Journal of Aviation 2 (2): 105-118 (2018)

JOURNAL OF AVIATION

https://javsci.com - http://dergipark.gov.tr/jav **e-ISSN: 2587-1676**

Research Article

DOI : 10.30518/jav.480981

Received : **09.11.2018 **& Accepted : 26.11.2018 **& Published (online) :** 23.12.2018

Analysis of Internal/External Factors Affecting Time Management and The Reasons of Delay in Aviation

Savaş S. ATEŞ[1], Haşim KAFALI[2], Meryem ÇELİKTAŞ[1]*

[1] Faculty of Aeronautics and Astronautics, Eskişehir Technical University, Eskişehir, Turkey
[2]Dalaman School of Aviation, Muğla Sitki Koçman University, Muğla, Turkey

Abstract

It is defined as the time when a work or formation passings, past, or will pass in an action. Time management is one of the issues of that are difficult to manage in the aviation operation managent process. When the aircraft is in place, time management is one of the important elements to make operational processes effective and efficient. Planned time-out in the ground operation process cause delays. Some of the deviations in the process are prevented by the management of staff. The source of precautions is usually internal factor. However, perceptions that some external factors, such as weather, are effective can not be managed by staff. If the aircraft can not depart at the time of departure, the reasons for the delay are classified based on the IATA Standard delay codes. The IATA delay codes were taken as reference during the survey. A questionnaire consisting of IATA delay codes was applied to the employees working in the aviation sector in Turkey. When the results of the questionnaire and findings were analyzed by Chi-square analysis and Binomial test method using SPSS program and reliability of the data was determined by KMO & Bartlett test. Based on the current study, time planning is important in aviation operations. An analysis of external factors that cannot be controlled, such as the internal factors that can be corrected for the problems caused by the system-induced or human factor for the correct operation of the planned time, and the constraints imposed on the environmental conditions or the operation of the system must be well analyzed.

Keywords: Aviation, Time management in aviation, Aircraft operations, Planning, Delay, IATA delay codes

1. Introduction

It is defined as the time when a work or formation passing, past, or will pass in an action. One of the issues that is difficult to manage in the aviation operation is time management process. When the aircraft is in place, time management is one of the important elements to make operational processes effective and efficient. Planned time-out in the ground operation process causes delays. Some of the deviations in the process are prevented by the management of staff.

***Corresponding Author:** Dr.Öğr. Üyesi Haşim KAFALI hasimkafali@mu.edu.tr

Abstract paper was presented in Sixth International Conference on Environmental Management, Engineering, Planning and Economics (CEMEPE 2017)

Citation : Ateş S. S., Kafalı H., Çeliktaş M. (2018). Analysis of Internal/External Factors Affecting Time Management and The Reasons of Delay in Aviation. Journal of Aviation, 2 (2), 105-118. DOI: 10.30518/jav.480981

1.1. Time Concept and Time Management

Time management is the process of planning and exercising conscious control of time spent on specific activities, especially to increase effectiveness, efficiency or productivit [1]. Because of that, how time is used is important. Since time is an unstoppable source of time, efficiency can be achieved through timely and efficient use. Time is an invaluable, unique resource that people have equally but cannot use in the same activity [2]. Time can also cause perception difference according to the ambience. People think fun and happy moments are too fast, but they may not know how to spend their time in obligatory environments. As you can see, time is a detection event at the same time [2].

Time management is the process of planning and organizing the targets to achieve tasks or events to meet needs, and to schedule the time by setting priorities. Time management has emerged from the demand of manager and management time. Managing time is an important issue because time is seen as a source of production and consumption [3]. The main area of activity of the time management is related to all the managers and employees, from the private life of the individual to the low-level employees from the senior managers. Effective time management enables both cost reduction for projects and more efficient employment of people who are invaluable resources for businesses [4]. Efficient management or use of time means planning every hour, every minute, by planning for a specific goal and purpose [1].

The conscious efforts made for effective use of time have numerous benefits for both managers and employers [4].

1.2. Air Traffic Delays and The Reasons of Delay

Airline flight schedules are prepared taking into consideration the economic and operational factors. Flight schedule shows the time take off and landing on airports [5]. Flight Schedules vary according to the nature of the airline business management and competitive strategy [6]. Depending on these strategies, airline operators may operate in scheduled, unscheduled, charter airline markets [7]. The success of airline companies' competitive strategies depends on the effective management and timeliness of their operational processes [8]. Important reasons for many passengers booking a flight are price of the ticket and the scheduled time of take off or arrival. Passengers on the other hand are very often interested in the operational performance of an airline. There are a vast number of operational performance indicators used by airlines [9].

- RPKs2
- Load factor
- Dispatch reliability of aircraft
- Denied boarding of passengers due to over sales
- Rate of diversions
- Rate of cancelled flights
- Flight Punctuality
- Other indicators.

Deviations greater than 15 minutes from the time of landing and departure in the flight schedule are defined as delays [10]. Delays occurred as a result of disruptions in airline service delivery process occurs in stages [11]. Delay classification developed by Eurocontrol CODA (Central Office for Delay Analysis) based on IATA (International Air Transportation Association) codes is used to record the delay in the European region [12]. NAS (National Aviation System) and FAA (Federal Aviation Agency) in USA classify the delays as the that originated from the air, and from late arrivals [13]. Late arrival is defined as delay at an airport due to the late arrival of the same aircraft at a previous airport.

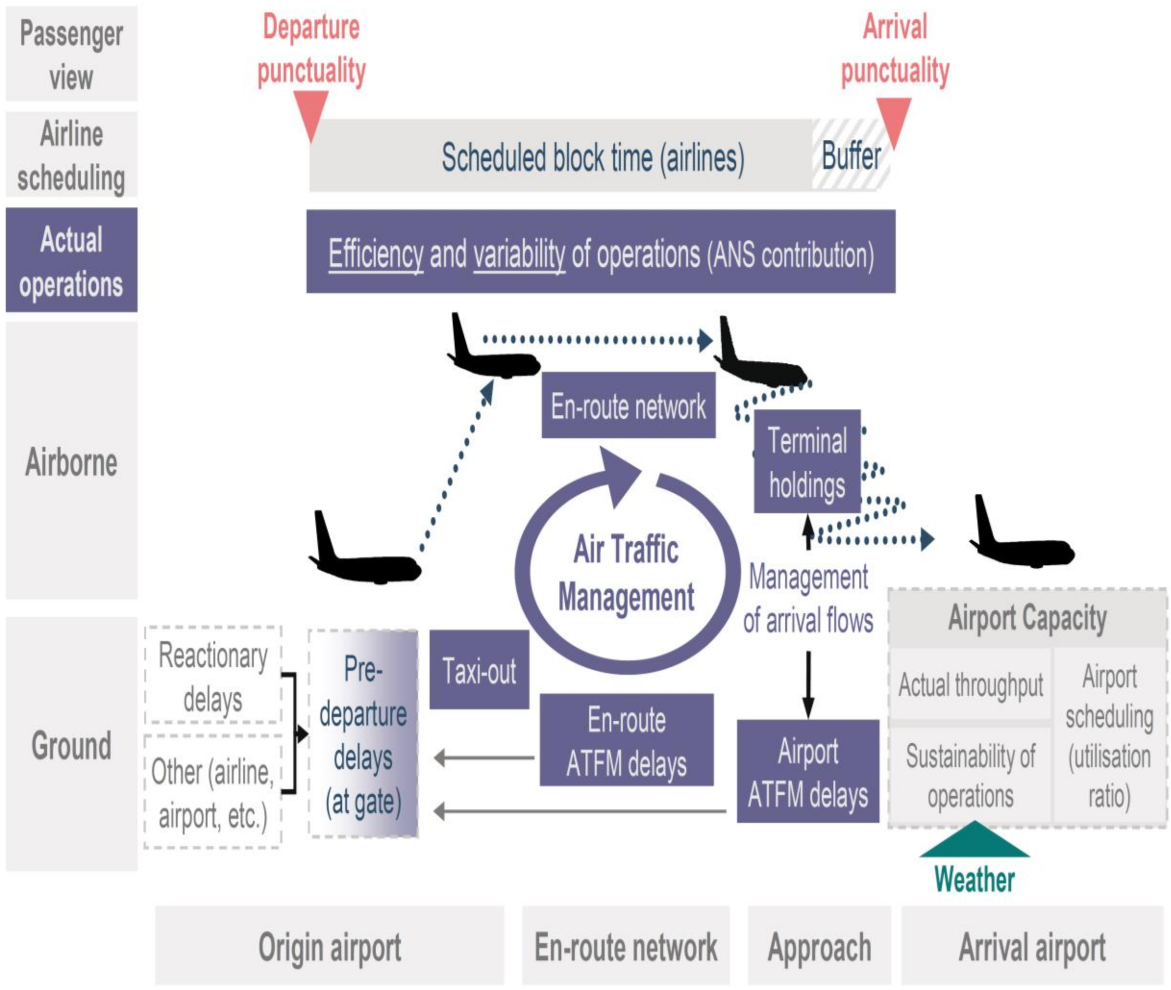

Figure 1. Delay Indicators for aircraft services [14].

In the classification of delays, the delay factors are taken into consideration as service processes, disruptions points and etc. The most frequently used classifications of delays are; delay before departure, departure delay, arrival delay, original delay, delays in taxi, delays outside the en-route network, delays at boarding gate, delays in en-route network, delays in the ground and delays in the airborne (Figure 1). A primary delay cause may be defined as delay that affects the initiation of the flight. This delay is unaffected by any earlier or accumulated delay. Delays are classified by IATA like that [15];

- **Airline-related Delays:** These are the delays that are directly under the influence of the airline. They are passengers and baggage; cargo and mail; aircraft and ramp handling; technical and aircraft equipment; aircraft damage and operations computer failure; flight operations; and other causes.
- **Airport-related Delays:** Congestion at airports can take a number of forms. Some congestion, such as the inability of more than one aircraft to move out of some parking cul-de-sacs, will affect start-up, and hence departure. Other airport congestion issues, such as lack of parking spaces, excessive arrival demand, or taxiway problems may result in arrival delay, or possible delay to aircraft which have not yet departed from the previous Airport.
- **En-route Delays:** This type of delay may be due to lack of en-route airspace capacity. This can result from an excessive peak of demand, say, or perhaps from a lack of Air Traffic Control staff due to sickness.

- **Due to weather at destination:** Weather delays may be encountered at either departure or destination airport and, occasionally, en-route. Some weather delays affect the ability of aircraft to move around the airport of departure, while some may be due, for instance, to a requirement to de-ice departing aircraft for safety reasons. Other weather events may affect the destination.
- **Miscellaneous**: There is always a small amount of delay which does not fit neatly into the above categories. Its recording is nonetheless important, hence the need for this group.

On-time arrivals mean that passengers can make their connections, that aircraft can be prepared in time for the next flight, that crew have sufficient time to change aircraft in case they are operating multiple-sectors, and it avoids late minute gate changes with possible lost passengers etc. [9]. An effective framework for approaching punctuality in a structured way should use three main levers; network planning and control, aircraft availability, ground operations and departure process [16].

Many of the approaches in the literature that are recommended for preventing delays in airline service delivery use quantitative methods. Developed theories about the delay is based on re-planning the resources to reduce the effect. Approaches to avoid delays in airline service delivery are important in terms of allocating resources; can be divided into three main categories: aircraft recovery models, crew recovery models, and passenger flow models [18].

- **Aircraft recovery models:** The most important source of aviation business is aircraft, however depending on the nature of the aircraft flight flights to the deterioration occurs. Depending on the delay, the flight schedule on the flight may be corrupted. Aircraft recovery models include the approach of reassignment of delayed flights. One of these approaches; fleet assignment models based on the reordering of connection hub airport flights [17]. Another method involves the approach of reducing the delay by swap (changing the flight legs in schedule an aircraft) [18]. One of the most commonly used methods by airline operators is the use of heuristic algorithms in the literature for aircraft change within the tariff [19]. But the success of this approach depends on a single type of aircraft fleet [20]. Otherwise, operational constraints make it impossible to implement algorithms in the real world. For that reason, some of the theories are based on irregular operations [21]. Because when aircraft changes are made, many planning related to the aircraft, especially the maintenance schedules, must be done again 22,23]. Algorithms that find the best result need to be recalculated re[peatedly for the flight route that is delayed by the delayed flight [24]. Thus, some of the theories developed are made practicable in everyday life with the help of computer software [25,26]. Besides, the feasibility of the developed theories is supported by the projects prepared in industry-university cooperation [11,27]. Software that monitors real-time rotation services is also used to determine the basic reasons for delay, which is one of the key components of delay prevention [28]. The greatest benefit of real-time service delivery follows; the delay has come out and can be noticed. This prevents the delay from spreading within the schedule.
- **Crew recovery models:** One of the most important sources of airline operators is the crew. The crew has operational restrictions, such as aircraft type, airport category to fly, and the ability to make scheduled flight legs during duty. Taking all these constraints into consideration, the crew is planned in accordance with the aircraft [29]. However, disruptions in service delivery lead to delays and deterioration of crew assignment plans. Crew assignments need to be done again to prevent delays from jumping on subsequent flights. Crew recovery approaches on delayed flights is possible to summarize as; assignment algorithms that will reduce cost the most [30], algorithms to correct crew assignments as soon as possible for situations where delays affect a large portion of the flight schedule [3], algorithms that make corrections taking into account crew duty time [32], algorithms used with decision support software [33,34]. Some of

these algorithms are supported by software and used in the air transportation sector.

- **Passenger flow model:** The final services of airline companies are taken by passenger and air cargo shipper. Some of the studies in the literature have focused on reducing the economic effects of delay on passengers [35]. Other investigations include mathematical approaches to the effect of delay on connected passengers and how connections can be made as soon as possible [36]. However, there are also models that will provide the shortest possible time to reach customers, taking customer satisfaction into account, and prevent delayed flights from being booked on a recurring basis [37]. Besides all these; national, regional, and international aviation organizations support to research about prevent delays.

2. Aims and Methods

Aim of the research is to find the perception of personnel who are working in the airport operation about delays dilemma as preventable / non-preventable. According to the data obtained from the General Directorate of Civil Aviation 2017 Activity Report, there are 187.459 personnel serving in the aviation sector in Turkey [38]. It is not possible in time and cost to reach all of these employees and implement the prepared questionnaire.

Stratified sampling method is used for the determination of the minimum size of sampling data according to the formula:

$$n = \frac{N * t^2 * p * q}{(N-1) * d^2 + t^2 * p * q}$$

t: Degree of the freedom alpha error level
p: Percentages of the interested events in the community,
q: Percentages of the interested events out of the community,
d: Deviation of the effect size from the previous research results,

For this reason, a specific sample was selected and in this context, the prepared questionnaire was applied to 307 people working in airlines, airports, airport terminal operations, ATC, ground services, passenger services and cargo services and other departments. The IATA delay codes (CODA: Central Office for Delay Analysis) were taken as reference during the survey [39]. The questionnaire consists of 28 questions in total. In the first part of the questionnaire demographic information was obtained about the employees. The sum of k independent and identically distributed (0, 1) variables has a binomial distribution [40]. The Binomial distribution, for tests where categories take yes or no question about delays. Employees are tried to analyze about perception about the reasons of delay (preventable / preventable). When the results of the questionnaire and findings were analyzed by Chi-square analysis and Binomial test method using SPSS program and reliability of the data was determined by KMO & Bartlett test.

3. Finding and Analysis

3.1. Demographic Findings

Of the 307 participants who participated in the survey, 76.5% were male, 23.5% were female. Survey results show that 60.6% of people working in the aviation sector are the result of people with high working potential in the 20-30 age range. While 50% of the participants are employees of Istanbul Atatürk Airport, the remaining 20% of the rest of the percentage are employees of Istanbul Sabiha Gökçen Airport. Participants were 30% airport, 17.9% airline, 20% ground handling, 11.1% passenger, 11.4% cargo, 2.9% air traffic control, and 5.9% are airport terminal operators (Table 1).

Table 1 Distribution of participants by demographic characteristics.

Demograpgic Variable	Groups	N	%
Working Airport	İstanbul Atatürk Airport	160	%50
	İstanbul Sabiha Gökçen Airport	68	%20
	Antalya Airport	13	%4,2
	Adana Şakirpaşa Airport	1	%0,3
	Ankara Esenboğa Airport	17	%5,5
	Bursa Yenişehir Airport	3	%1
	Dalaman Airport	16	%5,2
	İzmir Adnan Menderes Airport	11	%3,6
	Konya Airport	0	%0
	Balıkesir Kocaseyit Airport	9	%2,9
	Other	9	%2,9
Working Section	Airliene	55	%17,9
	Airport	92	%30
	Airport Terminal İşletmesi	18	%5,9
	Air Traffic Kontrol	9	%2,9
	Ground Handling Services	64	%20,8
	Passenger Service	34	%11,1
	Cargo	35	%11,4
Age	20-30	186	%60,6
	30-40	88	%28,7
	40-50	26	%8,5
	50 and up	7	%2,3
Gender	Female	72	%23,5
	Male	235	%76,5

Participants in the survey were informed about the professions of the participants and 13.7% are passenger service officers, 10.4% are technicians, 11.1% are operating officers, 8.5% are dispatchers and the rest of the percentage are various aviation professional groups. When the occupational years of the participants are investigated, more than the percentage is in the range of 1-5 years. The educational status of the respondents is mainly high school and undergraduate, 11.1% are graduate and 0.7% are doctorate education (Table 2).

Table 2. Distributions of participants by educational and professional characteristics.

Demograpgic Variable	Groups	N	%
Educational Status	High school	50	%16,3
	License	221	%72
	MSc	34	%11,1
	Doctorate	2	%0,7
Job	Dispatcher	26	%8,5
	ATC	6	%2
	Expert	24	%7,8
	Operation Officer	34	%11,1
	Apron Officer	9	%2,9
	Passenger Services Officer	42	%13,7
	Cargo Officer	34	%11,1
	Intern	66	%21,5
	Technician	32	%10,4
	Apron Chief	4	%1,3
	Team Allocation	2	%0,7
	Supervisor	6	%2
	Airport Operator	5	%1,6
	Officer, Accountant	7	%2,3
	Cockpit Crew	1	%0,3
	Worker	2	%0,7
	FIC	3	%1
	Other	4	%1,3
Business Year	1-5 years	171	%55,7
	5-10 years	69	%22,5
	10-15 years	42	%13,7
	15-20 years	14	%4,6
	20 and up	11	%3,6
Work Experience	1-3 years	138	%45
	3-6 years	48	%15,6
	6-10 years	87	%28,3
	10-15 years	0	%0
	15 years and up	34	%11,1

3.2. Elimination of Delays and Preventable Classification

Due to many reasons in air operations, there are interruptions in the operation flow. While some of these disruptions can be prevented by the operators, it may not be possible to prevent some of them. These operational malfunctions also cause delays. Participants in the survey were asked to classify the delays identified by IATA as preventable and unavoidable, taking into account the operational experience of the department.

The answer to the question "Is the distribution equal to the class of the preventable / non-avoidable class for the reason of delay first?" Was investigated with a double tail binomial test with a probability of 50% (H0 : ų = 0,5; H1: ų ≠ 0,5). It is aimed to classify the delay items which have a statistically significant difference (α = .05).

The hypothesis "H0: Classification of the cause of delay is equal to 50%", H1: Classification of the cause of delay is less than 50% "is tested with the left tail binomial test to determine the delay that can be avoided from the causes of delay which appear to be significantly different in classification (H0 : ų =0,5; H1 : ų < 0,5).

The power of the relationship between variables with the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test was measured. KMO predicts that the sample must be greater than 0.5 in order to be able to perform a satisfactory factor analysis. Barlett's test measures the relationship power between variables such as the same KMO. This test tests H0. Barlett's test (Barlet's test of sphericity) should be sig <0.05. H0 is rejected below 0,5. If the Bartlett value is p <0.001 it indicates that this can be done. In this study, KMO, 807 was obtained (Table 3). In order to be able to perform a healthy factor analysis, it is sufficient to obtain a value of more than 0.5, so it can be said that this analysis is performed in a healthy manner. On the other hand, we can say that the p value has been achieved in this direction and it can be progressed in this research in a healthy way.

Table 3. KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,807
Bartlett's Test of Sphericity	Approx. Chi-Square	2282,061
	Df	378
	Sig.	,000

- **Airline Operation-related Delays:** Delays due to "flight operations and crew (61-69)" are classified as preventable by 81% of respondents (H1 : ų < 0,5, N:307 p=.000). As can be seen in Figure 1, other sources of delay are considered delayable as preventable when properly managed (H1 : ų < 0,5).
- **Airport-related Delays:** 78% of the respondents indicated that delays due to "airport facilities / 87 (AF), parking positions, apron intensity, enlightenments, buildings, gate restrictions" can be avoided if the processes are managed correctly (H1 : ų < 0,5, N:307 p=.000). 65% of the respondents indicate delayed delays due to constraints at the destination airport, which are predictable delays when constraints are analyzed correctly (H1 : ų < 0,5, N:307 p=.000).
- **En-route Delays:** 69% of respondents believe that "Air Traffic Flow Management / 82 (AX) according to Air Traffic Control Personnel / Equipment along the way, extraordinary demand due to capacity reduction due to strike / job slowdown, personnel insufficiency or equipment failure" management has been carried out correctly and considered such delays as preventable (H1 : ų < 0,5, N:307 p=.000).
- **Due to weather at destination:** In airborne delays, 53% of respondents "unable to make ground services from bad weather conditions / 77 (WG)" classified it as an unavoidable delay. Because of the large significance test for this delay, there is no significant difference in terms of preventable incapability of this delay (H1 : ų < 0,5, N:303 p=.358). It is stated that the meteorological forecasts of delays due to other weather

conditions can be analyzed correctly and avoided if necessary precautions are taken for situations that may cause delays at departure and arrival stations.

- **Reaction Delays:** From the reaction delays "Aircraft rover has classified 51% of the respondents who answered" late arrival / 93 (RA) "from the previous section or from the other flight as preventable delay. However, the classification was not considered because the level of reliability was low (H0: ų = 0,5, N:307, p=.209). Another reaction delay, "Team route, waiting for the other flight cabin (cockpit or entire crew) / 95 (RC)" team planning resources were classified as delays of 73% preventable quality when properly managed (H0: ų = 0,5, N:307, p=.000).

Table 4. Delays preventable / unavailable classification.

■ PREVENTABLE ■ UNAVAILABLE

Asymp. Sig.*	N	Delay	UNAVAILABLE
		AIRPORT	
.000	307	Passenger and Baggage(11-19),Late check-in, congestions in check-in area/12(PL)	%19
.000	307	Cargo and Mail(21-29),Load connection, awaiting load from another flight/91(RL)	%28
.000	307	Aircraft and Ramp Handling (31-39)	%15
.001	307	Aircraft defects/41(TD)	%40
.001	307	Aircraft change, for technical reasons/46(TC)	%40
.000	307	Damage to Aircraft & EDP/Automated Equipment Failure(51-58)	%34
.000	307	Flight Operations and Crewing(61-69)	%19
.000	307	Late arrivals of aircraft, crew, passengers or cargo	%22
		AIRPORT	
.000	307	ATFM due to restriction at destination Airport, airport and/or runway closed due to…	%32
.000	307	Airport facilities, parking stands, ramp congestion, lighting, buildings, gate limitations,…	%22
.000	307	Restrictions at airport of destination/88(AD)	%35
.001	307	Restrictions at airport of departure with or without ATFM restrictions, including Air Traffic…	%40
		EN-ROUTE	
.000	299	ATFM due to ATC en-route demand/capacity, standard demand/capacity…	%26
.000	307	ATFM due to ATC staff/Equipment en-route, reduced capacity caused by industrial action…	%31
		WEATHER	
.000	304	Departure Station/71(WO)	%29
.000	307	Destination Station/72(WT)	%31
.358	303	Ground Handling Impaired By Adverse Weather Conditions/77(WG)	%53
.000	300	ATFM due to weather at destination/84(AW)	%35
		REACTION	
.209	307	Aircraft rotation, late arrival of aircraft from another flight or previous sector /93(RA)	%46
.000	307	Crew rotation, awaiting crew from another flight (flight deck or entire crew)/95(RC)	%27

* Based on Z Approximation.

3.3. Internal and External Factor Classification of Delays in Time Management in Aviation

In this work, taking into account the IATA standard delay codes, some delays can be preventable and some are unavoidable. In the formation of delays are influenced that the internal factors that cause the human factor in the aviation operations itself or in the process of operation or the external factors, which cause delays, are independent of the functioning of the aeronautical system. It is classified as preventable / non-preventable in internal and external factors. When the IATA delays included in the survey study are classified as internal factor and external factor in aviation time management;

- Delays due to passengers and luggage can be regarded as an internal factor as they can occur due to the operation of the system. Delays due to check-in glitches or delays due to catering orders are caused by errors in the operation process.
- Errors due to cargo and mail can be regarded as internal factors, as they can be from employees or from incorrect process. In the case of waiting for an overhead load, the delay may be due to reasons not controlled by the system and this is considered as an external factor effect.
- Delays in aircraft and ramp services are affected by internal factors. The lack of resources and technical problems of the airline may have caused these delays.
- It may be possible to see internal and external factors together due to delays caused by technical and aerodrome equipment. The maintenance of the airplane, such as spare parts, can be considered as an internal factor because it is under the control of the airline. However, even though the necessary technical measures have been taken by the aircraft, failure of the aircraft or malfunctions caused by a bird drive can be regarded as an external factor.
- Damage to aircraft and Electronic Data Processing / Automatic equipment failure may be due to the delays caused by technical and aircraft equipment, as well as internal and external factors.
- Delays due to flight operations and crew battles can be classified as external factors as they can be cumulative delays due to reactive delays.
- The ATFM (air traffic flow management) restrictions at the arrival airport are considered as internal factors because it is possible to control the delayed factors such as strike, staffing capacity, capacity, and the effect on the operational process can be controlled.
- It can be regarded as an internal factor that influences time management because the delays in the airport facilities can be removed or reduced from the center by proper arrangements.
- Restrictions at the arrival airport can affect both the external factor as well as the internal factor. If constraints due to weather non-control cause are considered external factors, constraints such as noise reduction applied at the destination airport can be regarded as an internal factor because delays can be prevented (or prevented) if flight planning is taken into account.
- Air Traffic Control according to the demand / capacity on en-route, Air Traffic Flow Management can be considered as an external factor because it can cause slot failure due to standard demand / capacity problems, It can be regarded as an internal factor as it is possible to control the factors causing Air Traffic Flow Management delays according to Air Traffic Control personnel / equipment along the road.
- It can be considered as an external factor because it is difficult to control delays caused by environmental conditions such as low visibility and strong winds and the impact of environmental conditions on time management in aviation operations is too great to be ignored.
- As long as the majority of the reaction delays are properly planned, the delay effect can be preventable (or unavoidable). This plan and its effect on the correct use of time as an internal factor, since the effect of those working in the process of running can be high.

4. Conclusion

Time benefit is the most basic source of production and consumption of aviation. Using time effectively and efficiently increases the quality of aviation service. Important steps for managing time correctly are to identify the needs of the aviation industry, to establish the goals, and to set priorities of needs. In the aviation sector, delays occur as a result of planned events not being realized at planned time. Delays are often associated with departure. Because planning in aviation is based on the time of departure. Delays have many causes. There are many factors that affect the management of time in aviation and consequently cause delays, such as originated from airport, technical and engineering mistakes, problems of airline can be welded a plane on the ground, problems caused by weather conditions such as low visibility or strong wind, problems arising from capacity and demand, problems caused by ground services, problems along the way, problems caused by safety, etc. Well-planned time management executes punctuality and this enable to do the right job in a short time by dynamizing predictability in time management. Robust network planning and control, airplane availability and ground handling and departure process have significant impact in ensuring timeliness. Inadequate network planning adversely affects time performance in very high traffic volumes, and different planning systems make it difficult to control. Accurate analysis of fleet planning increases precision by creating direct impact on safety and time created by spare parts and hardware problems.

This research, which was prepared by using chi-square analysis and Binomial test method, reached to 307 people in 187.459 personnel in the aviation sector in Turkey and conducted survey study. There are many internal and external factors that are crucial to effective and efficient management of aviation operations in time. Internal factors which factors that influence time management by ensuring uninterrupted control of aviation activities and making delays avoidable or preventable through the necessary precautions. External factors which are factors that are effective in preventing or avoiding delays because they are very unlikely to be controlled or predicted in the aviation system. When the effects of internal and external factors on the aviation activities are analyzed correctly, the delays that they cause can be controlled. The vast majority of delays that are effective in time management in aviation are preventable delays. These delays are influencing internal and external factors, including proper team planning, good process management of ground services, proper maintenance and repair planning, proper management of airport capacity and flight demands, efficient use of aviation resource and infrastructure systems and many more. Some delays in aeronautics cannot be avoided despite improved predictability and all measures taken. Due to poor weather conditions, failure to perform ground services, low visibility at departure and arrival airports, and strong winds, there are interruptions in the continuation of aviation operations due to external factors originating from nature. These interruptions cause delays and some of them are controllable while others are not controllable. Time planning is important in aviation operations. An analysis of external factors that cannot be controlled, such as the internal factors that can be corrected for the problems caused by the system-induced or human factor for the correct operation of the planned time, and the constraints imposed on the environmental conditions or the operation of the system must be well analyzed. The influence of internal and external factors on time management should not be ignored.

Contribution and Further Work

This article may contribute to both future works and scientific field via its proposed time management suggestion. It is planned to make cross-tabulations with the detailed researches to be done later and the departments where the internal and external factors are in charge. Thus, this article may do considerable contribution to airline and airport managers assisting them to their decision making process taking into account time management issues. An in depth study for this problem can be a challenging task for academics but more to airport and airline managers who are interesting in the specific case.

References

[1] Gürbüz, M. & Aydın, A. H., (2012), "Zaman Kavramı ve Yönetimi", *KSÜ Sosyal Bilimler Dergisi / KSU Journal of Social Sciences 9 (2),* pp. 1-20.

[2] Akçinar, S., (2014). *Örğütsel Zaman Yönetimi ve Etkin Zaman Kullanımı,* T.C.Beykent Üniversitesi Sosyal Bilimler Enstitüsü İşletme Yönetimi Ana Bilim Dalı Yönetim ve Organizasyon Bilim Dalı Yüksek Lisans Tezi, İstanbul.

[3] Toksoy, H., (2010), *Toplam Kalite Yönetiminde Zaman Yönetiminin Önemi,* T.C.Atatürk Üniversitesi Sosyal Bilimler Enstitüsü İşletme Ana Bilim Dalı Yüksek Lisans Tezi, Erzurum.

[4] Karaoğlan, A. D., (2006), *Üst Düzey Yöneticilerin Zaman Yönetimi,* T.C.Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Endüstri Mühendisliği Ana Bilim Dalı Yüksek Lisans Tezi, Balıkesir.

[5] Radnoti, G., (2002), *Profit Strategies For Air Transportation,* McGraw-Hill, New York.

[6] Porter, M. E., (2008), *Rekabet Stratejisi: Sektör ve Rakip Analizi Teknikleri,* Sistem Yayıncılık, İstanbul.

[7] Diederiks-Verschoor, I. H. P. & Butler, M. A., (2006). *An introduction to air law.* 8. th ed., Kluwer Law International, Alphen an den Rijn.

[8] Gupta, G., (2011), *Charter vs. scheduled airlines.* Cambridge: ProQuest, UMI Dissertation Publishing.

[9] Wandeler, Y. D. & Marsh, D., (2010), *Planning for Delay: influence of flight scheduling on airline punctuality-tat7,* EUROCONTROL Trends in Air Traffic, Avrupa.

[10] EUROCONTROL, (2005), *Report on Punctuality Drivers at Major European Airports,* EUROCONTROL, Brüksel.

[11] Kohl, N. et al., (2004), *Airline Disruption Management-Perspective, Experiences, and Outlook,* The Technical University of Denmark: EU-funded project DESCARTES, Denmark.

[12] EUROCONTROL CODA, (2012), *Central Office for Delay Analysis - CODA.* [Online] Available at: http://www.eurocontrol.int/articles/central-office-delay-analysis-coda
[Accessed 12 September 2012].

[13] Beek, S. D. V., (2000), *Categories of Cancellation and Delay for Air Carrier On-Time Reporting,* Wendell H. Ford Aviation Investment and Reform Act for the 21st Century, Washington.

[14] EUROCONTROL, (2011), *Performance Review Report (PRR 2011),* Bürüksel: EUROONTROL.

[15] Guest, T. & Marsh, D., (2007), *A Matter of Time: Air Traffic Delay in Europe-tat 2,* Eurocontol Trends in Air Traffic, Avrupa.

[16] Niehues, A. et al., (2001), *Punctuality: How Airlines Can Improve On-Time Performance,* Booz-Allen Hamilton, Avrupa.

[17] Rosenberger, J. M., Jhonson, E. L. & Nemhauser, G. L., (2004), "A Robust Fleet Assigment Model With Hub Isolation and Shot Cycles", *Transportation Science,* 3(38), pp. 357-368.

[18] Løve, M., Sørensen, K. R., Larsen, J. & Clausen, J., (2002), "Disruption Management for an Airline Rescheduling of Aircraft", *Proceedings of the Applications of Evolutionary Computing on EvoWorkshops 2002,* Issue 2279, pp. 315-324.

[19] Talluri, K. T., (1996), "Swapping Applications in a Daily Airline Fleet Assignment", *Transportation Science,* Issue 30, pp. 237-248.

[20] Slavica Dožić, M. K. O. B., (2012), "Heuristic approach to the airline schedule disturbances problem: single fleet case", *Procedia - Social and Behavioral Sciences,* pp. 000-0000.

[21] Abdelghany, K. F., Abdelghany, A. F. & Ekollu, G., (2007), "An integrated decision support tool for airlines schedule recovery during irregular operations", *European*

Journal of Operational Research, Issue 185, pp. 825-848.

[22] Gopalan, R. & Talluri, K. T., (1998), "The Aircraft Maintenance Routing Problem", *Operations Research,* 2(40), pp. 260-271.

[23] Sachon, M. & Cornell, E. P., (2000), "Delays and safety in airline maintenance", *Reliability Engineering & System Safety,* 3(67), p. 301–309.

[24] Jeng, C.-R., (2012), "Real-time decision support for airline schedule disruption management", *African Journal of Business Management,* 6(27), pp. 8071-8079.

[25] Sivaraman, E., (2007), *Station-Specific Aircraft Turn Times and Applications for Schedule Reliability,* AGIFORS 2007 – Airline Operations Study Group Meeting, Denver.

[26] TIBCO, (2007), *Airline Disruption Management.* [Online] Available at: http://www.tibco.com/multimedia/wp-airline-disruption-management_tcm8-2452.pdf,[Accessed 17 Ekim 2012].

[27] Zhang, Y., (2008), *Real-time Inter-modal Strategies for Airline Schedule Perturbation Recovery and Airport Congestion Mitigation under Collaborative Decision Making (CDM),* Dissertations, University of California Transportation Center, Berkeley.

[28] Wu, C. L., (2008), "Monitoring Aircraft Turnaround Operations", *Framework Development, Application and Implications for Airline Operations,* 31(2), pp. 215-228.

[29] Gao, C., Johnson, E. & Smith, B., (2009), "Integrated Airline Fleet and Crew Robust Planning", *Transportation Science,* 43(1), pp. 2-16.

[30] Ehrgott, M. & Ryan, D. M., (2002), "Constructing Robust Crew Scheduleswith Bicriteria Optimization", *J. Multi-Crit. Decis,* pp. 139-150.

[31] WEI, G. & YU, G., (1997), "Optimization Model and Algorithm for Crew Management During Airline Irregular Operations", *Journal of Combinatorial Optimization,* p. 305–321.

[32] Nissen, R. & Haase, K., (2006), "Duty-period-based network model for crew rescheduling in European airlines", *Journal of Scheduling,* pp. 155-278.

[33] Lettovsky, L., Johnson, E. L. & Nemhauser, G. L., (2000), "Airline Crew Recovery", *Transportation Science,* pp. 337-348.

[34] Yu, G. et al., (2003), "A New Era for Crew Recovery at Continental Airlines", *Journal Interfaces,* 1(33), pp. 5-22.

[35] Sherry, L., (2012), *Impact of Flight Delay Reliability on Passenger Trip Delay Metrics,* TRB, Washington DC.

[36] Wang, P. T. R., Schaefer, L. A. & Wojcik, L. A., (2003), *Flight Connections and their impacts on delay propagation,* The MITRE Corporation, Mclean.

[37] AhmadBeygi, S., Cohn, A., Guan, Y. & Belobaba, P., (2008), "Analysis of the potential for delay propagation in passenger airline networks", *Journal of Air Transport Management,* Issue 14, p. 221– 236.

[38] Sivil Havacılık Genel Müdürlüğü, (2017), *Sivil Havacılık Genel Müdülüğü 2017 Faaliyet Raporu,* T.C. Ulaştırma Denizcilik ve Haberleşme Bakanlığı, Ankara.

[39] EUROCONTROL CODA, (2012), *Central Office for Delay Analysis - CODA.* [Online] Available at: http://www.eurocontrol.int/articles/central-office-delay-analysis-coda [Accessed 12 September 2012].

[40] Altham, P. M. E., (1978), "Two Generalizations of the Binomial Distribution", *Journal of the Royal Statistical Society. Series C (Applied Statistics),* 27(2), pp. 162-167.