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FREIGHT TRANSPORT MODE CHOICE WITH STATED PREFERENCE METHOD: A SYSTEMATIC LITERATURE REVIEW

Gökçe Tuğdemir Kök[*1], Durmuş Ali Deveci[2]

[1] Dokuz Eylul University, Maritime Faculty, Maritime Business Administration Department, Izmir, Turkey
ORCID ID: 0000-0002-9642-3985
gokce.tugdemir@deu.edu.tr

[2] Dokuz Eylul University, Maritime Faculty, Maritime Business Administration Department, Izmir, Turkey
ORCID ID: 0000-0001-8348-073X
adeveci@deu.edu.tr

* Corresponding Author
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ABSTRACT
Modeling transport choice is one of the most important components of transportation analysis since it determines the parties to be involved, the resources to be used and the impact made on the environment. Many different techniques have been used to analyze choice modelling. As a principle, all choice modelling techniques suppose that goods/services can be defined in terms of their characteristics or attributes and the levels. In the stated preference methods, decision makers evaluate and decide on the multi-attribute and mutually exclusive alternatives they prefer. The aim of this study is to analyze the studies that use the stated preference method in transport mode choice in terms of transportation modes, study area, decision-makers, decision variables and general findings. The research points of this study is the identification of the most appropriate, scientifically (objectively) derived variables for use in the stated preference experiment of freight route/mode choice. This study carries out globally in terms of different variables provide novelty as it complements the limited number of studies most of which have involved only certain limited geographical areas. For this purpose, a systematic literature review method has been conducted for freight mode choice using "stated preference method". A systematic literature review from relevant academic studies has indicated such transportation choice variables through as transport time, transport cost, transport mode, flexibility, frequency, reliability, risk of delay/punctuality, risk of loss and damage and service quality. To analyze the freight transport choice, discrete choice experiments which are one of the stated preference techniques have been the most preferred methods. According to literature review, most effective variables in choosing freight transport mode are transport cost, transport time and reliability. This study is important in terms of providing an insight to academicians, practitioners and policy makers by analyzing attributes, types of stated preference models, theories, analysis methods and findings of academic articles about freight mode selection with stated preference methods. Additionally, it has been found that the features involved as effective variables in the preferred freight route / mode selection experiments indicated are most strongly confirmed by applying more mechanical, more easily and less subjective applied approaches to the literature review.

Keywords: *Freight Forwarders, Freight Transportation, Mode Choice, Shippers, Stated Preference*

1. INTRODUCTION

The transportation system is an organization that designs, plans, organizes and describes the movement of goods by considering the technical constraints in which the goods are transported from the point of origin to the destination by using loading units such as motor vehicles and pallet-containers (Khooban et al., 2011). Freight transportation is as "the movement of goods from one area to another" (National Academies of Sciences, Engineering, and Medicine, 2011). Another definition highlights as a main part of supply chain and all logistics systems (Ranaiefar and Regan, 2011). Intermodal transport in the field of logistics and transportation is growing rapidly as a new transportation market and has begun to form the basis of transportation policies of many countries, especially the European Union, United States and Far East countries (Deveci, 2010). Freight transport selection or decision making on carrier or mode to use from the view point of transportation service users has been an important research area in the literature (Denktaş Şakar, 2010). Mode selection and decision variables are two closely related issues (Köfteci, 2008: 43).

The primary freight transportation modes are road, rail, sea, air and pipeline (National Academies of Sciences, Engineering, and Medicine, 2011). Railway is the second low cost type of transportation preferred for large volume and long distance transportation. This type of transport, which is adopted and preferred as environmentally friendly, is particularly preferred for the transport of low value goods. The most convenient mode of transport for door-to-door transport is by road. It is the most widely used mode due to its wide range of transportation networks. Pipeline is a type of transport used for the movement of energy sources such as crude oil, natural gas and gasoline, where the risk of loss, damage and flexibility is low. The airline, which has the most advantageous position in terms of transportation time, is the most expensive mode of transportation compared to all types of transport. Despite its high reliability, it is not a flexible transport type. Seaway is the lowest cost transportation mode in terms of price. However, it is disadvantageous in terms of long transport times and low flexibility (Gourdin, 2006; Akay, 2016).

After the describing of the cargo and destination, exporter determines selection criteria in terms of transport mode and carrier and later they analyze and choose company for transportation. The exporters' decisions can be divided into "mode selection" and "carrier selection" (Tuna and Akarsu, 1999). The choice of transport mode is the outcome of the relationship between the attributes of the transport service and the nature of the product being transported and also the relationship between the buyer and the seller of the product (Gray and Kim, 2001; 37). It is very important to determine the mode of transportation that will provide services with minimum cost and maximum service quality for a certain route in freight forwarding (Krapfel ve Mentzer, 1982, Köfteci, 2008). According to McKinnon (1989), transport mode choices in freight transport are related to service (speed, reliability, cost etc.), traffic (length of haul, dimensions, value etc.) and consignor (size of firm, investment priorities etc.).

According to Golias and Yannis (1998), parameters affecting the choice of freight transportation are performance parameters (transportation time, reliability, frequency and capacity limits), cost parameters (price and credit contracts), service quality (loss and damage rate and management, communication, customer distribution and transportation services and planning flexibility) and general parameters (government interventions, company structure and organization and existing transport facilities).

Mode choice decision variables in literature are generally transport cost (Gilmour, 1976; Burdg and Daley, 1985; Pederson and Gray, 1998; Jovicic, 1988; Bolis and Maggi, 1998; Shingal and Fowkes, 2002; Garcia-Menendez et al., 2004; Patterson et al., 2006; Feo et al., 2016; Duan et al., 2017 etc.), transport time (Saleh and Das, 1973; Coyle et al., 1996; Jovicic, 1988; Bolis and Maggi, 1998; Shingal and Fowkes, 2002; Gubbins, 2003; Patterson et al., 2006; Feo et al., 2016; Duan et al., 2017 etc.), services (Krapfel and Mentzer, 1982; Matear and Gray, 1993; Murphy and Hall, 1995; Shingal and Fowkes, 2002 etc.), flexibility (Jovicic, 1988; Bolis and Maggi, 1998; Duan et al., 2017 etc.), frequency (Jovicic, 1988; Bolis and Maggi, 1998; Shingal and Fowkes, 2002; Feo et al., 2016; Duan et al., 2017 etc.), reliability (Shingal and Fowkes, 2002; Patterson et al., 2006; Duan et al., 2017 etc.), security (Bardi, 1973; Jovicic, 1988; Noda, 2004; Patterson et al., 2006; Duan et al., 2017 etc.) etc.) and route (Hayuth, 1987; Cullinane and Toy, 2000; Banomyong and Beresford, 2001 etc.) related factors. Transport cost refers to the charge for door-to-door transport. Reliability is the ability to comply with the promised delivery date. Flexibility can be defined as the ability to adapt to changing customer needs and conditions. The transport time is the duration of the entire transport process (door-to-door). Security is the possibility of preventing the loss of quality and damage of goods (Vannieuwenhuyse et al., 2003: 128).

2. STATED PREFERENCE

Many different techniques have been used to analyze choice modelling. As a principle, all choice modelling techniques suppose that goods/services can be defined in terms of their characteristics or attributes and the levels that these take. The focus is on the values given to these qualities (Competition Commission, 2010). Stated preference method is a theoretical method. It provides many advantages if designed correctly. For this purpose, the questionnaires representing the stated preference experiment should be in detail in accordance with the subject under investigation. Factors affecting the demand should be evaluated at the beginning. The differences between the proposed alternatives should not be small. There should be significant differences between them (Fowkes and Tweddle, 1988).

Choice modelling techniques with stated preference can be classified into five categories, which reflect differences in analysis methods, theoretical assumptions and procedures of experimental design (Adamowicz and Boxall, 2001, Bateman et al., 2002, Kjaer, 2005): "Contingent ranking", "discrete choice or stated choice experiments", "paired comparisons", "contingent rating", and "best-worst scaling" (BWS) (Finn and Louviere, 1992 and Flynn et al., 2007). In "discrete choice experiments" (DCEs), participants choose one of

two or more alternatives offered. In a "contingent ranking" exercise, participants should rank all proposed alternative options by their preference. In a "contingent rating" experiment, participants are presented one alternative at every turn and are asked to rate each on a semantic or numerical scale (for example low preference - high preference, 1-10). In "pairwise comparison" exercises, participants are asked to choose their preferred alternative from two options. The selected alternative is also expected to be explained numerically or semantically (Competition Commission, 2010). In "the best-worst scale" (BWS) approach, participants are asked to specify two preferred endpoints, given a single set of qualifications, which is considered to be the best and worst feature (Wittenberg et al., 2016).

Stated choice experiments are based on behavioral theories. There are "Social Judgement Theory" (Brunswick 1952; Hammond 1955), "Lancaster's consumer theory" (Lancaster, 1966), "Information Integration Theory" (IIT) (Anderson 1970), "Hierarchical Information Integration" (HII) Theory (Louviere, 1984) and "Random Utility Theory" (Thurstone 1927; McFadden 1974; Manski 1977; Shingal, 2002).

The researchers who have an advantage for using stated preference method to analyze mode selection have controlled over the qualifications and manipulated selection sets. The researchers have also analyzed how choices may change when if the composition or size of the selection changes (Witlox and Vandaele, 2005). The stated preference modelling technique has also mentioned some limitations. Firstly, selection experience has been difficult to perform and survey design has been serious to achievement. Secondly, stated preference models are based on hypothesis that decision making under semi-laboratory circumstances is interested in the real world. In this case, the selection or selection specified may not compromised very closely to the essential preferences or the selection (Daniels, 2002).

3. METHODOLOGY

The method used in this study, Systematic Search Procedure has been developed by Kitchenham (2004) and later adapted by Bacca (2014), which divides the process into planning, conducting the review, and report the review. This procedure requires several sub-stages, *"it starts with a set of search words and the scientific thesaurus, a search semantic structure, search script adapted to each database, a specific process of selection of studies and a list with the search results as a variable resulting from this procedure"* (Torres-Carrion et al., 2018).

In literature, there are a lot of studies in urban and travel transportation using stated preference method for the transport mode selection; Hartgen (1974), Hensher (1994), Alpizar and Carlsson (2001), Koppelman and Bhat (2006), Van der Waerden, et al. (2007), Catalano et al. (2008), Pavlyuk and Gromule (2010), Richter and Keuchel (2012), Bando et al. (2015), Anciaes et al. (2018), Wu et al. (2019). This study has focused freight transportation mode selection with stated preference method.

In this study, a general framework has been drawn by analyzing the attributes, types of stated preference models, theories, analysis methods and findings of academic articles about freight mode selection with stated preference methods.

The databases used in this literature review, conducted in October 2019, are Scopus, Web of Science, ScienceDirect and Taylor & Francis. The review has covered the "titles, "keywords" and "abstracts" (Table 1).

Table 1. Search terms used and amount records received from databases.

Search terms (Transport OR freight OR multimodal OR intermodal OR multimodal) AND "stated preference"
Limit to Journal (maritime OR shipping OR logistics OR transport OR transportation)
and not Public OR tourism OR traveler OR city OR urban OR passenger

The search strategies presented by the specific search strings have been formulated according to the search logic of each database, but containing the same terminology. Only the journals containing such words phrases as maritime, shipping, logistics, transport and transportation words are examined. Journal names, number of articles and impact factor are given in Table 2.

Table 2. Detailed information about journals in which the articles in the search results

Journal name	**No of Articles**	**Impact Factor in 2018**
Transport Reviews	1	.648
Transportation Research Part E: Logistics and Transportation Review	3	.253
Transportation Research Part A: Policy and Practice: An International Journal	2	.693
Transportation	1	.457
Transport Policy: Journal of the World Conference on Transport Research Society (WCTRS)	2	.190
International Journal of Sustainable Transportation	1	.586
Research in Transportation Business & Management	1	.065
Transportation Planning and Technology	2	.893
Journal of Transport Economics and Policy	1	.857
Transportation Research Board	1	.695
Maritime Policy Management	3	.4
Transportation Research Procedia	3	
Total	**21**	

The review has comprised research articles only and shippers and freight forwarders as decision makers. . The freight forwarders and shippers' selection allows to set light to market segment, which makes up more than fifty of the transport decisions (Bergantino and Bolis,

2008). After the rigorous screening and eligibility evaluation of titles, abstracts, and keywords, finally 21 studies are identified as eligible for the final synthesis; 9 of 21 studies have chosen shipper as decision makers, freight forwarders have been chosen as decision makers in 9 of 21 studies and studies have chosen both freight forwarders and shippers as decision makers.

4. ANALYSIS

Having identified 21 studies as eligible for the final synthesis, decision makers, research area, stated performance methods variables (modes of transport, attributes and number of alternatives) are given in detail in Table 3. As a result of literature review, the most used attributes considered in stated preference methods are "transport time", "transport cost", "frequency", "reliability", "risk of delay/punctuality", "risk of loss and damage", "flexibility" and "service quality" (Table 4).

Choice modelling techniques with stated preference can be classified into five categories; "contingent ranking", "discrete choice or stated choice experiments", "paired comparisons", "contingent rating" and "best-worst scaling" (BWS). 10 of 21 studies have used discrete choice experiments as stated preference techniques (Patterson et al. (2016), Daniels and Marcucci (2007), Arunotayanun and Polak (2011), Feo et al. (2011), Arencibia et al. (2015), Feo-Valero et al. (2016), Nugroho et al. (2016), Duan et al. (2017), Larranaga et al. (2017) and Vega et al. (2018). Shingal and Fowkes (2002), Witlox and Candaele (2005), Beuthe and Bouffioux (2006), Li and Hemsher (2012) and Simecek abd Dufek (2016) have used contingent ranking techniques to analyze transport mode choice. Vermeiren and Macharis (2016) have used paired comparisons techniques for choice modelling. The other studies in sample (Bergantino and Bolis, 2008; Norojono and Young, 2012; Bergantino et al., 2013; Regmi and Hanaoka, 2015 and Kim et al., 2017) have used contingent rating. To analyze the transportation mode selection variables with
stated preference method, studies have generally used logit models such as mixed logit model, Tobit mixed logit model, nested logit model, mixed nested logit model.

Studies using the stated preference method in the selection of mode of transportation are generally based on the "Random Utility Theory" and "Hierarchical Information Integration (HII) Theory". Studies which based on "Random Utility Theory" are Witlox and Candaele (2005), Beuthe and Bouffioux (2006), Daniels and Marcucci (2007), Bergantino and Bolis (2008), Arunotayanun and Polak (2011), Feo et al. (2011), Li and Hemsher (2012), Arencibia et al. (2015), Regmi and Hanaoka (2015), Nugroho et al. (2016), Simecek abd Dufek (2016), Duan et al. (2017), Kim et al. (2017), Larranaga et al. (2017) and Vega et al. (2018). Patterson et al. (2006), Norojono and Young (2012) and Bergantino et al. (2013) have predicated on "Hierarchical Information Integration (HII) Theory".

The articles are given in chronological order according to the type of decision makers which are only shippers, only freight forwarders and both shippers and freight forwarders.

4.1. Studies Involving Shippers Only

Studies in which shippers have been selected as decision makers; Danielis and Marcucci (2007), Arunotayanun and Polak (2011), Li and Hensher (2012), Arencibia et al. (2015), Feo-Valero et al. (2016), Vermeiren and Macharis (2016), Duan et al. (2017), Kim et al. (2017) and Vega et al. (2018).

According to Danielis and Marcucci (2007), the quality of loss and damage is the most affected; it is followed by cost, transport/transit time and late arrivals. In the area of acceptability, cost appears to be the most relevant feature; this is followed by loss and damage, transport/transit time, flexibility, frequency and late arrivals. The minimum requirements for transport services are quite stringent, particularly with regard to late arrivals, losses and damages and costs. There seems to be some flexibility with respect to transport/travel time. These results should be of interest to both intermodal service providers and policy makers.

Arunotayanun and Polak (2011) have based "stated preference method" to investigate taste heterogeneity influencing 186 shippers' mode choice behavior in Java, Indonesia. They have focused various commodity groups; leather, food, electronic and textile. Shippers of food are sensitive to both time and cost (by large truck) and shippers of textile are sensitive only to transport/travel time (by large truck). Shippers of food and leather pay attention to more frequent shipments so they have preferred small truck for transportation. According to results of this study, variables related to cargo, value and frequency are coherently significant.

Li & Hensher (2012) has identified a theoretical framework that brings about integration risk manners into modelling of freight behavior and places particular emphasis on convent variable of travel/transport time. They have used stated preference technique with random utility maximization for 35 shippers in Switzerland. Transport modes are road, piggyback, and combined transport. Shippers and transporters are liable to take risks when making risky choice about travel/transport time, but transporters are more risky than shippers.

Arencibia et al. (2015) have analyzed freight transport demand in a context of model choice. They have implemented stated preference survey through 93 shippers between Spain and continental Europe. The actions with the greatest effect on deviation of traffic to modes of alternative are those that influence the transportation cost.

Feo-Valero et al. (2016) have analyzed attribute cut-offs through a stated preference experiment in Aragon and Valencia with 94 shippers. The attributes have been transit time, door-to-door transport cost, frequency, delay and notice for contracting with two alternative modes (road and rail) using 12 alternatives scenarios. The results of the transport cost variable show that decision-makers strongly penalize the raises above the cut in transport costs. Regarding delays, the insignificance of coefficients when introducing quality cuts indicates that decision makers do not consider this variable in the modal selection process. For the frequency variable, the results obtained indicate the presence of extremely polarized positions; this highlights the traditional specifications weaknesses that averages extreme positions and leads to erroneous subjective values. Ignoring the presence of segments

Table 3. Literature Review on the Freight Transport Mode Selection through Stated Preference Method

Authors	**Decision Maker**	**Area**	**Modes of Transport**	**Attributes Considered in Stated Preference**		**Number of Alternatives**
Shinghal and Fowkes (2002)	32 Freight Forwarders	Delhi to Bombay corridor, India	Road Intermodal container Rail	Time Services Cost	Reliability Frequency	21
Witlox and Vandaele (2005)	88 Freight Forwarders and Shippers	Antwerp and Ghent Port Areas in Belgium	Road Rail Inland Short sea shipping Inter and multimodal	Cost Time Loss and damage	Frequency Reliability Flexibility	25
Beuthe and Bouffioux (2006)	113 Freight Forwarders	Belgium	Road Rail Inland navigation	Frequency Time Reliability	Flexibility Loss Cost	25
Patterson et al. (2006)	392 Freight Forwarders	Ontario and Quebec	Road Rail	Cost Reliability	Risk Time	18
Danielis and Marcucci (2007)	99 Shippers	Italy	Road Intermodal	Transport cost Door-To-door transit time Late arrivals	Loss and damage Flexibility Frequency	3
Bergantino and Bolis (2008)	16 Freight Forwarders		Road Maritime Ro-Ro	Price Time	Reliability Frequency	4
Arunotayanun and Polak (2011)	186 Shippers	Java, Indonesia	Road Rail	Cost Time	Service quality Flexibility	3
Feo et al. (2011)	45 Freight Forwarders	Spain	Road Maritime	Transit time Transport cost	Reliability Frequency	9
Li and Hensher (2012)	35 Shippers	Switzerland	Road	Transport price Damage	Time Punctuality	2
Norojono and Young (2012)	186 Freight Forwarders	Java, Indonesia	Rail Road	Transport cost Delivery time	Quality Flexibility	16

Table 3. Literature Review on the Freight Transport Mode Selection through Stated Preference Method (continued)

Authors	**Decision Maker**	**Area**	**Modes of Transport**	**Attributes Considered in Stated Preference**		**Number of Alternatives**
Bergantino et al. (2013)	92 Freight Forwarders	Sicily	Road Road with transshipment Road–sea(Ro-Ro)	Cost Time Punctuality	Risk of loss/damage Frequency	16
Arencibia et al. (2015)	93 Shippers	Madrid	Road-sea-road Road-rail-road Road-air-road	Cost Transit time	Punctuality Service frequency	18
Regmi and Hanaoka (2015)	10 Freight Forwarders	Laos and Thailand	Road Rail	Time Cost	Reliability Co2	3
Feo-Valero et al. (2016)	94 Shippers	Aragon and Valencia	Road Rail	Transport cost Transit time Frequency	Delays Notice for contracting	12
Nugroho et al. (2016)	161 Shippers and Freight Forwarders	Java, Indonesia	Road Rail	Cost Time	Frequency	4
Simecek and Dufek (2016)	51 Freight Forwarders	Slovakia	Road Rail	Cost Per One Shipment	Transport Time Reliability	4
Vermeiren and Macharis (2016)	32 Shippers	Rhine(Antwerp)-Scheldt (Rotterdam) delta	Rail Barge	Total cost CO2 emission	Frequency	16
Duan et al. (2017)	83 Shippers	Southwest area of China	Rail	Transport cost Transport time Service frequency	Service reliability Service safety	4
Kim et al. (2017)	190 Shippers	New Zealand	Road Rail Coastal	Size of shipment Cost	Reliability Distance – Time	18
Larranaga et al. (2017)	50 Shippers and Freight Forwarders	Rio Grande Do Sul	Road Intermodal Rail Intermodal Waterway	Transport cost Transport time	On-time delivery percentage Percentage of deliveries delayed	3
Vega et al. (2018)	49 Shippers	Ireland	Landbridge UK Direct	Cost Transit Time Probability Of Delays	Delays Duration Service Frequency	12

Table 4. Literature Review on the Most Often Used Attributes/Variables in the Transport Mode Selection through Stated Preference Method

Variables	Shinghal & Fowkes (2002)	Witlox and Vandaele (2005)	Beuthe & Bouffioux (2006)	Patterson et al.,(2006)	Danielis & Marcucci (2007)	Bergantino & Bolis (2008)	Arunotayanun & Polak (2011)	Feo et al. (2011)	Li & Hensher (2012)	Norojono & Young (2012)	Bergantino et al. (2013)	Arencibia et al. (2015)	Regmi & Hanaoka (2015)	Feo-Valero et al. (2016)	Nugroho et al. (2016)	Simecek & Dufek (2016)	Vermeiren & Macharis (2016)	Duan et al. (2017)	Kim et al. (2017)	Larranaga et al. (2017)	Vega et al. (2018)
Transport cost	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Transport time	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Frequency	✓	✓	✓		✓	✓		✓			✓	✓		✓	✓		✓	✓	✓		✓
Flexibility		✓	✓		✓		✓												✓		
Reliability	✓	✓	✓	✓		✓		✓					✓			✓		✓			
Risk of loss and damage		✓	✓	✓	✓				✓		✓										
Risk of delay / Punctuality					✓				✓	✓	✓	✓	✓	✓						✓	✓
Service quality	✓						✓			✓											

with polarized values and / or segments of the population may lead to erroneous results in terms of actual rail possibilities for withdrawing the quota from the road.

Vermeiren and Macharis (2016) have investigated the preferences of 32 shippers for intermodal land transportation and port choice in Rhine-Scheldt delta. They have used total cost, CO2 emission and frequency as variables for rail or barge transportation choice with stated preference method. The most striking results of this study are that the shippers have not interchanged their preferences when the names of the applicable maritime gateways are indicated. Shippers in the Delta have no particular choices preference for Antwerp or Rotterdam. Costs are the best solution for shippers. Maritime route, the trade flow direction, and type of mode haven't affected the choice behavior.

Duan et al. (2017) used 4 options in stated preference with logit model and latent class model. Road, rail and waterway have been used as transport mode alternatives. Transport cost, transport time, frequency, reliability and safety are used as transport choice variables. The finding of this study shows that quality attributes are more preferred than price attributes by railway shippers. A literature review through relevant academic studies has indicated the following transportation choice variables such as transport time, transport cost, transport mode, flexibility and frequency.

Kim et al. (2017) have used stated preference technique for 190 shippers in New Zealand. Transport modes are road, rail and coastal. Their attributes are size of shipment, cost, and reliability and time. According to the findings, policy makers can design more favorable strategies and policies for various segments of the population to provide intermodal transport and captivate the largest latent class. Additionally, the stated preference method specifies that the potential development in modal shift, which can be procured by implementing various policy options, varies with both shipment size and distance of transport. Furthermore, in order to support sustainable freight transport, a policy would be to raise the reliability of both the maritime freight transport and rail services.

Vega et al. (2018) have used stated preference method for maritime freight transport mode choice from Ireland to continental Europe with 49 shippers as decision makers. The attributes considered in stated preference have been transport cost, transit time, probability of delays, delays duration and service quality with two alternatives modes. Changes in costs are more effective in moving from the UK land bridge route to the direct continental option. In addition, there is a greater sensitivity to the deterioration in the cost of UK land bridge transport, directly from the further developments in the cost competitiveness of direct continental services. For this reason, transport policy aims to increase the use of direct routes as a mechanism to decrease dependence on the UK land bridge. Transport policy should also focus on enhancing the transit time - service, delays and frequency of the direct alternative. Similarly, any increase in the cost of road bridge roads will further affect the possibility of using a direct road from any policy aimed at decreasing the direct terrestrial road alternative costs.

4.2. Studies Involving Freight Forwarder Only

Studies in which freight forwarders have been selected as decision makers; Shinghal and Fowkes (2002), Beuthe and Bouffioux (2006), Patterson et al. (2006), Bergantino and Bolis (2008), Feo et al. (2011), Norojono and Young (2012), Bergantino et al. (2013), Regmi and Hanaoka (2015) and Simecek and Dufek (2016).

Shinghal and Fowkes (2002) have carried out an empricial survey on the significatives of mode choice for freight in India. Road and rail have been used as modes of transport in 32 companies on the Delhi to Bombay corridor. Time, services, cost, reliability and frequency are used as mode selection variables. Service frequency is an significant attribute to determine mode choice. Reliability valuation is generally lower than expected. Time value is quite similar across different product segments. Given prevailing costs, the results offer that intermodal services can be viable for high value and finished goods.

According to Beuthe and Bouffioux (2006)'s study, different qualitative factors play an essential and differentiated roles in the transport solution choice and their relative importance and values vary according to the firm and transport categories, as well as their willingness to change modes.

The findings of Patterson et al. (2006)'s study has developed first model for the Quebec City Windsor Corridor in 2005. These shipments were made by rail. The results of the study show that freight forwarders are very insecure about using railways to transport their shipments, and the increasing share of rail transport faces increasing challenges.

Bergantino and Bolis (2008) have constructed freight forwarders' preferences toward the maritime ro-ro transportation with attributes related to cost, reliability, frequency and time. The result of this study emphasizes the relative significance of frequency and reliability for decision of freight forwarders mode selection and modal shifts to maritime services.

Feo et al. (2011) aim to promote to the effective freight transport policy design through empirical analysis. Stated preference method has been used for mode choice between short sea transport and door-to-door road transport on the Motorway of the south-west European Sea in 2006 with 45 freight forwarders from five Spanish states (Barcelona, Zaragoza, Valencia, Murcia and Madrid). According to findings of this study, *"the percentage change in the probability of choosing the maritime intermodal alternative has been calculated when faced with variations in both own cost, transit time, reliability and frequency as well as that of the road alternative"*. Decision makers are more susceptible to changes in the service levels offered by the alternative mode in the case of reliability, as in transport costs, than in maritime mode. In the meantime, the possibility of choosing the intermodal maritime alternative is more sensitive tondevelopments in its transportation time than possible changes in the transition time in alternative mode. Cost policies have the greatest impact on the possibility of choosing the maritime alternative.

Norojono and Young (2012) have described the development of a discrete mode selection model applicable to a data collection approach and analysis of

transport company decision making. It focuses on railway and road selection in Java, Indonesia. The model demonstrates that reliability, responsiveness snd safety are the main characteristics that influence rail / road freight mode selection. In order to improve these dimensions, transport policies should raise the railway transportation attractiveness.

According to Bergantino et al. (2013), road transportation is preferred by freight forwarders who attach substantial to the risk of loss/damage. However, it was not preferred by freight forwarders who care about punctuality. Larger companies pay less attention to time but paid more attention to the risk of loss and damage if shipments are not frequent. Service reliability and cargo type significantly affect the choice of freight forwarders.

Stated preference survey includes questions about time, cost, reliability/punctuality, and CO2 emissions for transport by rail and road, and whether or not the freight forwarders would change to choose a mode. The flexibility and scenario analysis shows the variety modes considered. Finally, the changes in the possibility of the maritime intermodal alternative choosing has been estimated when faced with variations in both own cost, frequency, transit time and reliability as well as that of the road alternative (Regmi and Hanaoka, 2015).

Simecek and Dufek (2016) have conducted a survey through freight forwarders on freight preference in Slovakia. For each of the responsive tasks, mode, cost, travel time and reliability have passed the experiment of adaptive state preference where alternatives are characteristics. 51 freight forwarders have participated in the survey. It has been found that rail or road is not significantly preferred, but freight forwarders are resistant to changing the routine freight mode. Generally, the particular constant of the current mode of use has been found positive and almost thirty times greater than the value of time. This is a complex situation for the standard transport model shifts because it cannot be assigned to the alternative specific fixed specific transport mode equation. Moreover, the actual data on freight transport in Slovakia have different levels of accuracy. Very accurate and detailed information (commodity and values in origin-arrival pairs) is available for rail transport. On the other hand, there is a lack of information about land transport. This challenge allows to create a two-way split model for road and rail freight transport.

4.3. Studies Involving Both Shippers and Freight Forwarders

Studies in which both shippers and freight forwarders are involved as decision makers; Witlox and Vandaele (2005), Nugroho et al. (2016) and Larranaga et al. (2017).

The modes of transport considered have been rail, road, short sea transport, inland navigation and all combinations of inland and multimode. A total of 88 freight forwarder managers have participated. The study has 25 transport alternatives, each defined as six quality characteristics (cost, time, loss and damage, frequency, reliability, flexibility), and each with five levels. The stated preference experiment show that 11 alternatives are chosen over the status quo position. The respondents declare that they are ready to change modes of transport if alternatives are applicable (Witlox and Vandale, 2005).

Nugroho et al. (2016) have aimed to identify critical mode choice factors from shippers and freight forwarder's perspectives with stated preference method in Java, Indonesia. They have used cost, time and frequency as attributes considering in stated preference using road and rail transportation. Cost and time variables have negative affect to mode choice while reliability has affected positively the mode choice. According to the results of this study, fuel subsidies reduction for road transport and giving encouragements to decrease rail freight rates would ensure the most significant incentives to modal shift from road to rail transport.

Larranaga et al. (2007)'s study is concerned with the demand analysis for maritime freight transport services from Ireland to continental Europe. The purpose of the study is to procure empirical evidence on the determinants of route choice between the two alternatives: to the continent via the UK land bridge and directly to Europe without UK passage. They argue that investments to improve the reliability of intermodal alternatives are more effective than cost reductions in promoting intermodality. Policies and investments to promote multimodality should give priority to increased reliability of intermodal alternatives and combined policies of reliability and cost reduction.

5. CONCLUSION

Modeling transport choice is one of the most important components of transportation analysis. This paper presents and discusses the articles using stated preference method which is based on theoretical scenarios to route / mode choice literature in Scopus, Web of Science, ScienceDirect and Taylor & Francis databases and journals containing such terms as maritime, shipping, logistics, transport and transportation words. Mode selection and decision variables are two closely related issues. Many different techniques have been used to analyze choice modelling. In stated preference methods, decision makers evaluate and decide multi-attribute and mutually exclusive alternatives they prefer. In this study, a systematic literature review has been conducted for freight mode selection using stated preference method. The adoption of stated preference techniques in freight route/mode choice studies is in need of defining of the main modal attributes that affect these decisions. The research points of this study is the identification of the most appropriate, scientifically (objectively) derived variables for use in the stated preference experiment of freight route/mode choice. These variables will reflect, and emerge from, the dominant categories such as attributes, types of stated preference methods, basal theories, analyzing methods and general findings identified through the systematic literature review of a sample database of literature. This study carries out globally in terms of different variables provides novelty as it complements the limited number of studies most of which have involved only certain limited geographical areas.

There are many studies using stated preference method in academic literature. The aim of this study is to provide a general perspective for academicians, practitioners and policy makers by examining the

current academic studies. Thus, this study is important in terms of providing an insight to academicians for future studies by analyzing attributes, types of stated preference models, theories, analysis methods and findings of academic articles about freight mode selection with stated preference methods. From the point of view of policy makers and practitioners, this study suggest several things. First, transport cost should be the main concern of shippers and freight forwarders, since in all cases the cost factor is the most important. Secondly, transport time and reliability play a significant role in decision making, but their specific weights vary with the transports' characteristics and from one industry to another. This means that efforts and investments to promote specific modes should focus on markets where particular qualifications may be more valuable.

There are a lot of decision makers such as shippers, freight forwarders, shipping lines or carriers in the freight mode selection. This paper has used shippers and freight forwarders as decision makers. The freight forwarders and shippers' selection allows to set light to market segment, which makes up more than fifty of the transport decisions.

According to the systematic literature review, "transport time", "transport cost", "frequency", "reliability", "risk of delay/punctuality", "risk of loss and damage", "flexibility" and "service quality" use as the attributes considering the stated preference mostly. When the findings of the studies have been examined, it is concluded that the most effective variables in choosing freight transport mode are transport cost, transport time and reliability. To analyze the freight transport choice, discrete choice experiments which are one of the stated preference techniques have been the most preferred methods. Studies have generally based on Random Utility Theory developed by Thurstone (1927). Most of the studies in literature have been carried out with shippers and freight forwarders in Belgium and Indonesia.

A systematic literature review ensures a scientific basis and more logical for the justification of overall impact categories on freight mode choice decisions, as opposed to the more usual, ad hoc selection of attributes to be tested. Another result of this analysis is that the features that are the most effective variables in stated preference experiments of freight route/mode choice are most strongly confirmed by applying of the more mechanical, more easily approaches and less subjective to literature review.

In further research, studies using more than one mode could generally be scanned. Studies focusing only on one mode in future studies may also be included in the literature review. Besides, future studies could use any other mode selection methods other than the stated preference method used in this study. In further studies, articles may also be examined in terms of all decision makers. Furthermore, the future studies could expand the databases and journals only a few of which have been involved in this study.

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