

How can airports understand and capitalize on their passengers' needs to advance their strategic visions?

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## 1. Abstract

The retention of passengers is an essential prerequisite for Sharjah Airport to achieve a sustainable competitive advantage in the region; this is critical to all Sharjah Airport stakeholders in terms of resource planning, retail revenues increase, improved passenger experience, strategic plan formulation, and security measures. By studying passengers' flows and personas, as well as using contemporary profiling techniques, it is expected to identify innovative alternatives that better understand and meet passengers' expectations. This paper examines viable alternatives for Sharjah Airport to solidify its customer base by clearly identifying the expected level of services and airport features that would provide them with an outstanding service in an effective and personalized manner. This in turn will guarantee the loyalty of its existing customers, and assist in adding to it by attracting new customers who are seeking personalized and satisfying experiences during their travel.

## 2. Introduction

Air travel industry is constantly change driven by globalization processes that make people move for personal and business affairs. According to the International Air Transport Association (IATA), 7.2 billion passengers are likely to travel in 2035, which is almost twice more than it was expected in 2015 (see Figure 1). By 2036, the worldwide passenger flow may reach 7.8 billion persons, as it is shown by 3.6 percent of common Compound Annual Growth Rate (CAGR) ("2036 Forecast Reveals Air Passengers Will Nearly Double to 7.8 Billion"). The increase in passenger flows will ensure that those who need and wish to travel can meet their needs. Not only that but also from now airports should be capable in handling this number of passenger's and meet their expectations in an efficient manner.

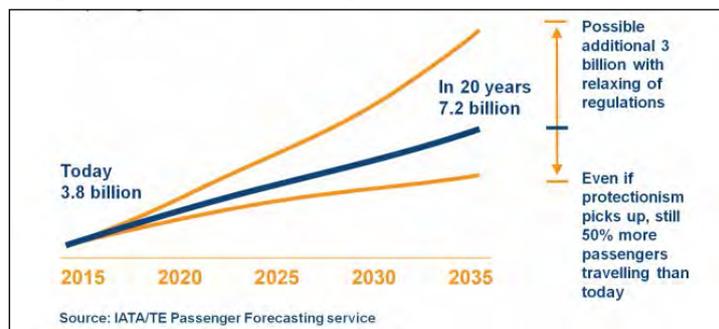


Figure 1. Anticipated passenger flows (IATA/TE Passenger Forecasting service).

Over the next 20 years, the Asia-Pacific region will be the driver of more than 50 percent of the total number of new passengers, which will be largely promoted by the rapid economic development along with the enhancement of domestic households and increasing population. Nowadays' leader of air travel industry, the United States, will be replaced by China with its rebalancing of economy towards consumption in the 2020s. In its turn, India is likely to surpass the United Kingdom in 2024, and Indonesia is expected to take place among the four largest markets in the 2030s. Thailand will be among the top ten global aviation markets, thus leaving behind Italy (see Figure 2).

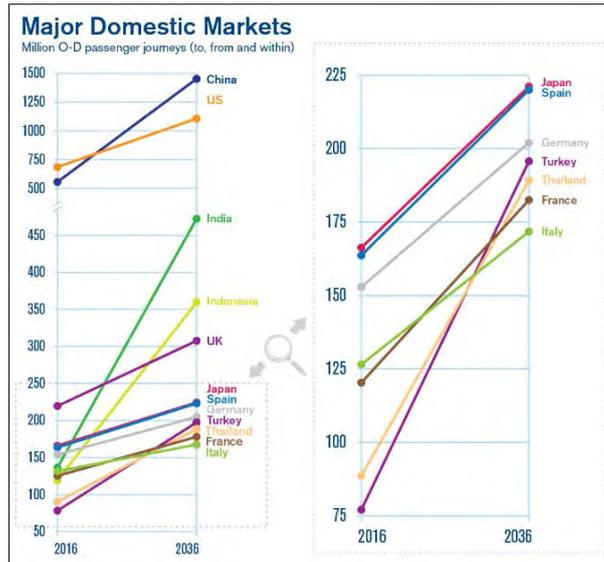


Figure 2. The largest domestic markets today and in the future (IATA/TE Passenger Forecasting service).

While the policy of protectionism was considered as the most appropriate for raising domestic markets, it is now clear that such an approach cannot ensure the highest growth. Instead, the constant policies scenario and market liberalization are two promising strategies that can potentially bring maximum benefits (see Figure 3). The most critical problem encountered by many airports is that passengers have to face waiting times, crowded terminals, and long queues, which the passenger spend less money while they are in airport and have a negative experience toward the airport itself. In this regard, an urgent need for elaborating and introducing relevant and feasible changes becomes evident. The solution lies in implementing modern technology to advance the infrastructure of airports at all levels.

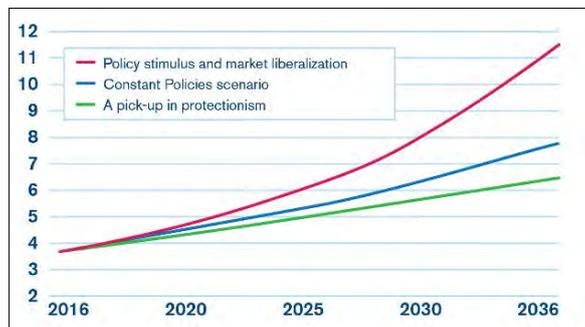


Figure 3. Segment basis for global passenger traveling (IATA/TE Passenger Forecasting service).

With the idea of revolutionizing passenger experience, global airports consider various options such as focusing on making passengers' time spent in terminals more pleasurable. Often, passengers should wait for luggage drop and pick up too long, which created additional stress while registering for a flight and receiving their bags. In this regard, it seems important to allow them to choose where to drop and pick up their baggage, which will provide more time spent in retails at airports. Baggage tracking opportunities should also be provided to passengers so that they can be aware of time and process of shipment. In term of the simplification strategy, it is possible to apply technology and eliminate the need to show the same documents multiple times before reaching an airport lounge. In addition, passengers are to be offered the choice in using airports' facilities while booking tickets and

requesting other similar services. Since modern passengers tend to be savvy and demanding, it is apparent that they need a more personalized variety of services.

In United Arab Emirates (UAE), there are four main passenger airports all varied in their capacity. Abu Dhabi Airport, Dubai Airport, Al Maktoum Airport, and Sharjah Airport. Sharjah Airport is considered as a medium to small airport, and since 1932, Sharjah Airport has been a gateway for international and regional airlines travelling to, from and through the UAE. The current terminal capacity is a 8 Million Passenger Per Annum (MPPA) while presently it reached 12 MPPA. With this rapidly increase in passengers numbers, “ the airport is going on a huge expansion project, consists of several phases, including constructing new building and a terminal for arrivals, as well as aircraft hardstands and connecting them to the current building, developing the roads leading to the airport, and building a new terminal for departures and separating it from the arrivals terminal in addition to upgrading the current building, adding 15 aircraft hardstands and constructing new service buildings. Moreover, a number of facilities that will contribute to increasing the capacity of the Airport to 20 million by 2027 will also be added” (Sharjah Airport).

### **3. Sharjah Airport Passenger Segment**

Several passenger subgroups circulate across airports terminals, behaving differently and presenting diverse needs. In particular, their perceptions of a concession program and attitudes regarding products and services should be taken into account while preparing segmentation strategies. Among the key segments, Sharjah Airport enumerates departing and arriving passengers, and about 40% connecting passengers. In addition, the air travel industry includes a non-passengers segment that consists of meters and greeters, accompanying departing passenger, and employees.

Figure 4 shows the numbers of both arrival and departure passengers including connecting passengers for the year 2017 and 2018. As stated the passenger numbers are increasing in 2018 comparing to 2017, while for some months such as April and September it's slightly decrease with -0.02% as it's not a seasonal period and some flight reduce its flight numbers. While in May its reduced by -1.22% due to the new regulation from UAE Ministry of Interior (MOI) that visit visa-holders no longer need to leave the country to amend the status of their visa to a residency permit.

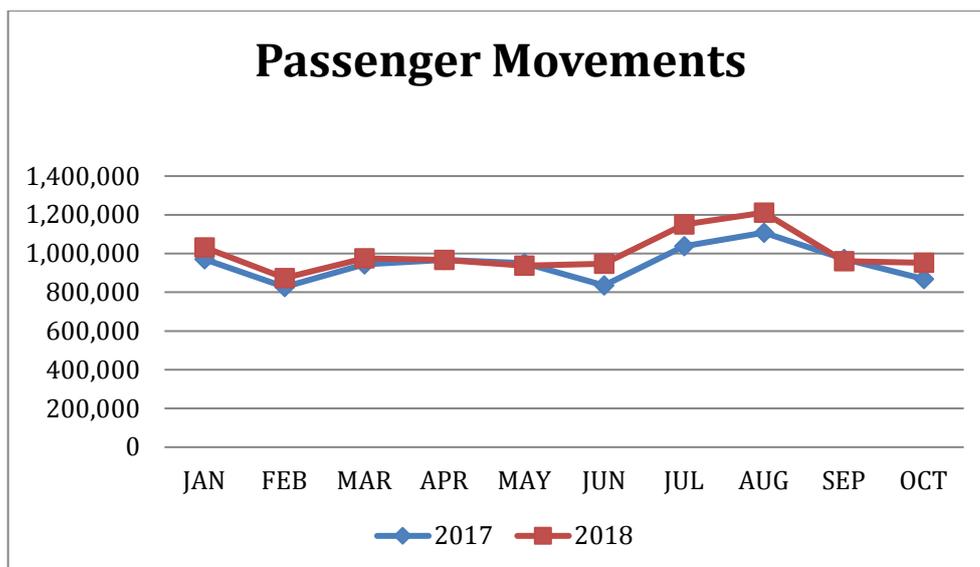


Figure 4. Passengers' Movement Statistics

In July 2018, the Airport announced “that it registered a growth of 4.34% in passenger movement during the first half of 2018, with the number of its users increasing to more than 5.731 million passengers, compared with 5.493 million passengers in the same period of 2017” (Sharjah Airport) The increase is a result the expansion of air carriers operating out of the airport, making Sharjah Airport one of the most important transfer hubs in the UAE region. Sharjah Airport handled 2.851 million passengers during the second quarter of 2018, growing by 3.59% as compared with the same period last year. With this sustained growth the airport is working on how to facilitate the passenger flow and meet the ever increasing expectation. We will elaborate more on this point in the rest of the paper.

The flow of passengers identifies products and services customers demand while arriving at or departing from Sharjah airport. Using surveys and feedback questionnaire, a summary of services that departure and arriving passengers are looking for at any airport is compiled as shown in (Table 1):

Departure Passengers looking for	Arrival Passengers looking for
1. Have a seamless journey from check in till boarding	1. Currency exchange shops in appropriate location
2. Duty free, outlets and restaurants	2. Pass immigration and customs inspection easily
3. Food offers	3. Baggage handling
4. Wifi	4. Transportation and rent a car offices
5. Notified with a real time data of flight status	

Table 1. Travelers Priorities

Regardless of their final destination, both departure and arrival passengers have their own interest of services determines their satisfaction. The cooperation of airlines, airports, and other stakeholders is likely to create a comprehensive and pro-active approach to managing passenger flows through the integration of technology and customer expectations.

In order to ensure the highest quality of its services, Sharjah Airport has Customer Relations (CR) section that is responsible for meeting customers' needs and anticipating their expectations. There are 11 Key Performance Indicators (KPIs) that are integrated into feedback questions every customer may provide to evaluate arrival, departure, and transit flights (see Figure 5). Passengers are welcome to answer feedback questions via Sharjah

Airport’s official website, CR kiosks in terminals, and feedback forms that can be found across the airport. By collecting and analyzing answers regarding check-in, immigration, customs, parking, duty free, and other issues, the airport strives to enhance the quality of its services.

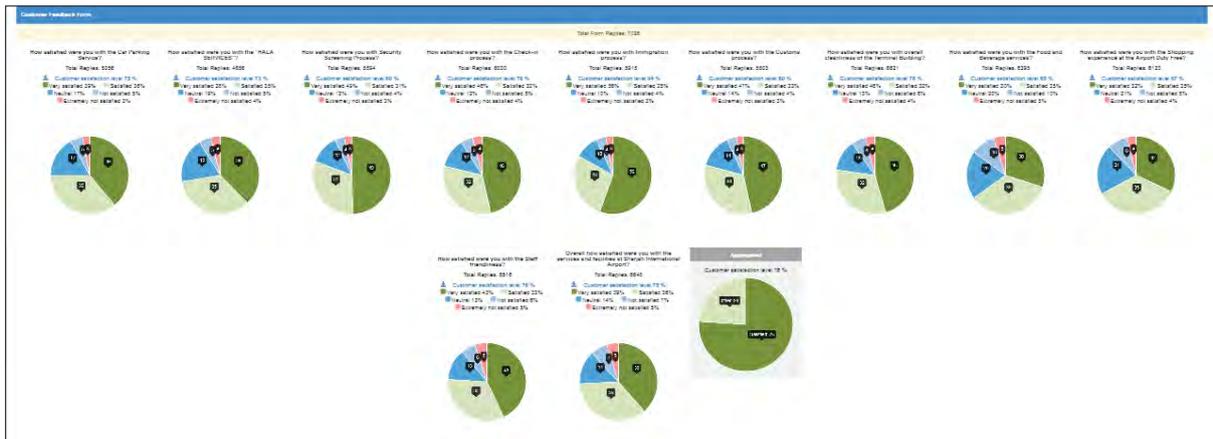


Figure 5. Customer Relation report that includes the 11 KPI's

#### 4. Sharjah Airport Passenger Personas

The representation of a passenger persona is a semi-fictional method to model, integrate, and disseminate key customer types. On the basis of Airports Service Quality (ASQ) 2015 passenger data, Airports Council International (ACI) developed six main personas that can be encountered in airports. It is essential that each airport should know the type of personas they have to provide them with the needed service. The personas are workmen, airports enthusiasts, friendly vacationers, value seekers, time keepers, and sun lounge tourists. Sharjah Airport has grown in popularity with workmen and friendly vacationers passengers.

#### 5. Sharjah Airport End-to-End Passenger Journey

In order to better understand passenger profiling ways after knowing the passengers segments and personas at Sharjah Airport, it is important to analyze end-to-end travels of customers in airports. Passenger profiling and airport structure plays a vital role in identifying the ways airports may capitalize on. In order to better understand how to adjust these ways, Sharjah Airport focused on several relevant questions helped in choosing the best tracking and passengers flow system:

1. How much is known about passengers and their flows?
2. When and how they arrive and depart?
3. Where do they spend their time and money in airports?
4. The average waits time for each queue area?
5. The people count for each zone?
6. The expected wait time for each zone?
7. The time for baggage drop off and pick up?

The first stage of any passengers’ journey starts with planning and budget, then booking a ticket. Once their booking has been approved, passenger can book their

transportation to or from the airport. The second stage is associated with the immediate duration of stay (dwell time) at an airport, being departure or arrival. The airport experience includes passenger identification, check-in, baggage drop-off, clarification of 'on the fly services' and boarding. While being engaged in one of the mentioned procedure, passengers move from one location to another, which shows their basic routes and, thus, specifies potential points of capitalization.

The ultimate aim of improving passenger experience is making their flights and journeys across the airport easier, faster, and safer. The convenience of customers is another factor that should be taken into account to make sure that operations are flexibly adjusted to changing passenger flows and airline behaviors. Below is the departure and arrival passenger journeys and waiting time at each process at Sharjah Airport. It is noted that the total spent time for departure passengers at Sharjah Airport excluding the time spend in duty free and restaurants is almost 50 min, thus a feedback questioner is done regularly for passengers by Sharjah Airport Customer relations staff, shows that passenger prefer to have a seamless journey to and through airport, thus, currently Sharjah Airport is working on the fast travel process that has been initiated by IATA to reduce waiting time. Table 2 & 3 shows the service provided for each stage as it will be noticed that human interaction has been reduced dramatically in each process:

Self-Check-in	Bags Ready to go	Document check	Flight re-booking	Self-boarding	Bags recovery
Providing different check-in channels such as self-check in kiosk, check in through mobile and website.	Self-Baggage Drop (SBD) Counters with facial recognition	Using Smart Gate (through facial recognition )	Kiosks for rebooking in lounges and waiting area  In winter Sharjah airport faces a situation when a flight is postponed due to the weather conditions, with the re-booking kiosks, this is an opportunity to enhance the passengers feeling towards an airport, by having robust Passenger welfare concerns.	Smart gates (through facial recognition)	Passenger can report mishandled bags using self-service channel
<b>Current waiting time spent for the whole above journey almost 50 min</b>					
<b>Waiting time after implementing self-service journey is 10 min</b>					
Status : In Process	Status : In Process	Status : Completed	Status : In Process	Status : In Process	Status : In Process

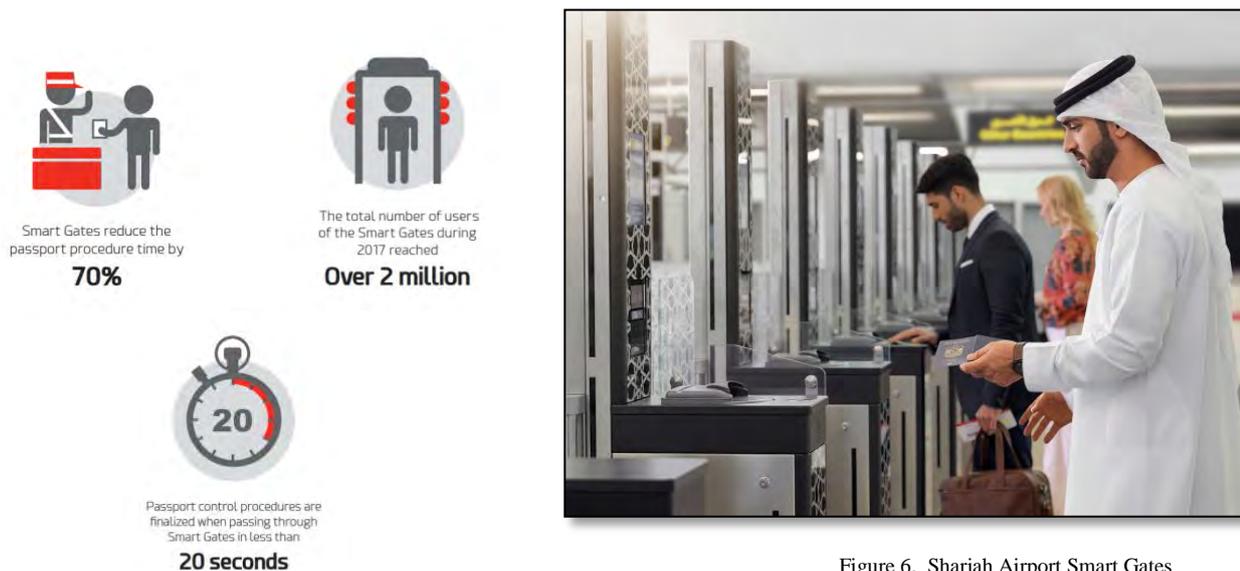
Table 2. Departure passenger fast travel flow

Connecting passengers will use the self-boarding , but they need to register before proceeding to the boarding gate using registration kiosks that will be available in the terminal.

Before landing	Landed	Immigration counter	Bags Recovery
Passengers will be informed through Sharjah Airport application the baggage belt number.  Passenger can manage his transportation through Sharjah Airport application	Informing the passengers that his baggage is delivered or in the process	Through the smart gate ( using facial recognition )	Passenger can report mishandled bags using self-service channel
<b>Current time spent for the whole above journey almost 40 min</b>			
<b>Waiting time after implementing self-service journey is 10 min</b>			
Status : Completed	Status : In Process	Status : Completed	Status : In Process

Table 3. Arrival passenger fast travel flow

From customer journey map, Sharjah Airport found that passengers spent almost **20 min** in the immigration counters where a target time to be **less than 1 min** only for immigration process. Sharjah Airport studied with Ministry of Interior (MOI) of all the possibilities solutions to minimize the immigration processes. In October 2016, Smart Gate has been rolled out for both departure and arrival passengers (see Figure 6), two smart gates have also been allocated for people with disabilities. The whole process takes only **10 seconds** to complete the boarding which leads to customer satisfaction and ease the flow. The arrival passengers at Sharjah Airport spend less than 40 min starting from leave the plane, passing smart gate and pick up their baggage's specially in peak hours.



## 6. Future Plan to automate KPI's measurement at Sharjah Airport

The innovative data management as a part of Total Airport Management (TAM) implies a holistic view on a passenger, which starts from his or her decision to travel anywhere. Before passengers leave their homes, TAM ensures that they purchase the most relevant offers and pay attention to road, weather, and railway issues (“Six Must Have Capabilities to Improve the Passenger Experience”). In case ticket agents and baggage staff know about the above factors, they will have some time to adjust their services and notify customers of delays. It is important to focus on “understanding passenger volume and activity that helps airports optimize wait times and better coordinate the passenger experience” (“Six Must Have Capabilities to Improve the Passenger Experience”). Thus, awareness of data regarding meteorological conditions, traffics, or flight prioritization is likely to reduce delays, costs, and the number of unsatisfied customers.

In the view of the abovementioned information, there are six core investing options, including airport operational database, scenario planning and forecasting, passenger flow measurement, information displays, resource management systems, and airport collaborative decision making system. One of the most significant areas is the creation of a comprehensive operational database, which will involve information from various sources that are currently disintegrated. For example, data on flights, passengers, and their baggage is usually requires

accessing several databases, which promotes longer wait times. It is also possible to target external sources of information to know about weather conditions, so that potential delays may be reported to passengers in advance. This data can be delivered to customers through their mobile devices and information displays located in airports.

In order to implement TAM, Sharjah Airport in the process of implementing devices and methods to compute passenger flow through sensors for people counter, Closed Circuit Television (CCTV), and Airport Collaborative Decision Making (ACDM) room. The consideration of each of them is important to understand both advantages and disadvantages of systems. As a result, the best solution will be found to address the current needs of airports based on proper analysis of passenger measurement systems.

Sophisticated sensors technology is used nowadays for passengers counting, which is in the proof of concept stage in Sharjah Airport. These sensors will gauge waiting times accurately, queue length and waiting time, process time for queues in check in, security check and boarding gate, and calculate passenger outflow rates. It will be placed on the ceiling for any chosen area for example in check-in counters, security check, and boarding gates. They work appropriately with ceiling heights below 2.2 meters; it will work with ceiling below 2.2, but many sensors to be placed for a coverage purpose.

CCTV is an alternative solution for measuring the passenger flow at Sharjah Airport which is in the proof of concept stage as well, by capturing anonymous facial images of passengers entering a designated area and will be tracked through agreed way-points including check-in, security and boarding controls. But from our point of view, both sensors and CCTV works together for a better passengers counting and monitoring the flow as CCTV will calculate the accurate time for a specific passenger spent in each area while the sensors will manage the passenger flow.

There are other devices for tracking system implies that passengers are counted through via GSM, Bluetooth, and / or Wi-Fi technologies. Even though this technique is accurate enough, it may be inconvenient for customers to hold their smartphones and at least one of the identified technologies switched on (“Passenger Flow Monitoring”). Thus Sharjah Airport considered the sensors and CCTV facial recognition than the above mentioned technologies.

The future of Sharjah Airport is closely associated with biometric human recognition systems (Facial recognition) as has been explained earlier, which will make passenger ID unnecessary. The facial recognition platforms can recognize a passenger’s face at the check-in counter, lounges, and throughout airports as well ensure passage through the traditional departure bottlenecks upon departure. The technology integrates with airport security systems, ticket reservation services, and airline loyalty programs (del Rio, Jose Sanchez, et al. 56). It can be deployed on the basis of the existing airport security and video surveillance system, which is a cost-effective solution. If a passenger checked in online, but is late for boarding, the system will tell the airline if he or she has arrived at the airport.

From operational side, but affect the passengers flow in emergency case is an Airport Collaborative Decision Making room (A-CDM). This room allows all stakeholders participating in the process of airport management to make decisions affecting their air traffic organization. In particular, airlines, ground handlers, airport operators, and Air Traffic Management are to cooperate in terms of the mentioned strategy. It is not limited to a

particular area, for example, an airport or end-route flights and may be applied in relation to solutions of all levels, beginning with long-term planning and ending with real operations. The effective information management and sharing allow every stakeholder to receive information that has an important influence on the decisions of others. Any stakeholder can propose a solution, which brings a particular benefit when combined with the effective implementation of TAM and timely information communication. The objective of (A-CDM) room is to increase the efficiency of planning and use of resources, ensuring the smooth operation of airports with the close cooperation of all partners (Kaduoka) which empower the main idea of building a long-term relationship with our passenger. The collective decision making contributes to adjusting the use of funds, the allocation of resources, prediction of potential development trajectories, and planning of arrival / departure times the airspace area in order to correct any imbalance.

## **7. Using IoT to study Passengers' Needs and Expectations**

Sharjah Airport is now becoming the basis of large multimodal units, parts of which are extremely complex due to the huge number of their constituent elements, the numerous links between them, and the complicated organization. The task of researching airport technologies is relevant to satisfy basic goals such as providing outstanding passenger experience, optimizing costs, and accomplishing operational excellence. The following issues are of particular importance: how all the systems work in combination depending on the load change; how the passenger traffic changes if one of the services updated to a new mode of operation or new ones are introduced. In achieving the specified goals, the paramount role is played by Information Technology (IT) innovations.

### **7.1. Better Information Leads to Better Outcomes**

Scenario planning and forecasting is one more valuable and innovative alternative that can be used to enhance airport operation. For example, planning software began operation at JFK Terminal 4, an airport in New York, which serves 20 million passengers a year (Nordstrom). The software analyzes flight data and delays in the airport database, which also includes passenger information or finds the necessary data in online sources. The program combines this information with statistics: how long before the departure passengers usually arrive at the airport or how long it takes to get to the terminal and to pass through each checkpoint. The result is a simple diagram showing the time of day at which the peak load on a certain terminal falls, which indicates how much time to wait for the largest influx of passengers at the airport.

The focal reason for installing this software is resource planning as it allows better understanding how circumstances change in real time. Using planning software, one can predict the density of passenger traffic not only a day or two ahead, but considering the long-term flight schedule and other factors, the system can roughly calculate the periods of peak loads for weeks, months, and even years (Nordstrom). Over time, program developers plan to teach the system to analyze not only actual information - arrival and departure times and the number of passengers but also intellectual data. For example, the program will receive information about the actual queue length for registration from surveillance cameras (Nordstrom). In addition, the system will be able to collect and process information about passengers from self-service terminals - automatic check-in or baggage collection points - which are becoming increasingly popular.

Birmingham airport is the UK's third largest airport, has seen a period of unexpected passenger growth over recent years, this increase has its challenges of planning, recourse management, and expenditures on new technologies, thus a dedicated capacity planning team has been initiated and investing in leading software to model and analyze different areas of passenger journey, and to simulate various scenarios and investigate the effect of increased footfall. (Passenger Terminal World ).

## **8. Aligning Passengers' Needs and Expectations with the Demands of Other Essential Airport Stakeholders to Advance Strategic Vision**

Today, Sharjah Airport target not only the optimization of processes but also delivering high-quality services and passenger experience, so that passengers to be loyal. The key idea is not to enlarge the airport and add more services, yet to revolutionize the very way of addressing problems with delays, long wait times, and insufficient staff attention ("Flow Predictor"). For example, specific guidelines and KPI's should be elaborated for personnel responsible for check-in: in case a passenger waits for more than four minutes, they should open a new counter or install a self-service machine. A similar approach may be applied to luggage issues: in case customers wait for their bags for more than 15 minutes, they should be given a discount in one of the airport stores or restaurants.

Airports should better organize employees and allocate resources in order to provide relevant sources in a timely manner. On the monitors in the halls of the terminal, passengers should see the actual information about the waiting time in the queues for registration or taxi tariffs. Even though the digital transformation of airports can be of great benefit, it also involves risks. The small yet rather unpleasant aspect of IT projects is that most of them turn out to be unsuccessful or cannot be implemented within the established budget or time frame. As the scale of the project increases, the risks raises as well. In this regard, any large-scale transformation should be based on a carefully thought-out business model, proving how technology can change the economic performance of an airport and improve travel arrangements for passengers.

Operators should also have a comprehensive concept of the conversion process. technology serves as the basis for digital transformation, but the coordination system is also critical (Figure 7). The digital transformations should be performed in collaboration with airport stakeholders, each of which should control this process to certain extent. Stakeholders cooperation may include airlines, security and immigration control agencies, airport retailers, as well as technology companies and new venture capital firms that help transform the flight management process ("Level of Service Concept"). In addition, they should act dynamically, develop products with minimal functionality, and introduce other feasible practices that are the basis of flexible transformations. Airports will need to train their staff and improve their skills in accordance with new policies. Last but not least, airports should strictly control change management projects and adjust them if necessary.

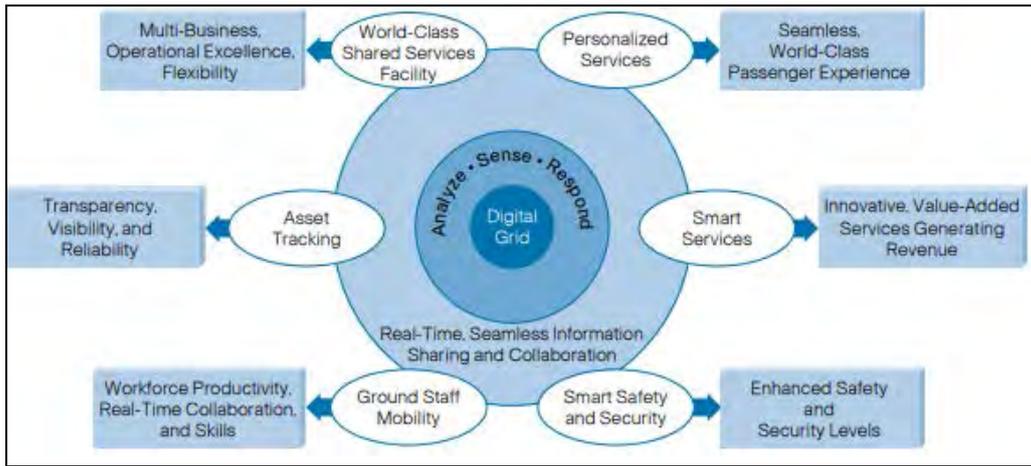


Figure (7) Process Integration to Enhance Passenger Experience (Fattah, Amir, et al.).

The concept of Level of Service (LoS) is a basic airport planning tool that refers to the detailed guide on airport renovation may be utilized to analyze the existing situation, identify goals, set milestones, and systematically achieve the stated goals. It is important from check-in process examination, security, and passport control to move to customs control and baggage claim characteristics. The optimum waiting times should be determined for every stage based on the flight type, a number of passengers, and other factors that are specific to a particular airport.

Each stakeholder in the airport should sign a service level agreement (SLA) with the airport, The purpose of this SLA is to provide the airport a clear understanding of all levels of services and outcomes to meet passengers expectations and to set airport KPI's. Effective KPI's can be through the monitoring systems that have been mentioned above, an airport can also not only monitor the passengers but also monitor that stakeholders whom are serving the passengers.

## 9. The links between passenger expectations, stakeholders and airport vision

The vision statement is used to project the company in the future and to visualize its ideal; it is a brand promise. An Airport vision require the airport to define what must be represented to assure that customer experiences are positively in all levels of services in the airport. “a vision statement is an assertion or image of the ideal of the company in the future that helps to inspire and empower the organization’s interested parties, such as shareholders and stakeholders.” By knowing the passengers profile, passenger’s expectations, operation bottlenecks, setting SLA with stakeholders all of this will work to shape an airport vision.

While determining the vision of an airport, it is essential to formulate it in a specific and outstanding way, so that employees and other stakeholders may easily remember it and implement in their work. The following question may be posed to define the vision statement: how an airport will distinguish from other airports and bring the maximum value? Most importantly, not only such areas as security and safety but the overall performance of the airport should be targeted. The vision of Sharjah Airport is to deliver exceptional customer services and ensure safety based on the continuous enhancement and Integrated Management Systems (IMS). The abovementioned vision is definitely specific and sounds

convincing as it shows that Sharjah Airport focuses on all the levels to fulfill its vision statement.

## **10. Conclusion**

To conclude, it should be emphasized that passenger flow is one of the main problems in the operation of terminals in airports, especially during periods of peak load. Tracking sensors, CCTV, and other tracking technologies can help in monitoring, analyzing, and enhancing passenger experience. By processing such data at peak periods, waiting times, baggage claim times, and so on, airports will be able to predict the appearance of critical areas and prevent problems before they occur. In particular, airport stakeholders should develop a holistic approach to the selection of new products and services as well as the enhancement of existing ones. When business executives and IT vendors work in collaboration, they can avoid the problem of scattered and non-core investments. By improving the quality of flight services at airports and passenger services in general, airports can ensure that any trip becomes not a complicated but a pleasant process, ensuring outstanding experience and convenience for passengers as well as increasing airport capitalizations.

## Works Cited

1. "2036 Forecast Reveals Air Passengers Will Nearly Double to 7.8 Billion." *IATA*, 14 Oct. 2017, [www.iata.org/pressroom/pr/Pages/2017-10-24-01.aspx](http://www.iata.org/pressroom/pr/Pages/2017-10-24-01.aspx). Accessed 14 Nov. 2018.
2. Airport Cooperative Research Program, et al. *Resource Manual for Airport In-Terminal Concessions*. Transportation Research Board, 2011.
3. "Everybody Counts." *Airport World*, 22 Nov. 2016, [www.airport-world.com/features/passenger-services/5890-everybody-counts.html](http://www.airport-world.com/features/passenger-services/5890-everybody-counts.html). Accessed 14 Nov. 2018.
4. Fattah, Amir, et al. "Smart Airports: Transforming Passenger Experience to Thrive in the New Economy." *Cisco Internet Business Solutions Group (IBSG)*, 2009, [www.cisco.com/c/dam/en\\_us/about/ac79/docs/pov/Passenger\\_Exp\\_POV\\_0720aFINAL.pdf](http://www.cisco.com/c/dam/en_us/about/ac79/docs/pov/Passenger_Exp_POV_0720aFINAL.pdf). Accessed 14 Nov. 2018.
5. "Flow Predictor." *SITA*, n.d., [www.sita.aero/globalassets/docs/use-cases/flow-predictor-use-case.pdf](http://www.sita.aero/globalassets/docs/use-cases/flow-predictor-use-case.pdf). Accessed 14 Nov. 2018.
6. Garcia, Marisa. "Survey: The Biggest Travel Pain Points for Passengers at U.S. Airports." *Skift*, 9 Sep. 2015, [skift.com/2015/09/09/survey-the-biggest-travel-pain-points-for-passengers-at-u-s-airports/](http://skift.com/2015/09/09/survey-the-biggest-travel-pain-points-for-passengers-at-u-s-airports/). Accessed 14 Nov. 2018.
7. "Hilton Worldwide Embracing Mobile Technology to Create a Personalized and Seamless End-To-End Travel Experience." *Future Travel Experience*, Sep. 2014, [www.futuretravelexperience.com/2014/09/hilton-worldwide-embracing-mobile-technology-create-personalised-seamless-end-end-travel-experience/](http://www.futuretravelexperience.com/2014/09/hilton-worldwide-embracing-mobile-technology-create-personalised-seamless-end-end-travel-experience/). Accessed 14 Nov. 2018.
8. "Innovation." *SITA*, n.d., [www.sita.aero/innovation](http://www.sita.aero/innovation). Accessed 14 Nov. 2018.
9. "WITH 4.34% GROWTH SHARJAH AIRPORT HANDLES 5.731M PASSENGERS IN FIRST HALF OF 2018." *Sharjah Airport*. 30 Jul 2018. Web. 25 Nov 2018. <<https://www.sharjahairport.ae>>.
10. Kaduoka, Carlos Yoshihiro. "Meeting Airport Passenger Growth with Technology Innovation." *SITA*, 11 Feb. 2018, [www.sita.aero/resources/blog/meeting-airport-growth-technology-innovation](http://www.sita.aero/resources/blog/meeting-airport-growth-technology-innovation). Accessed 14 Nov. 2018.
11. "Level of Service Concept." *IATA*, n.d., [www.iata.org/services/consulting/airport-pax-security/Pages/level-of-service.aspx](http://www.iata.org/services/consulting/airport-pax-security/Pages/level-of-service.aspx). Accessed 14 Nov. 2018.
12. Nordstrom, Robert. "Kennedy Int'l Uses Cloud-based Technology to Manage Terminal Traffic." *Airport Improvement*, Jan.-Feb. 2018, [airportimprovement.com/article/kennedy-intl-uses-cloud-based-technology-manage-terminal-traffic](http://airportimprovement.com/article/kennedy-intl-uses-cloud-based-technology-manage-terminal-traffic). Accessed 14 Nov. 2018.
13. Oxley, David. "Air Passenger Market Analysis." *IATA*, Jun. 2017, [www.iata.org/whatwedo/Documents/economics/passenger-analysis-jun-2017.pdf](http://www.iata.org/whatwedo/Documents/economics/passenger-analysis-jun-2017.pdf). Accessed 14 Nov. 2018.
14. "Passenger Flow Monitoring." *SITA*, 1 Nov. 2012, [www.sita.aero/resources/type/videos/passenger-flow-monitoring](http://www.sita.aero/resources/type/videos/passenger-flow-monitoring). Accessed 14 Nov. 2018.
15. del Rio, Jose Sanchez, et al. "Automated Border Control E-Gates and Facial Recognition Systems." *Computers & Security*, vol. 62, 2016, pp. 49-72.
16. "Six Must Have Capabilities to Improve the Passenger Experience." *Leidos*, n.d., [www.internationalairportreview.com/wp-content/uploads/Six-Must-Have-Capabilities-to-Improve-the-Passenger-Experience-white-paper-by-Leidos.pdf](http://www.internationalairportreview.com/wp-content/uploads/Six-Must-Have-Capabilities-to-Improve-the-Passenger-Experience-white-paper-by-Leidos.pdf). Accessed 14 Nov. 2018.
17. "Resolution 753 : Baggage Tracking". *IATA* , 2018,
18. " SAA Signs Three New Agreements Within the Comprehensive Expansion Project." *Sharjah Airport*. 10 May 2018. Web. 25 Nov 2018. <<https://www.sharjahairport.ae>>