European Research Studies Journal
Volume XXIII, Special Issue 2, 2020

pp. 99-109

Modal Choice Preferences in Inland Container Transport in Poland*

Submitted 17/9/20, 1st revision 26/09/20, 2nd revision 10/10/20, accepted 13/11/20

Damian Bonk[1], Sylwia Kowalska[2]

Abstract:

Purpose: *As part of this paper, three research goals were set. The first one concerns the identification of factors influencing the modal choice to carry intermodal transport units by inland transport. The second goal is related to determining what conditions would have to exist for a given operator to agree to shift the cargo from road to rail transport as part of the modal shift concept. The third goal is to specify the influence of COVID-19 on the modal choice.*

Design/Methodology/Approach: *Earlier studies have confirmed the difficulty in determining modal choice preferences due to their complexity. The complexity of the problem makes the use of quantitative methods ineffective. On the basis of the qualitative research conducted with the use of the in-depth semi structured interview, the authors identified the factors influencing the modal choice, at the same time defining the conditions that would have to be met in order to encourage cargo operators to make greater use of rail transport.*

Findings: *The conducted research study indicated differences in the factors determining the choice of transport modes, mainly depending on the size of the surveyed company. The above-mentioned factors in relation to the entire study group included the time and cost of transport, as well as the availability and quality of transport infrastructure. The surveyed enterprises agreed that the factors that would have to occur to increase the use of rail transport included: increasing the number of reloading points at railway connections and increasing the timeliness of transport.*

Practical Implications: *The results of the research can be used by decision-makers in formulating the directions of development of the transport system, and the entities responsible for the implementation of specific transport infrastructure investments, covering both linear and nodal elements.*

Originality/Value: *The added value of this article is predicated on original research related to the determination of the premises for the selection of the transport mode in freight container transport in Poland. Requirements that could be a stimulus for implementing the modal shift idea in Polish companies. The authors confronted the research results achieved with the current scientific knowledge in this area, in addition, they also raised the topic of the Covid-19 pandemic and its impact on modal choice.*

Keywords: *COVID-19, combine transport, intermodal transport, modal shift, rail transport.*
JEL codes: *O18, R42, R41.*
Paper type: *Research article.*

---

[1]*MSc, Faculty of Economics, Finance and Management, University of Szczecin,*
e-mail: sylwia.kowalska@usz.edu.pl;
[2]*MSc, Faculty of Economics, Finance and Management, University of Szczecin,*
e-mail: d.h.bonk@gmail.com;
**Paper presented in ICABE 2020.*

1. Introduction

Unquestionably, transport plays a vital role in nowadays economy, but at the same time it can be highly harmful to both the natural environment and people. In 2017, the share of the transport sector in greenhouse gas emissions in the EU member states amounted to 32.1 %, which constituted a 11.7% increase in relation to 1990 (European Commission, 2019). Road transport accounts for 71.7% of the emissions, out of which 26.3% is attributed to heavy goods vehicles and buses (European Commission, 2019). In Poland, the transport share in the total greenhouse gas emissions amounts to 16%, out of which the road transport is accountable for 92.9% of the emissions (European Commission, 2019).

The harmful impact of transport, particularly of the road transport, has come to the attention of the European Commission, the result of which was establishing a new development paradigm called a modal shift (European Commission, 2001, European Commission, 2011). The documents defined the goal consisting in increased use of energy-efficient means of transport. By 2030, 30% of freight road transport on distances exceeding 300 km is to be shifted to alternative transport modes. By 2050, the share should exceed 50% (European Commission, 2011).

A number of studies have shown that despite the growing share of road transport there is a possibility of modal shift from road to alternative transport modes, in particular to the railway. (Woodburn, 2003; Eurostat, 2017; TRAN Committee, 2018). Still, the modal structure of freight transport is not balanced[3]. Reducing the negative environmental impacts of transport, which results from using the modes of transport that are less detrimental to the environment and more efficient, fits into the concept of intermodal transport being a less environmentally harmful alternative to freight haulage using only road (unimodal) transport (Pizzol, 2019).

Additionally, in the academic literature it is possible to notice the need for providing expert appraisals connected with implementing the modal shift paradigm as well as establishing goals and scope of implementing the paradigm assumptions. These may include both in-depth analyses at a national level as well as on an international scale in view of similarities found in various countries (Szaruga, Skąpska, Załoga, and Matwiejczuk, 2018).

Addressing the above dilemmas, this paper poses research questions regarding the rationale that is decisive for cargo shippers in choosing a transport mode for a land transport leg, and the conditions on which any given cargo shipper would agree to shift the cargoes from road to rail transport. Moreover, in line with the new challenges posed to transport market players in the context of the COVID-19

[3] *In EU-28 in 2018 the share of road transport was 75.3%, whereas in Poland it amounted to 73.1%. (Eurostat, 2018).*

pandemic, the authors attempted to find answers to the question how the pandemic affected decisions on choosing the means of transport in land carriage.

2. Literature Review

Intermodal transport means freight carriage using the same one cargo unit or vehicle, whereas the implementation of the transport process takes place without the need to tranship the cargo itself (92/106/EEC). In the academic literature on the subject, intermodal transport is often researched in the context of the modal shift concept (Bouchery and Fransoo, 2015; Macharis *et al.*, 2012; Tsamboulas *et al.*, 2007). The research studies have found that intermodal transport affects the modal shift potential and benefits resulting from using rail in freight haulage (Behrends, 2017). Moreover, it is also possible to notice that implementing the assumptions of the modal shift concept in order to move cargoes to intermodal transport to a large extent relies on the level of provided services and the degree to which users' needs are satisfied (Tsamboulas *et al.*, 2007). Therefore, many researchers carry out studies' modal choice, using behaviour-related methodological approaches. Danielis and Marcucci (2007) even pointed out that in order to specify effective tools of a transport policy aimed at an intermodal shift, it is more efficient to apply an approach that considers a modal choice behaviour.

Also, the issue of modal choice for intermodal transport in relation to the modal shift concept has already been the object of research studies.

Table 1. *Review of selected literature regarding modal choice in intermodal transport in the context of modal shift*

The Authors	Methodology	Persons covered by the study	Main conclusions
M. Slimecek, J. Dufek (2016)	adaptive state preference survey	freighters	Freighters do not react to change the used routine freight traffic mode.
M. Tri Nugroho, A. Whiteing, G. de Jong (2016)	stated preference survey	shippers and forwarders	Reducing fuel subsidies for road transport and giving incentives to reduce rail freight rates would provide the most significant encouragements to modal shift from road transport to rail transport.
L. Larranga, J. Arellana, L A. Senna (2016)	stated preference technique, Discrete choice models	logistics managers'	Shippers significantly value the fulfilment of delivery time and cost.
D. Meers, C. Macharis, T. Vermeiren, T. van Lier (2017)	choice-based conjoint experiment	shippers and logistics service providers	Operators should try to provide daily services at a competitive price, with a focus on providing more reliable services than road transport. Additional efforts should be made to correctly inform decision-makers on the available intermodal services.
X. Tao, Q. Wu, L. Zhu (2017)	Stated preference survey, face-to-face	Shippers, freight forwarding	Subsidies can serve as short-term solutions, but a policy package,

	interviews, and group discussions	company, international trading company	including financial, technological, operational, and managerial measures, is required as a long-term strategy.
E. Kurtulus, I. B. Cetin (2020)	stated choice experiment technique, discrete choice models	rail operators, dry port operators and freight forwarders	- the transportation cost attribute has the biggest impact on modal shift, - the modal shift is more sensitive to the cost of road than the cost of intermodal, - the most effective policy is doubling the train frequency and reducing transit time.

Source: *Own work.*

The main factors of modal choice in intermodal transport are found to be cost, time and reliability. Moreover, it has been shown that subsidies are not an effective incentive for a shift from road to intermodal transport.

3. Methodology

It is pointed out that in view of the versatility of supply chains and preferences of supply chain participants, a study without an appropriate set of quantitative data on estimated demand for transport services may be hardly reliable when applying quantitative methods (Kotowska, Mańkowska, and Pluciński, 2020). As a result, most research studies carried out in relation to modal choice are qualitative (Table 1).

In view of the above, the Authors carried out a survey about modal choice, applying the in-depth, semi-structured interview method. Application of this method made it possible to obtain full and profound understanding of the issue from the point of view of the analysed entities operating in the transport, forwarding and logistics industry. The research study also made it possible to identify the factors that influence the choice of transport modes (mainly with regard to shifting from road to rail transport). Moreover, the way the interviews were conducted made it possible to specify the conditions that would have to be met in order to induce cargo shippers to use rail haulage to a larger extent. The research results were also confronted with the current body of knowledge determined in the course of the in-depth literature review with regard to the topic at hand.

The first phase of the research study was to develop the basic version of a survey consisting of 20 open-ended questions, divided into 4 thematic parts. The first part was to outline a general picture of the enterprise and the position of the respondent. Then, the Authors developed three thematic parts in which they focused on the particular research problems identified by them:

1. What rationale is decisive when choosing any given mode of transport by cargo shippers for a land transport leg?
2. On what conditions would the given cargo shipper or forwarder agree to shift the cargo or its part from road to rail transport?
3. Specifying the impact of the COVID-19 pandemic on decisions regarding the choice of means of transport, during the epidemic and after it ceases.

Next, the Authors selected enterprises operating in the transport, forwarding and logistics industry to be included in the study. The main assumption was that such an enterprise must run or organise cargo carriage using road transport. Following the initial discussions and determining the will and possibility of taking part in the survey, appointments were made to hold in-depth interviews with employees selected by the enterprises (i.e. the ones who were able to provide the fullest possible answers in that regard). Most enterprises involved in the study may be categorised as forwarding companies, operating as both mixed and pure forwarders; only one of the examined enterprises can be categorised as a transport company.

Half of the enterprises covered by the study used various modes of transport in addition to road carriage (mainly by rail and sea, but also by air). All the enterprises declared their geographical area of operation included mainly the western and northern parts of Europe, and in some cases even the whole of the world. The most often mentioned business sector, with which the respondents cooperated to a larger extent, was the steel industry, nevertheless, the range of mentioned industries was quite wide. The cooperating industries most often enumerated by the respondents included the food sector, paper, and wood-processing industries. The interviews were held with owners and managers (e.g. managers for road transport, sales directors, managers for forwarding, general directors, etc.) of the surveyed enterprises, in one case the interviewee was the regional manager of the enterprise.

The interviews on average took ca. 50–60 minutes, they were held on the phone according to appointments made beforehand. One of the assumptions was that all the companies involved in the research study must remain anonymous. A set of exhaustive answers along with any auxiliary questions asked in the course of interviews was aggregated to form joint conclusions being answers to the individual questions regarding the research problem addressed in the paper. The factors influencing change of transport mode were divided into two categories: demand factors and supply factors.

4. Research Results and Discussion

The in-depth interviews helped to identify some concrete factors in the areas of demand and supply, which have an influence on modal choices made by the surveyed enterprises and their customers. The factors predominantly depended on the size of the given enterprise and the transport modes already used by that

enterprise. The survey was aimed at depicting the current state as well as at identifying the concrete conditions that would have be met so as to increase the interest in the idea of modal shift. Shifting cargoes from road transport to more environmentally friendly modes such as rail constitutes the basis of the transport policy pursued by the EU as well as its individual member states. Taking the above into account, the research results may prove useful, and even form the basis for determining in which direction intermodal transport terminals should develop, as well as for drawing up national or regional transport policies.

In the first place, it was determined whether the given enterprise had already been applying the idea of modal shift using intermodal transport to any extent. All the companies but one unambiguously indicated that they had been moving cargoes using the intermodal technology, as part of their own transport chains, or as part of a cooperating company's chain. In the surveyed enterprises which reported that they had been using the possibilities offered by intermodal transport, the intermodal transport volumes ranged from 0.5 up to 20% of the total freight. As for the supply factors affecting the modal choice, the interviewees identified the following major factors:

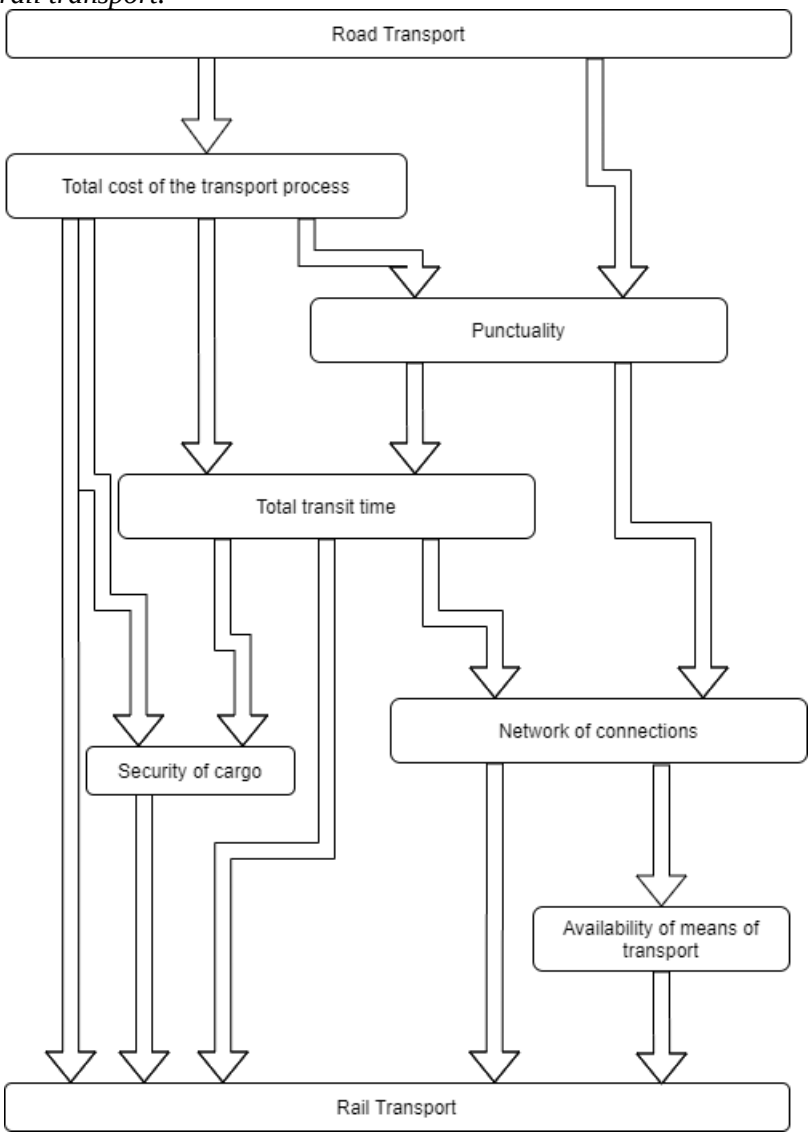
1. Transport cost (for the customer)
2. Transport punctuality (both pick-up and delivery)
3. Total transport time
4. Network of available connections
5. Safety
6. Access to means of transport.

The above factors were ranked according to their importance for the individual respondents, considering the fact how often they were indicated by the individual enterprises, and the importance of the individual factors described by them. When questioned why any given factor was the most important, the interviewees provided different answers depending on the factor; the general conclusion was that the customers strived to have the production and transport organised according to the just-in-time method[4], but at the same time they did not plan their transport correctly and sufficiently in advance. They also want to reduce transport costs to the largest extent possible. These are followed by factors such as cargo safety (as a rule it is higher in the case of transport using an intermodal cargo unit) or a connection network or availability of means of transport. In addition to the above, the additional factors affecting the modal choice, indicated by the interviewees, were total

[4] *"The just-in-time concept assumes delivery of materials and other goods in strictly specified quantities and precisely on time when the given company needs them, which makes it possible to minimise the costs of inventory and reduces waste in the logistic system.", lean-management.pl/just-in-time/, accessed on 10.09.2020*

transport time, accessibility of the infrastructure or possibility of monitoring the consignments.

Figure 1. *Supply factors indicated by the respondents, which affect modal shift from road to rail transport.*



Source: *Own study.*

As for the demand factors, all the respondents unanimously decided that the factor with the greatest influence on modal choice was the recipient's or supplier's geographical location. The additional factors also included the location in relation to a seaport or another point of intermodal transhipment. One of the respondents pointed out that in their case there would be significant costs of using intermodal

solutions: even though the road transport time will decrease, the transhipment time will increase. Thus, there would be not much difference between road transport alone and the transport involving a modal shift. At the same time, the owner of the means of transport would earn less.

As for the question about the conditions on which the given cargo shipper or forwarder would agree to shift the cargo or its part from road to rail transport, first it was necessary to specify whether the given enterprise at all considered rail transport as an alternative to road transport. In reply to this question, most surveyed companies declared that rail transport could not be an alternative to transport organised by them. At the same time, the declarations may be related directly to the percentage share of the use of intermodal transport technologies in the total transport volume of a given enterprise. The companies which declared using intermodal transport which accounted for 10–20% of their total transport volume, in reply to this question also declared that rail transport was a real alternative. As part of the survey, the respondents were asked to provide the detailed reasons for the answer given. The surveyed enterprises which declared that for them rail transport was not an alternative to road transport, indicated the following factors as the impediments to using rail transport:

- rail carriage services are infrequent and not punctual,
- long transport time,
- high cost,
- no interest in making use of alternative forms of transport, which is mainly due to the conviction that intermodal transport is less cost-effective for a given enterprise.

In the case of providing an answer indicating that rail transport is a viable alternative to road carriage for the given enterprise, the next question specified the conditions which would have to be met in order to increase the share of rail haulage in the total transport volume. The respondents pointed out to the poor rail infrastructure, total transport process duration, a small number of connections and transhipment points. One of the respondents also indicated that in the case of combining rail and road haulage the rate per km of the road transport should be increased so as to compensate the loss resulting from using the rail (which results from the reduced quantity of kilometres covered with road transport). In favourable conditions, i.e. when the criteria identified by the individual enterprises are met, the respondents declared that even up to 50% of cargoes could be shifted to rail transport. An exception was one of the respondents who was not interested in shifting any cargoes to rail transport (even when the option involved rail haulage of the whole road vehicle combination).

The last part of the survey regarded the influence of COVID-19 on choosing the means of transport in land carriage. The first question asked to the individual respondents was whether the COVID-19 pandemic has/had an impact on choosing

the means of transport (for the given enterprise). Replies to this question, upon an in-depth analysis, may be connected with the enterprise size and the kind of cargoes; however, most interviewees responded that the pandemic did not affect their decisions on choosing the means of transport. In the case of the enterprises which declared some connection between the COVID-19 pandemic and the choice of the transport mode, they indicated increased use of rail haulage, which at the same time led to decreasing the general possibility of applying it (due to the limits connected with available means of transport). Also, they mentioned the increased prices of air freight.

The next question referring to the pandemic was related to its impact on the surveyed enterprise (What steps did the company take in connection with the pandemic?) and the possibility of changing the customers' preferences in view of the pandemic-related constraints. In this case, the respondents were actually of the same opinion that the customers' preferences had not changed, only some companies had pressed on reducing the prices of transport services. Each company that took part in the survey had introduced a sanitary regime and – to a partial or full extent – telework. Another question pertained to the possibility of changing the transport mode when providing transport services after the pandemic has ceased, following up the steps taken during the pandemic. Only one enterprise among the surveyed ones considered an increase in the volume of rail transport after the pandemic ceases.

The last question regarded a possibility of accelerating the process of unitising subsequent cargo groups that so far had been transported largely conventionally, and also an indication to which mode of transport such cargoes would gravitate. None of the surveyed companies found that conventional cargoes were unitised to a larger extent in the course of the pandemic. Simultaneously they thought that, in general terms and despite numerous constraints, transport of containerised cargoes would be gravitating towards rail haulage, mainly due to political reasons.

5. Conclusions, Proposals, Recommendations

The previous studies on this topic found that the main factors determining the modal change were, inter alia, total cost and transport time. Based on this survey which involved the in-depth interview method it is possible to conclude that it is not the transport time, but predominantly its punctuality that is the major factor (in addition to cost) in modal choice. This distinction is important, as it determines the specific way of organising the transport (e.g. just-in-time) and calls for its reliability rather than speed. The respondents also voiced a conviction that using intermodal transport meant higher costs, which however was not supported by evidence. This means that there was not enough information available, which was also found in the previous studies.

The enterprises operating in this area have also indicated numerous impediments related to shifting cargoes to rail transport. These include:

- poor quality of railway infrastructure,
- high costs,
- too few transhipment points on the routes,
- too low frequency of services,
- long-time of intermodal transhipment,
- shortages in terms of quantity and adaptability of means of transport.

The described impediments are the core reasons for failing to implement a modal shift among the surveyed enterprises. Only an improvement of rail transport quality in the indicated areas would make it possible to consider any possibility of shifting cargoes from road transport. As for effects of COVOD-19 pandemic, the surveyed enterprises showed its impact was non-existing or negligible when it comes to a modal shift. At the same time, the respondents reported that the total transport volumes decreased by 30% during the lockdown, however, the differences varied depending on the served economy sector (one of the respondents had a 300% increase in transport of building materials); it was also found that following the opening of the economy the number of transport services was being restored to the previous level, and in the case of western Europe the difference was smaller even during the major lockdown, so it came back to normal faster than in Poland.

The identified impediments could be overcome via implementation of national and regional programmes for improving the infrastructure quality, construction of new transhipment points on rail routes, and also increasing the quantity and quality of the existing rolling stock. At the same time, it would be necessary to provide more incentives for smaller enterprises in order to incline them to expand their knowledge about modal shift and consequently make use of it. According to the research results, for best results the incentives should take a financial form, e.g. reduction of corporate income tax for companies that apply intermodal transport to a specific percentage level (in relation to the total transport volume carried out in the enterprise).

References:

Behrends, S. 2017. Burden or opportunity for modal shift? – Embracing the urban dimension of intermodal road-rail transport. Transport Policy, 59, 10-16.

Bouchery, Y., Fransoo, J. 2015. Cost, carbon emissions and modal shift in intermodal network design decisions. International Journal of Production Economics, 164, 388-399.

Council Directive 92/106/EEC of 7 December 1992 on the establishment of common rules for certain types of combined transport of goods between Member States, L368/38.

Danielis, R., Marcucci, E. 2007. Attribute cut-offs in freight service selection. Transportation Research Part E Logistics and Transportation Review, 43(5), 506-515.

European Comission. 2001. White Paper. European transport policy for 2010: time to decide. COM(2001) 370 final.

European Comission. 2011. White Paper. Roadmap to a Single European Transport Area –

Towards a competitive and resource efficient transport system. COM (2011) 144 final.

European Comission. 2019. Statistical Pocketbook. EU Transport in Figures. Available at: https://ec.europa.eu/transport/facts-fundings/statistics/pocketbook-2019_en

Eurostat. 2018. Modal shift potential of long-distance road freight in containers. Available at: https://data.europa.eu/

Kotowska, I., Mańkowska, M., Plucński, M. 2020. The Decision Tree Approach for the Choice of Freight Transport Mode: The Shippers' Perspective in Terms of Seaport Hinterland Connections. European Research Studies Journal, 23(3), 431-444.

Kurtulus, E., Cetin, I.B. 2020. Analysis of modal shift potential towards intermodal transportation in short-distance inland container transport. Transport Policy, 89, 24-37.

Larranga, A., M., Arellana, J., Senna, L.A. 2016. Encouraging intermodality: A stated preference analysis of freight mode choice in Rio Grande do Sul. Transportation Research Part A: Policy and Pratice, 102, 202-211.

Macharis, C., Vanhaverbeke, L., van Lier, T., Pekin E., Meers, D. 2012. Bringing intermodal transport to the potential customers: An interactive modal shift website tool. Research in Transportation Business & Management, 5, 67-77.

Nugroho, M.T., Whiteing, A., de Jong, G. 2016. Port and inland mode choice from the exporters' and forwarders' perspectives: Case study — Java, Indonesia. Research in Transportation Business & Management, 19, 73-82.

Pastori, E., Brambilla, M., Maffi, S., Vergnani, R., Gualandi, E., Dani, E. 2018. Modal shift in European transport: a way forward. STUDY Requested by the TRAN committee. European Parliament.

Pizzol, M. 2019. Deterministic and stochastic carbon footprint of intermodal ferry and truck freight transport across Scandinavian routes. Journal of Cleaner Production, 244(1), 626-636.

Slimecek, M., Dufek, J. 2016. A Freight Modal Shift Model for Slovakia. Transportation Research Procedia, 14, 2814-2819.

Szaruga, E., Skąpska, E., Zaloga, E., Matwiejczuk, E. 2018. Trust and Distress Prediction in Modal Shift Potential of Long-Distance Road Freight in Containers: Modelling Approach in Transport Services for Sustainability. Sustainability, 10(7), 1-19.

Tao, X., Wu, Q., Zhu, L. 2017. Mitigation potential of CO2 emissions from modal shift induced by subsidy in hinterland container transport. Energy Policy, 101, 265-273.

Tsamboulas, D., Vrenken H., Lekka, A.M. 2007. Assessment of a transport policy potential for intermodal mode shift on a European scale, Transportation Research Part A Policy and Practice, 41(8), 713-733.

Woodburn, A.G. 2003. A logistical perspective on the potential for modal shift of freight from road to rail in Great Britain. International Journal of Transport Management, 1(4), 237-245.