "Software side of the information system, good information" "Ability to plan and use modes of transport you need to come up with a system which can use resources in an efficient way" **ICT/ITS Technologies** • "Technology enabler" • "Tools" (i.e. ICT/ITS technologies) • "Hardware: Technology (sensors, ITS, ICT, different load units)" "Communication system (ITS, communication, information technologies"	**Physical Infrastructure** • "Network of nodes and routes" • "Reliable connections, at least daily train connections" "Hardware" (i.e. terminals, hubs, streets,…) **Legal/Political Framework** • "Role of public sector and government-investments required" • "Regulations. Insurance terms are different, role of public sector for development of infrastructure" • "Rules, agreements" • "Rules determine how flexible we are" • "Orgware: Governance" "Legal conditions (different modes of transport but only one bill of loading, dangerous goods…"	**Awareness/Mental Shift** • "Cultural view and mental shift" • "Orgware: Mind shift from shippers and logistics service providers. Shippers have to understand that it takes a lot of freedom from the system when shippers decide on mode. Mental shift to release control" • "Willingness of shipper to accept that LSP or intermodal operator can choose mode and performs on his own" **Pricing/Cost/Service** • "Price combined with quality is important for customers" • "Not just minimum cost but balance between cost and efficiency" • "Cost aspects" • "Service level, reliability" • "Different price mechanisms to make it work" • "You need to know what customers want" "Pricing questions: if you have not specified the modality you are in the situation that profit depends on the execution, agree in advance but may renegotiate the price"

A final evaluation of the selected success factors has been carried out with many national and some international stakeholders of the transport sector at the Austrian Logistics Day 2015 in Linz. After a detailed introduction to the concept synchromodality and its critical success factors they were asked to vote which of the CSF categories they consider to be the most difficult one to implement in Austria. For this purpose an interactive survey has been installed and participants of the workshop were able to vote with their mobile phones. On the whole, 44 responses have been gathered.

The results are very consistent with the estimation of the experts. Adequate hardware and software is not seen as a problem at all, that is to say sophisticated planning systems, ICT systems and physical infrastructure. No respondent voted for these options. Again, the most crucial factor is expected to be cooperation and trust between involved stakeholders, 17 responses confirmed this. Awareness and mental shift is the second most mentioned answer (12 times) followed by pricing strategy (9 times) and legal/political framework (6 times). This provides even more evidence that a very uniform opinion about the critical success factors for synchromodality dominates, since Austrian stakeholders came to a very similar evaluation like the Dutch experts.

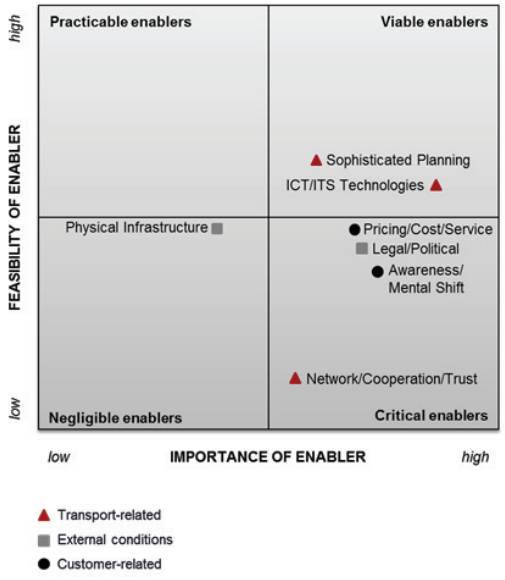

Fig. 1. Classification of Critical Success Factors.

4. Conclusion

The goal of this research is to foster a long-term shift from unimodal transport to intelligent, flexible and sustainable synchromodal transport. The concept of synchromodality combines the concepts of inter- and co-modality and incorporates different elements of both. Within synchromodality, the idea of using multiple transport modes is taken from intermodality and the element of stringent efficiency is derived from the concept of co-modality. Existing transport resources are sustainably used and optimized.

Implementing effective synchromodality depends on various requirements. As the concept fundamentally builds upon cooperation between all stakeholders along the transport chain, establishing close cooperation is the main concern to ensure efficiency and the flexible use of resources. They do not only have to collaborate, but they must also participate in a mental shift to grant the necessary freedom for fulfilling a-modal transport services. Providing sufficient technical infrastructure such as ICT- and ITS-systems is also an important prerequisite to support making transport decisions in real-time and switching transport modes whenever required. These technological conditions are basically not seen as a problem to realize. The same can be said for sophisticated planning systems. The physical infrastructure is another basis for synchromodality, which includes hinterland connections and smart hubs. Pricing, cost and service quality are further relevant aspects in a synchromodal network. Finally, the legal and political conditions constitute the framework for all other success factors.

In a final stakeholder workshop, we plan to validate our findings with potential Austrian pioneer companies which intend to introduce synchromodality. Although this concept is quite unknown apart from the Benelux region, it comprises a lot of potential to generate efficient and sustainable transport streams also in Austria. So far, various interest groups from the logistics sector, industry and also the government showed considerable interest in learning about synchromodality and a synchromodal pilot corridor might be implemented in a follow-up project.

References

ALICE Corridors, Hubs and Synchromodality WG2, 2014. Corridors, Hubs and Synchromodality Research Innovation Roadmap. http://www.etp-logistics.eu/alice/en/publications/. Retrieved on: 01.07.2015.

Behdani, B., Fan, Y., Wiegmans, B., Zuidwijk, R., 2014. Multimodal Schedule Design for Synchromodal Freight Transport Systems. Available at SSR_N 2438851.

Bontekoning, Y. M., Macharis, C., & Trip, J. J., 2004. Is a New Applied Transportation Research Field Emerging?—A Review of Intermodal Rail–Truck Freight Transport Literature. Transportation Research Part A: Policy and Practice, 38(1), 1-34.

Bullen, C.V., Rockart, J.F., 1981. Primer on Critical Success Factors. Cambridge, MA: Center for Information Systems Research, Massachusetts Institute of Technology, Massachusetts.

Caralli, R. A., Stevens, J. F., Wilke, B. J., Wilson, W. R., 2004. The Critical Success Factor Method: Establishing a Foundation for Enterprise Security Management. CMU/SEI-2004-TR-010 Software Engineering Institute, Carnegie Mellon University.

Caris, A., Macharis, C., Janssens, G. K., 2008. Planning Problems in Intermodal Freight Transport: Accomplishments and Prospects. Transportation Planning and Technology, 31(3), 277-302.

Daniel, R.D., 1961. Management Information Crisis, Harvard Business Review 39(5), 111-121.

ECT, 2012. Synchromodality Works, Fast Forward 54, 12-13.

European Commission, 2011, WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM/2011/0144 final, Publications Office of the European Union, Brussels.

European Commission, 2014. EU transport in figures: Statistical pocketbook 2014, Publications Office of the European Union, Luxembourg.

Groothedde, B., Ruijgrok, C., Tavasszy, L., 2005. Towards Collaborative, Intermodal Hub Networks: A Case Study in the Fast Moving Consumer Goods Market. Transportation Research Part E: Logistics and Transportation Review 41(6), 567-583.

Haller, A., Pfoser, S., Putz, L.-M., Schauer, O. 2015. Historical Evolution of Synchromodality: A First Step Towards the Vision of Physical Internet. Proceedings of the Second Physical Internet Conference, 6- 8 July, Paris, France.

Jacobs, F., Vercammen, S., Verstrepen, S., 2013. CO³ Test Project report - Creation of an Orchestrated Intermodal Partnership between Multiple Shippers. CO³ Project, Deliverable D4.2, TRI-VIZOR N.V. Waterfront Research Park, Belgium.

Lucassen, I. M. P. J., Dogger, T., 2012. Synchromodality Pilot Study. Identification of Bottlenecks and Possibilities for a Network between Rotterdam, Moerdijk and Tilburg. TNO Report 2012 P10128, Delft, Netherlands.

Mason, R., Lalwani, C., Boughton, R., 2007. Combining Vertical and Horizontal Collaboration for Transport Optimisation. Supply Chain Management: An International Journal 12(3), 187-199.

Oonk, M. E., 2014. Smart Logistics Corridors and the Benefits of Intelligent Transport Systems. Transport Research Arena (TRA) 5th Conference: Transport Solutions from Research to Deployment, 6- 8 July, Paris, France.

Pleszko, J., 2012. Multi-Variant Configurations of Supply Chains in the Context of Synchromodal Transport. LogForum 8 (4), 287-295.

Pomponi, F., Fratocchi, L., Tafuri, R. S., 2015. Trust Development and Horizontal Collaboration in Logistics: A Theory Based Evolutionary Framework. Supply Chain Management: An International Journal, 20(1), 83-97.

Rockart, J. F., 1979. Chief Executives Define Their Own Data Needs, Harvard Business Review 57(2), 81-93.

Rossi, S., 2012. CO³ Position paper - Challenges of Co-Modality in a Collaborative Environment, CO³ Project, Deliverable D2.3, Cranfield, Bedfordshire, United Kingdom.

Simina, D., Patrick, S., Radu, C., 2012. Economic Benefits of Developing Intermodal Transport in the European Union. Annals of Faculty of Economics 1(2), 81-87.

Tavasszy, L. A., Behdani, B., Konings, R., 2015. Intermodality and Synchromodality. Available at SSRN: http://ssrn.com/abstract=2592888.

Treiblmaier, H. 2015. Promoting an Academic Community for the Physical Internet. Proceedings of the Second Physical Internet Conference, 6-8 July, Paris, France.

Trip, J. J., Bontekoning, Y., 2002. Integration of Small Freight Flows in the Intermodal Transport system. Journal of Transport Geography 10(3), 221-229.

van Riessen, B., Negenborn, R. R., Dekker, R., Lodewijks, G., 2013. Service Network Design for an Intermodal Container Network with Flexible Due Dates/Times and the Possibility of Using Subcontracted Transport. Proceedings of the International Forum on Shipping, Ports and Airports (IFSPA 2013), Hong Kong, 256-265.

van Wee, B., Fransoo, J., van Hillegersberg, J., van der Mei, R., Rietveld, P., Ruijgrok, K., Tan, Y., Tavassy, L., Vis, I., Zidwijk, R., 2014. Sustainable Logistics. Netherlands Organisation for Scientific Research, The Hague, Netherlands.

Verweij, K., 2011. Synchronic Modalities: Critical success factors. In: van der Sterre, P. J.: Logistics Handbook 2011, 75-88.