

Risk and opportunities in the process of flight delay

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Abstract – Flight delays represent a common problem in everyday air traffic practise. The impact of flight delay can be a risk and this risk represents financial losses, the dissatisfaction of passengers, time losses, loss of reputation and bad business relations. If an airline doesn't deal with this problem immediately, it will cause other problems. The main goal is to solve this situation to ensure the continuity of air traffic. The most important is to identify the reason, that causes the flight delay. It can be technical reasons, such as aircraft damages, failures or operational reasons. An operational problem may be, for example, human factor failure, mismanagement or the process organization. There are many ways how to identify problems. One of the possibilities how to solve the problem and eliminate it is to usage process management and risk management. The paper will aim to describe a methodology based on risk management that will help identify problems that cause the flight delay.

I. INTRODUCTION

Flight delay is an operational irregularity and represents a problem in the air traffic. Airlines should respond to the problem quickly and efficiently to ensure the satisfaction of all stakeholders. The reasons that can cause the flight delay are various. These reasons also represent risks and it is necessary to review all technical, organizational, human and environmental aspects. Same as financial, economic, legal and other aspects that have a negative impact on the safety and continuity of the air traffic process. Before we begin to assess risks, it is necessary to understand the whole process of flight delay. We use process management and risk management. Process management helps up with understanding and working with problem and risk management is use for risk assesment.

Several authors have dealt with the air traffic, air navigation, communication and the other aspects (aviation, safe airspace) which can cause the flight delays, and as an example, the issue was mentioned in this topic Mitigating Air Delay: An analysis of the Collaborative Trajectory Options Program where authors said that Congestion is a problem at major airports in the world. Airports tend to be the bottleneck in the air traffic control system. The problem that arises for the air planner is how to mitigate air congestion and its consequent delay, which causes increased cost for airlines and discomfort for passengers [1]. The air

transport market is beginning to evolve rapidly thus bringing organizational changes for individual airports and air carriers [3]. In the presented article we discuss the operational economic aspects of detection and anti-collision systems [7]. The paper is dealing with the selected stages of Ultra-Wide Band (UWB) radar signal processing. To this purpose, it provides the definition of UWB and describes some of the phases of the UWB radar signal processing [14]. The submitted contribution analyses the principles underlying the operation of passive surveillance systems also presenting potentials of their use in air transportation. It focuses on their advantages compared to primary radars and the possibilities of integrating passive surveillance systems into operational systems of air transportation [4]. The contribution is a treatise on the potentials of applying communication technology when determining the position of a flying object in a system of relative navigation. It provides algorithms for computing the position of a flying object in a space. [10]. The article focuses on the problems of windmill construction impact on air traffic safety. We present the methodology for assessment of the windmill construction impact on the aviation electronic system operation and safety [11]. There are the relationship between the total size of an airline and its flight delays. Total size of an airline is measured by its total market share, total amount of assets and also total number of full-time equivalent employees [9]. The number of transported passengers as one of the most basic airport operation services is dealt with scheduled and non scheduled passenger transport for the chosen year [6]. The factor of the aircraft load or the load factor is the rate of capacity of the airline. It is the efficiency measure and is used estimate to describe the performance of the airline. The high load factor is important for the profitability of the airline, and it is interesting to identify factors that could influence the factors of the aircraft load [8]. Flight delays, causing much disorder of air traffics, economic losses of airlines, and downgrading the travel quality of millions of people in airports all over the world [5]. Predicting the flight departure delay can be the main input for the prediction of the flight arrival delay. Based on using the new dynamic reserve crew strategy, the total crew cost can be reduced. This significantly benefits airlines in flight schedule stability and cost saving in the

current big data era [12]. Aircraft refuelling is a one cause of flight delays because it is a slow process. The process does not begin as soon as the aircraft is available for ground handlers, there is an increasing risk of it being terminated after the final passenger has boarded [13]. Process management has a positive and significant effect on organizational performance due to the mediating role of competitive intensity. Process management positively influences organizational performance due to the mediating role of collaborative structure [2].

II. METHODOLOGY

We use several methods to describe the problem. We need to understand the whole process and for its understanding we use process management.

Our research found that many airlines do not have this process implemented in their operations. Insufficient process readiness can cause the risk of loss, which is most often a financial loss.

Process management steps:

1. Identification – every problem must be correctly identified. The identification is based on the first flight delay information provided by the aircraft crew, station manager, the AFTN information or any other source. Based on this information is prepare Flight delay report.
2. Analysis – each problem is specific, has characteristics and differences. In this step, we determine a technical or operational flight delay.
3. Solution – in this step we apply the solutions which can be helpful for problem elimination.
4. Resolutions – the aim is to eliminate the problem with minimize costs and ensure maximum satisfaction of the stakeholders.

It is advisable to outline this process, for example using a simple flowchart. The process is affected by various factors that may be a negative impact. It is necessary to realise that each factor has a participant. The participants create a requirement that needs to be fulfilled. Every fulfil requirement makes it possible to prevent potential risks and on the other side to bring opportunities. We also assess the level of impact that may be negative or positive and external or internal.

III. RISK MANAGEMENT

After we understand the process and determine the factors that affect the process, we can start with risks assessment. We start with all possible losses, in the event of a flight delay, for example, financial losses and loss of goodwill etc. In assessing the risk, we also assess the probability of a risk, and whether the event occurs for the first time, all factors which affected the risk and also using types of equipment and staff.

To assess the risks and opportunities properly, we need to set up an assessment scale. We work with the probability of the risk and the impact of risk. They are determined in airline management based on expert estimates, brainstorming, using statistics and so on.

Risk management formula:

$$\text{Effect} \times \text{Probability} = \text{Level of risk.}$$

The effect can be very low or very high and depends on the duration of the flight. Based on this duration of the flight delay, the airline can assess the losses and all negative impacts.

Table 1 Effect

Criterion	Description	Parameter
		Delay of flight
1.	Very Low (VL)	to 30'
2.	Low (L)	30'-120'
3.	Medium (M)	120'-240'
4.	High (H)	240-360'
5.	Extreme (E)	>360'

The probability of risk may be also high or low, and it is based on the experience of the airline's practice.

Table 2 Probability

Criterion	Description		
1.	Very Unlikely (VU)	<10%	Less times that 2/month
2.	Unlikely (U)	10%-30%	
3.	Likely (Li)	30%-50%	
4.	Most Likely (ML)	50%-70%	
5.	Very Likely (VL)	>70%	More times that 2/month

The formula mentioned earlier represents correlation between effect and probability. The result is a level of risk. The risk may be low or extreme for the airline.

Table 3 Level of risk

E		1 VL	2 L	3 M	4 H	5 VH
P	1 VU	1 L	2 L	3 L	4 M	5 M
	2 U	2 L	4 M	6 M	8 M	10 H
	3 Li	3 L	6 M	9 M	12 H	15 H
	4 ML	4 M	8 M	12 H	16 H	20 E
	5 VL	5 M	10 H	15 H	20 E	25 E

We use risk management for risk assessment. In assessing opportunities and risks, we are based on the actual process of flight delay. We describe the process using SIPOC (supplier, inputs, process, outputs, customer) diagram, which is focused on individual

activities and summarises their inputs and outputs in the simple and transparent table. A SIPOC diagram is a tool use by the organization to classify all significant elements of a process improvement project before work begins.

The diagram evaluates a key performance indicator – KPI. This KPI represents a risk or opportunity for all activities. On the flight delay process, KPI may be the duration of a flight delay, financial cost, human factor, passengers’ complaints, satisfied or dissatisfied passengers. The diagram also describes the strengths and weaknesses of the process and an airline can effectively manage it. This diagram is part of the Six Sigma method. This method is a set of techniques and tools for process improvement. Six Sigma strategies seek to improve the quality of the output of a process by identifying and removing the cause of defects and the SIPOC diagram is a part of it.

Table 4 SIPOC diagram

Input supplier	Input	Process	Output	Output recipient	Work position	Sources	KPI – key performance indicator
Pilot Cabin crew Station officer	Information about flight delay	Receive information about flight delay	Report about flight delay	Airline	Dispatcher	Pilot, cabin crew, maintenance	Duration of delay
Airline	IATA Delay codes	Choose the reason of flight delay	Type of flight delay	Airline	Station officer, maintenance	Dispatcher	Human factor Finance
Airport	Report about flight delay	Information for passengers	Information for passengers	Passengers		Airline	Duration of delay
Airline	Type of flight delay List of procedures for delay resolution	Implementation a procedure for delay resolution	Procedures for delay resolution	Passengers, airport suppliers		Airline	Angry passengers Complaints
Airline, airport	Check-in	Boarding	Departure	Passengers		Airline, airport	Finance
Airline Airport	List of procedures for delay resolution – procedures for delay from 2 to 6 hours	Implementation a procedure for delay resolution – procedures for delay from 2 to 6 hours.	Vouchers, gift vouchers	Passengers		Airlines	Passengers satisfaction
Airline Airport Suppliers	List of procedures for delay resolution – procedures for delay over 6 hours	Implementation a procedure for delay resolution – procedures for delay over 6 hours.	Reservations (hotel) Transport to hotel Transport to airport	Passengers		Airline Suppliers	Passengers satisfaction
Airline	AFTL (Aircraft Flight and Technical Log)	Decision about technical issue	Report from technical control	Airline	Maintenance	Pilot	Duration of delay Finance
Airline	Report from technical control	Spare part/aggregate	Spare part delivery	Airline	Maintenance	Airline	Duration of delay Finance
Airline	Spare part delivery	Resolution for technical issue	Back to operation	Airline	Pilot	Airline	Duration of delay Finance

VI. DISCUSSION

There are a lot of different reasons for a flight delay. The airline can assess these reasons in many ways. In this work, we have methodologically pointed out one of the possibilities. We used process management to describe the process and risk management in searching for risks and opportunities in the selected process.

First, we use process management. Process management allows to better understand the process, identify it correctly, analyse it and find the right solution. This solution should reduce the problem and prevent it from recurring.

In the next step, risk management is applied to the process to help identify flight delay risks. In addition to the risks, opportunities can be also created and the airline can use it effectively. Risk management allows to understand risks and opportunities and follows the origin of this risk, the main reason for its occurrence, the impact and the way how to eliminate it. Result of risk management is a risk register.

To solve the problem that causes the flight delay, we used:

- Process management – the result is a description of the process by a simple scheme, such as a flowchart.
- Assessment of individual factors and stakeholders – the result is their understanding and fulfilment of requirements.
- Determination of an assessment scale that represents the correlation between the effect on the risk and the probability of a risk. This determines the level of risk.
- Risk management – the result is a SIPOC diagram that describes the process activities and allows it to be properly understood. It identifies the strengths and weaknesses of the process, that means opportunities and risks.

By applying both selected disciplines, determining effects and setting an assessment scale, we can work with and assess the process. The result is a risk register that identifies the type of event. The event can be a risk or opportunity. Depending on this we apply the necessary measure and method of handling the event. The outcome should be mitigation or complete elimination of the risk – eliminating the problem.

The airline solves different problems causing flight delays. The most common cause is human factor failure and insufficient preparation for the operation. The human factor can be one of the greatest risks. Especially, for small airlines, a chaotic solution brings losses and inaccurate estimation of the problem. We assume that there are defined requirements form by legislation, but there are no procedures or methodology for its implementation. In this work, we pointed out one of the possible methods to solve the situation. This method should be helpful for work and point out the

problems of the process. The result is better management with the same situations in the future.

V. CONCLUSION

Flight delays are general and constantly solved the problem by airlines. It is a problem of everyday air traffic practise and it is necessary to deal with it immediately. The main goal is to solve this situation to ensure the satisfaction of all stakeholders. The impact of this situation is a risk. Risk represents a loss, especially financial losses and dissatisfaction of passengers. The most important is to identify the reason, that causes the flight delay. In this work, we pointed out one of the possible methods to solve the situation. First of all, we need to understand the whole process. In this step we usage process management. In the next step, we apply risk management that helps us to identify risks which can cause the flight delay. By applying both selected disciplines, determines effects and setting an assessment scale, we can work with and assess the process. The result is a risk register that identifies the type of event, which can be a risk or opportunity.

Limitations: In this work, we didn't work with real data. The problem is only illustrated by the model. The paper can be extended to cooperation with the airline. This collaboration could follow the current state of the problem and the state after applying the model, which we have outlined in this paper.

The proposed model could be helpful for work in the flight delay process. First. We identified the problem, understood it and then dealt with as a complex. We assume that there are defined requirements form by legislation, but there are no procedures or methodology for its implementation. The model just answers the question of what procedures can be applied to the problem of flight delay.

Recommendations: applying the model to the real situation in practice. Cooperation with the airline. Tracking economic, technical and other aspects and also changes in flight delay after model application.

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