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Technology and Management of Traffic

Review

U. D. C.: 656.73:65.011.4

Accepted: Sep. 27, 2004

Approved: Dec. 14, 2004

FUNCTIONAL ANALYSIS OF SPLIT AIRPORT BUSINESS PROCESSES

ABSTRACT

Optimisation of business processes represents the basis of improving the competitiveness of the Airport as a service provider. This directly implies not only the analysis and creation of the model of current organisation and technological processes but also the necessity to measure these processes in order to re-organise and improve them. Consequently, the Split Airport Authority considers the functional analysis of its business processes as one of the major issues. Since in April 2002 the analysis and modelling were completed in all the organisational units of handling service and cargo department organisational structures, both of the organisational structure of these services, as well as of processes of aircraft, passenger, baggage and cargo handling, this paper will analyse the implementation of ARIS Computer System at Split Airport Ground Handling Process.

KEY WORDS

transportation system; air traffic; airport, aircraft, passenger, baggage and cargo handling; process and functional analysis; processes optimization; extended event-driven process chain; employee capacity.

1. INTRODUCTION

The efficiency of every transportation system is measured not only by the possible number of operations over a certain period of time and over a certain distance, but at the same time also by the total costs necessary to realise these operations. In other words, the efficiency of every system, including air traffic system means maximal utilisation of the existing organisational structure, human and material resources, as well as the operation technology.

Therefore, since the airport is one of the three most important subsystems of air traffic, the optimisation of aircraft, passenger, baggage and cargo han-

dling processes, as the basic business airport processes, means significant contribution to the improvement of efficiency of air traffic system in general.

Since, however, optimisation (of any) business process means that it is necessary to measure it, the functional analysis of the aircraft, passenger, baggage and cargo handling processes represents one of the most important tasks of its management.

This paper analyses the application of the computer system ARIS in the passenger and aircraft handling process at Split Airport.

2. HANDLING SERVICE WITHIN THE MACRO-ORGANISATIONAL SCHEME OF SPLIT AIRPORT

In Annex 14 – Aerodromes, the International Civil Aviation Organisation, the term “aerodrome” has been defined as a land or water area with aprons, structures, devices and facilities, and with different manoeuvring surfaces intended for safe movement, taking off, landing and stay of aircraft. In the Croatian Air Traffic Law, however, airport means a space open to public air traffic, and consists of an area with operative surfaces, structures, devices, facilities, installation and equipment, intended for movement, taking off, landing and stay of aircraft, as well as aircraft, passenger, baggage, goods, things and post handling. Thus, in accordance with the definition given by the ICAO (International Civil Aviation Organisation), “aerodrome” is a technical facility intended for safe landing, taking off, movement and stay of aircraft, and according to the Croatian Law on Airports, it is not just the technical facility but also an economic subject intended for aircraft, passenger, cargo, post shipment and baggage handling in civil air traffic.

Regarding the topic of this paper, the organisational structure of airport will be analysed from the traffic and technological aspect, so that in that sense the most important task is to explain in detail the organisation and technology of work of the airport operative services (handling services). However, before that, a simplified organisational scheme of the airport in general, and regarding all the activities for which the airports are most often registered as companies by respective institutions, will show both the position of the aircraft, passenger, cargo, post and baggage handling service, as well as its necessary links with other services.

Airport Split has 374 employees. The majority work in two sectors: the traffic and technological (238) and in trade and catering (86) – a total of 324 employees, which is 87% of all the employees. The rest of 50 employees are distributed in the following services:

- legislative and personnel affairs;
- development, plan and analysis;
- commercial activities;
- finances, and
- accountancy.

The traffic and technical sector is the basic and the most important airport system both regarding the number of employees, but also regarding the value of the means and equipment used in everyday work. The head of the sector is the manager who is responsible for the work to the airport general manager. Regarding the different activities included, the sector is organised as a whole consisting of eight services led by managers.

Regarding the total number of employees and means, the biggest among them is the aircraft, passenger, and baggage handling service. It consists of two subsystems: passenger and baggage handling and aircraft handling. It has a total of 113 employees divided into three shifts, with a traffic manager heading each of them.

Passenger and baggage handling, as one of the handling service subsystems in general, consists of the following activities:

- co-ordination of all activities regarding passenger and baggage handling;
- preparation and co-ordination of passenger and baggage handling – “check-in” procedure;
- passenger and baggage at the check-in counter;
- security control (PDZ) of the passengers’ checked baggage;
- control of passengers at the gate of the terminal building (prior to boarding the aircraft);
- receiving the passengers and assisting them on their way from the terminal building to the aircraft, and vice versa;

- informing the passengers about the landing and take-off times of aircraft, and about the possible irregularities in traffic as well as all the other information available to the personnel and public, and which refer to all the transport modes, hotel accommodation, etc. either by internal information system or by telephone, and in personal, face-to-face contact with the passenger.
- monitoring and determining all the irregularities that refer to the passenger baggage, tracking it and forwarding it to the passenger to the appropriate address when all the legal and organisational conditions are met, or giving the baggage to the owner or an authorised person at adequate premises;
- assistance and care about the ill passengers, passengers in wheelchairs and/or on stretchers, and providing first aid and assistance to the physician on duty in administering first aid to the ill and injured in the area and/or near the airport area.

Aircraft handling includes the following activities:

- co-ordination of all operative activities in aircraft handling, including also:
 - organising weekly and daily checks, and regular maintenance of vehicles, means and equipment which are used in the aircraft handling;
 - keeping of technical documentation about regular preventive and intervention checks, maintenance, and repairs for each vehicle, means and for each single part of the equipment separately;
 - continuous control of the proper functioning of the manoeuvring areas, devices, means and vehicles used in the handling service, and the request for their repair;
 - control and responsibility both for the accuracy as well as for the delivery of adequate documents which refer to special – ordered tasks and control of correctness;
 - guiding aircraft to and from the position;
 - towing/pushing of aircraft by means of a special tractor and adequate shaft;
 - setting of chocks under the main or front aircraft landing gear;
 - in case of general aviation aircraft, its anchorage in order to avoid possible damage in case of storm;
 - if the aircraft has no proper supply of electricity, or it is not working properly, provision of ground supply of electricity (“Ground Power Unit – GPU”);
 - if the aircraft is equipped with jet engines, and the air supply system is not working (“Auxiliary Power Unit – APU”), before starting the aircraft engine, switching to the air starter;
 - if the aircraft is not fitted with passenger enplaning/deplaning stairs, setting of passenger stairs;
 - cleaning of the aircraft passenger cabin;

- emptying and cleaning of toilets;
- filling with fresh drinking water;
- co-ordinating the unloading/loading of baggage, cargo, and mail, according to the instructions and under the control of the handling controller;
- unloading/loading of baggage, cargo and mail;
- receipt and sorting of passenger baggage according to respective flight in special premises, and its transport to the aircraft,
- transport of unloaded baggage from the aircraft to the passenger terminal building and delivery to the passengers.

3. FUNCTIONAL ANALYSIS OF THE HANDLING PROCESS

To make the functional analysis of the process of handling the aircraft, passengers and baggage, at all possible, a very detailed repository of these processes has to be established, which has to be not only understandable and clear, but also has to contain all the information essential for the usage of human and material resources. Therefore, in April 2002, using the method of interviewing the employees of all the organisational units, Split Airport completed the analysis and modelling regarding both the organisational structure of the service in general, as well as the one of the handling processes themselves, determined by the existing technology of operation.

It has to be emphasised that all the activities have been documented on the computer system ARIS as a process chain initiated by the eEPC (extended Event-driven Process Chain), which can be supplemented by time and other various quantitative attributes (value added), so that various calculations would:

- determine the weak points in the existing organisational and technological structure, and therefore,
- carry out the reorganisation of the service and reengineering of business processes with the aim of optimisation.

In other words, the basic activity of Split Airport is presented as a process organisation in which the costs of products (services of handling aircraft, passengers and baggage) represent in fact the costs of the process, and the process optimisation would in turn mean optimisation of their costs as well, including the price of the supplied services.

After having completed the modelling and developing of the repository of the handling process, at the beginning of November of the same year, the project of functional analysis was continued by the calculation of costs of these processes using the PF analysis (Process & Function Analysis). In the first phase, which was completed in December 2002, the costs were cal-

culated regarding the price of labour, consisting of costs of gross incomes increased by the costs of:

- education,
- work-wear,
- representation,
- mobile phones, and
- transport.

The second phase including the calculation of costs regarding the used material and means was planned for the beginning of 2003.

Thus, based on the computer organisational and process model of handling activities, a diagram of workplaces with the exact number of employees was developed, grouped according to:

- detailed description of jobs, and
- average gross expenditures per workplace (sum of gross income of all the employees at the respective workplaces divided by the total number of these employees) over the observed period from 01 September 2001 to 31 August 2002.

Here, the employees who were absent during the given period due to illness for more than 42 days were excluded from the analysis.

The analysis processed the data which referred to the employees of:

- the handling service,
- fire-brigade,
- cleaning services, and
- cargo services.

Regarding other services of traffic and technological sector (security service, information technology service, facilities and manoeuvring surfaces maintenance service, mechanical maintenance service and electrical supply service and since no computer organisational and process model has been developed, the total expenditures of the employees are presented separately and are simply added to the costs of employees at the handling and cargo services.

Besides, it should be emphasised that due to the increased number of flights during the tourist season, the need at the handling service for a greater number of employees is solved by part-time, seasonal employment, so that also for these employees the data were presented separately and added to the costs of the permanently employed at the handling service.

During the observed period, a total of 5881 aircraft landed and took off, out of which 911 (15.49%) belong to the category of general aviation, and 4970 (84.51%) to the category of narrow-body aircraft. Also, during that period a total of 601,181 passengers were handled, out of which:

- 292,470 were incoming passengers,
- 287,970 were outgoing passengers, and
- 20,741 were transit passengers.

Table 1 - Real presence of employee at work

Service	No. Emc Units	Total Availability Hours/Year
Handling service	113	163,784
Fire-brigade	30	43,483
Cleaning service	28	40,584
Cargo service	11	15,944
Total	182	263,795

It should be emphasised that the international passengers accounted for 74.18% of the total number of passengers.

Considering EMC (Employee Capacity) of the handling process, the calculation included only permanent airport employees, and the average availability at work of every employee amounted to 1449.49 hours annually (1 EMC = 1449.42 hours / annually).

In calculating the EMC, and based on the experience in other companies, a relatively high percentage of sick-leaves was observed so that the average EMC is by 25 hours lower than the usual one, which multiplied by 182 employees results in an average loss of 4,550 hours annually.

Thus, the analysis of the totally spent working time per single activities, and based on the interviews with the employees, has shown to what extent (regarding the value of one working hour) these activities participate in the total costs of the aircraft, passenger, baggage and cargo handling processes.

Some of the activities that the employees in their responses emphasised as dominant during their working hours are certainly focused on:

- «other general activities» with the spent 4,382 hours,
- preparation for the next operation with the spent 7,137 hours, and
- «other activities due to weaknesses in the organisation» with the spent 5,618 hours, etc.

The fact that, apart from the above mentioned activities, the most dominant of all that had been suggested were precisely the activities related to management and control, and cleaning, manipulation of means and internal meetings, indicate both that there is a need for reorganisation of single services and redefinition of workplaces with the aim of their adaptation to the requirements of the new technology, and the organisation of high quality process control in every single phase.

Table 2 represents the ratio between the numbers of working hours per groups of handling process activities. It shows great engagement of the workers who are not airport employees, but of other companies that offer adequate services to the airport in the realisation of the handling processes of aircraft, passen-

Table 2 - Working hours per single activities in the Handling process of narrow-body aircraft

Narrow-body aircraft handling	100.00%
Baggage and Cargo handling ES2	14.60%
Manipulation of means used in handling	10.62%
Duty hours for phone calls	8.97%
Bus ride for transport of passengers	7.56%
Handling of passengers with special needs ES1	6.62%
Passenger handling ES4	6.50%
Fire-service duty ES5	4.90%
Provision of information	4.87%
Activities re. handling of passengers with special needs	4.73%
Work on obligatory reports re. handling	4.53%
Co-ordination of all services involved in handling	3.60%
Activities re. aircraft Parker handling	3.21%
Control at check-in	2.82%
Control at dispatch	2.59%
Presence at aircraft handling	2.37%
Aircraft balancing	1.87%
Communication with users	1.80%
Preparation for handling of aircraft, passengers, baggage and cargo	1.49%
Handling scheduling	1.08%
Charging the services to users	0.61%
Creating, updating and testing of data on aircraft balancing and check-in	0.40%
Co-operation with integral services	0.26%
Co-operation with integral services and companies	0.10%

gers, baggage and cargo (ES = external service). This is partly the result of the business policy of the company management, based on the assessment that it is economically feasible to engage workers employed by other service companies for certain simple jobs. Otherwise, such practice is very frequent and common at airports worldwide.

Besides, it is a characteristic feature of the data that 11,711 hours are spent annually on the manipulation of the handling means. Since the average aircraft handling time amounts to a maximum of 40 minutes, it follows that one worker engaged in these jobs during the observed time spent 3,920.67 hours. This means that during the handling of every aircraft (including general aviation aircraft, which do not require the presence of these workers) 3 instead of the necessary 2 workers were engaged.

Aircraft handling is in this analysis defined by the jobs that do not refer to unloading and loading of baggage and cargo, as well as enplaning and deplaning of passengers. The reason lies in the intention to emphasise the relation between the activities presented in Table 3 by singling out these, regarding the total necessary time, dominant activities.

Table 3 - Working hours per single jobs in the Handling process of narrow-body aircraft

Aircraft handling	100.00%
Aircraft cleaning	82.13%
Emptying and removal of waste	13.00%
Supply of drinking water	4.88%
Handling control	3.38%
Other activities as required by aircraft crew	0.51%

Thus, the analysis of the data that the most spent time refers to the aircraft cleaning (total of 19,567 hours), noting that the cleaning of a narrow-body aircraft takes on the average up to 15 minutes, leads to the conclusion that every cleaner for 5,881 aircraft during this period spent a total of 1,470.35 working hours. When this result is divided by the total spent working hours for this activity, the data is obtained that every aircraft was cleaned by 13 instead of 5 cleaners, which is the real number of cleaners per aircraft?!

General aviation (GA) aircraft handling activities understand a whole series of tasks directed to offering services to the users who need assistance supplied by the airport employees during their whole stay at the airport.

Table 4 - Working hours per single activities in the Handling process of General Aviation aircraft

GA handling	100.00%
GA aircraft handling activities	69.77%
Charging users' services	24.81%
Aircraft anchorage	5.42%

Since it was impractical for this analysis to study separately each of these jobs, taking into consideration the lack of standardisation, Table 4 presents them in such a manner. However, even the activities grouped in this manner, and based on the data that during the observed time 9,618 hours were spent on them indicate the need for reorganisation of the handling process in such a way as to separate the handling of aircraft and passengers of general aviation from the handling of narrow-body aircraft and (its) passengers.

Table 5 - Working hours per single activities in the Handling process of incoming passengers and baggage

Handling of incoming passengers and baggage	100.00%
Baggage handling	46.96%
Handling of all other passengers	32.20%
Handling of passengers with special needs	20.84%

Passengers with special needs are in general patients, invalids or elderly people assisted when deplaning or enplaning by the physician on duty, a nurse or other employees. Therefore, although they are few in numbers compared to the total number of passengers, the number of working hours spent on their handling is relatively big compared to the working hours spent on the handling of all the other passengers.

Table 6 - Working hours per single activities in the passengers and baggage Check-in process

Passenger and baggage dispatch	100.00%
Activities re. X-ray screening of baggage	24.92%
Check-in	24.83%
Baggage dispatch	13.54%
Exit and taking PAX to A/C	11.85%
Monitoring, control, and concluding the check-in	10.40%
Preparation for check-in and dispatch of PAX	8.97%
Dispatch of PAX with special needs	5.49%

Table 6 clearly shows the dependence of the process regarding the control and issuing of the passenger documents on the process of checked baggage security control, during the check-in procedure. This is the result of the limited capacity of the security screening system compared to the system for the control and issuing of passenger documents.

Table 7 - Working hours per single activities in the Handling Planning process

Planning handling	100.00%
Planning human resources	50.79%
Planning flight schedule	32.85%
Planning of material resources	16.36%

Single processes in Table 8 are grouped into adequate sub-units in order to present more clearly the total number of working hours spent in the single phases of work during the observed period of 12 months.

Table 8 - Working hours per single sub-units in the Handling process

Adequate sub-units	Work hours
Handling of aircraft, passengers and baggage	175,312
General activities	40,765
Other internal jobs at the airport	19,901
Management activities	18,334
Maintenance of the means	9,484
Total	263,796

This overview of only some of the results obtained in the first phase of the PF cost analysis of the process of handling aircraft, passengers, baggage and cargo at Split Airport, will be concluded by an approximate price of one passenger aircraft handling procedure, which has been done precisely from the results of this analysis. Thus, by distributing costs to the total number of narrow-body aircraft, i. e. general aviation aircraft, an average price is obtained which is HRK 4,474 per aircraft, regardless of the category. Regarding the total number of general aviation aircraft, which form just one quarter of the total number, the costs of the handling process presented in this way are not realistic. Therefore, the costs of activities, that refer to the aircraft of both categories, were specially singled out and divided in the ratio equal to the numerical ratio of every of these two aircraft groups. The cost of the general aviation aircraft handling obtained in this way amounts to HRK 921.45, and for the narrow-body aircraft HRK 4,212.29. By adding the costs incurred by the personnel from the traffic and technical department, whose work is closely related to the process of handling passengers, baggage and cargo, the total cost for the general aviation does not change and the cost for the narrow-body aircraft amounts to HRK 5,125.51.

4. CONCLUSION

The price of any product or service on the market is not determined only by the costs of production or service provision, but also by a whole series of other factors which are very often completely outside the influence of the producer or the service provider, or under their slight influence. In other words, the rationalisation of the costs of production or service provision is precisely the safest, although not always the easiest way to the more rational operation. Therefore, it may be already concluded that one of the major objectives of a functional analysis of the process of handling aircraft, passengers and cargo (which means determining of the drawbacks, both in the organisational structure

of the handling service, and in the technological processes) has been partly realised.

Achieving the optimal price of service provision by means of adequate process reorganisation and reengineering, not neglecting here its quality, represents one of the next, equally important objectives.

Apart from this, and since the understanding of the processes regarding their interconnections and values, and therefore also the continuous improvement of these processes based on the objective measurements, are in the very core of the functional analysis of the business processes, this functional analysis represents at the same time also the necessary requirement for successful application of the quality management system, that is, one of the objectives that the Split Airport authorities have decided to achieve.

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SAŽETAK

FUNKCIONALNA ANALIZA POSLOVNIH PROCESA U ZRAČNOJ LUCI SPLIT

Optimizacija poslovnih procesa predstavlja temelj unapređenju konkurentnosti zračne luke kao uslužnog poduzeća, a to, drugim riječima, podrazumijeva ne samo analizu i izradu modela postojeće organizacije i tehnoloških procesa, već i nužnost mjerenja tih procesa u cilju njihove reorganizacije i unapređenja. U tom smislu, funkcionalna analiza poslovnih procesa u Zračnoj luci Split jest jedan od najvažnijih zadataka njene uprave. Kako je u travnju 2002. godine u svim organizacijskim jedinicama službe prihvata i otpreme, te robne službe, završena analiza i modeliranje kako organizacijske strukture tih službi, tako i samih procesa prihvata i otpreme zrakoplova, putnika, prtljage i tereta, u ovom će radu biti analizirana primjena računalnog sustava ARIS u procesu prihvata i otpreme putnika i zrakoplova u Zračnoj luci Split.

KLJUČNE RIJEČI

transportni sustav; zračni promet; zračna luka; proces prihvata i otpreme zrakoplova, putnika, prtljage i tereta; procesna i funkcionalna analiza; optimizacija procesa; proces potaknut događajem; produktivnost radnika

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