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SAFETY AS AN ELEMENT OF CREATING COMPETITIVE ADVANTAGE AMONG AIRLINES GIVEN THE EXAMPLE OF THE AIRBUS A350 XWB AND THE BOEING 787 DREAMLINER AIRCRAFT

Summary. The competitive advantage of the passenger air transport market is a significant part of airline operations. An important element, a condition that may determine the achievement of competitive advantage, is the issue of safety, which also applies to the operation of aircraft. An example of creating an effective competitive advantage may be the operation of a new aircraft by air carriers. This article presents the process of creating a competitive advantage on the example of the Airbus A350 XWB and the Boeing 787 Dreamliner aircraft considering the safety aspect, which in the case of new means of transport in civil aviation may primarily concern the seeming childhood diseases occurring in the initial use of new aircraft. This article, in the form of comparative analysis, indicates the key features that determine the attractiveness of the new aircraft as a product on the passenger air transport market. Secondary data on the characteristics of the Airbus A350 XWB aircraft were used and compared with the data of the Boeing 787 Dreamliner to illustrate the properties that may indicate the manufacturer's superiority. Furthermore, this article proposes a scheme of creating competitive advantage in passenger air transport, which can be a model for creating a competitive advantage in civil aviation. The close relationship between the

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economic and technological aspects in creating competitive advantage was buttressed as well. This article also analysed secondary data related to the number of ordered and used aircraft and aviation events registered on the website: <https://aviation-safety.net> [8], which could have an impact on the level of safety of flight operations. Brought to the fore were situations in which the seeming childhood diseases in aircraft operated by the American manufacturer, Boeing 787 Dreamliner, such as defects in engines, power elements and risks associated with the use of composite materials, which were first used on such a large scale in the construction of wide-body aircraft.

Keywords: competitive advantage, safety, Airbus A350 XWB, Boeing 787 Dreamliner, passenger air transport market

1. INTRODUCTION

The passenger air transport market is a process of exchange in conditions of strong competition among carriers providing passenger air transport services. The key foundation of this market is security. The International Civil Aviation Organization (ICAO), defines it as a state in which the possibility of injury or property is reduced and maintained at or below an acceptable level through a continuous process of hazard identification and safety risk management. [11] In turn, G. Zając defines aviation safety as a set of all standards, measures and mechanisms taken by entities responsible for maintaining the highest safety standards in civil aviation. [22] Until the first decade of the 21st century, travel time and comfort could be considered significant determinants of competitive advantage among airlines. Both the period in which the appropriate travel distance was covered and the quality of the on-board service were connected with the economic dimension of enterprises associated with the aviation market and the technological dimension, determined by aircraft manufacturers as well as by entities providing specific components or systems necessary for the operation of aircraft. After decommissioning Concorde aircraft, it can be assumed that the key factor affecting the level of competitiveness among airlines is the level of comfort of passengers travelling by plane with turbojet engines through the prism of time reaching the target. Both economic and technological dimensions remain significant, which may significantly affect the level of safety of flight operations [7].

In the first decade of the 21st century, the European aircraft manufacturer, Airbus and the American Boeing, in response to airlines' demand for more economical wide-body aircraft in service, offered aircraft such as the Airbus A350 XWB and the Boeing Dreamliner 787, respectively. The new products were designed to revolutionise passenger transport in terms of both passenger comfort and positive impact on the economic situation of carriers. The aircraft constructed were themselves product innovation in terms of construction. New turbojet engines have become an important element, for Airbus manufactured by Rolls-Royce, and for Boeing, both by the British Rolls-Royce and by the American General Electric conglomerate, the use of composite materials for the construction of the hull and other shipbuilding elements turned out to be the key procedure of aircraft. The development costs were also significant, in the case of the A350, the cost of the program was over USD 39 billion, and the cost of Boeing Dreamliner 787, USD 4 billion. Aviation market forecasts presented by the Boeing in the Current Market Outlook report, CMO [13] – Current Market Perspectives, for the next two decades 2014-2033, predicted a 2.5-fold increase in air transport and the purchase of 36.8 thousand aircraft with an estimated market value of 5.2 billion USD. The number of aircraft

currently in use will increase from 20,910 units to 42,180 aircraft. 15.5 thousand older generation vessels will be withdrawn, airlines will buy a total of 36,770 machines, which means that each year, airlines will produce 1,840 new aircraft. The passenger air transport market is a place of exchange for transport services in conditions of strong competition. To maintain a high level of quality of the product or service offered, airlines purchase new aircraft. The new aircraft fleet can contribute to creating a competitive advantage among air carriers. In the last decade of the 21st century, major aircraft manufacturers such as the European Airbus and the American Boeing, introduced completely new types of twin-engine, wide-body aircraft, offering airlines A350 XWB and Boeing 787 Dreamliner in several product variants, respectively.

2. COMPETITIVE ADVANTAGE IN CIVIL AIR TRANSPORT

Competition [18] in civil air transport can be defined as attracting customers by offering them more favourable prices, quality and other conditions, to increase their turnover and profits. Such competition should enable customers to choose and obtain the best service based on the most favourable conditions for them [10, 16]. In turn, competitive advantage [17] can be defined as a set of specific actions taken by a given company operating for the benefit of civil air transport with the help of specific tools to achieve a superior position in relation to a significant number of potential passengers. In the economic dimension, within the competitive advantage [4], three basic types of competitive advantage are distinguished:

- qualitative advantage acquired through marketing instruments and activities that lead to desired changes within the product. With reference to civil air transport, an example of qualitative advantage may be the introduction on the market of civil air transport of a new type of aircraft, which due to the use of technological innovations in the construction of the hull, becomes more attractive for potential buyers, leasing companies and airlines,
- price advantage that can be achieved through marketing instruments and activities directly affecting the price at which buyers buy a given product. In the case of the civil air transport market, the price advantage may concern both the unit price of a new aircraft, tariffs determining fees due, the amount of the business class, economy class, price for jet fuel, handling services, aircraft take-off and landing fees. The price advantage applies primarily to marketing instruments and activities for which the consumer and the contractor receives physical confirmation in the form of an invoice, receipt or document based on which the transaction was concluded,
- an information advantage that directly relates to the flow of information between exchange parties. This is an example of the impact on passengers by means of messages in the form of advertising or other forms of communication to stimulate the recipient's interest in a product or service. A common practice used by airlines is audiovisual advertising because it has a wide range of impact. An interesting example of achieving an information advantage is the painting of aircraft of the Hungarian low-cost carrier Wizzair, which placed the airline's website address on the fuselage of its aircraft.

Competitive advantage in passenger air transport gained importance after the deregulation of the US air transport market and in Europe as a result of the spread of the open sky policy. The liberalisation of the air transport market has strengthened competition between airlines. Two types of competitive advantage can be distinguished when one considers the costs and technology used, such as:

- competitive advantage based on the economic aspect, which refers to the management of the assets and liabilities of an enterprise operating for civil air transport in such a way that the activity is profitable and the profit generated allows the purchase of new aircraft or modernisation of existing fleets within the equipment passenger cabin, ergonomics of pilots work in the cockpit, implementation of modern safety systems, and marketing activities aimed at promoting the airline. An important element of competitive advantage based on the economic aspect is the financial capacity of air carriers, through which airlines can purchase new aircraft using various forms of financing. A popular form of financing is financial or operational leasing, due to which the airline increases its operational capacity. Only a few airlines can afford to buy new aircraft for cash, which is associated with a high unit cost,
- competitive advantage based on a technological aspect, for which the reference criterion is primarily a product - aircraft, a system that is the result of, among others, design, structural and material engineering based on scientific and technical knowledge. The competitive advantage based on the technological aspect of passenger air transport relates to the launch of a new product, solution, system that can gain an advantage over competitors. With regard to aircraft, the European aircraft manufacturer introduced new aircraft such as the Airbus A320neo, the Airbus A330neo, the Airbus A350 XWB and the Airbus A380 in the last decade.

Both the competitive advantage in the economic aspect and the technological dimension are closely related, as economic advantage enables financing development works of a new type of aircraft, system, and solution to gain a competitive advantage. Building competitive advantage is also determined by the business model and strategy of the airline. [14] As an example, combining the economic dimension with the technological dimension to achieve competitive advantage, it may consider creative behaviour, understood as intentional human action, focusing on the creation and implementation of innovative activities in the form of concepts, ideas, and materialising these activities in the form of a finished product or final solution. Creative behaviour in enterprises conducting business activity for civil air transport can be presented as an end product [12] with features of innovation that improves the competitive advantage, safety level, and the supply and demand of this solution may determine the profitability of the company's operations in the aviation industry. Creative behaviour should positively affect the company's financial result due to the potential of implementing a given innovative solution in economic and technological terms. As part of creative behaviour, product innovations play an important role, constituting a completely new product, as well as introduced modifications or configurations of new solutions in the output product. Product innovations are expressed, among others, in the technological dimension using knowledge from a given field or scientific discipline. An innovative product can be presented in the form of products or services. Considering innovations, four types of innovations are listed [15]: within products, within processes, marketing innovations and organisational innovations.

3. AIRBUS A350XWB AND BOEING 787 DREAMLINER AS NEW PRODUCTS

Work on the development of a new twin-engine, wide-body Airbus A350 XWB passenger aircraft was initiated in 2005 with an estimated cost of EUR 3.5 billion. The new aircraft of the European consortium was designed as a response to the demand of the passenger air transport market for a new twin-engine, wide-body passenger aircraft, which will create a competitive advantage for the operating airlines by reducing operating costs due to reduced fuel demand, the use of composite materials, avionics systems, hull structure and passenger cabin equipment, different from previous aircraft structures. The Airbus venture was risky due to the fact that within a dozen or so years, it was putting into service new narrow and wide-body aircraft.

The introduction of a new aircraft on the civil air transport market involves the risk of occurring during the initial period of use, the so-called childhood diseases, which relate to the disclosure of potential design flaws, design errors, malfunctioning of systems that are designed to facilitate piloting, and other more or less identifiable risks that may adversely affect the safety of flight operations.

Tab. 1

Comparison of the features of the Airbus A350 XWB
and the Boeing 787 Dreamliner models

Aircraft type	Airbus A350-900	Airbus A350-1000	Boeing 787-8	Boeing 787-9	Boeing 787-10
Feature					
Lenght [m]	66,8	73,79	57	63	68
Height [m]	17,05	17,08	17	17	17
Wingspan [m]	64,75	64,75	60	60	60
Hull diameter [m]	5,96	5,96	5,74	5,74	5,74
MTOW [t]	280	316	216	245	-
Fuselage	Low-wing aircraft with two turbofan engines	Low-wing aircraft with two turbofan engines	Low-wing aircraft with two turbofan engines	Low-wing aircraft with two turbofan engines	Low-wing aircraft with two turbofan engines
The use of composite in aircraft construction	Yes	Yes	Yes	Yes	Yes
Number of seats	325 - 440	366 - 440	242	290	330
Reach [km]	15,000	15,557	13,620	14,140	11,910
Crusing speed [mach]	0,85	0,85	0,85	0,85	0,85
Operational ceiling [m]	13,000	13,000	13,100	13,100	13,100

Engine manufacturer	Rolls-Royce	Rolls-Royce	General Electric/ Rolls-Royce	General Electric/ Rolls-Royce	General Electric/ Rolls-Royce
List price [mln] USD	317,4	366,5	248,3	292,5	338,4
Key element of competitive advantage	Product innovation				
Examples of implementation of competitive advantage by selected airlines	Connection made by Singapore Airlines on the Singapore-New York route, high quality onboard service based on passenger cabin equipment offered by Qatar, Singapore Airlines		Opening of a new router to Tokyo, Beijing, Seoul, increasing the frequency of connections to New York, Toronto via PLL LOT, experimental Qantas flight on the Sydney-New York route, high quality on-board service based on passenger cabin equipment offered by Qantas, Air New Zeland		
Selected product innovations	Composite construction, improvement of aerodynamic properties, titanium chassis, avionics, winglets, pressurisation of the cabin to given conditions, assembly of the cabin in a plug and play system		Composite construction, improvement of aerodynamic properties, lighting system, avionics, pressurisation of the cabin to given conditions		
Aviation events registered in the ASN database and selected malfunctions	12 recorded events: landing gear damage during landing in difficult Feather conditions, collision with another aircraft on the apron and during taxiing, rupture of the front undercarriage tires during landing in difficult weather conditions, pressure drop in the cabin, collision with a bird during the climb chase, appearance, messenger about		4 recorded events: failure of the cell system – faulty battery design initiated a fire in the cabin, collision on the apron, collisions with other aircraft during taxiing. In addition, there is the periodic grounding of Boeing 787 Dreamliner aircraft due to the need to remove the defects of Rolls-Royce engines, the need for regular boroscopy of engines before take-off. The need for regular checking of the hull plating to detect signs of oxidation on the plating		

	engine failure during the flight, hydraulic system failure				
Mitigation of danger, forms of compensation	Respecting and implementing guidelines for reports of entities operating for the safety of civil air transport, reviews, financial compensations and purchase discounts for producers, leasing of other aircraft (AMCI, dry lease), Just culture, diversification of air fleet				
Example of users	Qatar, Air China, Delta Air Lines, Iberia, LATAM Brasil, Vietnam Airlines	Qatar, Cathay Pacific	LOT, Air Canada, El Al, All Nippon Airways, Avianca, United Airlines, Oman Air	LOT, Air Canada, El Al, Aeromexico, Air New Zeland, Korean Air, Qantas	Etihad Airways, Singapore Airlines

Source: authors' study based on [1, 5]

The basic features [2] of the Airbus A350 XWB aircraft, which can be the basis for building a competitive advantage on the passenger air transport market, include:

- 70% of the aircraft was made from advanced materials, 53% of the carbon composite, combination of materials of titanium, modern aluminium alloys to create a lighter construction and to minimise maintenance requirements, the revolutionary design of adaptive wings that undergo specific changes in the air in such a way as to achieve maximum aerodynamic efficiency as a result of optimising wing loading. The technological aspect directly affects the dimension of the economic operation of the aircraft, since there is a reduction in operating costs by 25% reduction of combustion of fuel and emissions of carbon dioxide compared to the legacy aircraft, innovatively designed passenger cabin, with wider seats, high ceiling and friendly lighting, which is supposed to affect the comfort of passengers travel. According to the manufacturer, the aircraft has the quietest passenger cabin among wide-body aircraft. Optimal pressurisation of the passenger cabin to the pressure conditions at an altitude of 1800 m a.s.l. and the corresponding 20% humidity level as well as the temperature level, due to advanced solutions aimed at ensuring the best air quality, the exchange of which occurs in the passenger cabin from 2 to 3 minutes, no purported childhood diseases, longer flight range than its direct competitor, the Boeing 787 Dreamliner [6]. The Airbus A350ULR- Ultra Long Range, has a modernised fuel system, holding 165,000 litres of fuel, which translates into an increase in the range up to 17,900 km and the possibility of extending the flight to 20 hours [3]. There is a possibility of modular adaptation of the passenger cabin without interference in the aircraft structure. Airbus has proposed the idea of using the luggage compartment as an additional space for passengers, where it would be possible to make the interval which is a children's playground, conference rooms, and small wellness clinics. A3, owned by Airbus, is responsible for developing the modular cabin. The skeleton structure of the module, which is the equivalent of ULD air cargo containers, has the shape of a geodetic truss [21]. It can be assumed that Airbus effectively uses the most important competition instruments, because it offers a high-quality product, provides flexibility

to adapt to the expectations of a potential customer through different versions of the same product, provides a technical basis and, as far as the efficient organisation of the supply of its product, and provides a wide range of additional services in form of adjusting the passenger cabin to the needs of the airline.

As at February 28, 2019, Airbus had an order backlog of 852 Airbus A350 XWBs, of which 249 were delivered. A significant part of the orders was realised for the Asian market [20]. The introduction of the Airbus A350 XWB is part of the proposed scheme for achieving competitive advantage in passenger air transport. It should be noted that a frequent cause of the creation of new products in air transport is an undesirable aviation event in the form of a catastrophe, an air incident, which forced the action to minimise the effects of an aviation event. In relation to the product of the American manufacturer, the elements constituting the competitive advantage include [19]:

- composite construction, which accounts for over 50% of all materials that make up the aircraft, makes the aircraft lighter than other long-haul aircraft, which in turn contributes to better efficiency, that is, more economical fuel combustion and also extends the range of the aircraft. The innovative design of the passenger cabin, which is to ensure adequate comfort of travel: pressurisation of the cabin to the pressure level at 1900 m.a.s.l., larger windows and lighting system that helps to alleviate the effects of changing time zones during long flights. The new passenger cabin has been designed to increase travel comfort and minimise jetlag. Thus, the aircraft has a higher income potential for the airline, which can be realised through: higher cruising speed, increased operating cycles in which the Dreamliner can be used, launching new directions of flight, using classes in the passenger cabin and the possibility of a greater amount of cargo while transporting passengers on one plane. The Dreamliner ensures lower operating costs during the operation of the aircraft due to exceptional fuel savings, lower costs of maintaining the ship for operational tasks, while the Boeing also indicates advanced avionics, aerodynamics, optimised cockpit, and increased share of electrical systems responsible for airworthiness.

Competitive advantage can be a key element of the airline business strategy. It can be initiated by an idea, concept, aviation event that leads to the development of a new aircraft. All activities related to this process should be carried out with the highest safety standards and constantly monitored to detect and eliminate all risks. The very process of creating a new aircraft is supervised by entities whose task is to verify safety procedures at every given stage of the project. A significant process seems to be cooperation between producers, airlines and regulators of the passenger air transport market. Failure to comply with specific rules of cooperation and the desire to achieve competitive advantage by abandoning safety procedures may lead to air disasters and the collapse of the manufacturer's brand prestige. An example of this may be the Boeing 737 Max aircraft, which as a result of two air disasters revealed defects in the operation of its MCAS system [9], which were supposed to prevent loss of lift force during flight. Currently, all Boeing 737 Max aircraft are grounded and work is underway for entities involved in civil aviation safety to clarify the circumstances of the disasters.

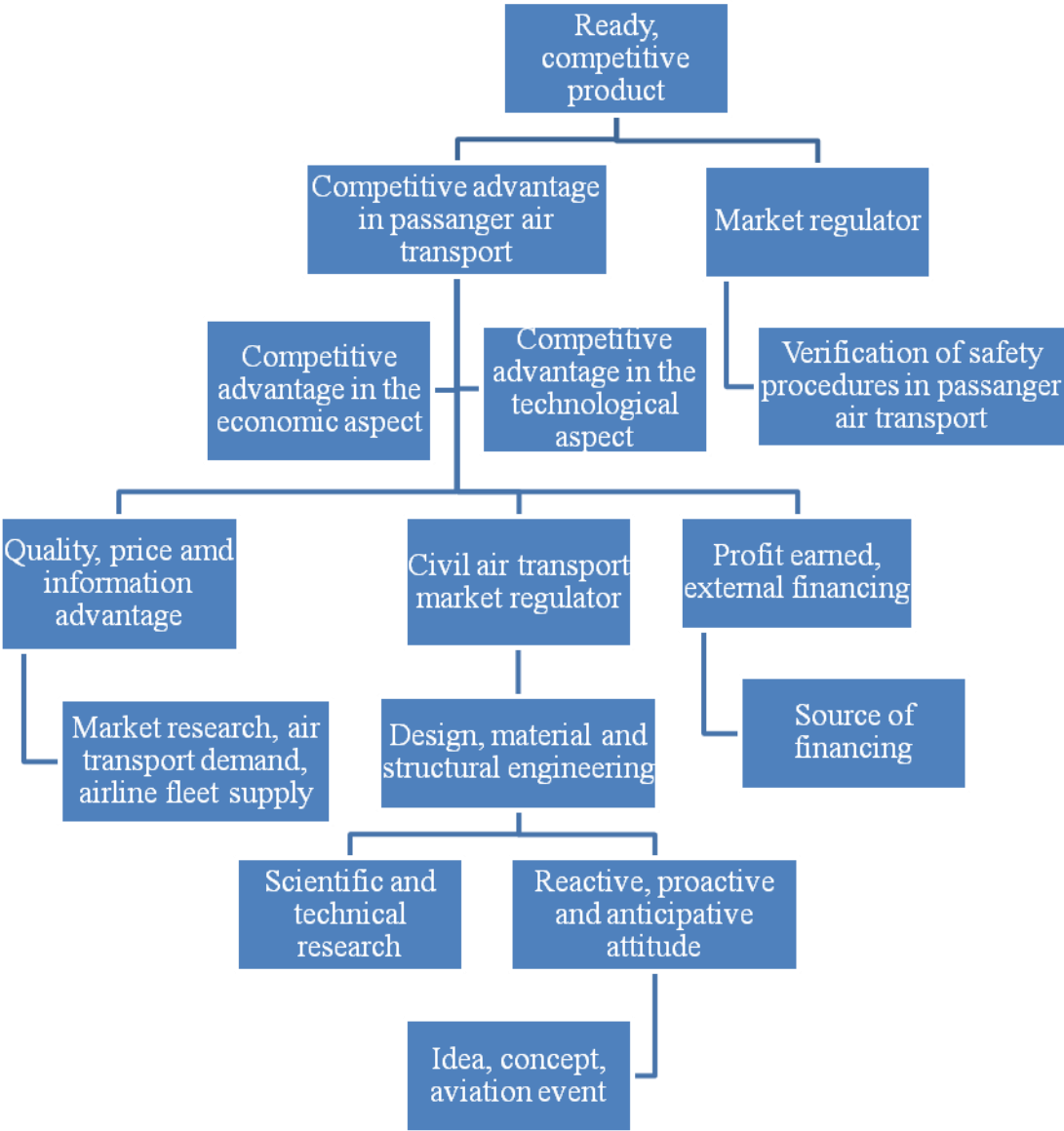


Fig. 1. Diagram of competitive advantage in passenger air transport
Source: authors' study

Obtaining competitive advantage by airlines should be associated with maintaining and following safety procedures. This is the reason close cooperation of aviation market stakeholders with market regulators is important, as well as a proactive attitude in civil aviation, which may contribute to the mitigation of potential undesirable security threats in civil aviation. Competitive advantage should not be achieved at the expense of bypassing or manipulating acceptable levels of security.

4. SUMMARY

The air passenger market is a dynamic market where the conditions for exchanging certain transport services are agreed. The activity of this market is subject to strict supervision through appropriate institutions, which are to exercise control over the acceptable level of

safety in civil air transport. Despite rapidly advancing technological solutions serving the construction of new aircraft and the provision of optimal (that is, cost-effective) solutions for financing ships by airlines in the economic dimension, obtaining competitive advantage by airlines through the prism of managing a fleet of new aircraft can be extremely difficult. First, the purchase of new aircraft may be associated with the problem of childhood diseases that manifested themselves during the use of Boeing 787 Dreamliner aircraft in the form of defective batteries and engines. To date, no significant defects have been revealed in Airbus A350 XWB aircraft. The design of the European manufacturer was introduced to the civilian transport market later than the Boeing product. It can be assumed that the elimination of childhood diseases and maintaining an acceptable level of safety during the implementation of air operations by airlines that have decided to operate the products of a European and American manufacturer may have a positive impact on the competitive advantage of a given carrier. The following can be considered as important elements of this advantage: reduction of fuel costs, increase of cruising speed, increase of operational cycles, possibility of establishing new air connections, and increase of passenger comfort.

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