

## How improve passenger experience in peak time of airport flights

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### Abstract

The aviation industry has become so complicated that the basic airport services will not meet all the up-to-date needs of this area. Therefore, airports invest more in the field of smart environment and providing expandable services. To recognition and improve these kinds of services, passenger experience management (PEM) and passenger flow management (PFM) can clarify and implement step by step the smart airport requirements and services. One of the concerns of passengers and of course airports is to receive and provide appropriate services during peak flights. And its consequences are crowded terminal environment, lack of proper service by passengers and their companions, and also cognitive problems such as anxiety and confusion. This article presents a practical solution to improve passenger experience in peak flights. The mentioned solution covers the travel time of the passenger to the airports, service at the origin airport, flight and service at the destination airport. Also, the performance of the management and the results of using the mentioned solution in Bandar Abbas International Airport are presented.

**Keywords:** Smart Airport, PEM, PFM, Cognitive, Smart Environment.

## Introduction

Providing smart airport and passenger services is undergoing changes and improvements every day. Therefore, smart airports plan their architecture and management strategy according to the current and future requirements of this industry. Also, this concept is not only related to the airport area, but also to the areas of smart environments such as smart city. Now, considering the importance of passengers and all customers in the field of airport services, lifecycle of passenger experience management and passenger flow management, in the subsections of departure home, departure airport, arrival airport and arrival home can be of great help in peak of flights. On the other hand, due to the presence of various stakeholders and vendors in airports, Airport Collaboration Decision Making (ACDM) improves the experience of providing the required services. Therefore, smart environment concept in parking lots, terminals and other airport environments will be a prerequisite of providing smart services for passengers, customers and citizens at airports.

## Research methodology

This work has been developed using a combination of experimental research and information received from a specialized survey about airport issues. The survey was addressed to international and especially Iranian airports with the purpose to understand the opinion of airport collaboration about the introduction of the peak time of the airport flights and the passengers flow management measures applied. The format of this survey and other details, including questionnaire, is provided in the real situations. All survey responses received were promised to be treated with confidentiality and data from this research is reported only in the aggregate. Our research goal was to define the passenger experience of reasonable practices in combination with cognitive status, through smart airport opinions. Since there was a great diversity of technological evolution in airports examined, we have made an aggregated analysis of responses, combined with airport classification. Based on survey results, we extended our research, in order to develop peak time scenario analysis for passenger cognitive impairments that may influence the operational efficiency of smart airports. [1]

## Literature review

There are lots of viewpoints of researches about airport operational improvements. Review on future of the Airport Operations and services can be among of methods. [2][3] Airport Passenger Processing Technology and Passenger-Arrival Patterns are other samples of these kinds of researches and ideas. [4][5] According to Airport Transfer Passenger Flow management can be mentioned that lifecycle of passenger/customer experience have been presented. [6][7][8] among of forecasting, a wide range of theoretical and experimental, state-of-the-art models, methods, principles, and approaches have been provided. [9][10] The smart airport management approaches were also followed in some specialized methods and process lifecycles. [11][12]

## Issues

### Passenger's issues

Passenger's issues will be considered in the following sections in order to provide service to all customers of the airport zone.

### Urban traffic

Transport traffic during the movement of passengers and other customers and citizens to the airport is one of the problems of urban services leading to delay or loss of flight. Sub issues like urban transport routing, street congestion and traffic, as well as airport parking are located in this subsection.

### Service error – Failure

The presence of different service providers such as airlines, retail providers and other centers in the airport can be a challenge in providing integrated and consolidated services. ACDM, stakeholder, relationship management and security services will be included in this area.

### Service detection

Due to the crowding during peak flights, it can be challenging in service detection for passengers familiar with airport services as well as other passengers unfamiliar with this area. Because the crowded environment even for travelers who already have the experience of being in the city and airport of origin or the airport and city of destination also causes improper reception or non-receipt of required services.

### Cognitive challenges

Crowded flights cause passengers, customers and citizens to worry about being stuck or receiving inappropriate service. Stress, squabble and bad experience are some of the challenges that endanger the customer and the service provider.

### Management difficulty

Management and monitoring of all matters, including control of environment and services, as well as coordination between all the people and centers present at the airports will be among the challenges ahead. This challenge exists before the flight rush, during the rush and also after these conditions.

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### Proposed method

In this article, according to figure #01, the provision of services will be presented to passengers and others such as customers and citizens at the airport based on the passenger experience lifecycle.

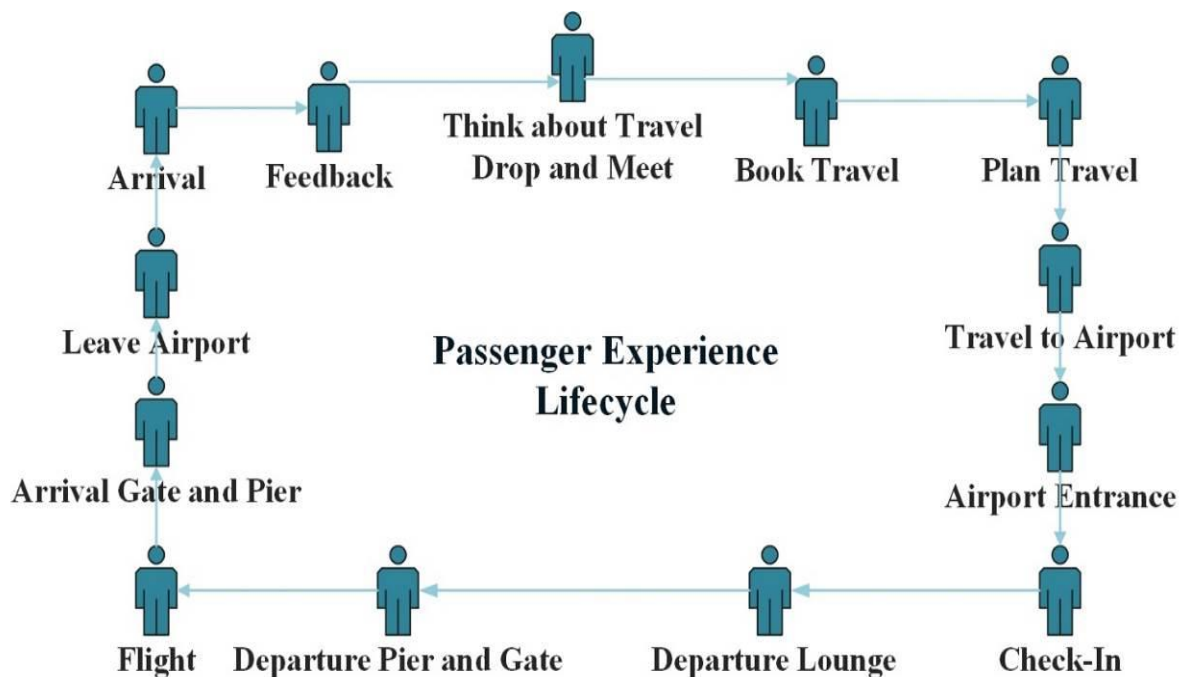


Figure 1. Passenger experience lifecycle.

### Book travel

The database and previous information of passengers, flights, days of the year, weather and other events can help passengers in booking and purchasing tickets. Also, better guidance and suggestions

can be provided by using Passenger Relation Management (PRM). Also, the following service will be provided for those requesting instant tickets. (Known as waiting list)

#### Online requester

Due to the busyness of the flights, it is likely that in the moment canceled tickets will not be offered in general online sales portals. Therefore, in the phone call and automatic response, the information of the ticket requester is placed in the waiting list. And the requester can monitor its stages at the levels of "waiting", "referring to the airline", "reservation or non-receipt". It should be noted that a part of the ticket amount must be paid to ensure the genuine requests of the callers. And if the ticket is not received, that amount will be returned.

#### Applicants in person

According to the time of request, their details will be registered in the same online waiting list and according to the mentioned levels, it can be monitored online. Also, dedicated waiting list screens are installed in the passenger terminal.

#### **Travel to airport**

##### Flight Information Display System (FIDS)

Passengers, customers and citizens can view the details of flights, check-in state and other matters such as delays or cancellations at any time from the airport's FIDS online service.

##### Stakeholder Relation Management (SRM)

Due to the crowded flights, there may be a need for online operational collaboration between airport service providers. Therefore, in speeding up these matters, stakeholder relationship management system can be of great help in registering requests, referring and following up on airport matters.

##### Smart systems and Subsystems

Platforms (AoT - IoT - CoT)<sup>1</sup> can be very useful and fast in providing status reports and estimating the conditions of environments, systems and services. Also, the processing load of the required information can be assigned to the mentioned sub-platforms. Information such as environment congestion, cooling-heating systems, request registration, security information, etc can be handled by these sub-platforms.

##### Urban mobility

It is possible to help passengers and users with time estimation sub service from the chosen origin to the airport, as well as routing and other located based services in the form of integration with smart city services.

##### Airport entrance

As soon as the passenger, customer and citizen arrive at the airport, they should be able to access the services they want. Cases like the location of the terminals considered for the flight check-in of each airline, parking, facilities and information desks can be mentioned in the form of fixed notice boards and online displays.

##### Smart parking

The map of the parking lots, their location, the number of empty spaces, as well as the location of the proposed or reserved parking spaces is placed in this section. It is also possible to manage the parking of vehicles by using smart platforms that take into account the schedule of flights and the passengers associated with each flight in such a way that parking spaces with greater distances from the terminals are included for people who have enough time to check-in and fly. And the parking lots close to the relevant terminals should be selected for passengers with time constraints. Also, smart parking service should be able to manage parking suggestion considering that the car is whose plans to park for a long

<sup>1</sup>intrAnet of Things (AoT), Internet of Things (IoT), Cloud of Things (CoT)

time (a passenger who plans to fly to a destination and then return); or for a citizen who intends to be in the airport parking lot for a few moments or hours.

### **Check -In**

#### Security

The dimensions of security at the airport will include the terminal, cargo areas and other environments. In addition to the topic of physical security, it will be support from the point of view of confidentiality, integrity and availability. Actually, due to the presence of passengers in the airport lounges for the purpose of check-in, the following tools and services can be used for better productivity during the busy hours of flights. Also, according to global experiences such as covid-19, tools and services to deal with CBRNE<sup>2</sup> should also be provided and used in airports. [13]

#### Parallel platforms

For critical security systems and other related services, the use of back-up tools can lessen service disruptions and can also be used as parallel systems to reduce congestion in the inspection of entrance passages. The important point in this section is how and where parallel platforms are deployed; because with smart positioning, it can play a great role in spreading the crowd in service environments. Alternate systems like X-Ray, DCS and BHS<sup>3</sup> are included in the check-in stage automatic/semi-automatic memory system of passengers. Automatic identification tools can be used for passengers who have already been at the airport and have been identified. Platforms such as CoT and IoT that can identify people by face, fingerprint, passport, etc.

#### Service detection improvements

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Crowded flights not only cause confusion for inexperienced passengers and foreign passengers; which also makes experienced travelers have problems in check-in. Because the services that can be provided at this stage may change depending on the conditions, both in terms of location and type of service. For example, service steps of passenger check-in due to the crowding of terminals are one of the reasons why fixed signs and displays do not work perfectly and optimally. On the other hand, for foreign and inexperienced passengers, general signs may not be fully effective; therefore, smart and controllable online boards can be useful for guidance and service detection. Also, according to the geographical location of the terminal and airport congestion, service guides should be installed not only in indoor areas but also in outdoor areas. This method will help the presence of the passenger and customer in the shortest time in the expected place; which not only reduces environmental congestion, but also reduces cognitive issues such as stress, fear and even chaos of passengers. (Due to inappropriate service or missed flight)

#### Smart Announcement

In addition to the Public Announcement service that announces flights and other related information, private announcement tools can also be used. Because it reduces environmental sound pollution and minimizes the lack of recognition and misdiagnosis of the passenger. Furthermore, information can be provided for foreign travelers in different languages. And for less experienced travelers, it should be clearly stated with additional explanations. This service can be installed in the form of dedicated screens and stands located in the terminal environment, or it can be provided to passengers in the form of mobile applications.

#### Airport Collaboration Decision Making

Due to the presence of many stakeholders and service providers in the airport field, integrated management plays a fundamental role in the peak time of flights. Therefore, automation tools such as SRM and resource management platforms such as AoT and IoT platforms can be of great help in providing the proper service to passengers.

<sup>2</sup>Chemical, Biological, Radiological, Nuclear and Explosive

<sup>3</sup>Departure Control System (DCS), Baggage Handling System (BHS)

### Service distribution (Located Based Service -LBS)

The precise and optimal placement of the service can be of great help in dispersing congestion during peak time of flights. For example, declaring the DCS system to receive tickets as self-checking and also providing retail facilities in secluded places will reduce local crowding in the terminals. In order to cover passenger requirements regarding the facilities and places of providing those services, flight information display tools and navigation boards are necessary. Stand and mobile application tools that provide information of facilities and retails, whether they are active or not, and display the location of the desired service and its position relative to the location of the passenger, will be very useful.

### Service Attraction

Creating a favorable environment with comfort facilities in secluded places will greatly help the population spread in the limited environment of terminals and flights peak time. Creating high-level crediting and franchising services for retail and other services can be useful when choosing similar services between crowded and quiet places. Also, PRM, CRM and ZRM<sup>4</sup> tools are required for service quality and direct interaction with passengers and clients.

### **Transit and Boarding**

At this stage, along with the tools and services of the previous stage, the following items will also be useful.

### Passenger Experience Management

Due to the forced waiting of passengers in the transit environment to boarding, this golden time can be used to provide various retail services. And along with service attraction and smart announcement services, PEM tools can be used for passengers' behavior recognition and their needs, as well as receive feedback from their experience at the airport.

### **Arrival**

#### Security and customs

In addition to the security explanations provided in the check-in section, by using the CoT and IoT platforms, passenger identity information can be obtained from the airport of origin, which will help in identifying passengers faster when incoming flights are busy. Also, according to the laws of different countries, customized tools and platforms should be used for the Customs and cargo department. Parallel platforms, service detections, ACDM and other tools and services can also be provided like the origin airports.

### **Leave Airport**

The steps of using this section to control passenger traffic during peak time of incoming flights will be in accordance with the following process.

#### Smart Parking

According to the items mentioned in the smart parking subsection, suitable conditions should be installed to identify the car parking location, pay the fee, and quickly exit the vehicles. IoT infrastructure and crediting and franchising services will also be used in this field.

#### Urban Mobility

Public transportation services, time estimation service from the airport to the chosen destination, as well as routing and other located based services can be provided for passengers and others in the form of integration with smart city services.

#### Outdoor Facility

In the form of social tools and services, it is attractive to provide information about the destination city, urban facilities and other flight and airport information for the next presence and re-experience of

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<sup>4</sup>Customer Relation Management (CRM), citizen Relation Management (ZRM)

the passenger. Smart announcement services can also be used to remind and help airport customers plan their time.

### **Total Experience Management**

In order to receive feedback from passengers, citizens and customers, as well as stakeholders and other partners in the airport and flight domains, it is necessary to collect all the lifecycle information mentioned above. This action will help in better management, creating new and forward-looking strategies. Also, ASQ and AEQ<sup>5</sup> can be examined more realistically. All these things will lead to more efficient services in normal and crowded conditions of airports and flights.

## **Case study**

### **About Bandar-Abbas International Airport**

Bandar Abbas International Airport is located near Bandar Abbas city, and it is built on a land with an area of 4.481 hectares. At present, Bandar Abbas airport, having 2 passenger terminals and one cargo terminal, can accommodate about 1.2 million passengers annually with the cooperation of domestic and foreign airlines. This airport has a parking lot with a capacity of 350 passenger cars and 16 airlines are engaged in providing passenger services in the Bandar Abbas terminals with the cooperation of some retail and internal and external services. Due to the commercial location of Bandar Abbas city, this airport has numerous domestic and international flights and welcomes native and foreign passengers who speak Persian, English, Arabic, East Asian and other languages around the world (in the form of business and tourist passengers). The figure below shows a view of Bandar Abbas airport. According to passenger experience improvement in peak time of flights, the following items have been applied in Bandar-Abbas Airport since the beginning of 2022.

### **Outdoor (departure - arrival)**

#### Parking

At the entrance to the parking lot, display boards of internal and external terminals, as well as the cargo terminal board, have been installed. The route of long-term parking lots and temporary parking lots has also been determined. When people park in the long-term parking lot, service detection tools are provided; which includes display boards of terminals as well as outdoor environment services. (Such as administrative services, banks, retail services, the location of wheelbarrows, services for the disabled and the Covid-19 test station)

### **Indoor (departure and cargo terminal)**

#### Entrance

Due to the geographical location of the airport in the tropical region, many seasons the weather is hot and humid, and when the flights are crowded, many people would gather in front of the internal terminal inspection gates. Therefore, creating a dedicated space attached to the entrance terminal, as well as adding inspection gates, helped the order and speed of passengers entering the check-in section. Also, the management of flight cards in front of the inspection gates has also helped a lot by creating a special space for cards and installing the relevant signs.

#### Service detection (foreign/inexperienced passenger)

As soon as the passenger passes through the security gate, FIDS boards are installed to receive information related to flights. All the service detection boards are in Persian and English, and for some

<sup>5</sup>Airport Service Quality (ASQ), Airport Experience Quality (AEQ)

boards, Arabic has also been added. Also, for other foreign passengers, trained colleagues have been used to guide them.

### **Check-in**

It has been tried to install the counters in such a way that the passengers can hand over their luggage and receive their flight card in column queues and at a distance from the adjacent queues. The baggage packing service is also installed in the place closest to the counters, which takes the least amount of time from the passenger. Also, Departure Control Systems (DCS) have been deployed for passengers who do not have baggage.

### Airlines services

With peak time of flights, there are many applicants to buy tickets in person and also visit the airline offices. So It has tried to provide the airlines offices with two separate spaces for the ticket sale desks in a solitude space as well as dedicated offices for airlines management on the upper floor in the quietly with proper space.

### Public Announcement

To inform passengers, automatic public announcement service has been installed to announce flights and their status in Persian and English languages (for domestic and foreign flights). Also, when receiving a flight card, passengers with less experience or who are unfamiliar with Farsi and English are recommended to refer to the guides stationed at the terminal.

### Passenger relation management

During peak time of flights, there are many instances where passengers need help or information about a specific service. Therefore, a special unit called the service desk has been installed, which along with the flight information unit, specifically provide guidance and help passengers.

Also, due to the presence of numerous service providers, the ACDM working group has already determined and communicated the instructions, agreements and specific and common duties of all established stations in the terminals and other areas of the airport.

### Retail

It has been tried to locate most of the retail providers in low-traffic areas as much as possible. Which itself causes the crowd in the terminals to spread. Resting places, televisions and other basic services are also located in the same space.

### **Transit and Boarding**

In the transit route, exit gates have been created on two floors. And as soon as the passengers enter the transit hall, the FIDS board is installed to show the gate boarding and the floors related to the gates. Other retail facilities and public services such as smoking room have been moved to the most solitude areas of the floors. Also, rest areas have been provided in other places with more facilities such as television, use of free services and adequate information. During boarding, in addition to FIDS and public announcement boards, guide staffs have also been deployed on both floors. Also, the establishment of two airbridge exits has increased the speed of transferring passengers to planes, which has reduced boarding queues during busy flights.

### **Arrival**

In the way of the entrance terminal for domestic flights, there are baggage delivery displays on the conveyor belts, as well as signs of the route leading to the location of the conveyor belts. For foreign flights, the passenger's movement is arranged linearly from the moment of arrival to carry out passport matters, cargo delivery and then customs matters; which causes inexperienced or foreign travelers who are unfamiliar with international languages to automatically complete all exit procedures correctly.



After completing these steps, retail and other PRM services are available. During leaving the airport, it is also possible to use special airport transportation and city services. Also, the tourist desk located next to the exit door provides all the information and adequate services to all domestic and foreign travelers.

Also, the establishment of two airbridge entrances has increased the speed of transferring passengers from airplanes, and also the integration created by ACDM has reduced the time of transferring passengers' loads to conveyor belts; which has led to the reduction of passengers' waiting time.

#### CEM

In domestic and foreign terminals and for departure and arrival flights, in addition to systems and service staffs, the integrated system of Airport Service Quality has been used. So, passengers and other visitors can register their opinions and satisfaction level. Also, the mentioned system is designed interactively, and applicants can receive or track the result of their request or complaint by entering their supplementary information.

#### Results

The comparison of the distribution of population based-on before and after applying the things stated in the case study section is presented below. It should be noted that the results below compare between the seasons of the year 2020 and 2021 (before the changes) and the seasons of the year 2022 (after the mentioned changes).

#### Parking

The graphs below (figure #2) show the average time required to park a car in static and temporary parking lots.

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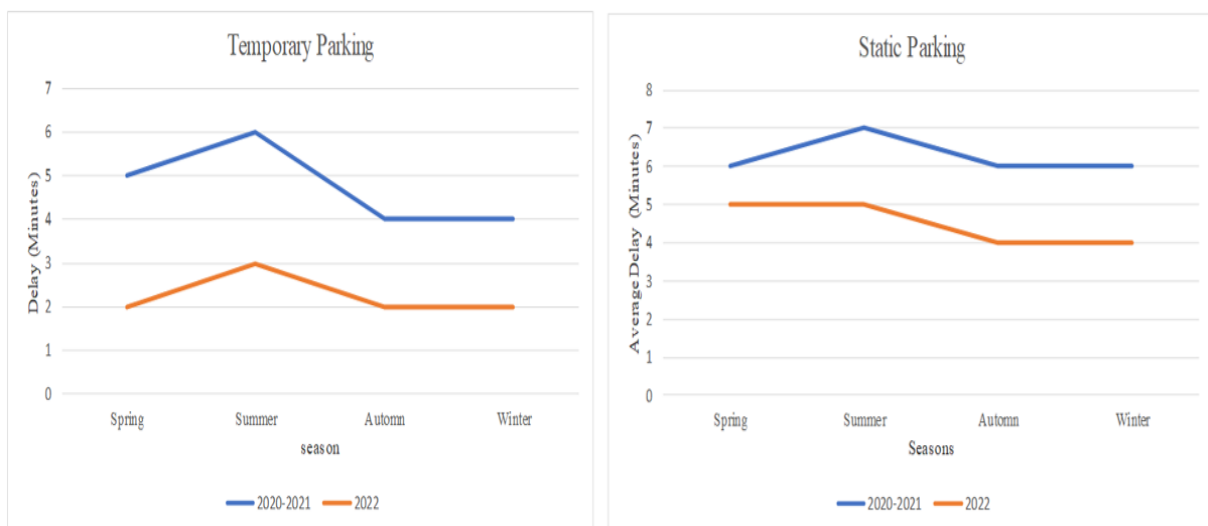
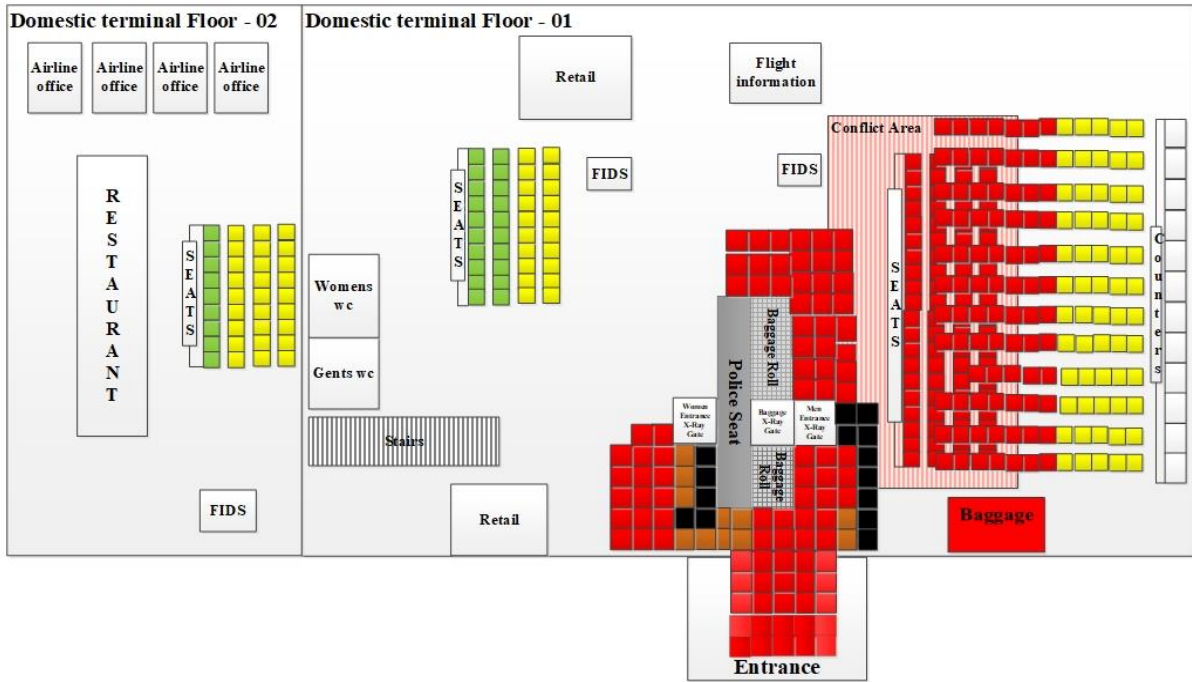


Figure 2. Average required time to park a car in temporary and static parking lots.

#### Entrance and Check-In

The figures 3 and 4 show the amount of crowding at the entrance and inside the terminal for security inspection check-in and other matters related to passengers.



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Figure 3. Security inspection, check-in crowding before smartening.

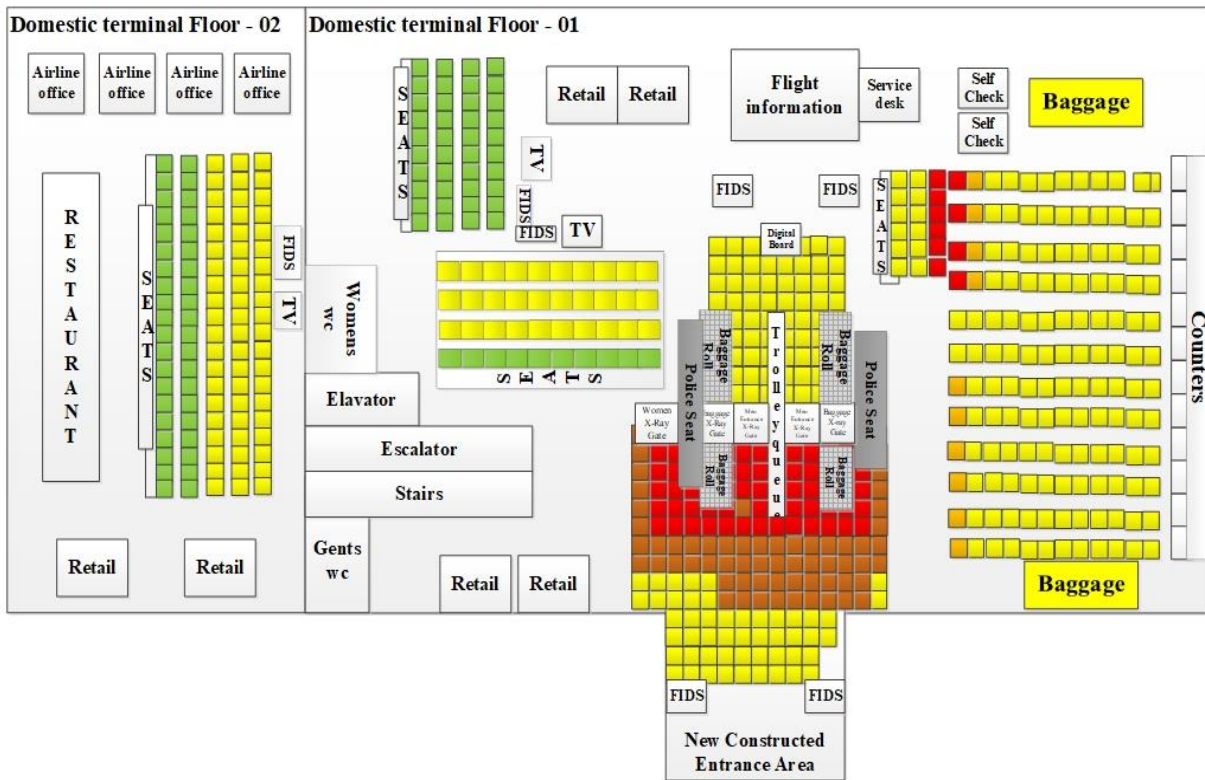


Figure 4. Security inspection, check-in crowding after smartening.

**Transit and Boarding**

The figures 5 and 6 show the amount of crowding at transit hall for boarding and other matters related to passengers.

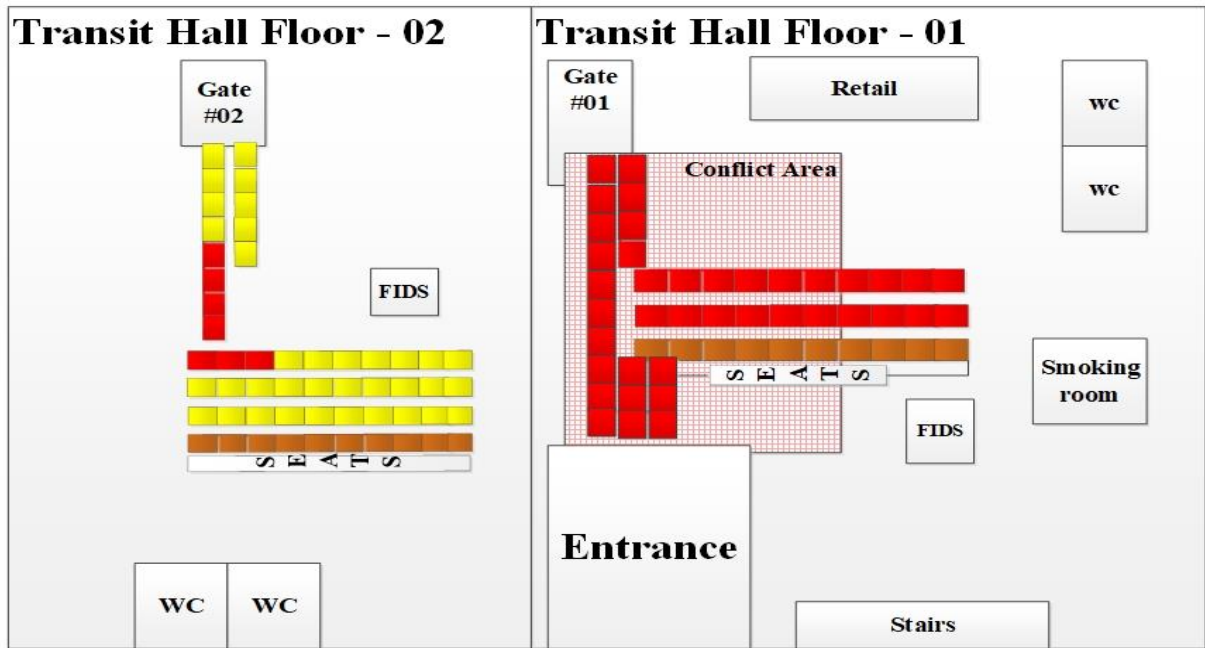


Figure 5. Transit and boarding crowding before smartening.

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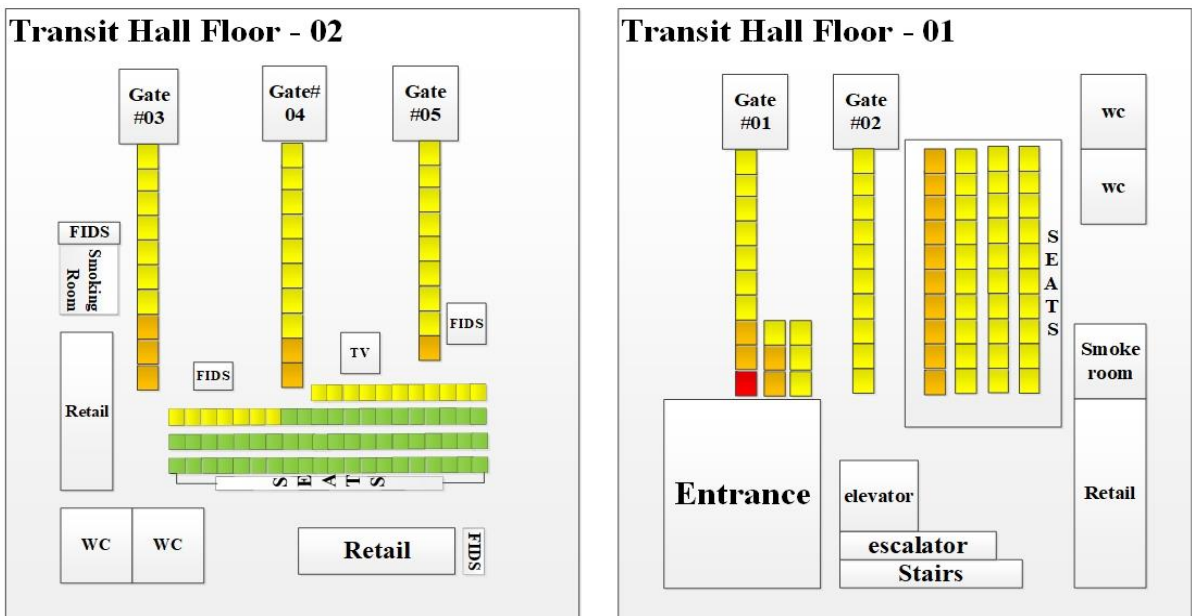


Figure 6. Transit and boarding crowding after smartening.

**Arrival**

The graphs below (figures 7 and 8) show the average time required to deliver passengers' luggage and also the time required to do other things until leaving the airport.

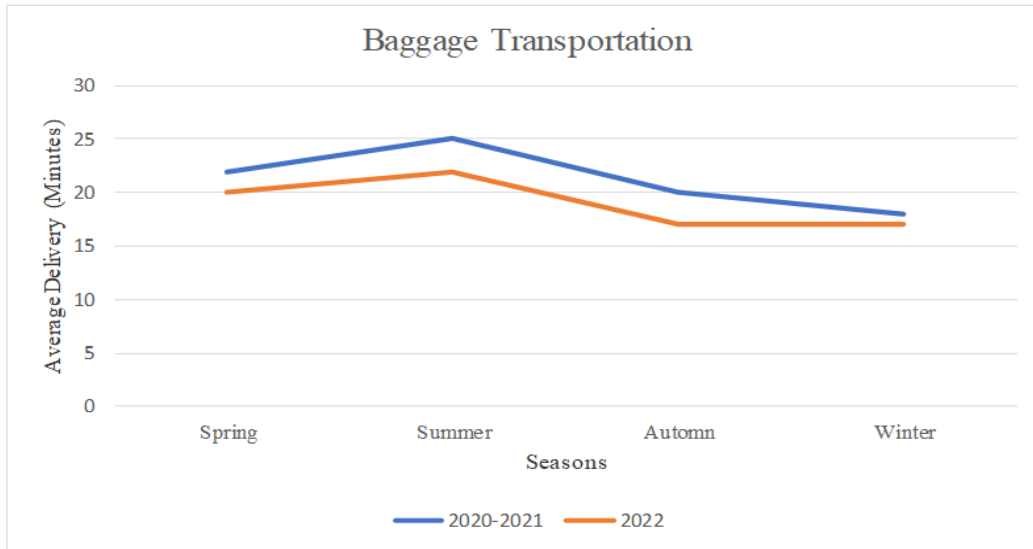


Figure 7. Average required time to deliver passengers' luggage.

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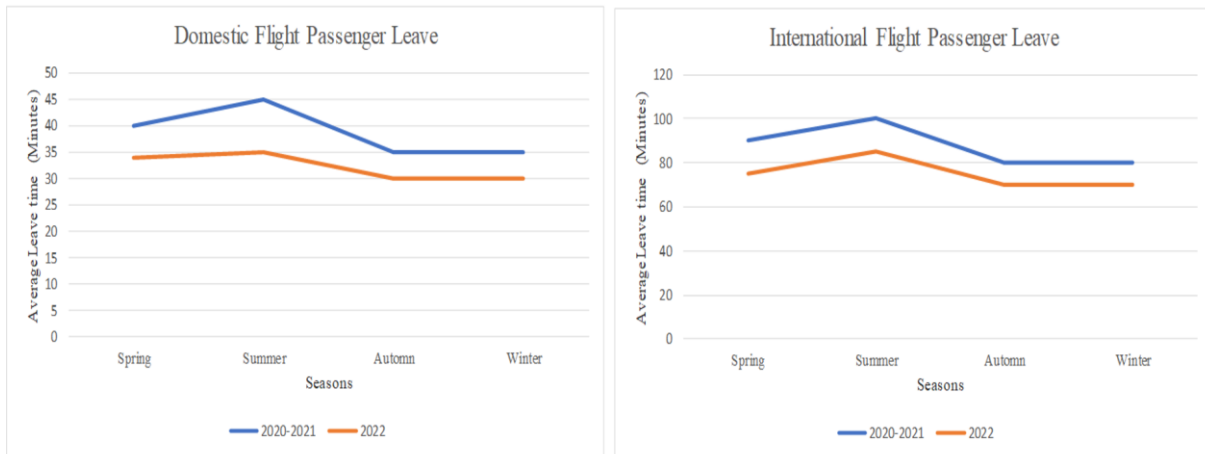


Figure 8. Average required time for domestic and international flights passenger leave.

### Airport Service Quality

Figure 9 shows the level of satisfaction of passengers and customers by ASQ system in a period of three years.

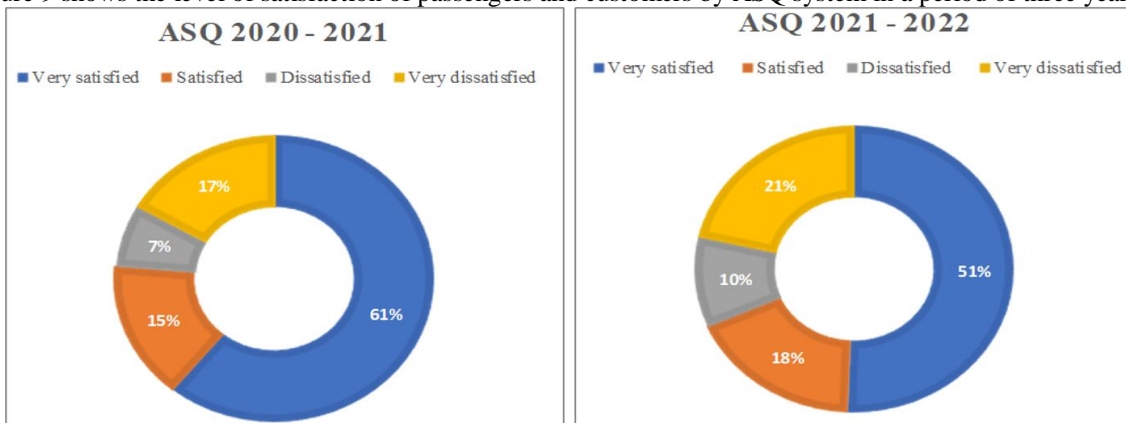


Figure 9. level of satisfaction of passengers and customers.

## Conclusion

Smartification has found a special place in all high-level technology industries. Because it helps great influence in providing integrated and consolidated services. Therefore, airports try to improve aviation and airport services to respond to their passengers and customers. One of the challenges ahead is the crowded time of peak flights. Because passengers want to receive the service at the right time, but the large amount of work and the lack of collaboration of the units involved in the field of airport services cause disruption. In this article, by using passenger flow management solutions, it has been tried to provide better passenger experience than before. The provided solutions cover the time of the passenger's departure to the airport, service at the origin airport, flight and service at the destination airport. Cognitive issues are also considered in passenger lifecycle experience. The performance of the proposed method and the results obtained from the deployment and implementation of these solutions at Bandar Abbas International Airport have been examined; which shows the significant progress of the intended goals.

## Future works

Considering the progress of decision-making support systems, it is suggested to use systems and sub-systems based on artificial intelligence and online analytical and transactional processing. Also, online remote services can be provided for parking reservation services, receiving flight cards, cargo delivery and special services such as CIP and VIP services. The cloud and System Wide Information System (SWIM) services can be of great help in the exchange of passenger and flight information, such as passenger identification information, their requirements and also aviation prerequisites.

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