
FACTORS THAT INFLUENCE A CHOICE OF AIRPORT BY FREIGHT FORWARDER: SERBIAN, CROATIAN AND SLOVENIAN MARKET

Danica Babić ^{a,*}, Milica Kalić ^a, Slavica Dožić ^a, Stefan Živojinović ^b

^a University of Belgrade – Faculty of Transport and Traffic Engineering, Belgrade, Serbia

^b Transfera Transport&Logistics, Belgrade, Serbia

Abstract: *Choice of airport is a crucial issue from freight forwarder point of view. In order to find optimal solution related to transport of shipment, it is necessary to identify factors that influence an airport choice. It is important to emphasize that airport can attract cargo airlines and freight forwarders if airport is supported by infrastructure such as direct highway access, a fully operational cargo terminal, as well as a positive reputation for cargo established over time. Thus, freight forwarder takes into account all airports within an acceptable radius, considering supply of airlines. The supply includes total costs, structure of price and quality of connections affecting on transport time of shipment. This paper will analyze factors that influence a choice of airport and will illustrate by example of Serbian, Croatian and Slovenian market. The choice of departure airport and appropriate airline is based on real data of above-mentioned factors.*

Keywords: *freight forwarder, airport choice, airline supply*

1. INTRODUCTION

Transport of goods by air, as a mode, fills the need for time-sensitive deliveries over larger distances, especially where the alternative modes, such as road, rail or maritime transport on international or transcontinental routes, are considerably slower. The movement of air cargo from origin to destination using several modes of transport represents intermodal or multimodal transport chain with the air segment as a central leg. Efficiency and sustainability of multimodal transport and logistics can be achieved by using multimodal transport that combines optimally the various modes of transport, exploiting each one's advantages and minimizing the disadvantages (European Commission, 2022).

Air cargo transport is very complex business. It involves different players, very sophisticated processes, a combination of weight and volume, varied priority services, integration and consolidation strategies, and offers many different (possible) routes. Main

* d.pavlovic@sf.bg.ac.rs

stakeholders involved in air cargo transport are the so-called combination carriers, all-cargo carriers (scheduled or *ad hoc* charter), integrators, contract freighter operators, freight forwarders and consolidators (Doganis, 2002).

Freight forwarders are the link between the airline and the final customer who is the consignor/consignee. They provide services which include consolidation of deliveries from multiple shippers, choice of airport, space reservation on flights of cargo operators or passenger-cargo combination carriers, transport shipment arrangements, to/from freight forwarder' warehouse, to (from) departure (arrival) airport and to final destination as point of delivering shipment.

Freight forwarders are often located landside of an airport or they have warehouses that are located airside or on the border between landside and airside. Generally, from the origin, which is the supplier, to the destination, which is the customer, the process of air cargo transport covers several segments (Fig. 1): 1) transport from pick-up cargo point (supplier) to warehouse (consolidation of shipments), 2) transport from warehouse to the airport A, 3) flight (or several flights) from airport A to airport B, and 4) transport from airport B to the warehouse and further to the final point.

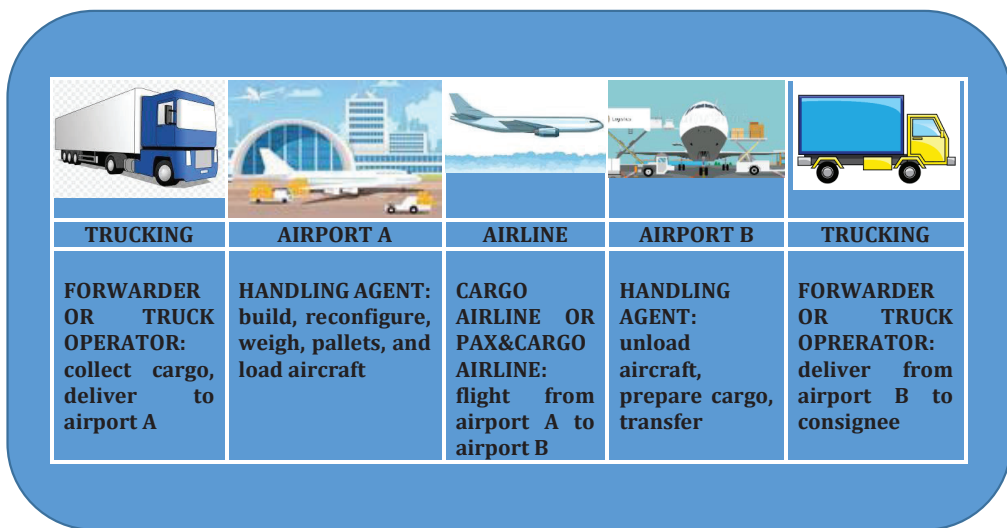


Figure 1. The air cargo chain

Freight forwarder (same as in first part of chain or another) arranges pick-up of shipment from arrival airport (airport B) and organizes transport to its warehouse or another location, and finally delivers it directly to customer (consignee). Accordingly, freight forwarder may offer a service related to the pick-up cargo from supplier, preparation, storage, carriage and final delivery of goods, including all necessary documentation, custom processing and insurance.

The forwarder acts between the shipper and the airport and airlines. The freight forwarder or truck operator provides the ground transport services before and after air transport. The airport through handling agent and airline receives, stores, transfers, tracks, loads and unloads cargo, and assigns and manages capacity.

From the perspective of truck operators and airlines (cargo or combination carrier), freight forwarders are customers and represent demand side of the business while from the shippers' point of view, forwarders are part of supply side, offering transport services in competition with other operators (freight forwarders and integrators), (Morrell and Klein, 2019).

In this paper the focus is on the freight forwarding activity where the main transport mode is air transport. The objective of the paper is to research how freight forwarders choose airport and create supply chain at the air cargo market from shipper to customer, and how to propose different options (offers) to consignor. With the aim to understand the factors influencing the freight forwarder's choice of airport, the case study of an actual location decision by a freight forwarder is adopted. The case study covers three air cargo markets, in Serbia, Croatia and Slovenia.

2. LITERATURE REVIEW

Generally, airports closer to shippers and with lower total costs and shorter delivery times are strong candidates for freight forwarders' choice. Therefore, the most important factors when choosing an airport are geographical location, costs, and delivery times (Park, 2003).

Regarding the most important attributes for selecting cargo carriers in Taiwan, it is revealed that they are reliable and on-time services, possibility for express shipments and a good reputation of the carrier. On the other hand, the highest-rated attributes related to route choice, in the case of forwarders in Taiwan, are: less intermediate stops, efficient handling, and customs clearance service at the destination airport (Chu, 2014).

Competitive factors among airports which offer air cargo service also include infrastructure, customs, intermodal transport, and international aviation policy (Zhang, 2003). Additionally, Gardiner et al. (2005) emphasized that the factors considered by air freight companies when choosing airports include opening hours, total costs, reputation in cargo transport, demands for local O/D cargo, influence of freight forwarders, transport from airports, customs clearance times, and financial incentives offered. As Chao and Yu (2013) stated the opening hours of an airport have a significant impact on airline flight scheduling and timely delivery of transshipment cargo. Shorter cargo clearance times may also reduce cargo transport times and stock costs.

Another significant finding mentioned above by Gardiner et al. (2005) was that freighter operators placed so much importance on the reputation and experience of the airport for handling freighter flights. Results of research conducted by Li (2017) show that "if the freight-forwarding companies know the terminals and transit cities on the routes between origins and destinations, they will not risk trying new routes", even though those routes may result in lower costs and shorter transport time.

3. AIRPORT CHOICE BY FREIGHT FORWARDER

Freight forwarders usually make decisions about airport in the following way. First, based on geographical location, they consider airports that can be reached by truck within

acceptable time*. Additionally, they take into account airport capabilities for processing and handle cargo. The availability of modern well-designed and cost-effective cargo facilities is a key advantage in airport attractiveness for freight forwarder. An airport operator is responsible for the provision and security of the airport infrastructure (ICAO-WCO, 2016). Ground handlers are responsible for dealing with operational aspects, based on the instructions of freight forwarders and airlines. Ground handlers' activities encompasses handling, preparing, and tagging cargo and mail, loading/unloading, transit, and storage of cargo and mail.

Second, they compare the total cost and transport time for each airport and appropriate routes from consignor to consignee and analyze trade-off between cost and quality of service (needed time to transport good). Airports often might produce the most delays in supply chain (Morrell and Klein, 2019). Thus, it is important to have data for each airport related to timetable, delays, customs clearance times as well as airports opening hours.

After choosing the airport and the route, negotiations with the airline will begin. One of the issue is how much capacity to book, or how to manage contracted space. Namely, freight forwarder can have contracted space for specific flight for specific day in one week. For other flights and other days, it is necessary to book space. Decision about flight is based on required time to deliver shipment as well as on special requirements related to goods. For example, perishable or dangerous goods must be handled with particular care and under strict procedure.

Further, air carriers can charge by volumetric mass, which is dimensional weight, or by actual weight. Cargo rates are negotiated between airlines and freight forwarders and usually quoted per kg or per ULD. The level of cargo rate is depending on specific product or service as well as on freight forwarder importance and its contribution to airline demand. Generally, rates are not published. The actual rate paid a freight forwarder to an airline may differ from the tariff, and are bilaterally agreed and remain confidential.

Additionally, there is a surcharge as an extra fee, charge, or tax that is added on to the cost of a good or service. Surcharges could include airport handling fee, airport screening fee, airport transfer fee, dangerous goods fee, fuel surcharges, handling fee, letter of credit fee, security surcharge and terminal handling fee (IATA, 2021).

One of the main questions is, what are the deciding factors influencing the freight forwarder choice of airport. In the next section, airport and airlines' supply will be analyzed in order to illustrate input (factors) affecting airport choice for shipment.

4. CASE STUDY: FREIGHT FORWARDER'S CHOICE OF AIRPORT

In this section the case study is discussed, focusing on the characteristics of the supply in terms of transport cost and airline timetable. The primary data sources for this case are derived from the real pricelists of the considered airports and airlines. In order to illustrate the choice of airport of freight forwarder, the examples of Serbian, Croatian and Slovenian markets are considered. The example covers following: 1) service "door to airport" will be offered by freight forwarder, 2) the origin point is Belgrade (Serbia), 3) the final destination is Dubai, and 4) three potential departure airports (Belgrade – BEG,

* For example, for the given market, one freight forwarder considers only airports that can be reached by truck within 12 hours.

Zagreb – ZAG, Ljubljana – LJU) and one arrival airport (Dubai International Airport – DXB) are taken into analysis.

The selection of the most appropriate route is based on two criteria: total transport costs and the quality of connection (with respect to airline schedules). In the case study, the airports are ranked first based on total transport costs which include cost of transport to the airport by truck, cost of ground handling and cost of transport by air. Then, for each of the considered airport the quality of the connection is determined based on available airline schedules and the most appropriate route is chosen.

Cost of transport by truck (from consignor to airport), cost of ground handling and airline air cargo rate, as factors that affect the airport choice of freight forwarder, will be analyzed, for different masses of goods (45kg, 100kg, 500 kg, 1000kg, 3000kg). Tables 1-3 display information regarding these costs. Table 1 contains the road transport cost for different masses of goods, from origin to the selected airports. In this example, we consider the transport of general cargo which does not require a special type of handling equipment or service. The truck operator, generally takes into account the cargo mass, dimensions and the number of pallet spaces required. Based on those data, it was determined that goods up to 100 kg can be packed in a vehicle with a capacity of two pallet places. In that case, it would cost 30 euros to be transported to Belgrade Airport, 250 euros to Zagreb Airport, and 280 euros to Ljubljana Airport. For goods over 100 kg and less than 1000 kg it can be transported by a vehicle with four pallet places (van), and goods between 1000 kg and 3000 kg can be transported by a vehicle with 10 pallet places (avia truck). In order for these costs to be comparable, it is necessary to convert them into unit costs per kilogram and this is, also, given in Table 1. It is evident that costs decrease with increasing mass, but it is also observed that the difference in unit costs decreases with increasing mass.

Table 1. Transport cost and unit cost from origin to airport, by truck

Departure airport	Mass of goods				
	45 kg	100 kg	500 kg	1,000 kg	3,000 kg
	Transport cost from origin to airport, by truck, in EUR				
BEG	30	30	70	70	120
ZAG	250	250	350	350	420
LJU	280	280	400	400	510
	Transport unit cost from origin to airport, by truck, in EUR/kg				
BEG	0.66	0.3	0.14	0.07	0.04
ZAG	5.55	2.5	0.7	0.35	0.14
LJU	6.2	2.8	0.8	0.4	0.17

Ground handling cost represents the cost of unloading the goods from the truck, the cost of placing the goods in the customs warehouse at a certain position and the cost of X-ray control of the goods (Table 2). This cost is usually charged by airports as a unit cost per

kilogram of actual mass and it can be observed that Belgrade Airport is the cheapest among these airports.

Table 2. Ground handling cost at the airport, in EUR/kg

Departure airport	Mass of goods				
	45 kg	100 kg	500 kg	1,000 kg	3,000 kg
BEG	0.06	0.06	0.06	0.1	0.1
ZAG	0.15	0.15	0.15	0.15	0.15
LJU	0.1	0.1	0.1	0.1	0.1

Table 3 shows the unit cost of air transport service from the departure airport to the destination airport. The airline rates in Table 3 refers to the summer flight schedule in 2018. Although, the airline rates decrease with the mass of goods transported, the airline from Belgrade airport charges the highest prices in all cases, while from Zagreb airport is the cheapest. Generally, airlines determine rate based on simple calculation. To calculate the volumetric mass, first the volume should be determined: length multiply by width multiply by height (all values in centimeters). Then this number should be divided by 6,000.00 for air freight (for other mode of transport this value is different), (IATA, 2021). The final shipping costs are calculated based on the highest value of the actual and volumetric mass: this is the “chargeable mass”.

Regarding this case study, there are two assumptions:

- aircraft capacity issue is not considered (i.e. available capacity is sufficient),
- the chargeable mass is actual mass (kg).

Table 3. Airline rates – transport cost by plane, in EUR/kg

Departure airport	Mass of goods				
	45 kg	100 kg	500 kg	1,000 kg	3,000 kg
BEG	2.37	2.21	2.05	1.9	1.77
ZAG	2.22	2.12	1.75	1.35	1.25
LJU	2.35	2.22	1.92	1.88	1.05

To determine which route is the most cost-effective, a freight forwarder needs to sum up the following: a) the cost of transport to the departure airport; b) the cost of ground handling, and c) the cost of air transport from the departure airport to the destination airport. Table 4 summarizes the costs of door-to-airport services. Based on this total cost Belgrade airport is the first choice for goods up to 500 kg, Zagreb airport is the first choice for goods of 1000 kg and Ljubljana airport is the most suitable for goods of 3000 kg. Note that total transport costs vary from airport to airport depending on the mass of goods. Moreover, the difference among unit costs of transport from origin to the departure airports (Table 1) decrease with increasing mass.

Table 4. Total transport cost from door to arrival airport, in EUR/kg

Departure airport	Mass of goods				
	45 kg	100 kg	500 kg	1,000 kg	3,000 kg
BEG	3.09	2.57	2.25	2.07	1.91
ZAG	7.92	4.77	2.6	1.85	1.54
LJU	8.65	5.12	2.82	2.38	1.32

In case that the clients are not only interested in the total transport costs, but also take into account the transit time and the quality of the connection at the given airports, then it is necessary to analyze the flight schedule of the airlines. The available flights and departure timings for the selected departure airports and destination airport are given in Table 5. The data used is collected from Flight radar between July 30 and August 8, 2020.

Table 5. Airline supply from Belgrade, Zagreb and Ljubljana to Dubai

FLIGHT WITH ONE STOP	AIRLINE OFFERS: TIMETABLE, AIRCRAFT TYPE			
	FIRST LEG		SECOND LEG	
BEG-DBX	BEG-IST TK6575 A310F	31.07.2020. DEP. 17:30 ARR. 19:10	IST-DBX TK760 B777W	01.08.2020. DEP. 18:10 ARR. 23:43
ZAG-DBX	ZAG-CDG AF6767 B767F	31.07.2020. DEP. 21:40 ARR. 23:40	CDG-DBX AF662 A350	01.08.2020. DEP. 13:45 ARR. 22:35
LJU-DBX	LJU-MOW SU2611 A320	01.08.2020. DEP. ---- ARR. ----	MOW-DBX SU521 B737	02.08.2020. DEP. ---- ARR. ----

The *NetScanCargo* model is then used to quantify the performance of air transport networks, i.e., to measure the quality of a network's indirect connections (Boonekamp and Burghouwt, 2017). Main parameters are given in Table 6.

In order to achieve $T_{\max} \approx 48\text{h}$, time sensitive parameter (α) and correction parameter for short flights (τ) are chosen to be $\alpha = 15$ and $\tau=0.5$. It should be noted that a higher value of α indicates a lower time-sensitivity. Regarding parameter τ , it is included to allow for a little more time flexibility for short flights. These parameters are determined based on the freight forwarders' historic data.

Connectivity is a measure of accessibility and centrality of airports, regions and countries, while accessibility denotes the extent to which an airport provides connections to other world regions. It should be noted that this accessibility relates to airside accessibility and it should not be confused with landside accessibility (i.e., accessibility by road, rail or maritime transport), Burghouwt and Redondi (2013).

Table 6. Net Scan Cargo model

Parameters	Description	BEG-DXB	ZAG-DXB
Frequency (f)	Weekly number of flights	1	1
T_{nonstop}	Theoretical non-stop flying time	5.33	5.66
T_{max}	Maximum acceptable transport time	47.64	49.29
T_{fly}	In-flight time	6.79	10.33
T_{transfer}	Transfer time	23	9.91
$T_{\text{perceived}}$	Perceived travel time is a linear function of the total in-flight time, transshipment time and a penalty for the inconvenience of a transshipment.	29.79	20.24
$P_{\text{perceived}} - T_{\text{nonstop}}$	Difference between indirect and direct non-stop flight time	24.46	14.58
$T_{\text{max}} - T_{\text{nonstop}}$	Maximum allowed difference between indirect and direct non-stop flight time	42.31	43.63
q	Quality of the connection	0.42	0.67
$\text{CNU} = q * f$	Connectivity network unit	0.42	0.67

The amount of CNU on a certain route is determined by the system of equations given by Boonekamp and Burghouwt (2017). Considering data related to airlines' offer from selected airport, it is observed that flights from Ljubljana are performed by inappropriate aircraft type; therefore, the value of CNU for Ljubljana – Dubai is equal to zero, and the airport in Ljubljana is excluded from further consideration. The values of CNU for Belgrade – Dubai is equal to 0.42, while for Zagreb – Dubai CNU is equal to 0.67 (Table 6).

Adding information related to CNU to previously determined costs (Table 4), Zagreb appears as the most suitable airport for larger shipments (1000 kg or more), while Belgrade still is the best option for shipments up to 500 kg.

However, to make final choice of the airport, freight forwarder needs to take into account maximum transit time required by consignor. Depending on this time, and bearing in mind that departure times of flights are fixed, the freight forwarder would decide whether the requirements can be met or not, and under what conditions. Moreover, if shipments need to be sent periodically, then airline's flight schedule can be limiting factor.

5. CONCLUSION

This paper presents an analysis of airport choice by freight forwarder located in Serbia. In most circumstances, the attractiveness of an airport depends on the characteristics of the supply in terms of transport cost and airline flight schedule. For the sake of this paper, an airline flight schedule is evaluated in terms of transit time and the quality of the connection at the given airports.

Belgrade airport is generally cost-effective in term of transport costs, due to its proximity. However, the shipping rates offered by airlines tend to be high in comparison to the Zagreb and Ljubljana, which put them in first choice for higher masses (over 1000 kg).

Moreover, for high-volume shipments, truck operators offer discounted shipping rates and in those cases Zagreb and Ljubljana can be cost-effective, too.

In terms of quality of the connections, there is a large difference between considered airports (Belgrade, Zagreb and Ljubljana) in their role as cargo airports. Ljubljana airport offers very limited number of cargo services, while the situation at Belgrade and Zagreb airports is much better which makes two of them very competitive.

There are a number of areas for further research. A thorough survey of the freight forwarder airport choice should be conducted in order to develop a choice model based on real data. Moreover, it would be interesting to assess the preference of cargo routings for freight forwarders and which route characteristics determine their choice. Also, the role of road transport in air cargo networks in this part of the Europe should be studied, too.

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REFERENCES

- [1] Boonekamp, T., Burghouwt, G., (2017). Measuring connectivity in the air freight industry, *Journal of Air Transport Management*, Volume 61, 81-94.
- [2] Burghouwt, G., Redondi, R., (2013). Connectivity in air transport networks: an assessment of models and applications, *Journal of Transport Economics and Policy*, Volume 41 (1), 35-53.
- [3] Chao, C.-C., Yu, P.-C., (2013). Quantitative evaluation model of air cargo competitiveness and comparative analysis of major Asia-Pacific airports. *Transport Policy*, Volume 30, 318-326.
- [4] Chu, H.-C., (2014). Exploring preference heterogeneity of air freight forwarders in the choices of carriers and routes, *Journal of Air Transport Management*, Volume 37, 45-52.
- [5] Doganis, R. (2010). *Flying off course: Airline economics and marketing*. London: Routledge.
- [6] European Commission, (2022). *Logistics and multimodal transport*, https://transport.ec.europa.eu/transport-themes/logistics-and-multimodal-transport_en.
- [7] Gardiner, J., Ison, S., Humphreys, I. (2005). Factors influencing cargo airlines' choice of airport: an international survey. *Journal of Air Transport Management*, 11 (6), 393-399.
- [8] IATA (2021). *Air Cargo Tariffs and Rules: What You Need to Know*, <https://www.iata.org/en/publications/newsletters/iata-knowledge-hub/air-cargo-tariffs-and-rules-what-you-need-to-know/>.
- [9] ICAO-WCO (2016), Joint brochure on "Moving Air Cargo Globally: Air Cargo and Mail Secure Supply Chain and Facilitation Guidelines", <http://www.icao.int/>.
- [10] [Security/aircargo/Pages/Air-Cargo-and-Mail-Security-and-Facilitation.aspx](#), second edition.

- [11] Li, D. (2017). The Impact of using air cargo in multimodal transportation systems, Master thesis, HEC Montreal, Canada.
- [12] Morrell, P.S., Klein, T. (2019). Moving Boxes by Air: The Economics of International Cargo, Routledge, second edition.
- [13] Park, Y. (2003). An analysis for the competitive strength of Asian major airport. *Journal of Air Transport Management*, 9 (6), 353-360.
- [14] Zhang, A. (2003). Analysis of an international air-cargo hub: the case of Hong Kong. *Journal of Air Transport Management*, 9 (2), 123-138.
- [15] Živojinović, S. (2020). Ponuda aviokompanija na tržištu robnog transporta u Srbiji, Hrvatskoj i Sloveniji, završni rad, Univerzitet u Beogradu – Saobraćajni fakultet.