

The influence of innovation onto the logistics process of goods transport by air

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Abstract. The logistics of air transport assumes the usage of the airplane and airport warehouse capacities to transport goods from one point to another. Within this paper the process of goods manipulation is explained by using air transport and innovations introduced by various companies have been presented. The modern transport market faces the companies with numerous challenges which these companies wish to address in an adequate manner. By innovating, the companies express their constant tendency to increase the competitive advantage by improving the efficiency and effectiveness of their business processes. The number of innovations is multiple and they exist in every area of air transport. The innovations mostly appear based on the company initiative, but can also be generated by state entities, as well as national and international institutions and associations.

1. Transport

Transport represents the movement of goods or passengers from one destination onto the other in a certain time frame. The transport market supply side consists of transporters which possess the capacities for transport such as trucks, boats and airplanes. The transport market demand side refers to individuals/companies which have the need to transport goods in order to fulfill their business processes. The global market of transport services is developed and all types of transport can be accessed. In some parts of the world, where infrastructure is inadequate, it is more difficult to perform transport activities, but in the 21st century, the number of such countries has significantly been diminished. The contemporary supply of transport capacities within certain types of transport is specialized for different kinds of loads that need to be carried.

The transport market, as is the case with the market of any other product is determined by its basic constitutive elements: the product (the transport service), space, time, supply and demand [1]. The transport service refers to the movement of goods from one place onto the other. Besides the physical manipulation of goods, this service may also include the acquisition of the adequate documentation.

2. Goods air transport

Due to the globalization of economics and the technological advancement, the company connectedness with the global market is very high, which enables these companies to do business activities with other

companies around the globe. Therefore, the importance of air transport is increasing and it plays a vital role in the national economic development. The logistics of air transport assumes the usage of an airplane and warehousing services for a quick goods transport from the sending point to the receiving point. That is the fastest way of transport and it offers the advantages of security, speed, geographic and time flexibility.

In order to perform transport and the logistics services by using the air transport and adequate land infrastructure is needed, such as airports, terminals and warehouses. Also, it is needed to develop the infrastructure which would enable a high level of connectedness with the other means of transport, rail tracks and transport access points.

The air cargo can be transported by passenger and cargo planes. In case of using the passenger planes to transport goods, the passengers are seated in the upper part of the airplane, while the cargo is below them, in the space where the baggage is, called the "airplane stomach". The cargo planes are especially designed to transport only cargo. The cargo planes do not have seats but the entire space within them is adjusted to cargo transport.

The service lenders in air transport are a heterogeneous group of operators. They offer various types and levels of logistics services. There are three main categories of operators within the cargo air transport [2][3]:

- Line-haul operators
- Integrated operators, courier services
- Niche operators

Line-haul operators only perform goods transport from airport to airport. They do not negotiate with buyers, but pass over that activity to freight forwarders. These operators can be divided into: cargo, combined and passenger operators.

Cargo operators transport only the cargo within airplanes especially designed for that purpose and their fleet consists of only that type of airplanes.

Combined operators offer the services of cargo transport, both by cargo airplanes as well as passenger airplanes.

Passenger operators only use the space of "airplane stomach" to transport the goods, in case that this space is not used enough.

Integrated operations combine the functions of freight forwarders, air transporters and land transport within one subject, i.e. the management of the complete cargo delivery from the place of origin to the final destination. Most often, these companies have within their ownership the land transport and warehouse capacities and the fleet of cargo airplanes.

Niche operators perform the cargo of specialized equipment, technology and cargo with proportions and characteristics which demand a particular airplane type.

The types of goods transported by air transport are: IT components, devices, easily spoiled goods (food and agricultural produce), weapons, explosives, dangerous goods, construction materials, metal elements and parts, live animals, converters, cars, machines, pesticides, human remains, value shipments (gold, money, noble metals), human organs for transplantation etc [4]. Certain kinds of cargo need to have secured special conditions such as particular warehousing spaces, transport procedure, surveillance and protection measurements. Besides these conditions, it is needed for the employees performing the physical manipulation of the goods to pass through an adequate training.

3. The process of transport

The logistics process of goods transport via air represents a timely set endeavour which assumes the coordination of various subjects [5], transporters, freight forwarders, warehouse agents, customs, goods senders and receivers and the coordination of various activities of loading, unloading, warehousing, customs setting, documentation gathering etc.

The process begins once the goods arrive into the warehouse of the transporting agent who is in charge of goods manipulation [6]. That agent is usually an individual company which has an agreement relationship with the airline transporter, but this job can be performed even by the very transporter, as part of its business, especially within big and frequent airports. It is not such a rare case that one air

transporter offers this kind of service to other transporters for a fee. The agent takes care of cargo movement from one airplane to another.

Depending on the type of cargo, the destinations onto which the goods need to be transported and the urgency, the delivery of the goods to the agents must be performed at a certain time before flight departure. That period before take-off is called slot-time.

The entire process of performing air transport by steps is shown within Figure 1.



Figure 1. Scheme of the entire airplane goods transport process.

Within air transport, there is the possibility of cargo being transported to the destination by cargo transfer, i.e. cargo being unloaded from one airplane and reloaded onto the other airplane at some other spot before the final destination. This only refers to airplane transfer, but not the change of the final destination. At that point, the cargo is in transit. It is up to the freight forwarder (who is in communication with the transport company whenever it is necessary) to decide whether to send goods directly or within the process of transit, which depends on the majority of factors such as: price, time (depending in a great deal on the timetable of flights of other airlines), special conditions regarding cargo (security, live animals etc.).

In case of a transfer/transit shipment, the process between flights would correspond to the one shown within Figure 2.



Figure 2. Scheme of the transit shipment process.

In case that goods with high degree of urgency are being transported, and if the flights fit the time frame, the process can be significantly shortened and shown as within Figure 3.



Figure 3. Scheme of the transport process of a very important transit shipment.

The checks before the loading and flight take off are very important for air carriers [7]. A check is performed of physical characteristics of the cargo and the containers, the following documentation, declarations, numbers, marks, security flight checks, etc. The documentation is prepared and temporarily situated and the goods are prepared for loading.

At a certain time before the take-off, the loading shall begin and the accompanying documentation shall be set in an appropriate bag. Once the process of loading is finished, the bag with the documentation is given over to the crew. The doors of the plane are closed and all is ready for take-off.

During the flight, the crew controls the temperature within the trunk. In many airplanes, the temperature and the circulation of air can be set by compartments. When a stable, low temperature is required, containers with cooling equipment are used, together with the isolation equipment, and also ice. In case of transporting bigger live animals (elephants, horses) the airplane can have an animal keeper who will take care of the animals during the flight. The transporters which have this option in offer have special premises where animals spend their time at the airport before the flight.

At a precisely determined time before landing the agent from the country of take-off shall get in touch with the agent from the country of landing and inform him about the details of the flight and delivery. That helps the agent to prepare the goods arrival, to plan the priorities while cargo unloading and to secure an uninterrupted and quick flow of the shipment through the following steps. This notification by the agent from the country of take-off is called the freight forward message. At the destination airport, the cargo and the very flight shall pass through the same procedure once more, only in a reverse order.

Besides physical manipulation, the other important agent functions are [5]:

- To control the total weight and balance of the plane on that side where the cargo is located, to form the loading list and take care of flight security;
- To form a bill of lading for the goods on the plane, for the needs of the air carrier import and export declaration;
- To fill out the form which is called the notification to the plane captain, which contains information for the crew about the possible risks of cargo in case of emergency situations and demanding conditions for the cargo in the trunk;
- To plan and control the reservation, time slots, flow of goods through the warehouse, the flow of goods from the plane and to the plane due to the prevention of hold ups.

4. The innovations within the logistics process

Within the modern transport market, cargo transporters in the air transport industry, especially those coming from the developing markets, are faced with numerous challenges. With the quick growth of the e-sales and production migration to South-Eastern Asia, the rising challenge faced by the modern transport companies is the efficient goods delivery from the aforementioned region to the final destinations. In order to secure business success, the air transporters must efficiently manage the logistics operations. Innovation is imperative in this current and uncertain environment for the survival of an organization [8]. The digitalization of documentation, which shall allow the improved efficiency of documentation processing, can enable the efficient operations management. Investing in information technology is not only an investment in the future but also in the present, where an effective business strategy is focused on the productive use of IT technologies [9]. New technologies enable companies to use information in real time and to easily coordinate business activities. The usage of technology in different operations can secure competitive advantage to business subjects in the way that it shall shorten the time of the cycle duration, enable inter-functional connecting and increase the degree of punctuality and reliability.

Programs, techniques and technologies of the modern IT sector are designed to follow and plan the cargo manipulation and the accompanying actions represent the solution for the modernization of the air transport. The innovations most often appear at the initiative of the companies, but can also appear at the initiative of state organs and national and international institutions and associations.

With the aim to increase the efficiency of logistics operations, to speed up the performance of the entire process of delivery and to enhance innovative thinking, IATA has started the program of air cargo transport transformation called the StB Cargo (Simplifying the Business) [10]. The program consists of six projects: e-freight and e-AWB, ONE record, Interactive Cargo, Smart Facility, ACID (Air Cargo Incidents Database), Cargo Connect.

That aim which is wished to be achieved by using e-freight is the development of the entire process without papers for goods air transport through the regulatory frame, modern electronic deliveries and high level of data quality. To achieve the mentioned goal the prime importance is set on e-AWB and Cargo-XML standard. E-AWB represents an electronic agreement about transport between the sender

and the carrier. Cargo-XML standards are used for the electronic communication between air transporters, senders, freight forwarders, agents for cargo manipulation at the airports and custom services. Consequently, three types of paper documents are eliminated: customs, transport and commercial documents of the specialized cargo.

The essence of ONE record is to pass over from the model of message exchange between users onto the model of data sharing. ONE record is not a substitute for e-freight communicating, but is rather developing along its side. Every participant in the process of transport is enabled, with the use of internet technology and cloud hosting, to insert data in the mutual virtual shipment record as well as everyday access to information stored within the data base. For efficient performance measurement, the collection of data and their integration must be simple [11].

The interactive cargo is the project with the aim to develop technology which shall allow interaction of cargo with the data base, which facilitates the participants of the transport process the tracking of state within transport units and locating the cargo in real time.

The first aim of the Smart Facility project is to improve the visibility of the operator service for handling the cargo at the airports and increasing the capacities for performing the basic transport operations. For carrying out the first goal an on-line platform has been developed with publically available information on physical infrastructure, available resources and operator equipment. The second aim of the project is to simplify the procedure of operator capability revision to fulfil the operative standards and the availability of capacities by every air transporter. In order to ensure the safety of air transporters and to diminish the number of revisions and time spent on those activities, a mutually recognized revision has been established, as well as the scheme for the accreditation within the entire branch.

ACID has the aim to collect and secure reports on the incidents concerning cargo, without stating information on the subject and to unite the gathered safety and operative information into a unique data base, where based on these data trend analyses would be performed, the foreseen risk would be diminished and the programs for cargo manipulation improvement would be created.

The aim of Cargo Connect project is to simplify, standardize and modernize the connection with and between the cargo community systems. The absence of relevant and precise information can lead to process inefficiency and the appearance of hidden costs. Therefore, the digital cooperation is important in order to improve the efficiency by creating stronger bonds between air transporters, freight forwarders and other partners.

Besides IATA, companies are also examples of the development and implementation of new solutions. SEW-EURODRIVE is a company which is developing mechanical and software solutions for managing the movement of cargo within airports [12]. The company is familiar with the demands of the airport industry for the air goods transport and is trying to respond to these demands in an adequate manner. The aim is to achieve the highest degree of process automation, which brings to the reduction of costs and shortening the time period needed for the manipulation of goods at the airports. The technological solutions are offered for the entire process of physical manipulation which is performed at the airport, the loading and unloading of airplanes and trucks, the movement of pallets and containers within warehouses and between airplanes and warehouses.

The technology for safety cargo handling assumes the usage of transport rolls, rotation tables, track lines for containers and pallets and software for the control and management of these components. A special feature of the containers is that they demand big contact surfaces. They cannot, as is the case with pallets, be handled by stow sides, but must also be supported in the middle. As a result, today's solutions for warehousing are based on mechanical transport rolls, within which the containers can be moved and placed. Within contemporary solutions, in order to secure such big contact surface, several narrow lines are engaged simultaneously to pull one container.

The majority of airports have limited warehousing capacities so the cargo needs to be lifted and stored high, which results in modern high storage warehouses. The size of the high storage warehouse constantly keeps increasing, so therefore do the demands for the warehousing systems. The solutions which are offered are new vehicles and new systems of automated vehicle management.

To unload the cargo from the truck onto the warehouse and vice versa truck docks are used. Due to

the diversity of trucks the height of the truck transfer points must be set using the truck docks. The ramp is self-adjustable and compensates for the height difference in the width of the vehicle. It also has installed protective battens which prevent damages within transport rolls.

Another example is the Web-Cargo Sky platform presented by the company Freightos. It represents a free service which allows the freight forwarders quick access to tariffs and information regarding the availability of capacities of more than 350 airlines and booking in real time [13]. The platform is used as a search engine, by entering data on the departure and arrival destinations, data on physical characteristics of the load being transported, and there is a possibility to choose the currency and the desired transporter. The advantage is seen in the simple search of the base platform and the significant diminishing of time needed to acquire information and arrange the transport.

During the last competition organized by IATA in the field of innovation called "2019 IATA Air Cargo Innovation Awards" the winner was the company Unilode Aviation Solutions with the concept of digital transformation [14]. With its partners, Unilode developed a solution for tracking based on Bluetooth. These devices help the users to track the cargo at any moment, regardless of its location. With the aid of this technology data are gathered on temperature, moisture, hits and light, as well the information on current state within the airplane which is important for the users in case of specific cargo transport, such as easily damaged goods, precious goods or other sensitive cargo. The flexible reader network is important for the securing of global visibility and Unilode cooperates with the leading service providers of transport activities within the branch and with airports in order to fulfil the set aims.

Besides these programs, there is also a notable development of platforms for the simplification and speed increase of performing the customs procedures. The example of such a platform is BE-GATE, developed at the initiative of the Department for customs and excises of Belgium, and supported by the airports in Brussels and Liege [15].

In case of imports, BE-GATE enables the processing of a greater number of notifications concerning the arrival of one such transaction, through the forms approved by the customs service. For deliveries of 22 € and less, this form can also be used as a declaration for placement into circulation. For deliveries greater than 22 € it is needed to present an additional declaration to the PLDA. The results of the selection (packages which must be shown to the customs) shall automatically be sent to the declarant, along with the needed information about the selection.

In case of exports, BE-GATE is used for shipments of value less than 1000 €, and the weight lower than 1000 kg. For greater values and weights it is needed to deliver additional declaration to the PLDA.

The type of goods for which this platform cannot be used is excise goods, goods which require a license, goods with limitations and those goods which have the prescribed measures of control.

5. Conclusions

The growth of importance of air transport is noted on a global level. The investments in infrastructure are greater and more expressed. All stated is followed by a serious information and technological advancement without which modern logistics business cannot be efficient and effective to perform. The development of technique and technology also plays a significant role in securing the uninterrupted performance of activities within the logistics chain. The decreased number of missed flights and their delay achieve savings in time and costs, while the adequate usage leads to the decrease of material losses and damages. By decrease of costs the competitiveness of this type of transport is also achieved.

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