Contemporary Air Freight Transport Market

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The worldwide air freight transport is seen mostly from the angle of long-distance passenger flights. Given that, one often tends to forget the role of this transport branch in the case of commodity transport. Air freight transport is a booming branch with great development potential. This, however, is related to considerable experience and knowledge, on the part of both the carrier and the owner of goods, with regards to technical capacities of a given aircraft, maintenance costs, and rule awareness. The objective of the study is to analyse the global market of air freight transport. In view of the vast scope of the subject, the issues were presented, to a large extent, on the basis of existing airports.

Keywords: air freight transport, global air cargo services, air transport market, market analysis.

1. INTRODUCTION

The air freight transport market is one of the elements of contemporary economies and the global transport system. It is commonly considered the youngest, state-of-the-art and fastest growing branch of transport, which in terms of functionality, organization and technology is best placed to serve the diverse market of passenger, cargo and postal needs. Nowadays, this means of transport is responsible for the carriage of around 1% of the global freight services. With regard to its value, cargo carried by air accounts for approximately 10% of the value of all transported cargo. The underlying feature of air transport is long distance cargo movement in a very short time. This allows one to reach any given point on Earth within 24 hours. This characteristic is of utmost importance for well-functioning global enterprises. But at the same time, we need to stress that this mode of transport is the most expensive one. Moreover, *air transport in cargo services is supplementary to other forms of transport in the case of rapid cargo movement of a sufficiently high value or if losses resulting from longer delivery times, caused by road transport for example, are high enough*[1].

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2. CARGO CARRIERS

It is possible to define the following air carriers providing cargo services on the aviation market:

- passenger carriers providing cargo transport services;
- freight passenger carriers with distinct companies for cargo services;
- all cargo carriers;
- ACMI carriers.

[1] W. Rydzkowski, Współczesna polityka transportowa (Modern transport policy), PWE, Warszawa 2017, p. 165; S. Kamosiński, Przewozy ładunków drogą lotniczą w Polsce w latach 1945-1989 i po przełomie ustrojowym 1989 r. Zarys problemu. (Cargo transport by air in Poland in the years 1945-1989 and past the 1989 systemic breakthrough. An outline.), [in:] K. Bukowska, Z. Bukowski, Działalność lotnicza w Polsce (Aviation activity in Poland), Wydawnictwo Uniwersytetu Kazimierza Wielkiego, Bydgoszcz p. 83.

The first group of carriers is mainly composed of traditional passenger carriers offering also freight services. Freight is transported in passenger aircrafts' free space, which without a doubt becomes a source of extra income.

The second group of carriers includes traditional carriers, for whom cargo services are not only extra activities. Within their framework they separate companies responsible for air freight carriage, with the use of passenger, cargo and combination aircrafts. Examples of such carriers may be Lufthansa and its distinct company: Lufthansa Cargo, and British Airways or Air France.

Another group of carriers consists of those offering scheduled and charter cargo transport services by specialist planes. One example of the above described business model carrier is Cargolux, which has many Boeing 747-400F aircrafts used for air freight transport across all regions of the world.

The final group of carriers are mainly independent airlines, which carry flights as subcontractors of cargo carriers. The ACMI (aircraft, crew, maintenance, insurance) type is a form of an agreement between a flight operator and a contracting party, whereby the contracted carrier is obliged to provide an aircraft, crew, aircraft maintenance and insurance[2].

The largest carriers in terms of cargo services are courier carriers (Table 1), owing nearly 30% of the global market. For many years, the leader in the field has been FedEx (approximately 2.5%). In 2015, the greatest growth dynamics was observed by Asian carriers: Air China (15%), China Southern (12%), Korean Air (9%) and Emirates (8%). On the other hand, a drop in growth dynamics was noted by: Lufthansa (-2.88%), UPS Airlines (-3.26%), Singapore Airlines Cargo (-5.10%) and China Airlines (-27.29%).

The domination of Asian countries in cargo transport is a consequence of their immense economic potential and hence, in the nearest future, we should be expecting their further expansion.

Rapid development of Asian economies and carriers has allowed also their airports to become global leaders. The largest airports with regards to cargo operations in 2015 were: Hong Kong, Shanghai, Incheon and Dubai (Table 2). The top five biggest airports handling cargo held 19% of the market[3].

Table 1. Carriers in cargo market operations between 2012 and 2015.

Position	Carrier	2012	2013		2014		2015	
		Transport operations in billion tkm	Transport operations in billion tkm	Dynamics compared to 2012 in %	Transport operations in billion tkm	Dynamics compared to 2013 in %	Transport operations in billion tkm	Dynamics compared to 2014 in %
1.	FedEx	16 262	16 225	-0.23	16 097	-0.79	15 876	-1.38
2.	Emirates	9 270	10 459	12.83	11 240	7.47	12 157	8.16
3.	UPS Airlines	10 761	10 889	1.19	11 208	2.93	10 843	-3.26
4.	Cathay Pacific	8 942	8 750	-2.15	10 044	14.79	10 586	5.40
5.	Lufthansa	10 203	8 731	-14.43	8 612	-1.36	8 364	-2.88
6.	Korean Air	8 185	7 813	-4.54	6 293	-2.55	5 972	9.47
7.	Air China	4 554	5 015	10.12	5 691	13.48	6 558	15.23
8.	Singapore Airlines Cargo	6 764	6 458	-4.52	6 293	-2.55	5 972	-5.10
9.	China Southern	4 123	4 326	4.92	5 056	16.87	5 661	11.97
10.	China Airlines	7 861	4 854	-38.25	7 405	52.55	5 384	-27.29

Source: D. Tłoczyński, Rynek lotniczy. Raport 2016 (Aviation market. 2016 Report), Eurosytem Jarosław Śleszyński, Warszawa 2016, p. 16.

[2] S. Chakuu, P. Kozłowski, M. Nędza, *Podstawy transportu lotniczego (Foundations of the air transport),* Konsorcjum Akademickie, Kraków-Rzeszów-Zamość 2012, pp. 61-62.

[3] D. Tłoczyński, *Raport lotniczy 2016 (Aviation Report 2016)*, Eurosytem Jarosław Śleszyński, Warszawa 2016, p.14.

Table 2. Airports handling cargo traffic between 2012 and 2015.

Position	Airport	2012	2013		2014		2015	
		Transport operations in billion tkm	Transport operations in billion tkm	Dynamics compared to 2012 in %	Transport operations in billion tkm	Dynamics compared to 2013 in %	Transport operations in billion tkm	Dynamics compared to 2014 in %
1.	Hong Kong	4 066	4 166	2.46	4 416	6.00	4 460	1.00
2.	Memphis	4 016	4 137	3.01	4 259	2.94	4 291	0.75
3.	Shanghai	2 938	2 928	-0.38	3 182	8.66	3 274	2.89
4.	Anachorage	2 463	3 432	-1.71	2 493	2.96	2 631	5.53
5.	Incheon	2 456	2 464	0.33	2 558	3.80	2 596	1.49
6.	Dubai	2 279	2435	6.85	2 368	-2.77	2 506	5.83
7.	Louisville	2 168	2 216	2.21	2 293	3.49	2 351	2.50
8.	Tokyo	2 006	2 020	0.70	2 134	5.62	2 122	-0.53
9.	Paris	2 151	2 069	-3.81	2 086	0.85	2 091	0.21
10.	Frankfurt	2 066	2 094	1.36	2 132	1.81	2 068	-3.01
11.	Taipei	1 577	1 967	24.72	2 089	6.20	2 022	-3.20
12.	Miami	1 929	1 945	0.83	1 999	2.76	2 006	0.35
13.	Los Angeles	1 688	1 747	3.50	1 816	3.95	1 939	6.75
14.	Beijing	1 800	1 843	2.40	1 848	0.28	1 890	2.25
15.	Singapore	1 898	1 886	-0.63	1 880	-0.31	1 887	0.37

Source: D. Tłoczyński, Rynek lotniczy. Raport 2016 (Aviation market. 2016 Report), Eurosytem Jarosław Śleszyński, Warszawa 2016, p.16.

3. CARGO TRANSPORT

As part of air transport, which features very low capacities, goods may be transported as follows:

- by passenger aircrafts;
- by combination aircrafts, clearly divided into the passenger area and cargo holds;
- by cargo-only aircrafts.

Passenger aircrafts typically carry small packages, weighing between several and a dozen or so kilograms. The total cargo weight depends on the type of aircraft, but it is no more than several hundred tonnes. Here, commodities are placed beneath the aircraft's deck.

In the combination type aircrafts, cargo is stored on the lower deck and in cargo holds. This distribution allows between several and several dozen tonnes of cargo on-board. One example of such an airplane would be Boeing 747 400 Combi, which can take up to 30 tonnes of commodities in any single flight.

However, the greatest capacities are found in dedicated cargo aircrafts. The decks in such aircrafts are fitted with mechanical rolls over which commodities, pre-formed in loading units, move. Special aviation containers or pallets, on which goods wrapped in foil or nets are placed, are applied for that purpose. Thanks to the use of loading units, transhipment seems easier and faster.

The capacity of a freighter depends on its construction and range. Freighters include conventional (narrow-body) and wide-body aircrafts (more than 4.72 m wide). For example, Lockhead Herkules C 130, which in its transport version may take up to 20 tonnes of cargo, Boeing 737 700F – 19 tonnes and Airbus A 300 600F – 54.7 tonnes.

The Boeing range of aircrafts includes also much bigger freighters. One of them is 747 400F, with two decks for cargo carriage and a total capacity of 113 tonnes. Airbus, in turn, offers an A 380, which in its freight version can carry, at any one time, 150 tonnes of cargo at a distance of over 10,000 km, without a stop-over. The aircraft has three decks for freight carriage and five loading gates. The aircraft of the highest capacity, i.e. 250 tonnes, is the Ukrainian An 225 Mrija. It is the holder of the world's record of load capacity 2004 (for the transport of an electric generator weighing 247 tonnes from Prague to Tashkent).

Another difficulty associated with air cargo transport is aircraft construction, which impedes the loading of very high, wide or long goods[4]. With respect to the above, air transport services may be used for the carriage of the following commodities:

[4] J. Neider, *Transport międzynarodowy (International transport)*, PWE, Warszawa 20015, pp. 82-83.

- maximum height on European routes – 75 cm,
- maximum height on transatlantic routes – 160 cm,
- maximum height in cargo aircraft – 220 cm[5].

In the case of cargo of such size, the best aircrafts will be those with tilting ramps.

Aircrafts may never carry the following types of load: bulk, break-bulk, liquid, oversize or ISO containers.

Freight transport in air navigation is handled as part of the regular (scheduled) and irregular (charter) traffic. The transport itself is conducted based on the principles similar to those in maritime navigation but for one thing – while scheduled services involve all types of aircrafts, charter services are provided most of all with the use of cargo aircrafts.

Regular transport services include mixed cargo from several consignors intended for many consignees. Charter operations, in turn, are associated with all-aircraft loads, wherein the consignor and the consignee is the same entity. Moreover, air carriage employs charters for a particular journey and a specific time period (periodic fleet rental under an agreement between carriers).

If the load is large in size, does not fit in the passenger aircrafts, and must be shipped from a local airport to a hub airport, air carriers may avail of the so-called trucking – RFS (road feeder service), which involves the transport of commodities by trucks. In any such case, these journeys are given air flight numbers[6].

Relying on data of the International Civil Aviation Organization (ICAO), in 2015 a global increase in cargo transports of 2.2% with respect to the year 2014 was recorded (Table 3), whereas at the turn of 2013/2014 the dynamics of performance reached 4.4%. International air cargo transport accounted for 87% of the total market service. In addition, the capacity utilisation coefficient decreased from 50% in 2014, to 47% in 2015. The drop was a result of a more effective use

Table 3. Dynamics of the cargo operations market between 2013 and 2016.

Region	Dynamics of transport operations with reference to loads	Dynamics of cargo space supply	Utilisation of cargo space
Year 2015 compared to 2015 in %			
Africa	3.1	25.5	22.2
Asia and Pacific	2.1	3.6	52.8
Europe	7.6	6.7	44.5
Latin America	-4.2	-2.0	33.3
Middle East	6.9	8.4	42.8
North America	2.0	3.4	34.3
World	**3.8**	**5.3**	**43.0**
Year 2015 compared to 2014 in %			
Africa	2.5	4.0	30.0
Asia and Pacific	2.6	5,8	54.0
Europe	-0.2	4.2	44.8
Latin America	-5.9	1.8	38.4
Middle East	11.9	16.3	42.9
North America	-0.4	3,5	34.2
World	**2.3**	**6.0**	**44.1**
Year 2014 compared to 2013 in %			
Africa	6.7	0.9	30.7
Asia and Pacific	5.4	5.7	55.4
Europe	2.0	3.0	46.9
Latin America	0.1	0.3	41.8
Middle East	11.0	11.1	44.5
North America	2.4	-0.5	35.5
World	**4.5**	**3.7**	**45.7**

Source: Own research.

[5] www.spedycja-polska.pl

[6] J. Neider, Transport międzynarodowy (International transport), PWE, Warszawa 2015, p. 83.

of cargo space in passenger aircrafts, at the expense of specialist cargo aircrafts[7].

4. BASIC ELEMENTS OF THE MARKET: DEMAND, SUPPLY, PRICE.

Demand is an integral element of the aviation services market, most often referred to as: *the intention to buy as revealed by customers, formulated on the basis of needs and real purchasing power*[8]. Typically, the primary sources of demand are needs, varying in terms of time, space, and aspirations of potential buyers related to the purchase of said services.

Therefore, demand for aviation services may be defined as: *a reported need for branch services provided at a given place and time*[9].

The following types of demand may be distinguished in air transport:

- potential demand (resulting from the natural demand for aviation services);
- effective demand – the real demand, which reflects the power to purchase a given aviation service at a given time by a given group of buyers and under specific payment conditions.

On the air cargo transport market, demand is generated by trading companies, production companies and shipping firms. The most often transported ranges of commodities consist of the products of the electronic, chemical, motor, textile, clothing, and agricultural and food industries. Demand for courier parcels and post is usually reported by postal and courier companies. Their characteristic feature is the obligatory nature ensuing from the sales agreements and compliance with trading regulations and on-time deliveries.

Demand for aviation cargo services depends on the offer of a particular carrier and the extent to which the user takes advantage of the branch's benefits. The primary values are:

- speed, as measured by the time of journey/delivery of a load to its consignee;
- safety level;
- punctuality;
- price;
- state of the art of the fleet;
- availability of air transport (network of connections);
- level, quality and comprehensive nature of the services provided[10].

To determine the demand for transport services, one may use forecasts of the future service price level and the changes in the level of social wealth. The most crucial factor which affects demand in air transport is the time value factor. An evaluation of the value of human time rises together with the level of income. With respect to the above, a demand for air transport services growth factor is a non-aviation factor regarding the overall economic situation and social affluence[11].

Yet another element of the market is supply. The supply of aviation services is defined as *an amount of services provided for sale on the market by aviation companies in any given period*[12].

The representatives of the supply side of the market of aviation services are:

- air transport companies (carriers and airports);
- companies cooperating with carriers and airports;
- institutions creating policy regarding the air transport;
- aircrafts – means of transport;
- industry operating sources;
- transport technologies.

The supply of transport services on the air cargo transport market is expressed in tonne-kilometres (tkm) (Table 4) and is dependent on:

- reported supply in time and space;
- fleet used and its use level;
- strategy of market carriers operation;
- state air transport policy.

[7] D. Tłoczyński, Rynek lotniczy. Raport 2016 (Aviation market. 2016 Report), Eurosystem Jarosław Tłoczyński, Warszawa 2016, p. 13.

[8] D. Rucińska, A. Ruciński, D. Tłoczyński, *Transport lotniczy.* Ekonomika i organizacja (Air transport. Economics and organization), Wydawnictwo Uniwersytetu Gdańskiego, 2012.

[9] Ibid.

[10] K. Rutkowski, *Rynek międzynarodowych przewozów lotniczych (International air transport services market)*, Szkoła Główna Planowania i Statystyki, „Monografie i opracowania" , nr 236, Warszawa 1987, p. 13.

[11] T. Rokicki, Ekonomiczno-organizacyjne uwarunkowania towarowego rynku usług transportowych (Economic and organizational preconditions of the cargo market of transport services), Wydawnictwo SGGW, Warszawa 2016. p.93.

[12] W. Januszkiewicz, Transport i spedycja lotnicza. Ekonomika, Organizacja. Technologia (Air transport and forwarding, Organization, Technology), Wydawnictwo Komunikacji i Łączności, Warszawa 1985, p. 148.

Table 4. Performance between 2010 and 2014.

Years	Transport operations in billion tkm	
	cargo	including post
2010	642	4.763
2011	674	4.910
2012	697	5.096
2013	727	5.480
2014	768	5.910

Source: Own research.

With regards to the planning of the size of transport services supply, a crucial coefficient is the load factor, which guarantees air operation cost coverage with revenue[13] *(Table 5).*

Table 5. Supply of cargo space in cargo operations.

Region	Total Cargo transport		International Cargo transport	
	Supply of cargo space in aircrafts in %	Load factor in 2013 in %	Supply of cargo space in aircrafts in %	Load factor in 2013 in %
Africa	0.9	30.7	1.3	32.1
Asia and Pacific	5.7	55.4	5.5	58.7
Europe	3.0	46.9	3.1	48.1
South America	0.3	41.8	-1.4	44.7
Middle East	11.1	44.5	11.3	44.9
North America	-0.5	35.3	-0.9	40.2
Total	3.7	45.7	4.2	49.2

Source: Own research.

The starting point for the calculation of the price in air transport may be the goods gross weight including packaging, or its volume. Typically, the option selected is the one most advantageous to the carrier. The value 6 dcm3, which corresponds to 1 kg, is adopted for the purpose of calculations. Whenever the volume of the load is higher, the cost is based on the volume. Otherwise, the price is calculated according to the weight.

The air transport differs from other transport branches, especially with regards to the setting of the transport fee. Air carriers' tariffs distinguish the following rate types:

- general cargo rates:
  - regular – for cargo < 45 kg;
  - quantitative (reduced) – for cargo > 45 kg.

An increase in cargo mass is associated with a reduction in the unit price. The type of commodity, however, has no influence on the rates;

- specific commodity rates – set for consigners with large batches of specific goods. They are binding only between specific airports and only in one direction. For the price to be reduced, commodities must exceed the minimum weight;
- class rates – applied in the transport of some, specifically defined loads. Expressed in % of the regular rates.
- Proportional rates – used in combination with previous rates, if an international flight is combined with a domestic flight. Should the direct rate not be published in TACT (The Air Cargo Tariff), the basic source of information for consignors and shippers (e.g. between Chicago and Gdańsk), the national rate (Warszawa-Gdańsk) is proportionately added to the international one.

The air freight fee must be paid in full (consignor or consignee). According to the CP formula (charges prepaid), the consignor pays all the costs of transport at the time of dispatch. Under the CC formula (charges collect), on the other hand, the consignee covers the costs on delivery[14].

The factors differentiating the air cargo transport prices are:

- distance and direction of operation;
- time of delivery;
- mass and size of consignment;
- type of consignment;
- date of transport.

There are three tariff areas in the air transport:

1. North and South America with the surrounding islands;
2. Europe and Africa with the surrounding islands and the part of Asia west of Iran;

[13] D. Rucińska, A. Ruciński, D. Tłoczyński, Transport lotniczy…., op.cit., pp. 64-67.

[14] J. Neider, Transport międzynarodowy (International transport), PWE, Warszawa 2015, p. 89.

3. Asia, Australia and New Zealand with the surrounding islands[15].

With reference to the Drewry's Sea & Air Shipper Insight, in 2016 the average rates for air cargo transport were as follows:

3.15-3.20 USD/kg – transpacific routes;
2.10-2.30 USD/kg – Far East – Europe routes;
2.20-2.30 USD/kg – Europe – North America routes.

The averaged transport rate in 2016 was 2.72 USD/kg[16].

5. CONCLUSION

The unique feature of the air cargo transport is its global nature, which makes it highly dependent on the global economic situation. All changes in the dynamics of the world trade are reflected by the volume of air transport operations. This is demonstrated by the tabular data concerning transport operations presented herein. In 2015, airlines carried 52.2 million tonnes of loads, and in 2016, 53.5 million tonnes of loads, with a total value of USD 5.6 trillion. Data estimated regarding transport indicates that 35% of the world trade's value is transported by air. In view of the above, it is surprising that it accounts for less than 1% in terms of weight and volume. The causes of this state of affairs should be sought in the role of air cargo, which is of key importance in the trade of high value industrial goods and commodities which must be transported in a fast, reliable and safe manner[17].

Without a doubt, the recent fluctuations in the prices of oil on the world's markets will have an additional effect on the dynamics of air cargo transport operations. However, their real impact shall be the object of further considerations in the studies yet to be published.

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