CRANFIELD UNIVERSITY

ALHUSSIN K. ABUDIYAH

FRAMEWORK DEVELOPMENT FOR IMPROVING ARRIVAL PROCESSING OF PILGRIMS AT HAJJ AND UMRAH AIRPORT TERMINALS

SCHOOL OF AEROSPACE, TRANSPORT, AND MANUFACTURING
CENTRE FOR AIR TRANSPORT MANAGEMENT

DOCTOR OF PHILOSOPHY (PhD)
Academic Year: 2016 - 2020

Supervisor: Mr. Rich Moxon
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This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy (PhD)

ABSTRACT

Millions of Muslims around the world perform the Hajj, a mandatory religious journey to the holy city of Mecca, at least once in their lifetime. Therefore, hundreds of thousands of pilgrims arrive weekly at Jeddah and Medina Airports during the Hajj period determined by the Islamic calendar. Numerous research studies have been published on the health, security, risk management and logistics aspects of the mass gathering. However, studies on pilgrims' wait times, flow and satisfaction at the Hajj and Umrah Terminals (HT)s are very limited. The research evaluating the inbound passenger domain is especially limited. Therefore, this study contributes to the literature by combining different perspectives regarding the inefficiency of HT processes. Furthermore, this study proposes and investigates various aspects to improve the processing of arriving passengers at HTs. It does so by identifying and studying the factors that impede the flow of passengers within these terminals from users' and providers' perspectives. This research aims to contribute by developing an innovative integrated framework to improve the flow of pilgrims through arrival terminals and determining how large crowds at airports can be better managed. To meet the study's aims, a simulation model is developed to verify and confirm the performance of arrival passenger processes at HTs by conducting a mixed-methods analysis and integrating the numerical results of the agent-based and discrete-event simulation models. This study creates a problematic review matrix based on users' and providers' perspectives. In addition, the survey on providers' perspectives indicates that there are five factors, human, infrastructure, operational, technical and organisational factors, influencing arrival passenger processes at HTs and interacting with level of service (LoS) variables. The study indicates the suboptimal processes at airport terminals to focus on the factors negatively affecting the HT processes. In addition, the research highlights the role of terminal configurations. This study compares two airports in terms of peak demand patterns. According to the study, sharp peaks can have strong negative impacts on HTs, while evenly distributed demand can improve LoS at HTs. The simulation model outcomes verify and confirm the parameters and factors influencing LoS. In addition, the study's integrated framework provides diverse viewpoints on the operational processes at HTs, while the density map matrix helps to classify the processes. This study applies what-if scenarios to identify the impact of pilgrims' experience and biometric characteristics and finds that inexperience and certain biometric characteristics have negative impacts on LoS. Limitations of the study and suggestions for future research are discussed.

Keywords:

Passenger Flow, Arriving Passenger Processing, Crowded Airports, User's Perspective, Providers Perspective, Integrated Simulation Model, Level of Service, Hajj And Umrah Airport Terminals

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Thanks to my mother, my ultimate support, my guidance after ALLAH. I would like to thank her for everything. This is for you! Thanks to my mother for her sacrifices, compassion, and full support. Thanks to the love of my life, my beautiful, and my amazing wife, Amnah, for her great support and forgiveness. Thanks to my brother, Yehia, my sister, Salha, all my brothers and sisters, my niece "Zahoor" and daughters, Sarah, Sally, and my little babe “Mayar” for their fantastic support without knowing.

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LIST OF ABBREVIATIONS

ABM	Agent-Based Simulation
ACI	Airports Council International
ASQ	Airport Service Quality
BC	Baggage Claim
BS	Bus Connection
BTO	Build, Transfer and Operate
CDSI	Central Department of Statistics & Information
CGA	Ministry of Health and Customs General Authority
CI	Customs Inspection
DES	Discrete Event Simulation
GACA	General Authority of Civil Aviation
GDP	General Directorate of Passports
HI	Health Inspection
HMC	Health Monitoring Centre
HT	Hajj and Umrah Terminal
IATA	International Air Transport Association
KAIA	King Abdulaziz International Airport
LoS	Level of Service
OE	Overall Evaluation
PC	Passport Control
PPMDC	Ports Projects Management & Development Company
SEM	Structural Equation Modelling
SGS	Saudi Ground Services
UA	Unified Agents

1 CHAPTER ONE: INTRODUCTION

1.1 Introduction and background

Air transportation plays an important role in the development of tourism and trade and thus boosts the economies of countries around the world. This contributes to increases in national income as well as social progress. Therefore, the air transportation industry is influenced by many interacting variables that require orchestrated efforts to modernise and develop this rich human activity. In particular, in the areas of security, safety and environmental protection, new technologies should be applied to optimise the development of air transportation systems. Today, air transportation faces multiple challenges and difficulties in operations and management, particularly in growth and the fluctuation of demand given the limited capacity of most public infrastructure elements. Statistics from the International Air Transport Association (IATA) and Airports Council International (ACI) indicate that global passenger traffic recorded an annual rise of more than 7.5 % in 2017, with more than 8.2 billion annual passengers estimated for 2017(ACI, 2018) and more than 9 billion estimated for 2025(Stevens, Baker and Freestone, 2010). In the United States, the demand for airport and air transportation services varies significantly from year to year as a function of variations in passenger demand, airline business strategies, airport services and regulations and airport performance (Jacquillat, 2015). Furthermore, Sasser (1976) stated that maintaining the balance between supply and demand is not easy, as reflected in many elements of the service industry. Moreover, he discussed some important concepts that should be understood by all managers working in this industry. First, the service is direct. Second, there is an interaction between the consumer and service provider. Third, the service cannot be transported. Fourth, the service is intangible; thus, measuring service capacity is a highly subjective and qualitative task. The main causes of airport crowding are the imbalance between the demand and capacity of the airport infrastructure, climatic conditions, environmental conditions, security risks and a lack of operational efficiency (Ball et al., 2010). In addition, the imbalance between the demand and capacity of the airport infrastructure leads to passenger traffic congestion, disruptions to services, increased costs and lower quality of service at airports, which in turn leads to dissatisfied citizens and tourists and a negative impact on the national economy and environment.

Crowding is a social phenomenon that has been known to humanity throughout the ages, and it has been differently defined by a wide range of scholars in diverse contexts. In 1972, Stokols defined it as ‘a motivational state aroused through the interaction of spatial, social, and personal factors’. In a later publication, Stokols et al.(1978) modified and elaborated on the definition to include ‘a physical condition involving the limitation of space’ and ‘an experiential state in which the restrictive aspects of limited space are perceived by the individual exposed to them’. Crowding affects the emotions, behaviour and health of people and groups. High-density crowding is linked to stimulus overload, interference, social fears, spatial fears (i.e. claustrophobia), stress, increased uncertainty, frustration, depression, anxiety, mood changes, aggression, withdrawal, psychiatric symptoms and illness (Stokols et al., 1978). In addition, Paulus (1989) reported that increases in prison populations without increases in space available for inmates might lead to higher rates of discipline problems, suicide, psychiatric problems and death. Paulus also suggested that crowding has physiological effects. For instance, it can cause changes in blood pressure, steroid levels and catecholamine levels (hormones associated with the fight or flight response). According to Paulus, crowding due to density factors results in increased cognitive load and cognitive strain. Moreover, crowding negatively affects workflow in many industries and areas of business. For example, it can lead to poor performance, slow processes, a lack of accomplishment, and increased costs and health/security risks (e.g. reduced passenger flow within a crowded airport).

Airports are a key part of public infrastructures for countries throughout the world, and they are considered an important factor for tourism and economic development. Accordingly, most countries are currently focusing on effective airport construction design and increased capacity to meet high demand. This is especially true for countries interested in using tourism as a source of income or hosting global events, such as Hajj, the World Cup and the Olympic Games. Maintaining airport passenger flow during specific seasons and events is considered a big challenge for airport decision makers and operators. This is because decision makers are often unsure of whether they should expand and invest in infrastructure, which is a difficult option, or face the operational problems during these peak times, another difficult option. Accurately quantifying the number of flights, the passenger volume and other data for peak times at airports is not easy, but it is a crucial task, especially depending on what periods are designated as ‘peak’. The various international transport-related institutions and ministries offer several definitions of peak periods (Neufville and Odoni, 2003). Although countries are eager to expand airport capacity and services, difficulties with operational and environmental variation, rapid growth and fluctuation in demand cause problems(Albanese, Aaby and Platchek, 2014). Airports suffer from fluctuating demand, particularly during events and in the summer. However, the improvement of airport operation processes and services is one of the most complex problems due to the variations, complexity of operations and different stakeholders (Al-Dhaheri and Kang, 2015). This confusion is caused by the difficulty of balancing several economic and political aspects. The most important rule for success in the service industry is to balance supply and demand, something most airports today are failing to do. This leads to crowded airports with slow passenger flow, the accumulation of queues and flight delays, dissatisfied passengers and poor levels of service (Bubalo, 2011). Due to the importance of these issues, governments and the companies owning and operating the airports, airlines and other related entities have started to focus more on passenger flow, level of service (LoS) and performance and the evaluation of passengers’ perceptions of airport service quality (Bezerra and Gomes, 2015).

Those in the academic field have also become highly interested in this topic. Through a review of the previous literature, we noted several studies concerning the many services and operational problems of civil aviation and airports due to the direct impacts of crowding, especially in services at airports. Examples of these problems include the imposition of costs on both providers and users of airline transportation services, the deterioration of service quality, increased wait times and queuing and passenger dissatisfaction. The quality of service at airports, traveller and visitor satisfaction, and passenger traffic and seamless passenger flow through airport processes are subjects of particular interest, especially in crowded airports. Therefore, efforts to face this problem can be classified into three main categories: (1) increasing system capacity (e.g. runway construction), (2) capacity allocation (e.g. airport congestion pricing, which imposes tolls on airlines to reduce air traffic), (3) enhancing operational efficiencies (e.g. air traffic flow management (ATFM)) (Jacquillat, 2015). ATFM uses new, innovative technologies to improve passenger flow within terminals, such as biometric technology and self-check-in, increased numbers of employees and changes to the processes and procedures strategy.

Furthermore, a number of issues in airport service have been studied in the literature, including airport service performance (Humphreys and Francis, 2002; Lemer, 1992), passenger satisfaction (Bogicevic et al., 2013), passenger flow and movement (Young, 1999), passenger traffic (Mota, Mujica Mota and Mota, 2015) and innovative service and technology(Chen, Batchuluun and Batnasan, 2015; Ucler and Martin-Domingo, 2015). Unfortunately, there was a lack of scientific research focusing on arrival domains and processes at airport passenger terminals especially at the Hajj and Umrah Terminals (HT)s. Hence, this was a motivating factor for the current research to focus on this area of airport passenger terminals.

1.2 Research problem

Millions of Muslims around the world perform Hajj, a mandatory religious journey to the holy city of Makkah', at least once in their lifetime. It is the largest annual religious event in the world (Katz, 2013). In this event, more than 2.5 million Muslims from all over the world gather in one place during the month of Dhul-Qadah determined by the Islamic calendar. According to Central Department of Statistics & Information(CDSI)(2017) more than 67% of them come from outside of Saudi Arabia, and 94% of them come by air transport as shown in Figure 1-1. These millions of pilgrims arrive through the ports of King Abdulaziz International

Airport (KAIA) in Jeddah as well as the Prince Mohammed Bin Abdul Aziz International Airport in Medina where the Saudi government created terminals for Hajj and Umrah in both airports. According to CDSI (2017), HT at KAIA in Jeddah receives 60% of pilgrims coming from outside Saudi Arabia, while the HT at the Medina airport receives the remaining foreign pilgrims. That means that a huge number of pilgrims arrive at these terminals in both airports during a short period, exceeding their capacity by several times. This leads to crowding and bottlenecks in these terminals, increased queue lengths and wait times, low levels of service, increased operation costs and dissatisfied pilgrims. This problem requires many in-depth research studies that consider several factors. These include infrastructure, the human characteristics and perspectives of pilgrims and workers on the problem, the stockholders and agencies working in this environment and the rules governing them and tools and techniques to assist in this kind of research (e.g. modelling and simulation).

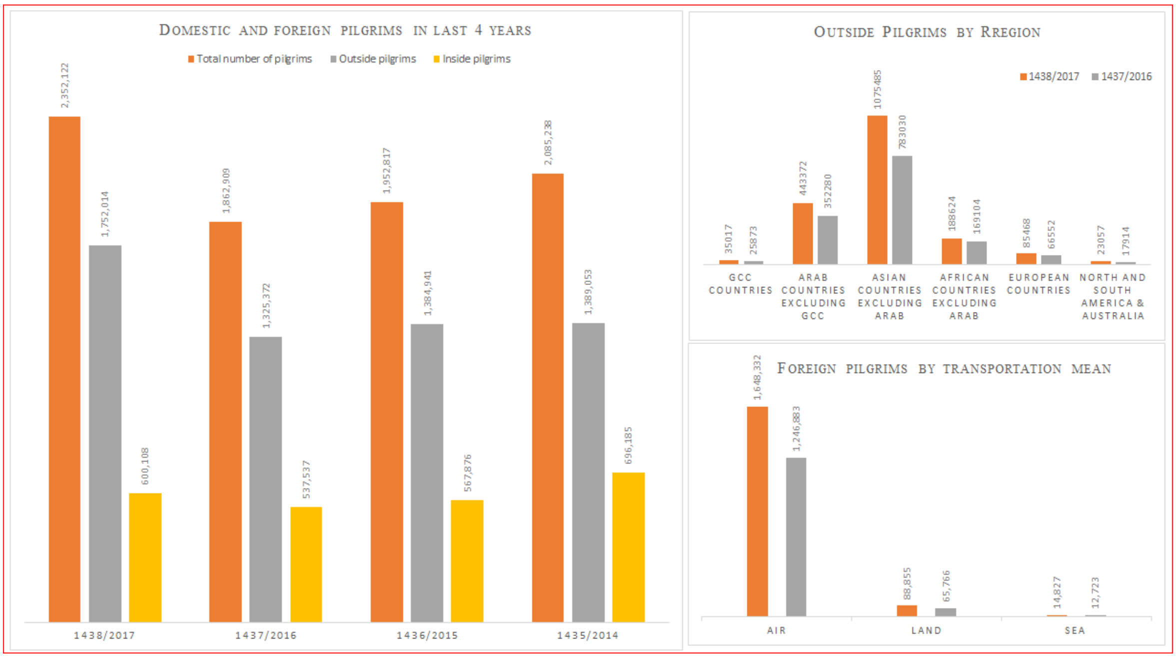


Figure 1-1 Statistics on Hajj 1438/2017

Source of data: CDSI (2017)

1.3 Research aim and objectives

The aim of this research is to develop an integrated framework to improve the flow of pilgrims arriving at HTs in the KAIA in Jeddah and the Prince Mohammed bin Abdulaziz International Airport in Medina.

To meet this aim and fill some research gaps in this field, the researcher has identified and set the following objectives:

1. To understand the performance of arriving passenger processing and evaluate the current HT systems and processes.

2. To identify the characteristics of the flow of pilgrims through arrival terminal processes from the user's perspective.

3. To identify the characteristics of the flow of pilgrims through arrival terminal processes from the perspective of providers.

4. To develop an integrated simulation model to evaluate the current HTs by applying what-if scenarios with a simulation model to help this study to suggest solutions that facilitate the flow of pilgrims arriving at HTs.

5. To develop and validate the integrated framework.

1.4 Research motivation

As mentioned in the introduction, the air transportation industry is crucial in advancing economic and social development at the international level, which contributes to increases in national income and strongly influences the social progress desired by all countries for stability and well-being. However, the air transportation industry, which is associated with complex, interacting variables, requires concerted, multidisciplinary efforts for effective research and development.

Tourism is one of the most important sources of income for most countries in the world. Therefore, many countries place great importance on the development of the tourism sector. According to World Tourism Organization (2020) the air transportation industry is an important element for tourism development, as 58 % of tourists around the world travel by air in 2018. In particular, efforts are made in the areas of service, security, safety and environmental protection through the adaptation and use of optimisation in the upgrading and development of all of the factors related to the air transport industry.

Airports are an important part of the air transport industry. Therefore, construction and service activities are underway in most countries to develop them, especially international airports. This is due to their role in attracting tourists and the positive impact on visitors' and transit passengers' perceptions of the country, as international airports are considered gateways to host countries. Hence, there have been efforts at the government level to improve the service at airports, including departure and arrival areas, focusing on passenger flow and satisfaction. Passenger satisfaction has been linked to reduced wait times, improved services, faster processes and procedures, attention to the airport capacity and environment, entertainment facilities, markets and restaurants, concern for the environment and safety and other services and procedures. Responding to passenger needs and taking corrective action has become necessary, and companies must work continually to identify and meet passenger needs. Thus, measuring the service level and flow performance based on their perspective is required to identify the operational problems of these airports and the criteria of passenger satisfaction.

One of the challenges facing the operations and services at airports is congestion resulting from imbalances between airport demand and capacity. This causes malfunctions and failures in services and direct and indirect negative effects, especially in the arrival areas of international airports. Examples of direct negative effects include long waits in queues, slow immigration and customs processes and procedures and decreased levels of passenger satisfaction, especially for passengers arriving after long trips. On the other hand, indirect effects include the reluctance of tourists, negative perceptions of service and negative expectations of the country. A review of SKYTRAX, a website that collects and combines reviews of airlines and airports (Skytrax, 2015), revealed that a large proportion of the airports with the worst ratings suffer from congestion, poor organisation and low passenger flow. Therefore, governments, airport management companies, airlines and academic researchers are paying increasing attention to this problem. However, it still needs more attention, particularly in terms of arriving passenger flow.

According to CDSI(2017), more than 1.7 million pilgrims came from outside Saudi Arabia during the Hajj season 1438/2017, 94% of them arriving by air transport. Therefore, hundreds of thousands of pilgrims arrive weekly at the Jeddah and Medina international airports during this period. Many operational problems and issues have been recorded in both airports, such as passenger and baggage congestion, poor service, dissatisfied pilgrims, higher operating costs, delayed flights, long queues and other operational and service problems. Numerous research studies have been published on the health, security, risk management and logistics aspects of the mass gathering. However, studies on the arrival areas of HTs, including service levels, passenger flow, wait times and satisfaction, are very limited.

Furthermore, according to Saudi vision (2016), the Saudi government is interested in developing systems processes at HTs to ensure the smooth flow of pilgrims to maximise the operating capacity and minimise the operating cost and processing time. Therefore, it invited all Saudi universities and research centres to participate in the study of this problem. One of the universities that decided to study this problem was the Department of Industrial Engineering at Jazan University where I work as a researcher, and that was what motivated this research.

A large proportion of the literature has focused on solving the problem of crowding at airports. As mentioned above, crowding at airports affects passenger satisfaction as well as quality of airport services, such as check-in, baggage check-in and claim, security inspection, customs inspection and boarding, and the provision of spaces for non-aeronautical activities (e.g. commercial areas). This problem represents a threat to the aviation industry and its profitability. Thus, various new, innovative ideas, techniques, tools and solutions have been introduced to mitigate the negative effects of airport crowding and passenger traffic. Passenger perspectives of the service in crowded airport arrival terminals is a promising topic for further research, as it is not sufficiently understood from a systems perspective.

1.5 Research scope

The LoS of airports passenger processes can be evaluated based on several points of views and experiences of players in this environment, such as the user and the service provider. Each approach of this evaluation, several methods of evaluation and measurement can be adapted. However, this research takes into account an evaluation of the LoS for inbound pilgrims processing of HT based on passengers and providers perspective and using an integrated simulation model. Therefore, there may be a difference in some characteristics and configurations when using this method with other airports, which should be taken into account.

1.6 Structure of the thesis and outlines

This section summarises the chapters covered by this study, as shown Figure 1-2.

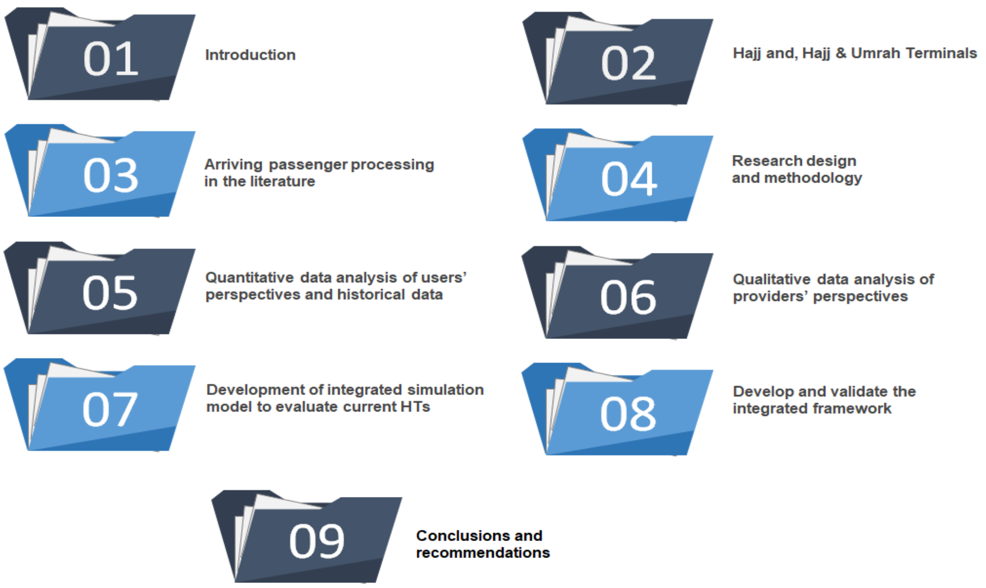


Figure 1-2 1Thesis Structure.

Chapter one

Chapter one of this thesis covers the study introduction and background, which illustrates the passenger arrival processing. Then, the research problem follows, which highlights the passenger arrival processing at HTs. The research problem indicates the current HTs problems such the limited capacity, crowdedness, long average waiting time, long queue length, and passenger dissatisfaction. This chapter clarifies the research aims, objectives, and the research motivations. In addition, this chapter specifies the scope of the study. Finally, this chapter recognises the rest chapters in the thesis structure.

Chapter two

Chapter two will briefly explains the term of Hajj, that includes the Hajj definition, Hajj period, and scared Hajj sites. Furthermore, this chapter introduces the HTs at Jeddah and Medina airports, including the infrastructures, configurations, and regulations, as well as the authorities, and agencies that work at HTs.

Chapter three

Chapter three gives the reader an overview regarding the airport’s passenger terminals with both the arrival and departure domains. Topics related to passenger arrival processing such as airport capacity, demand, and passenger flow, are also introduced. Finally, this chapter identifies the existing studies related to passenger arrival processing through both comprehensive literature review and systematic literature review.

Chapter four

Chapter four describes the research methodology followed by this research. It explains the philosophical position of this study, and displays and adopts the previous methodology to evaluate the performance of passenger arrival processing. Besides, this chapter justifies, illustrates, and exhibits the study integrated framework.

Chapter five

Chapter five explains the procedures followed for the collection and analysis of data on pilgrims' experiences with Hajj terminals using univariate and multivariate analysis. The process includes the usage of detailed questionnaires, where survey samples are randomly collected from pilgrims in two airports to obtain their perceptions using both quantitative and qualitative methods. Furthermore, the data collection considers and focuses on identifying the characteristics of human/passenger factors, and the aspects of processes and other service-level criteria.

Chapter six

Chapter six focuses on the development of open-ended interview questions based on the literature review and results obtained from the quantitative analysis of passenger experience. The main objective of these interviews is to engage airport employees and management in evaluating management's perceptions of the performance of pilgrim flow through arrival terminal processes and the outcomes achieved. Chapter 6 also includes the use of face-to-face interviews to high-level personnel representing all organisations in both airports. The audio recordings are transcribed verbatim for thematic analysist hat is carried out using NVivo. The analysis outcomes seeks to identify the themes and sub-themes associated with the service level provided for Hajj terminal passengers and the different issues faced by employees.

Chapter seven

Chapter seven involves a simulation model that is developed using AnyLogic simulation employing the current data on HTs collected with permission from General Authority of Civil Aviation (GACA), top managements of all organisations that work in the HTs and related ministries. The simulation determines the most critical variables for assessing potential system outcomes. The integrated simulation model based on Agent-Based Simulation (ABS) and Discrete Event Simulation (DES) is used to ensure that the different scenarios can be considered to show how the system would operate under different circumstances

Chapter eight

Chapter eight includes the validation process of the study's integrated framework. The validation tests the ability of the integrated framework to measure LoS, the ability to be applicable and understandable, the ability the reduce the processing time and congestion level, and the ability to increase the passenger's satisfaction. Thus, Chapter 8 develops and concludes the validation of the study framework by using an expert's judgment.

Chapter nine

Chapter 9 emphasizes on the research conclusion, research key findings,

2 CHAPTER TWO: HAJJ AND, HAJJ AND UMRAH TERMINALS

2.1 Introduction

This chapter aims to provide a brief overview of the Hajj and the HTs as an introduction to this study. Section 2 of this chapter discusses the Hajj in general, exploring the definition of the Hajj, the Hajj period and the places pilgrims should visit during the Hajj trip. Subsequently, it reviews the statistics on the number of Hajj pilgrims during the last 30 years. Then, Section 3 of this chapter provides general information about the HTs, including its infrastructure, systems and regulations. Finally, it discusses the authorities and organisations working in those terminals and their roles.

2.2 Hajj

2.2.1 Hajj definition

In the literal sense, the word Hajj means going to a particular place to visit. However, in Islam, it is defined as going to the city of Mecca in Saudi Arabia at a specific time each year, and it is associated with certain rituals called the rituals of the Hajj (Matthew, 2011). The Hajj is the fifth pillar of Islam and one of the biggest annual events in the world. Every Muslim, male or female, who is mentally, financially and physically fit, must participate in this event at least once in his/her lifetime.

The Hajj is a big event in which many Muslims with different cultures, languages and colours from all over the world gather every year. Hence, it can be one of the busiest events, as 2 to 3.5 million Muslim pilgrims can be expected to gather in the Holy City (General Authority for Statistics, 2018). According to Caidi (2019), the Hajj is considered one of the largest religious events in the world. Furthermore, it is a major event in the lives of Muslims, offering many benefits, including religious, academic, scientific, social, economic, political and other advantages.

2.2.2 Hajj period

As mentioned above, the pilgrimage takes place at a specific time each year. The Hajj involves several rituals, which must be performed according to the sequence of events. These rituals start by making the intention and wearing the ihram in Miqat before reaching Mecca (Khan and Shambour, 2018). Then, the pilgrims have to wait until the eighth of the Dhul Hijjah month (twelfth month) according to the Islamic lunar calendar to move to Mina. Afterwards, the pilgrims begin the ritual pilgrimage and move between sacred sites until the thirteenth day of Dhul Hijjah, the last day of the Hajj. Thus, the Hajj is performed between the eighth and thirteenth days of Dhul Hijjah.

There is a specific period for the arrival and departure of pilgrims from abroad through the air, sea and land ports according to the organisational regulations set by the Ministry of Hajj and Umrah in the Kingdom of Saudi Arabia in coordination with other government agencies and missions of pilgrims' countries (Ministry of Hajj and Umrah, 2019). The period of pilgrims' arrival in the Kingdom of Saudi Arabia extends from the first day of the month of Dhul Qadah until the fifth day of the month of Dhul Hijjah. The period of departure extends from the fifteenth day of the month of Dhul Hijjah to the fifteenth day of the month of Muharram, according to the Islamic lunar calendar. Furthermore, all flights are scheduled based on this regulation.

2.2.3 Sacred Hajj sites

During the Hajj trip, the pilgrims have to visit or stay at several sacred sites, some of which are optional based on the pilgrim's desires. The places that the pilgrims must visit or stay at include the Great Mosque (Haram Mosque), Mina, Arafat and Muzdalifah, all of which are in Mecca in Saudi Arabia. Thus, the pilgrims move to various sacred places around the town of Mecca during these days, where they live in tent camps for several evenings.

On the other hand, a large percentage of pilgrims visit several optional holy places, especially those performing the Hajj for the first time. An example of such places is Al-Masjid an-Nabawi in Medina, Saudi Arabia. In 2012, the government of Saudi Arabia established the unified electronic path for external pilgrims (Foundation for Civil Guides Medina, 2017). According to the system, the pilgrims who wish to visit Al-Masjid an-Nabawi in Medina have to specify the time of their visit before or after the Hajj to determine the arrival and departure ports of pilgrims arriving through the airports.

2.2.4 Number of pilgrims in last 30 years: descriptive statistics

Millions of Muslims around the world perform the Hajj each year. Moreover, the foreign pilgrims who come from outside of Saudi Arabia constitute 55–75% of the total number of pilgrims, as shown in Figure 2-1 (General Authority for Statistics of Saudi Arabia, 2020).

The procedures for determining the number of pilgrims allowed every Hajj season are carried out by the government of Saudi Arabia in coordination with the member states of the Organization of the Islamic Conference according to the obligation document that was made during the organisation’s meeting in 1988 (Saudi Press Agency, 2007). This document states that the number of pilgrims allowed for each Islamic country is determined by dividing the population of each country by the number of Muslims in the world.

From the data in Figure 2-1, it can be seen that the number of foreign and domestic pilgrims has fluctuated during the last 30 years. This leads us to note that there has been an increase in the growth rate of pilgrims in some years and a decline in others. To discuss the growth in the number of pilgrims, both foreign and domestic, the growth in the number of pilgrims between 1990 and 2019 was analysed and evaluated. The annual growth trend in the number of pilgrims was found to be between -37% and 30%. Moreover, the annual growth trends in the number of foreign and domestic pilgrims were found to be between -57% and 46% and -21% and 32%, respectively. The average annual growth rate in the number of pilgrims, including both foreign and domestic, was 3%, as shown in Figure 2-2.

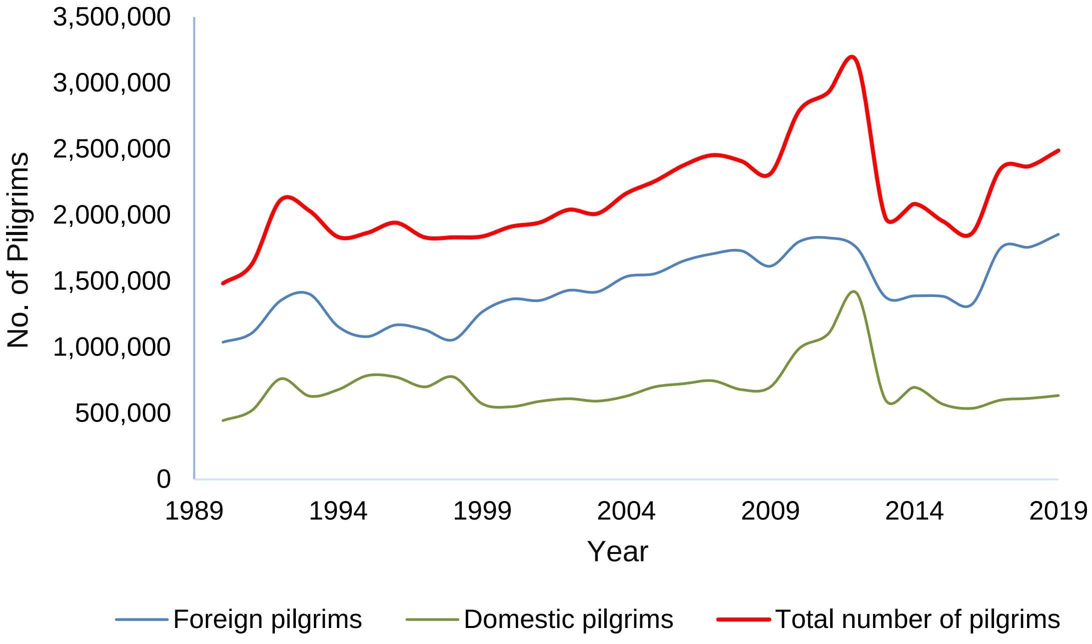


Figure 2-1 Number of pilgrims in last 30 years

Source of data: General Authority for Statistics of Saudi Arabia (2020).

There is a strategic plan for the gradual increase in the number of pilgrims according to Saudi Vision 2030 (Government of Saudi Arabia, 2016). Therefore, the Government requested a detailed study from the Institute for Hajj and Umrah Research at Umm Al-Qura University in cooperation with the relevant authorities to study this plan (Institute for Hajj and Umrah Research, 2018).

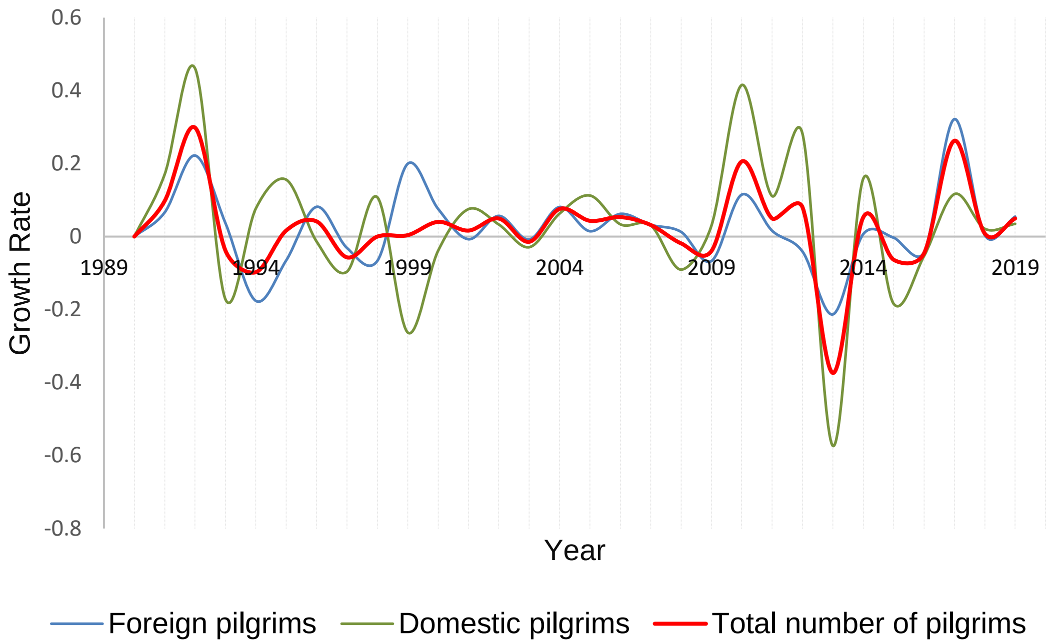


Figure 2-2 Annual growth rate of number of pilgrims from 1990 to 2019

Source of data: General Authority for Statistics of Saudi Arabia(2020).

Foreign pilgrims travel to Saudi Arabia to perform the Hajj through air, land or sea transport. Figure 2-3 illustrates that most foreign pilgrims use air transport: the average percentage of pilgrims who use air transport to perform the Hajj of all foreign pilgrims is 94%. Thus, the number of foreign pilgrims who use air transport is far greater than the number who use other types of transport to travel to Saudi Arabia to perform the Hajj.

According to the GACA (2018), more than 67% of pilgrims come from outside of Saudi Arabia, representing more than 180 countries around the world. These masses of pilgrims arrive within a specified period, which is 35 days from the first day of Dhul Qadah to the fifth day of the next month of the Hijri calendar (Dhul Hijjah). These millions of pilgrims arrive at the ports of King Abdulaziz International Airport (KAIA) in Jeddah and at the International Airport of Prince Mohammed Bin Abdulaziz in Medina. The Saudi government has developed HTs at both airports, which are discussed in the next section.

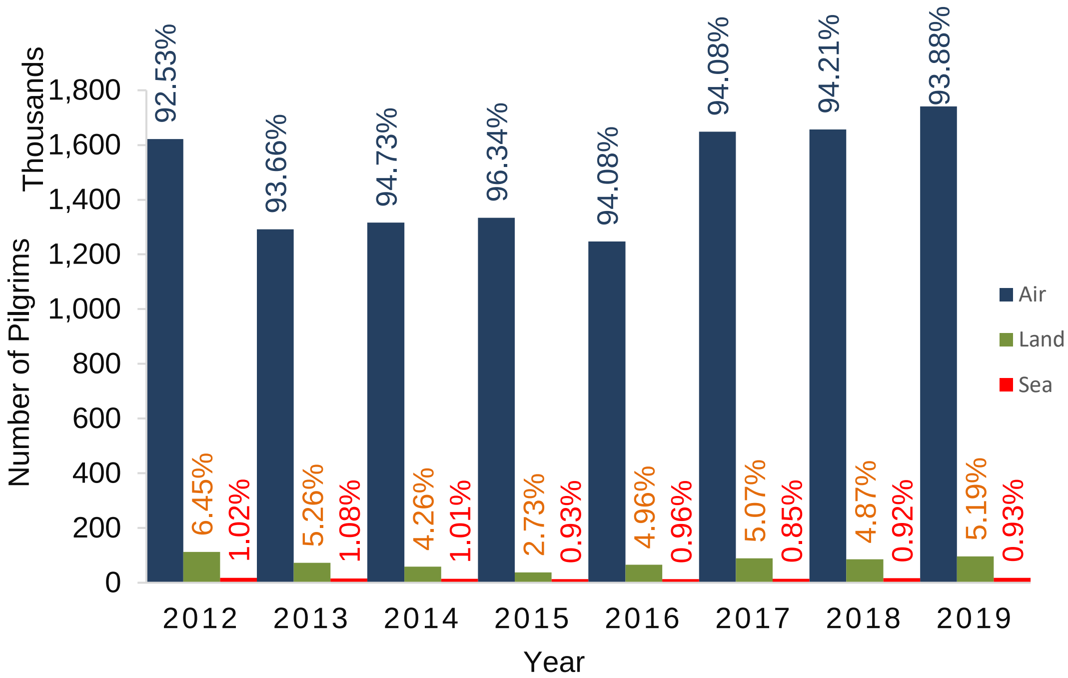


Figure 2-3 Transportation means of foreign pilgrims for performing Hajj

Source of data: General Authority for Statistics of Saudi Arabia (2020)

2.3 HTs

The use of air transport in the Kingdom of Saudi Arabia began in 1945 when the first civil airplane arrived in Jeddah (Khail, 2017). Then, in 1952, the first airport in Jeddah was opened to serve travellers, especially those who came to visit the holy places in Mecca and Medina (GACA, 2018). Subsequently, the idea of establishing HTs to accommodate the increase in the number of pilgrims arriving by air transport emerged in 1981, evidenced by the opening of the first terminal especially for pilgrims (i.e. a HT) at KAIA in Jeddah (Mcmurdo, 1981). After that, the Saudi government developed Medina Airport to receive pilgrims because the high number of pilgrims arriving through air transport exceeded the operating capacity of the pilgrim terminal in Jeddah. Thus, the Saudi government identified these two airports for the arrival of pilgrims and established special terminals for Hajj and Umrah within them.

These terminals differ from other arrival terminals at international airports in terms of procedures. There are five processes in these terminals through which pilgrims have to pass. The first process, the health check, takes place when the pilgrim disembarks from the plane, enters the terminals and passes the health checkpoint. The second process is passport control. Third, the pilgrim receives his/her luggage and then goes to the customs inspection point, which is the last process inside the HT. Subsequently, in the fourth process, the pilgrim enters the external halls (plaza area) to finish his/her registration and confirm his/her accommodation in Mecca or Medina, which is done through the Unified Agents' office. Finally, the pilgrim is directed to the sixth process, which is that of identifying, registering and distributing pilgrims and sending them to buses.

The following sections explain the HTs at both airports in more detail and discuss the agencies that work at these terminals.

2.3.1 HT at Jeddah Airport

The first phase of the HT at KAIA in Jeddah was completed in 1981. Then, the second phase of the terminal was finished in 1982, and it is classified as one of the largest airport terminals, as shown in Figure 2-4 (Ghamdi, 2020). The HT at Jeddah Airport (open tents) continued to receive pilgrims until 2007.

Figure 2-4 HT at Jeddah Airport - top view

Source: Ghamdi (2020)

Then, in 2007, GACA in Saudi Arabia signed a contract with Ports Projects Management & Development Company (PPMDC) on a Build, Transfer and

Operate (BTO) for 20 years. This project involved the eastern tents, as shown in Figure 2-5. The construction work was performed in phases: the first phase began in 2007, and the last phase ended in 2009.

Figure 2-5 HT at Jeddah Airport - side view

Source: Ghamdi (2020)

The terminal has five running colour-coded lounges. Furthermore, it has 10 jet bridges connecting it to the aircraft and allowing disembarking pilgrims to access the five lounges located on the first floor (PPMDC, 2019). Four of the five lounges have ground floors for the arrival/departure of passengers transported by bus to/from aircraft parked in remote areas. This terminal has a particular function during the arrival period of the Hajj season, as mentioned above, when it serves as an arrival terminal to receive inbound pilgrims only. According to PPMDC (2019), the operating capacity of this terminal is between 1500 and 3700 pilgrims per hour. In addition, it can accommodate 13 flights per hour.

2.3.2 HT at Medina Airport

Medina Airport was first established in 1950 as a short unpaved runway and two small tents close to the buildings of Medina (Khail, 2017). Then, in 1972, the Saudi government opened Prince Muhammad bin Abdulaziz Regional Airport, considered at that time one of the most important airports in the Kingdom after the three international airports. After that, this airport underwent numerous expansions and continuous development programmes until it was qualified to receive international flights departing from the cities of Cairo, Istanbul, Karachi, Damascus, Jakarta and many others. In 2006, the Saudi government, represented by GACA, decided to accredit it as the fourth international airport in Saudi Arabia (Sabq.org, 2017).

Later, upon signing the contract for the construction and operation of Prince Mohammed bin Abdulaziz Airport by Build – Operate – Transfer (BOT) for 25 years with Tibah Company, the construction of the HT was included within this project, and the new Medina Airport began operating in 2012. The HT in this airport contains two lounges, and it is connected with other terminals, unlike the HT at Jeddah Airport, which is separate from the other terminals, as shown in Figure 2-6. One of these lounges is located on the upper floor, and the other is located on the ground floor. In addition, there are six waiting halls in the external area for the Unified Agents registration process and for allocating the pilgrims and sending them to the buses. According to GACA (2017), the operating capacity of this terminal is between 1200 and 2000 passengers per hour.

Approximately 35–45% of pilgrims arrive via the HT at Medina Airport, while the remaining 55–65% arrive via the HT at Jeddah Airport (GACA, 2018). Thus, hundreds of thousands of pilgrims arrive at the HTs at Jeddah and Medina International Airports every week during this period.

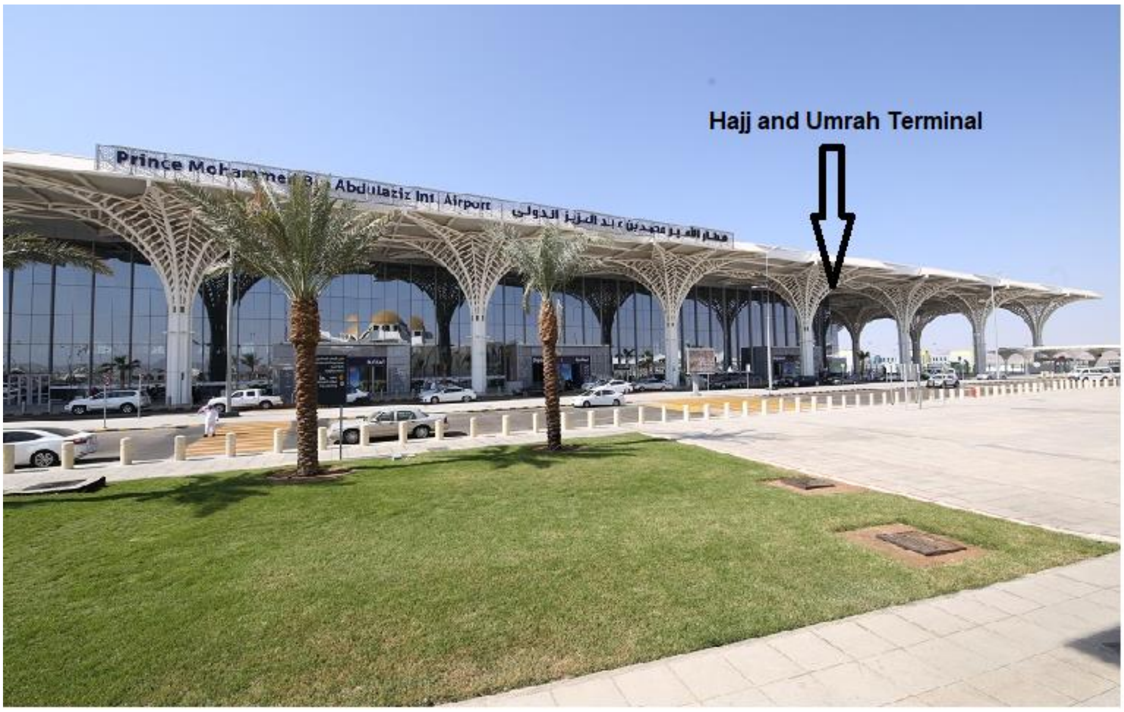


Figure 2-6 Prince Muhammad bin Abdulaziz International Airport, Medina

Source: the photo has captured by the author in 2017.

Hence, during a short time, an enormous number of pilgrims arrive at both of these airports' terminals, far exceeding their capacity. This leads to crowding and bottlenecks in these terminals, which in turn increases waiting times and operating costs and decreases pilgrims' satisfaction levels.

2.3.3 Authorities and agencies working at arrival sections of HTs

As mentioned earlier, the HTs are considered the most complex terminals and work environments, because they have more processes and agencies than other airport terminals. Specifically, travellers must undergo six processes in the arrival sections of these terminals: Health Inspection (HI), Passport Control (PC), Baggage Claim (BC), Customs Inspection (CI), Unified Agents (UA) and Bus Connection (BS). Thus, there are numerous government and non-government agencies responsible for operating these processes. Examples of government agencies include the Ministry of Hajj and Umrah, GACA, General Directorate of Passports (GDP), Health Monitoring Centre (HMC) - Ministry of Health and Customs General Authority (CGA), while examples of non-government agencies include the General Cars Syndicate, United Agents Office, Saudi Ground Services (SGS) and Tibah Company. The following section briefly explains the most important agencies in the HTs.

- HT administration - GACA:

The HT administration is a government agency working under GACA. This administration is responsible for organising, supervising and following up on the performance of Hajj service operators and other agencies working in HTs. These agencies are shown in Table 2-1. It is also responsible for following up on the services provided, whether inside terminals, in public areas or on airport aprons, to ensure they are all performed in an ideal manner and the passenger spends the shortest time possible and avoids wasting time in long procedures.

- HMC:

The HMC is a government agency working under the Ministry of Health, and it is responsible for HI processes in the HTs at both airports. Therefore, the duties of this agency include preventing the entry of any cases or suspected cases of infectious diseases in addition to administering vaccinations required by the World Health Organization. The teams are available 24/7 at the HTs at Jeddah and Medina.

Table 2-1 HTs' administrations and regulators

Function		HT	
		Jeddah Airport	Medina Airport
Regulator		GACA of Saudi Arabia	GACA of Saudi Arabia
Responsible for slot allocation		GACA in coordination with other Saudi agencies	GACA in coordination with other Saudi agencies
Operator		PPMDC	Tibah Company
Contract type		BOT	BOT
Ground service		SGS	SGS
Processes of arrival section	HI	HMC*	HMC*
	PC	GDP	GDP
	BC	SGS	SGS
	CI	CGA	CGA
	UA	United Agents Office**	United Agents Office**
	BS	General Cars Syndicate**	General Cars Syndicate**

* One department of Ministry of Health
** Working under Ministry of Hajj and Umrah

- GDP:

The GDP is a government agency working under the Ministry of Interior, and it is responsible for the PC process in the HTs at both airports. This agency is involved in supervising, monitoring and following up on the PC process at the HTs and ensuring the work progresses as it should. It is also responsible for following up on the workforce and facilitating the procedures of registering pilgrims who enter the country to perform Hajj or Umrah.

- SGS:

SGS is a private agency responsible for the disembarkation of pilgrims and BC in the HTs at both airports. The duties of this company in the arrival domain of HTs include receiving the flight from the moment of the plane's arrival, installing equipment, supervising the pilgrims' disembarkation and unloading and then sending baggage to terminal gates. Other assigned tasks for this agency include ensuring all operational locations of HTs are covered in terms of baggage service and providing the adequate number of staff for every shift.

- CGA:

CGA, a government agency working under the Ministry of Finance, is responsible for the CI process in the HTs at both airports. This agency is responsible for simplifying customs procedures across borders and assisting the supervisory authorities in Saudi Arabia by applying security, health, agricultural, environmental, media and other oversight provisions as well as collecting customs duties.

- United Agents Office:

The United Agents Office is a non-government agency working under the Ministry of Hajj and Umrah, and it is responsible for the UA process in the HTs at both airports. This agency also works with the General Cars Syndicate on the allocation and distribution of pilgrims to buses (Ministry of Hajj and Umrah, 2020). In addition, it is involved in linking the stages of the services provided to pilgrims, starting from receiving them in the airport and guiding them to their destinations and ending with assisting with their procedures and meeting the fees of the services of the raft. It is also responsible for facilitating their transportation between Medina and Mecca and the holy sites as well as transporting their belongings from the arrival outlets and overcoming any difficulties they might face.

- General Cars Syndicate:

The General Cars Syndicate, a non-government agency working under the Ministry of Hajj and Umrah, is responsible for the BS process in the HTs at both airports. In addition, this agency is accountable for supervising work related to transporting pilgrims between both air and sea ports and sacred Hajj sites in Mecca and Medina.

- PPMDC:

PPMDC is a for-profit organisation and the first Saudi company specialised in operating airports. The HT Project began in 2007 through the strategic partnership between this company in the private sector and the government. The first company to win a BOT contract for the HT at Jeddah, it is responsible for operating the HT at Jeddah throughout the entire 25-year contract duration. In addition, it is responsible for the cleaning and maintenance of this terminal.

- Tibah Company:

Tibah Company, a for-profit organisation, consists of three firms: TAV, Al Rajhi Group and Saudi Oger. This company has undertaken the project of Medina Airport by a BOT contract, which spans from 2012 until 2037. It is also responsible for operating and maintaining Medina Airport, including the HT.

2.4 Summary

This chapter discussed the Hajj in general and related issues. It also presented the history of air transport use in the Hajj and that of the first HT. It also discussed information related to the HTs in some detail, including their system, operating capacity and agencies. This chapter also showed the need for more work on both the academic and practical sides to improve the Hajj in terms of environment, infrastructure and transportation, particularly HTs. Therefore, the next chapter reviews the academic literature related to this subject.

3 CHAPTER THREE: ARRIVING PASSENGER PROCESSING IN THE LITERATURE

3.1 Introduction

Research and studies related to air transport have flourished in the last two decades, particularly concerning airport service, management and operations. An airport is considered a complex system because of the multiplicity of stakeholders, actors and agencies, issues and overlapping operations as well as the existence of complex interactions between these actors (Wu and Mengersen, 2013; Zografos and Madas, 2006). There have been many types of academic research based on airports and their development in different regions across the globe. Research on airports has been focused on ensuring that airports offer efficient services and that airport management is able to perform its job effectively. Academic research in the sector has mainly focused on airport capacity and operation, including passenger flow at airport terminals, security at airports, physical airport environments and services offered at airports.

Starkie (2008) states that the demand for airport services is estimated to have doubled every 15 years since the 1970s and continues to be characterised by a high growth rate. Therefore, an increase in the number of international airports across the globe resulting from economic advancement and globalisation has called for more research on services, operations and conditions at airports.

Chiang (2014) indicates that the airport sector has become an issue of concern for many sectors of the economy, with business and tourism being the greatest beneficiaries. Airport management needs to outdo its competitors for this high-demand service and thus appreciates research in this area. Hence, many academic researchers have greatly contributed to the field. Technical information provided to airports has enabled airports to reduce their management costs and even develop more products and services for their members.

The research on airports began more than four decades ago and covered multiple aspects. This research has intensified over the last two decades, as indicated in Figure 3-1, which describes the trends in research related to issues such as airport capacity, airport service level, airport performance, airport passenger flow and crowded airports, especially at events, over time. Hence, this leads us to the conclusion that there is a lack of research related to airport operational performance during events and peak season times, including passenger flow and passenger processing performance. Accordingly, the literature on airports can be divided into multiple aspects, themes and domains. These include not only airport demand management (Fan and Odoni, 2002; Ryerson and Woodburn, 2014) but also airport economics and business models. Examples of these include airport management, airport operations, airport planning, airport regulations and airport decision-making (Karlsson et al., 2008; Price, 2014; Wijnen, Walker and Kwakkel, 2008; Xiaojiang and Jixian, 2001); airport traffic, passenger flow and business processes (Wu and Mengersen, 2013; Xiao et al., 2016); and airport security and safety (Enoma and Allen, 2007; Xie, Shortle and Donohue, 2004). Moreover, many studies have been concerned with the physical design and development of airports, including facility planning, terminal layout design and new technology introduction (Chatzikonstantinou, Sariyildiz and Bittermann, 2015; Harrison, 2015; Jaffer and Timbrell, 2014; Kalakou, Psaraki-Kalouptsidi and Moura, 2015; Stevens, Baker and Freestone, 2010).

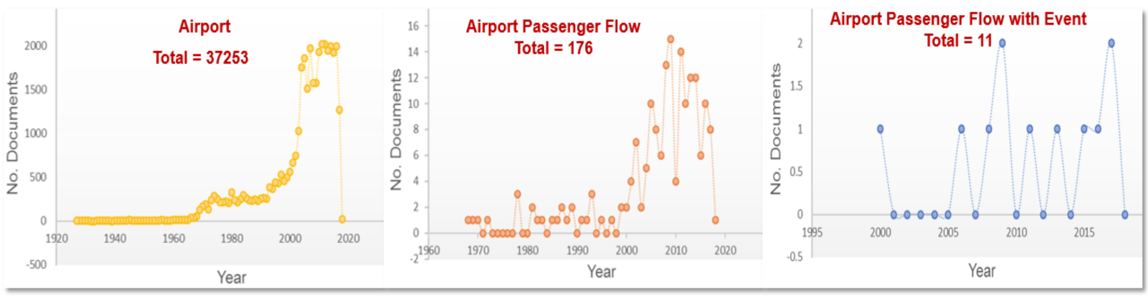


Figure 3-1 Number of published articles relevant to research on airports, airport passenger flow and airport passenger flow at events 1930 – 2018.

Source: source of data Scopus.

Accordingly, this chapter aims to review previous studies conducted on topics related to the performance of airport passenger terminals, including airport passenger flow, airport passenger processing and performance of crowded airport passenger terminals. The goal here is to understand the performance of arriving passenger processing and evaluate the current HT systems and processes. Thus, the literature review for this study was conducted in two stages. In the first phase, the literature was studied to explore the scope of this research in general. A systematic literature review was used in the second phase to provide a deeper understanding of the performance of arriving passenger processing and determine the current state of the literature on this subject. Chapter 3 mainly addresses the first objective of this research and adopts these data collection methods to identify the research gaps and provide a roadmap for further study.

3.2 Overview of Airport Passenger Terminals

The airport is considered a complex system due to its multiple processes, stakeholders/actors and jurisdictions/regulations, all of which interact. To review the previous literature on airport systems and passenger flow, it is necessary to briefly cover the airport components. An airport has two major components; an airfield and terminal buildings, as well as aprons, control towers, hangars parking, and other facilities(Rodrigue, 2020). Chiang and Taaffe (2014) state that thousands of passengers visit an international airport daily and millions of passengers commute within airport passenger terminals, which is where congestion often occurs. A simple delay or breakdown of systems reveals the huge number of people passenger terminals service. The design of an airport terminal determines how effective it is at serving passengers. International airports usually have more than one terminal. Problems with air transport are commonly associated with operation services at the passenger terminal, and hence, they are a key area of concern when it comes to winning competitors' customers. Many problems are encountered at airport terminals, and they greatly affect the flow of passengers. For example, many changes have been implemented after 9/11 in screening procedures due to security concerns, which has affected passenger throughput times (Alodhaibi, Burdett and Yarlagadda, 2017).

There are two main lounges in an airport, departure and arrival, each with unique processes and activities, as shown in Figure 3-2. The airport management literature includes many research studies on airports in general, including the two lounge types. However, some studies have focused on each lounge type separately, as discussed in the following sections.

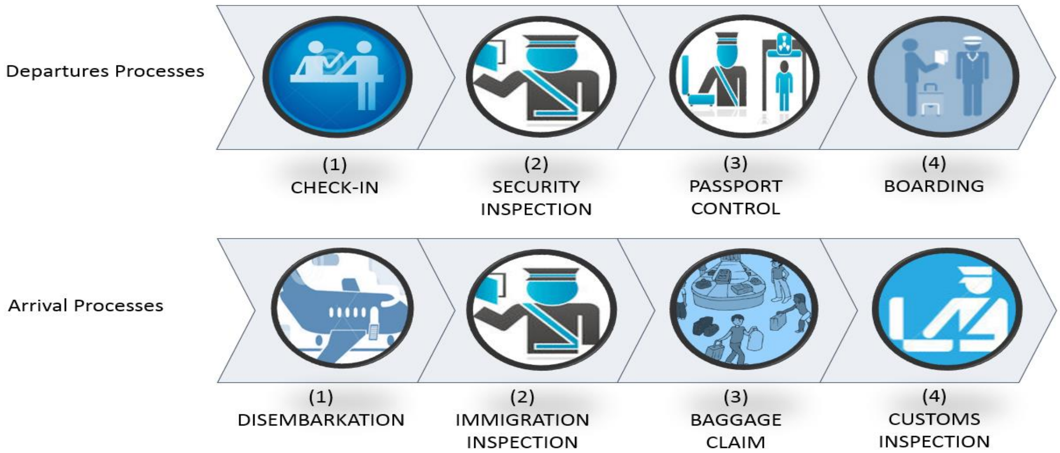


Figure 3-2 Processes at international airport terminals.

Source: Created by the author based on (IATA, 2014).

3.2.1 Departure Terminal Domain and Processes

The departure area contains two main domains: a processing domain, including processes such as check-in, security, immigration, customs and boarding, and a non-processing domain, including points of airport access, airport facilities and retail areas (Wiredja, Popovic and Blackler, 2015). The flow of passengers through this area is regarded as the most important, since it exerts a great impact on the entire operation of a passenger terminal together with other important elements in the airport. Therefore, the departure terminal is the busiest terminal in terms of passenger verification, authorisation and security operations. The departure procedure for passengers starts with access to the airport facilities (Chiang and Taaffe, 2014). Passengers have to go through security screening at different check-in points. Passengers follow the procedure based on the intended category of transport: customs, check-in, immigration, security screening and boarding. Alodhaibi et al. (2017) stresses that a lot of time in airports is spent at the departure terminals due to the many processes passengers must complete.

3.2.2 Arrival Terminal Domain and Processes

Arriving passengers go through the following disembarking procedures: immigration, customs, baggage claim, quarantine and finally airport departure. In airports where there is more than one terminal, passengers are required to check for the terminal where they are to be served. Arriving passengers are usually directed to follow signs that lead them to either baggage claim or flight connections for transit passengers. Customers from abroad must go through passport control (Matas, 2010). In baggage claim areas, passengers are supposed to check for the flight information on the screen and then the carousel number. Where necessary, passengers are provided with free baggage trolleys. Arriving passengers go through the baggage claim where necessary before heading to the public arrival areas (Yoon and Jeong, 2015).

Past research studies have discussed processes at airports using different approaches and methods with a focus on accuracy in the characterisation of airport processes. For example, Kalakou et al. (2015) predicted the dynamic changes in future airport terminals resulting from the impact of supply and demand using a simulation model. They focused on the impact of modern technologies, including identity management tools and biometrics, near-field communications, big data analytics and smartphone applications, on the central passenger processing functions. In addition, they found that the introduction of new technologies in airport processes, such as check-in and security, has significantly reduced. Moreover, Kleinschmidt et al. (2011) developed an ABM simulation model to study passenger flow and behaviour inside international arrival terminals and related issues, such as length of time spent waiting in queues, bottlenecks/congestion and LoS. The authors considered the engagement of passengers in non-aviation activities in the airport, such as shopping, and examined its impact on the reduction of queue length. However, it is difficult to generalise their findings to arrival terminals around the world due to design differences between the airports. For example, there are no retail areas or restaurants before the immigration and customs checkpoints at most airports around the world. Another weakness of this study is that it is difficult to predict passengers' desires and behaviours without a direct survey/study of passengers, especially at arrival terminals in international airports. Wu et al. (2014) developed a model of passenger facilitation in a complex environment using a hybrid queue-based Bayesian network framework. In general, service use time and passenger flow rate are used to gauge the level of performance in airports (Wu and Mengersen, 2013). This is considered in the present research.

3.3 Airport Capacity Constraints and Passenger Flow

3.3.1 Definition and Overview

Caves and Pickard (2001) indicate that airport capacity constraints include inadequacies in all areas of airports, ranging from runways all the way to operations within the airspace. Airport capacity constraints include the inability to handle a large number of passengers through a terminal, ineffective safety and health regulations, poor performing baggage systems and inadequate passport and immigration facilities among others. Airport capacity is measured by its performance. Airport capacity constraints greatly contribute to customer dissatisfaction and overall poor performance of airports.

Passenger flow in the context of the airport is defined as the process that takes place from the time customers, whether arrival or departure passengers, arrive at airports up to the time they leave the airport facilities. The design of an airport concourse determines the level of passenger flow, which also dictates customers' satisfaction or dissatisfaction. Air travel has grown at a very high rate, which has led to the need to expand airport facilities to serve the increased number of passengers at airports.

3.3.2 Airport Demand and Capacity

Kalakou et al. (2015) stress that the aviation industry is one that has experienced tremendous changes in the past five decades. They predicted that the number of worldwide air passengers will double by 2030 to 5.9 billion customers. Many international airports have sufficient capacity to allow high levels of passenger flow. However, the demand for air travel in certain seasons supersedes the capacity of even the international airports. Generally, the demand for air travel is increasing significantly. In the past decade, many international airports have expanded their airports to serve customers better and to prepare for the future increases of passengers. The rise in the number of middle-income travellers has led to the increased demand for airports in both developed and developing countries. Airbus was introduced as a result of increased passenger flow and decreases in airport capacity in terms of runways and other resources.

The growth of air transportation has, in turn, led to global and local impacts in social and economic areas of the industry. The increased demand has exposed the limited capacity of airport infrastructure.

3.3.3 Airport Passenger Demand

- Demand during Seasonal Periods and Events

Halpern (2011) indicates that air travel demand patterns differ, mainly as a result of social factors that vary from one nation or region to another. During the summer, there is high demand for air travel because most people go on international vacations during this time. During the first quarter of the year, congestion is usually witnessed at airports.

Additionally, during events, such as cultural, religious or sports events, airport management usually lowers airfares, which keeps the demand for air travel high during such times. During holidays, such as Christmas and New Year, there is increased air travel, which is also boosted by reduced fare prices as airlines try to outdo their competitors.

A number of airlines have also switched to offering only seasonal flights because they make almost no profit during normal monthly flights due to reduced demand and increased competition in some regions. Airport passenger demand during events and seasonal periods is relatively high considering the fact that there is economic growth in most regions, which means that a good number of people are in the middle class and above and hence can afford air travel.

- Airport Passenger Crowding

Matas (2010) indicates that increased demand for air travel and ineffective management of flight demands at airports have led to congestion or crowding in local and international airports. The increased demand along with capacity constraints at airports leads to delays for passengers at the arrival and departure terminals, resulting in congestion and crowding. Lack of sufficient infrastructure at both the departure and arrival terminals affects the flow of passengers, since the two sections are related. Moreover, holiday travel hassles result in overcrowded airports. During holidays, many customers travel with bigger carry-on and checked bags, leading to longer baggage claim and security check lines. The delays at baggage claim and security result in delays in other airports sections, and hence, the airports end up with slow passenger flow, which results in crowded airports. Furthermore, the demand for flights to airports close to world events, such as the Hajj, World Cup or Universal Exposition (Expo), is increasing, leading to passenger overcrowding.

One of the challenges facing the operations and services at airports is crowding resulting from imbalances between airport demand and capacity. This causes malfunctions and failures in services and direct and indirect negative effects, especially in the arrival areas of international airports. Examples of direct negative effects include long waits in queues, slow immigration/customs processes/procedures and decreased passenger satisfaction, especially for passengers arriving after a long trip. On the other hand, indirect effects include the reluctance of tourists to travel, poor perceptions of airport service and consequent negative expectations of the destination country. A review of SKYTRAX, a website that collects and combines reviews of airports (2015), revealed that a large proportion of the airports with the worst ratings suffer from congestion, poor organisation and low service quality. Therefore, governments, airport management companies, airlines and academic researchers are paying increasing attention to this problem.

The major researchers in the airport sector are also striving to find a solution to the problem of overcrowded airports. Crowding at airports is largely attributed to the ineffectiveness of other airport processes and operations, and it is an indicator of the need for infrastructure expansion. During special events, airports are unable to meet the high demand because they have the same infrastructure and resources used in normal operations.

3.3.4 Airport Capacity Constraints

Mature airport markets have been the most affected by capacity constraints in airports. The Asia-Pacific region, Europe and the US have particularly felt the impact of operational, environmental and economic constraints in airports. Capacity constraints have impeded the future growth of air traffic and airport demand. Technically, airports are highly affected because only a small number of passengers and aircraft can be accommodated in a given period of time (Gelhausen, Berster and Wilken, 2013).

Capacity constraints at airports lead to extended waiting and delay times at every step in the airport process. Departing and arriving passengers are all affected, leading to customer dissatisfaction. Passengers have to pay higher travel prices due to capacity constraints. That is, in areas where airports do not face stiff competition, they take advantage of the capacity constraints by charging high prices. Congestion is a challenge that airport management finds hard to address. Zidarova and Zografos (2011) stress that airport congestion leads to poor services for passengers as well as poor management of the airport operations and processes.

Capacity constraints lead to increased airport management costs because most employees are forced to work longer hours due to delays. Another challenge is that there are also increased cases of system failures as a result of increased use. Ultimately, some airports may record reduced profits because of the loss of passengers to competitors.

3.3.5 Arrival Terminal Capacity Constraints

Capacity constraints affect arrival terminals through extended delays before passengers are cleared at the arrival terminals. The number of passengers who can be served in the arrival terminal is limited, since there is limited terminal space available. Capacity constraints also affect arrival terminals through problems at destination or origin airports. Delays at arrival terminals also affect departure terminals because they are highly related (Matas, 2010).

The arrival terminals in international airports are constantly busy just like the departure terminals. Baggage claim capacity constraints are a challenge that increases the delay for arriving passengers. Passengers often feel dissatisfied with the service at arrival terminals because they end up spending a lot of time at the terminals, defeating the purpose of choosing air travel to save time. Delayed arrival flights are more costly than delayed departure flights, and hence, airports incur huge costs leading to reduced profits for airports. Despite the importance of this subject, little attention has been paid to this area of research. For instance, Borille and Correia (2013) is one of the few studies on the evaluation of service levels at airport arrival terminals.

3.3.6 Airport Capacity Solutions

Solutions to the airport capacity problems will only be possible if airport management analyses all the different elements of the constraints to deal with the problem in the larger airport system. Different airlines, air traffic management, airports and ground handling crews are the key airport services that need to cooperate efficiently to meet the ever-increasing demand for flights. The only solutions for airport capacity constraints are managing the flight demand effectively and adding infrastructure at the airport. The addition of infrastructure should be systematic and all-inclusive: the extension of runways should be accompanied by expansions of terminals, staff and aircraft systems. The baggage claim sections should also be expanded to deal with the drastically increased passenger flow at different terminals (Jaffer and Timbrell, 2014).

Yu and Huang (2014) indicate that managing flight demand encourages fuel efficiency and saves construction costs, as the airport enjoys an increased level of passenger flow. Airports can manage flight demand when they use modern technologies in their systems to improve airport operations. Mobile technologies are currently used in airport systems and can greatly help in dealing with technical capacity constraints. Regional development and traffic alternatives are used to analyse air travel behaviour in defined regions, and hence, solutions need to be managed regionally to ensure manageable passenger flow. Therefore, airport passenger flow is an important subtopic of airport management requiring significant research attention.

3.4 Airport Passenger Flow

3.4.1 Arriving Passenger Flow at Crowded Airports

The rate of passenger arrival and the arrival patterns of passengers are highly affected by flight departure times and flight destinations. Most international passengers' arrivals are affected by congestion, especially during certain events and seasons. In regions such as Australia, the arrival domain in international airports are usually busy, especially during peak tourism seasons.

At crowded airports, the arrival terminals are faced with numerous tasks, ranging from clearing passengers through both immigration and customs to ensuring the flow of passengers from the terminals and out of the airports. Arrival terminals with capacity constraints in terms of the systems lead to passenger crowding, poor general passenger flow and ultimately passenger dissatisfaction. Some airports may have the capacity in terms of systems but have limited space for holding arrival passengers (Kalakou, Psaraki-Kalouptsidi and Moura, 2015). Passenger flow from the arrival gates to the greeting area and the restricted areas is usually affected by a simple delay in one of the systems in the holding area at baggage claim. Modern technologies and improved infrastructure at arrival terminals are the solutions to ensure smooth passenger flow by holding a greater number of customers.

3.4.2 Relationship between Human Factors and Passenger Flow

Rauch and Kljajic (2006) stress that many incidents related to passenger flow result from human factor issues. Human errors and negligence are the main contributors to problems with passenger flow. Human errors in the air transport industry include errors by maintenance personnel, flight crew members and air traffic controllers. Most (70%) incidents and even accidents in the air transport industry have human factors as a significant contributor(Clothier and Walker, 2015). Various aspects of human factors are associated with reduced passenger flow at departure and arrival terminals. Human operational factors associated with the training and selection of terminal staff determine the quality of service being offered at terminals.

Increases in the number of passengers result in an increased workload for airport staff and hence reduced efficiency, which directly affects passenger flow. A high level of attention, awareness, embedded skills, adherence to procedures and coordination of activities on behalf of both the staff and the passengers can effectively ensure smooth passenger flow (Caves and Pickard, 2001).

The design of airport systems is also a human factor that highly determines the level of passenger flow. Poor design of buildings and systems at airports results in poor passenger flow and vice versa. Human factors are concerned with the fit between equipment, users and their environments. Therefore, the inability to fit airport users with effective functions, tasks and information results negatively affects the flow of passengers at airports regardless of the size and type.

3.4.3 Arriving Passenger Flow and Passenger Perspectives

A wide variety of functions is offered for both arriving and departing passengers. Passengers expect that they will be treated with quality hospitality, especially for international arrivals, but this is not always the case. Passenger flow at arrival terminals is a big concern for airport management, as passenger perspectives are vital for airport terminals. Passengers are dissatisfied with poorly designed and arranged facilities. Foreign visitors form first impressions of the country of destination as they commute from the aircraft to the airport exit (Jaffer and

Timbrell, 2014). Arrival terminals offer a number of functions that facilitate connections between flights and transportation modes.

Kleinschmidt et al. (2011) indicate that passenger movement is controlled via customs clearance, immigration control and check-in. A few supplemental services affect the perspectives of passengers, and they include dining facilities, shops, greeting areas and conference spaces for arriving passengers. Arriving passengers usually go through the following disembarking procedures: immigration, customs, baggage claim, quarantine and finally airport departure. In airports where there is more than one terminal, passengers are required to check for the terminal where they are to be served. Arriving passengers are usually directed to follow signs that lead them to either baggage claim or flight connections for transit passengers.

3.4.4 Arriving Passenger Flow and Provider Perspectives

From the perspective of providers, arriving passengers are more important for airports because most of them are from foreign countries and will probably use the same airlines the next time they travel in the region. The providers, airport management, are focused on ensuring that passengers' delay times do not exceed the maximum as well as offering services that passengers will highly appreciate. Arriving passengers are supposed to go to the baggage claim section and then undergo clearance of their passports at the immigration or customs checkpoints without much interference.

Kalakou et al. (2015) indicate that airline management is focused on ensuring that there is a stable passenger flow to enhance the attractiveness of the destination airport. Passenger delays are regarded as big contributors to customer dissatisfaction. Providers of air transport services use a number of detectors to help them adjust their operations and satisfy passengers. For example, video detection, infrared scanning and microwave scanning are used to monitor the real-time flow of passengers at arrival terminals. The information retrieved is used to forecast the spatial distribution of passenger flow and as a reference to allocate passenger service resources at airport terminals.

3.4.5 Modern Technologies and Arriving Passenger Flow

Airports have increased their focus on customer satisfaction, since positive passenger experiences have been proven to correlate to relaxed and pleased passengers. Airport management has measured customer experiences and satisfaction to understand the unique requirements at their facilities, and many of them have been forced to focus on modern technologies to help them service customers better. For instance, gate experiences and airport processes have been addressed with digital technologies to improve customer experiences. Airports have invested in digital solutions, such as mobile applications, wayfinding apps and self-service check-in/baggage drop, as a way of improving issues with customer experiences (Bontikous, Dieke-meier and Fricke, 2016).

Arriving passenger flow is improved with digital technologies not only in the internal processes at arrival terminals. Passengers are able to navigate the airport, locate suitable car boarding points, find their baggage quickly and reduce boredom/wait times. Modern technologies have brought effective digital solutions with self-service kiosks, smartphone applications, biometrics for security checks and other operations (Jaffer and Timbrell, 2014). Modern technologies have significantly affected passenger flow at airports by reducing the number of processes and waiting times.

Passenger experience and engagement continues to be of higher importance as international airports continue to focus on commercial pursuits. Passenger flow in arrival terminals needs to be improved technologically, because passengers get more bored when they are delayed after arrivals than when they are delayed for their departures. Hence, modern technologies have emerged as the ultimate solutions for effective passenger flow at arrival terminals.

3.5 Previous Research on HTs

Numerous research studies have been published related to the Hajj in terms of the health, security, risk management and logistics aspects of the mass gathering. However, there is a lack of scientific research in the field of transportation, especially regarding air transport and airports. One of the issues is the passenger flow and service level within HTs, including both the departure and arrival domains. Most of the existing research studies were written in Arabic and measured the time spent by pilgrims upon their arrival at HTs ((Aljamal et al., 2015).

Khan (2011) proposed introducing a new system of tracking pilgrims through the arrival processes of King Abdulaziz International Airport in Jeddah to facilitate wayfinding and registration processes for pilgrims. However, this study did not address the backgrounds of the terminals and infrastructures or the other aspects and characteristics of the agents and actors in this environment, such as traveller culture, education and patterns or the extent to which service providers accept this technology. Therefore, in-depth studies using modelling and simulation are needed to understand all current and future aspects of this environment in order to introduce and apply new tools and techniques related to improving passenger flow. Moreover, Gronfulaa and Abbod (2013) tried to develop an index based on processing time to assess and optimise the LoS provided to arriving passengers within HTs. However, the sample used in this study was not representative of all pilgrims, as the study did not cover a range of periods and locations. It focused on measuring processing times without considering the multiple characteristics of all agents in this environment.

3.6 Methods and Techniques Used to Evaluate Performance of Airport Passenger Flow

3.6.1 Airport Security Information Systems Analysis

Matas (2010) indicates that airport security systems are information systems that provide a wide variety of information related to baggage delivery, check-in information, boarding review and equipment monitoring. The information retrieved is incorporated into the information used to evaluate passenger flow performance. The flight control systems, which consist of the computerised arrival and departure systems, together with the airport surveillance systems are used to evaluate the conditions at different terminals and even help ascertain the level of performance at the airport.

3.6.2 Analysis of Airport Demand Information

Collecting information from the baggage system about the time taken to service passengers of a given flight is also essential in evaluating the performance, and hence, it is a method applied by airport management systems. Advanced technologies are being used in airports to record and then later help in analysing the flow of passengers. For example, video detection, infrared scanning, microwave scanning and CCTV are used to monitor passenger flow in real time (Bontikous, Dieke-meier and Fricke, 2016).

Regression analysis technology is used to analyse and forecast the future passenger flow distribution in the functional areas of airports. Regression analysis relies on passenger flow, ticket booking and check-in and baggage information to produce results. Additionally, airport pavement analysis systems, airport capacity modelling and bird hazard systems are also used to evaluate passenger flow information. Airport capacity reports and traffic forecasts are produced from the reports.

3.6.3 Simulation Model

Simulation has long been used as a performance improvement tool in several fields, and several studies have applied it to transport terminals as well (Alodhaibi, Burdett and Yarlagadda, 2017). Some simulation modelling-based studies related to passenger flow in airports discuss transport terminal design, such as Thomet and Mostoufi (2008), in which an object-oriented, dynamic pedestrian model was observed using a simulation study. A flight itinerary for a day (24 hours) was researched to study the number of passengers that arrived at and departed from an airport. Another similar study by Curcio (2007) examined passenger flow analysis and security issues at airport terminals. The main objective of the study was to assess the average wait time of passengers reaching the gate area of an airport, which was the main measure of system performance. Several other studies have also been done to analyse and thus address problems, such as optimisation of check-in points, low flow capacity and long wait times to board planes, at the micro level (Enciso, Vargas and Martínez, 2016).

System modelling is a beneficial tool to solve problems that exist in the real world, where implementing solutions or modifying components of an existing system to overcome a problem/s can be either very costly or dangerous if not impossible (Enciso, Vargas and Martínez, 2016). The best solution in such cases is to construct a computational model of the existing realistic system. The computational modelling process offers an abstraction level that allows only relevant system features to be included, thus making it less complex compared to the original real-world system.

Airport terminals encounter several problems that affect the handling of passenger flow. In recent times, safety concerns have brought about many changes in security screening procedures, which have affected passengers' throughput time. Since the 9/11 incident, the security aspects of airports have become more critical. Another aspect that is of high concern for modern airports is the airport infrastructure and limited capacity. This also includes the number of available resources, such as airport personnel and common check-in counters that are open for airport passengers.

At the same time, airports also have to consider passenger processing, including processing luggage weight, checking passenger identification, ensuring the safety and security of checkpoints, extending the major airport infrastructure as well as operating smart methods and systems, which are typically both costly and time-consuming (Barnhart et al., 2012; Manataki and Zografos, 2009). A recent investigation of airport operational efficiency and passenger experience revealed that passengers that spend less time in airport functional areas have higher levels of satisfaction (Guizzi, Murino and Romano, 2009).

Haksever and Render (2013) stated that simulation is a technique in which random numbers are used for drawing inferences related to probability distributions. Through this approach, several hours', days' and months' worth of data can be developed through systems in a matter of a few seconds. In this way, the analysis of controllable factors, like adding in other service channels without actually making physical changes, can be done easily and effectively. When a standard analytical queuing model gives a poor approximation of the actual service system, developing a simulation model is the best option.

According to Lee and Longton (1959), the queuing process is closely associated with the check-in of airline passengers. This is the first thing that a passenger is required to do when reporting for a flight at the terminal. In several instances, passengers may be checking in for different flights for which several service positions are required. In this study, a simulation model to analyse the flow of passengers at international airports needs to be developed.

Fayez et al. (2008) found that the terminal operations have gradually changed in terms of passenger service, which can also be associated with tightened security measures. The research conducted by the authors focused on a simulation tool of the airport terminal, which intended to assess the current situation of the functional areas for which several airport scenarios were built to evaluate the level of airport services.

Hartvigsen (2004) also discovered that a simulation technique can be very useful where there exists uncertainty in a process. In terms of airport services, uncertainty can exist in passenger arrival time, service demand, time taken to perform the service as well as quality of service provided. This uncertainty makes it very difficult to predict the effects of bringing in changes within a process.

Previous studies on the service quality of airports have mainly focused on airline service quality (Chen and Kuo, 2008). Cejas (2006) suggested in his study that Airport Service Quality (ASQ) is an approximation to the evaluation of the service quality provided to tourism and measured service quality by a linear programming model. On the other hand, Fodness and Murray (Fodness and Murray, 2007) analysed passenger expectations of ASQ and, based upon their qualitative and quantitative research results, found that it has three dimensions: function, interaction and diversion.

Several methods are being employed to investigate ASQ. Tam and Lam (2004) presented a quantitative measure, known as the Visibility Index (VI), for evaluating the different facilities available in the departure hall of Hong Kong International Airport. Later, Tam, Lam and Lo (2010) incorporated ASQ with the calibration of the airport ground access mode choice model.

This section reviews the present studies on airport passenger flow modelling with special reference to the departure system for measuring the performance of workstations and understanding the factors affecting passenger flow. Wu and Mengersen (2013) found that existing airport flow models can be categorised into four sets: operational planning and design, capacity planning, security policies and planning and airport performance review. These can be based on simulation, hybrid or analytic approaches. Their require varying levels of detail (e.g. microscopic, macroscopic and mesoscopic) and have stochastic and deterministic characteristics (Wu and Mengersen, 2013; Zografos and Madas, 2006). These models are designed to capture various performance metrics to determine operational efficiency, including length of queues, service time and congestion.

Because of the macroscopic nature of these studies, complex models are not necessary for analysing passenger behaviours. This can be very appropriate, as passenger behaviour is limited in the functional areas of check-in point immigration, security and boarding. For example, when passengers enter a check-in queue, they only have to move forward slowly until they reach the counter. Once they reach the counter, they are processed according to the formalities. Here, there is no need to consider complex behaviours, as explained by Lee's (1966) queuing theory for check-in processes.

In fact, most of the time passengers spend at the airport is spent beyond the mandatory processing areas (Takakuwa and Oyama, 2003). When the passengers leave the compulsory areas, they need to perform several other activities and follow a large number of routes within the airport space to complete the process. This makes the passenger behaviour more complicated and harder to predict. As such, it can be said that in between processing areas, airport passengers tend to have complete autonomy, which renders a complex decision model for describing their behaviour effectively and accurately.

In recent years, simulation modelling has become a very common tool for analysing passenger flow at airports along with simulating and integrating two or more components (Pitchforth et al., 2015). Takakuwa and Oyama (2003) developed a simulation model at the microscopic level for investigating the flow of passengers in an airport terminal building with international departures as its main focus. They noted that the check-in time took up the highest percentage (about 80%) of the whole waiting time at the terminal.

Ma et al. (2011, 2012) developed a similar ABM model that was primarily focused on human factors, such as passenger characteristics. The proposed model was used to analyse check-in operations of airport passengers and their use of discretionary facilities. Integrating advanced traits of airport passengers in these agents rendered the simulations more realistic. As a result, they found that peak check-in times can be reduced by distributing passengers over the entire range of airport facilities.

Process models are also quite often used to provide an extensive view of terminal-related operations with respect to processing time and passenger capacity. Verbraeck and Valentin (2002) developed a discrete event model used to handle complex processes within a limited capacity structure. Another good explanation of this model was presented by Dorton and Liu (2016), who define DES as ‘a collection of theories, applications and methods for replicating the actual behaviour of real systems for experimentation or assessment’.

Several studies have proposed simulation methods for analysing the passenger flow of departure halls (Novrisal, Wahyuni and Hamani, 2013; Rauch and Kljajić, 2006). According to Guizzi et al. (2009), passengers tend to behave in different ways at airports due to their previous experiences, which makes it difficult to forecast priorities and delays. The simulation presented was used to predict and assess delays in a rational and logical manner within security and check-in points. In this way, the volume of passengers and available capacity can be analysed effectively based upon passenger behaviour and time of day.

The Rockwell Arena simulation application model was used to study passenger behaviour and provided results based on the average waiting time and queue length. On the other hand, Rauch and Kljajić (2006) constructed a model through the General Purpose Simulation System (GPSS), a simulation programming language. Through the model, the authors intended to identify system blockages and their impact on the departure process, including services ranging from airport check-in to boarding, at a certain time prior to departure. They measured several key factors, such as passenger arrival patterns, passenger time of service and operational procedures.

Similarly, Novrisal et al. (2013) presented a simulation model for analysing congestion issues related to airport passenger flow. The purpose of the model was to reduce the waiting and processing times in the system. They concluded that the number of check-in counters at airports should be increased, as approximately 61% of the total time is spent in check-in queues.

Other studies have analysed not only the differences among passengers but also the differences among airports. Park (2003) presented an assessment of the competitive standing of major airports within the East Asia region. The airports were assessed based upon five factors: demand, service, facility, managerial and spatial qualities. Yeh and Kuo (2003) presented a multi-attribute decision-making approach for evaluating passenger service quality in 14 key Asia-Pacific international airports. The model helped to elucidate the airports' rankings with respect to passenger service attributes.

Magri and Alves (2005) suggested that passengers' behaviours are also affected by airport efficiency and comfort. Similarly, Widarsyah (2013) stated that although access, facilities and services along with information services are considered very important factors determining customer perceptions of airport services, the airport environment also has a huge impact on passengers' perceptions of quality service and behaviour.

3.7 Results of Systematic Literature Review

The second stage of the literature review, the systematic literature review, identified core papers and documents relevant to airport capacity and arriving passenger processing at crowded airports. This was intended to identify and review previous studies in the area via decisive identification, assessment and integration. Hence, it allows all relevant, high-quality research to be accessed and reliable information to be produced and enables a better understanding and clarification of the results. According to Webster and Watson (2002), a systematic literature review is beneficial for any academic research that strives to elucidate a certain topic and increase the knowledge of the researcher. This literature review approach has long been employed in the area of health research, but it has recently been applied in other research areas, such as air transport (Bezerra and Gomes, 2016; Ginieis et al., 2012). It provides accurate and reliable data, which decreases the risk of bias (Kalemba and Campa Planas, 2016).

In this research, the systematic literature review was used as a tool to determine how arriving passenger processing at crowded airports has evolved over the past 16 years and highlight any gaps in the literature. This was done to provide an overview of the evolution of the phenomenon by covering a wide-ranging period in the literature. Figure 3-3 illustrates the systematic literature review steps applied in the current research to analyse the literature on passenger processing at crowded airports and airport passenger flow to reach the literature relevant to this topic, as described by Kitchenham (2004). Only papers published in academic journals and high-quality proceedings were considered, and all reports and other sources, including master's and PhD theses, books, news articles, government agency reports and working papers, were excluded. This strategy was taken to ensure the literature review was focused on reliable facts, peer-reviewed manuscripts and high-quality sources. Furthermore, it facilitated the collection, classification, comparison and interpretation of these types of scientific sources. In addition, during the selection process for the systematic review, high-impact journals related to this topic were given priority.

The systematic review of the literature began with the development of a comprehensive bibliography on this subject. This bibliography was compiled by searching the six most relevant scholarly online databases: Emerald, Science Direct (Elsevier), ProQuest Global, Google Scholar, Mendeley and SCOPUS. All these databases provide access to numerous high-quality scientific papers and journals on a wide variety of topics. Moreover, the systematic literature review process was carried out using the following keywords: airport*, passenger*, processing, crowded, passenger flow and performance. Thus, the steps of the systematic literature review can be summarised as follows:

- An initial scholarly database search of selected keyword combinations revealed 2,099 titles.

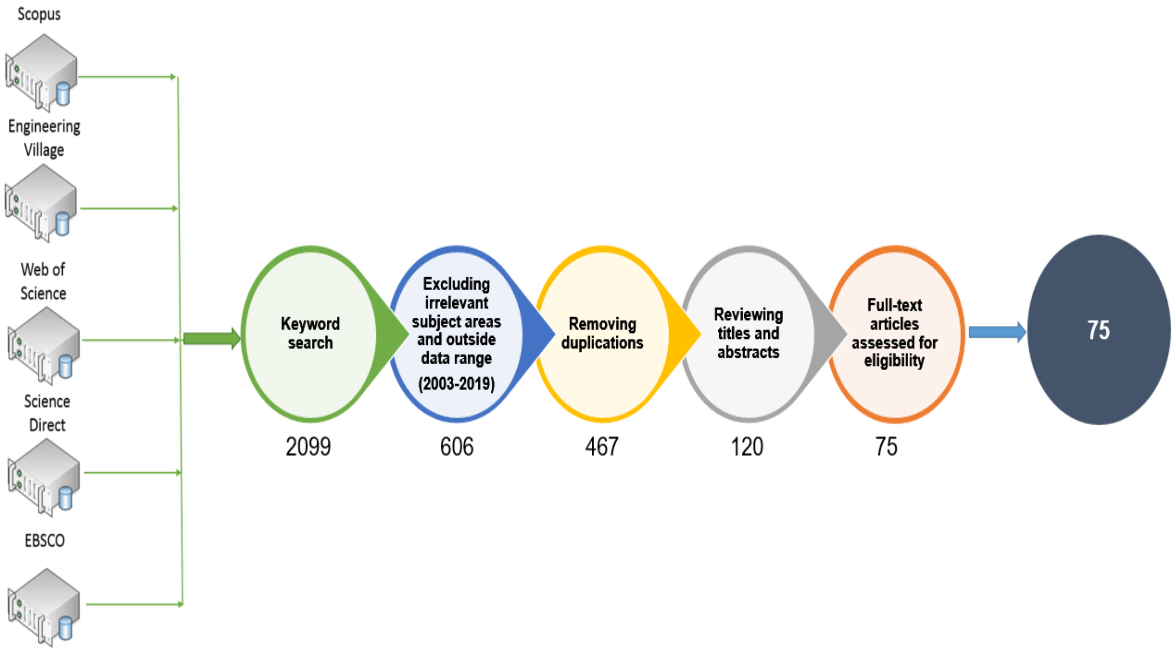


Figure 3-3 Steps of systematic literature review process.

- After excluding all documents written in a language other than English and all documents that were not journal or proceeding papers, the search resulted in 1,621 articles.
- After excluding all documents on irrelevant subject areas and themes (e.g. medicine, earth and planetary sciences, biochemistry, agricultural and biological sciences, other transportation and arts), the search resulted in 606 articles.
- After removing duplicate records, the search resulted in 467 articles.
- After excluding irrelevant documents by screening titles and abstracts, the search resulted in 120 articles.

- Finally, by screening the full text of the selected articles, 75 documents relevant to the research and qualified for the review were found.

Many of the titles in the initial steps of this systematic literature review were not closely related to the topic of this study but appeared within the search process due to the inclusion of some of the keywords used in the search process of this review. Thus, only the 75 articles remaining after screening and filtering were obtained from the 2099 titles in the systematic review process. Moreover, all 75 papers were closely related to this study.

These 75 articles were analysed and classified to obtain a deeper understanding, identify weaknesses and strengths in the previous literature and determine the gaps in the research. Hence, all these papers were classified and clustered based on the following five criteria:

- academic journal
- geographic region studied
- airport terminal and domain
- year of publication and methodological approach
- subtopic

3.7.1 Clustering of Articles by Academic Journal

The academic journals from which the papers were collected through the systematic review focused on many topics, such as operations management, transportation, air transportation, service management, tourism, economics, simulation and modelling and quality. Table 3-1 shows that the 75 articles were collected from 48 academic journals. The largest share of these scientific papers was from the Journal of Air Transport Management (16 of 75 articles), followed by Transportation Research Part A and Part C with three articles each. The remaining 53 papers came from the remaining 45 academic journals. The large number of academic journals in which these research papers were found indicates the comprehensiveness of this systematic review, and this characteristic is considered one of the greatest advantages of this type of literature review.

Table 3-1 Clustering of articles based on academic journal

Journal Title	Author Name and Publication Date	
Journal of Airport Management	(Felkel and Klann, 2012a; Mayer, Felkel and Peterson, 2014)	2
arxiv.org	(Nikoue et al., 2015)	1
Aviation	(Kneale, Baxter and Wild, 2014)	1
Benchmarking: An International Journal	(Bezerra and Gomes, 2016a)	1
Building and Environment	(Liu et al., 2018, 2019)	2
Case Studies on Transport Policy	(Verma, Tahlyan and Bhusari, 2018)	1
Computers and Industrial Engineering	(Hsu, Chao and Shih, 2012)	1
Computers and Operations Research	(Majeske and Lauer, 2012)	1
Computers and Security	(Rio et al., 2016)	1
Computers in Human Behavior	(Castillo-Manzano and López-Valpuesta, 2013)	1
Human Factors and Ergonomics in Manufacturing & Service Industries	(Dorton and Liu, 2016)	1
IEEE Transactions on Intelligent Transportation Systems	(Carvalho et al., 2018; Zhong et al., 2017)	2
International Journal of Hospitality Management	(Kokkinou and Cranage, 2013)	1
International Journal of Mathematics and Computers in Simulation	(Kovács et al., 2012)	1
International Journal of Process Management and Benchmarking	(Yu and Huang, 2014)	1
Journal of Air Transport Management	(de Barros, Somasundaraswaran and Wirasinghe, 2007; Bezerra and Gomes, 2016b, 2015; Borille and Correia, 2013; Correia and Wirasinghe, 2007; Gelhausen, Berster and Wilken, 2013; Gkritza, Niemeier and Mannering, 2006; Greghi et al., 2013; Huang et al., 2016; Kalakou, Psaraki-Kalouptsidi and Moura, 2015; Kim, Kim and Chae, 2017; Li et al., 2018; Pitchforth et al., 2015; Rocha et al., 2016; Skorupski and Uchroński, 2018; Yoon and Jeong, 2015)	16
Journal of Airline and Airport Management	(Gonçalves and Caetano, 2017)	1
Journal of Services Marketing	(Fodness and Murray, 2007)	1
Journal of Simulation	(Beck, 2011; Fayez et al., 2008)	2
Journal of Software	(Yang, Li and Zhao, 2014)	1
Journal of the Brazilian Air Transportation Research Society	(Magri Jr and Alves, 2005)	1
Journal of the Eastern Asia Society for Transportation Studies	(Ahyudanari and Vandebona, 2005)	1
Journal of the Operational Research Society	(Casado, Laguna and Pacheco, 2005)	1
Journal of Tourism and Recreation	(Yang and Lu, 2015)	1
Journal of Visual Communication and Image Representation	(Ding, Liu and Xu, 2019)	1
Mathematical Problems in Engineering	(Wang, Yan and Wang, 2015)	1
Modelling and Simulation in Engineering	(Wang et al., 2018)	1
Nase More	(Fetisov and Maiorov, 2017)	1
Organizacija	(Rauch and Kljajić, 2006)	1
Pattern Recognition	(Unar, Seng and Abbasi, 2014)	1
Procedia Engineering	(Alodhaibi, Burdett and Yarlagadda, 2017)	1
Reliability Engineering and System Safety	(Lee and Jacobson, 2011)	1
Simulation Modelling Practice and Theory	(Casas, Casanovas and Ferran, 2014; Cavada, Cortés and Rey, 2017)	2
Studies in Computational Intelligence	(MacLeod and McLindin, 2011)	1
Sustainability (Switzerland)	(Xu et al., 2018)	1
Technological Forecasting and Social Change	(Bogicevic et al., 2017)	1
Technology in Society	(Oostveen and Lehtonen, 2017)	1
Tourism Management	(Rendeiro Martín-Cejas, 2006)	1
Tourism Management Perspectives	(Gitto and Mancuso, 2017)	1
Tourism Review	(Bogicevic et al., 2013)	1
Transportation Planning and Technology	(Park and Ahn, 2003)	1
Transportation Research Part A	(Correia, Wirasinghe and Barros, 2008a; Kiyildi and Karasahin, 2008; Wu and Mengersen, 2013)	3
Transportation Research Part C	(Janssen, Sharpanskykh and Curran, 2019; Manataki and Zografos, 2009; Wu, Pitchforth and Mengersen, 2014)	3
Transportation Research Part E	(Correia, Wirasinghe and Barros, 2008b; Yeh and Kuo, 2003)	2
Transportation Research Procedia	(Adacher et al., 2017; Kalakou and Moura, 2015)	2
Journal of the Transportation Research Board	(Zidarova and Zografos, 2011)	1
Transportmetrica A	(Tam, Lam and Lo, 2010; Xiao et al., 2016)	2
Universal Journal of Management	(Trakoonsanti, 2016)	1
Total Number of Journals: 48	**Total Number of Papers: 75**	

3.7.2 Clustering of Articles by Geographic Region Studied

An examination of the scientific papers collected through the systematic review revealed that many used case studies, representing about 22 countries and 5 global regions. On the other hand, some did not use specific case studies but were general. Moreover, some included more than one country or region, while some others focused on the entire world.

Table 3-2 shows that out of the 75 papers, 10 focused on Brazilian airports, representing the highest percentage of scientific papers focused on one country. Seven articles focused on Chinese airports, six focused on United States airports and five focused on Australian airports. A high percentage of these scientific papers did not use any specific geographic sector or country as a case study, and these were classified as undefined.

On the other hand, these scientific papers were also distributed and clustered according to larger geographic regions (i.e. according to continent), as shown in Figure 3-4. In addition, Figure 3-4 indicates that the greatest number of scientific papers (20) examined cases or countries on the continent of Asia. This was followed by Europe with 18 articles and Latin America with 11 articles. Furthermore, 15 articles were classified as undefined, as mentioned earlier. This was followed by North America and Oceania with six and five articles, respectively.

On the other hand, none of these scientific papers used any case representing Middle Eastern or African countries as a case study, suggesting the total absence of studies on Middle Eastern or African airports relevant to this topic. There are few studies on this geographic region in many research areas due to the difficulty in accessing the necessary data and information.

Table 3-2 Distribution of articles according to geographic region

	Geographic category	Academic Journal Article (Papers)	
Single country	USA	(Dorton and Liu, 2016; Fayez et al., 2008; Fodness and Murray, 2007; Gkritza, Niemeier and Mannering, 2006; Lee and Jacobson, 2011; Majeske and Lauer, 2012)	6
	Brazil	(Bezerra and Gomes, 2016b, 2015; Borille and Correia, 2013; Correia, Wirasinghe and Barros, 2008a, 2008b; Correia and Wirasinghe, 2007; Gonçalves and Caetano, 2017; Greghi et al., 2013; Magri Jr and Alves, 2005; Rocha et al., 2016)	10
	Chile	(Cavada, Cortés and Rey, 2017)	1
	Slovenia	(Rauch and Kljajić, 2006)	1
	Greece	(Manataki and Zografos, 2009)	1
	Portugal	(Carvalho et al., 2018; Kalakou, Psaraki-Kalouptsidi and Moura, 2015; Kalakou and Moura, 2015)	3
	UK	(Beck, 2011)	1
	Germany	(Felkel and Klann, 2012b)	1
	Russia	(Fetisov and Maiorov, 2017)	1
	Italy	(Adacher et al., 2017)	1
	Poland	(Skorupski and Uchroński, 2018)	1
	Turkey	(Kiyildi and Karasahin, 2008)	1
	Spain	(Casado, Laguna and Pacheco, 2005; Casas, Casanovas and Ferran, 2014; Castillo-Manzano and López-Valpuesta, 2013; Rendeiro Martín-Cejas, 2006)	4
	China	(Ding, Liu and Xu, 2019; Li et al., 2018; Liu et al., 2018, 2019; Wang et al., 2018; Yang, Li and Zhao, 2014; Zhong et al., 2017)	7
	Taiwan	(Hsu, Chao and Shih, 2012; Huang et al., 2016; Yang and Lu, 2015; Yu and Huang, 2014)	4
	South Korea	(Kim, Kim and Chae, 2017; Park and Ahn, 2003; Yoon and Jeong, 2015)	3
	Sri Lanka	(de Barros, Somasundaraswaran and Wirasinghe, 2007)	1
	Hong Kong	(Tam, Lam and Lo, 2010; Xiao et al., 2016)	2
	Thailand	(Trakoonsanti, 2016)	1
	India	(Verma, Tahlyan and Bhusari, 2018)	1
	Australia	(Alodhaibi, Burdett and Yarlagadda, 2017; Kneale, Baxter and Wild, 2014; Nikoue et al., 2015; Pitchforth et al., 2015; Wu, Pitchforth and Mengersen, 2014)	5
Two or more countries/regions	Turkey & Belgium	(Janssen, Sharpanskykh and Curran, 2019)	1
	Europe	(Gitto and Mancuso, 2017; Rio et al., 2016)	2
	Asia-Pacific region	(Yeh and Kuo, 2003)	1
Undefined	Undefined	(Bezerra and Gomes, 2016a; Bogicevic et al., 2013, 2017; Kokkinou and Cranage, 2013; Kovács et al., 2012; MacLeod and McLindin, 2011; Oostveen and Lehtonen, 2017; Wang, Yan and Wang, 2015; Wu and Mengersen, 2013; Xu et al., 2018; Zidarova and Zografos, 2011) (Ahyudanari and Vandebona, 2005; Gelhausen, Berster and Wilken, 2013; Mayer, Felkel and Peterson, 2014; Unar, Seng and Abbasi, 2014)	15
			75

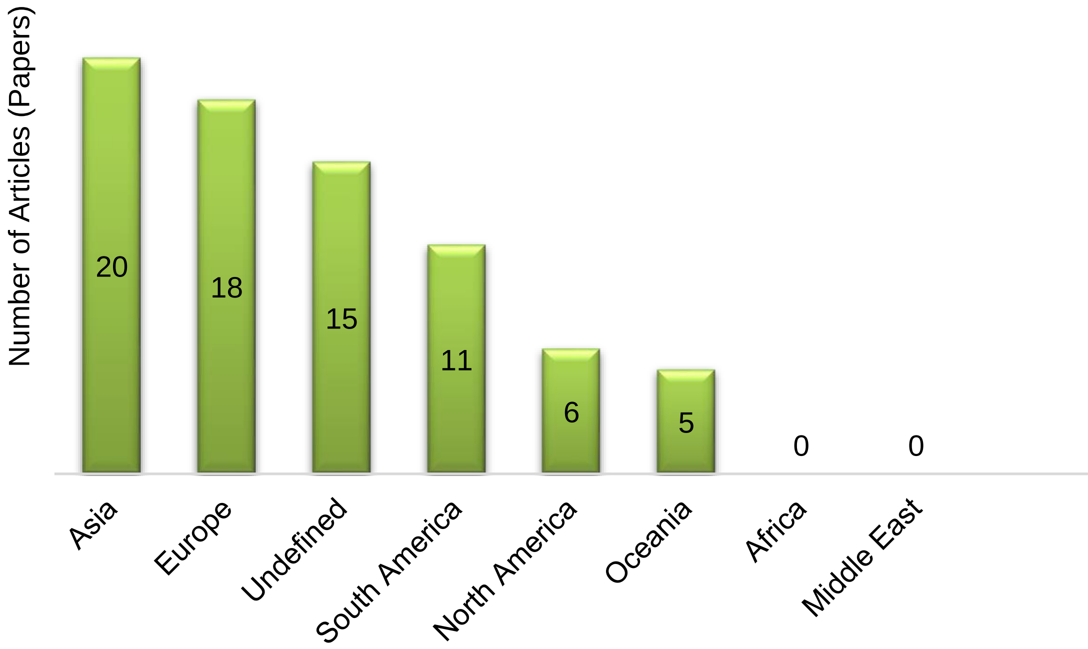


Figure 3-4 Distribution of articles based on geographic region.

3.7.3 Clustering of Articles by Airport Terminal and Domain

An examination of the articles collected in the systematic review revealed that 11 scientific papers were related to the subject of the study but used case studies on transport hubs other than airports, such as metro and train stations and maritime terminals, while the rest of the articles were focused on airport passenger terminals. In addition, the articles that focused on airport passenger terminals were classified into three categories based on the terminal domain of study, as presented in Figure 3-5. The first group was focused on departure terminals and recorded the highest number of scientific papers (32), the second group was focused on arrival terminals and recorded the lowest number of scientific papers (12) and the third group was focused on airport passenger terminals generally (20).

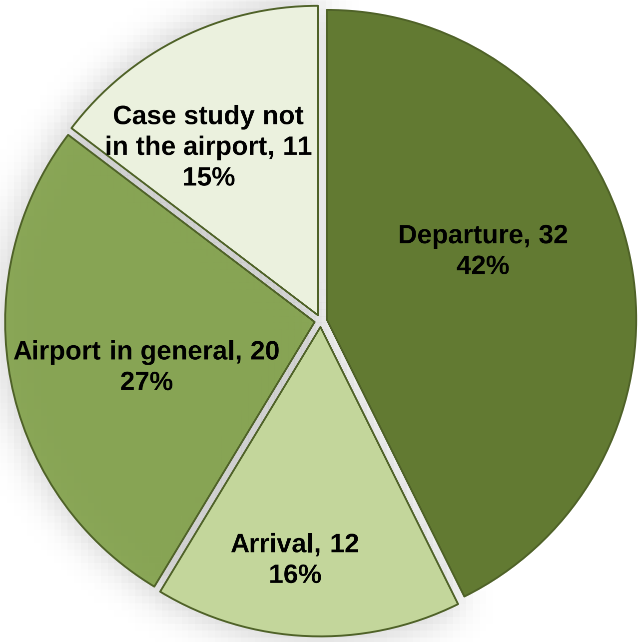


Figure 3-5 Distribution of articles based on airport domain.

3.7.4 Clustering of Articles by Year of Publication and Methodological Approach

This section categorises the obtained papers according to two factors, methodology and year of publication, to offer a general overview of the development of research on airport passenger terminals in recent years and reveal the number of studies each year, the peak year for research on this topic and the most commonly used methodologies.

Table 3-3 and Figure 3-6 indicate that most research on this topic has been published in the past seven years. Thus, 2017 was the peak year for research with 10 articles, followed by 2015 and 2016 with 8 papers each.

On the other hand, the obtained papers were also classified into two categories based on methodological approach: monomethod and multimethod. Most articles (48) used the monomethod approach, while 27 articles used the multimethod approach.

Furthermore, the articles that used one method were classified into four groups based on the method used: articles that used 1) simulation, 2) review, 3) mathematical and optimisation models and 4) multivariate and statistical analysis. Most monomethod articles 19 used multivariate and statistical analysis, while 17 articles used simulation, indicating that these articles used diverse methodologies.

Table 3-3 Distribution of articles based on year of publication and method

Year	Monomethod				Multimethod											
	S	**O**	**M**	**R**	**MS**	**MO**	**SO**	**MM**	**MO**	**SM**	**SOM**	**SR**	**SOQ**	**MQ**	**QR**	**Total**
2003	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	**2**
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**
2005	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	**3**
2006	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	**3**
2007	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	**3**
2008	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-	**4**
2009	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
2010	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	**1**
2011	-	1	1	1	-	-	-	-	-	-	-	1	-	-	-	**4**
2012	1	1	1		-	-	-	-	-	1	-	-	-	-	-	**4**
2013	1	-	4	1	-	-	-	-	-	1	-	-	-	-	-	**7**
2014	-	-	3	1	1	-	1	-	-	-	1	-	-	-	-	**7**
2015	3	1	1		-	-	-	3	-	-	-	-	-	-	-	**8**
2016	1	-	2	2	-	-	1	1	-	-	-	-	1	-	-	**8**
2017	3	-	2	-	-	-	2	1	-	-	-	-	-	2	-	**10**
2018	3	1	-	-	-	-	1	-	1	-	1	-	-	-	-	**7**
2019	2		-	-	-	1	-	-	-	-	-	-	-	-		**3**
Total	17	7	19	5	1	2	6	6	3	2	2	1	1	2	1	**75**
	48				**27**											

S Simulation
O Mathematical and optimisation model
M Multivariate and statistical analysis
R Review
Q Qualitative
MS Multiple simulation methods
MO Multiple optimisation methods
MM Multiple multivariate analysis methods

On the other hand, the articles that used multiple methods were also classified according to the methods used. In this group of articles, 24 articles used two methods, while the remaining articles used three methods. An example of the scientific papers that used three methods is Wu, Pitchforth and Mengersen (2014), in which they developed an integrated complex systems model. In addition, Gitto and Mancuso (2017) and Oostveen and Lehtonen (2017) used a mixed-methods approach that included both qualitative and quantitative methods. Furthermore, some articles used two simulation methods, such as Fonseca I Casas, Casanovas and Ferran (Casas, Casanovas and Ferran, 2014), who used airport micro-simulation and ABM simulation. In addition, some articles used two statistical analysis methods, such as Bezerra and Gomes (Bezerra and Gomes, 2015), who used exploratory factor analysis and a probabilistic approach. Moreover, the number of scientific papers that have used the multimethod approach has increased in the last five years. This approach gives strength to any study, especially specific case studies in which the influencing elements have different characteristics and agents, such as those on airport passenger terminals. Unfortunately, there is a lack of multimethod research, especially on this topic.

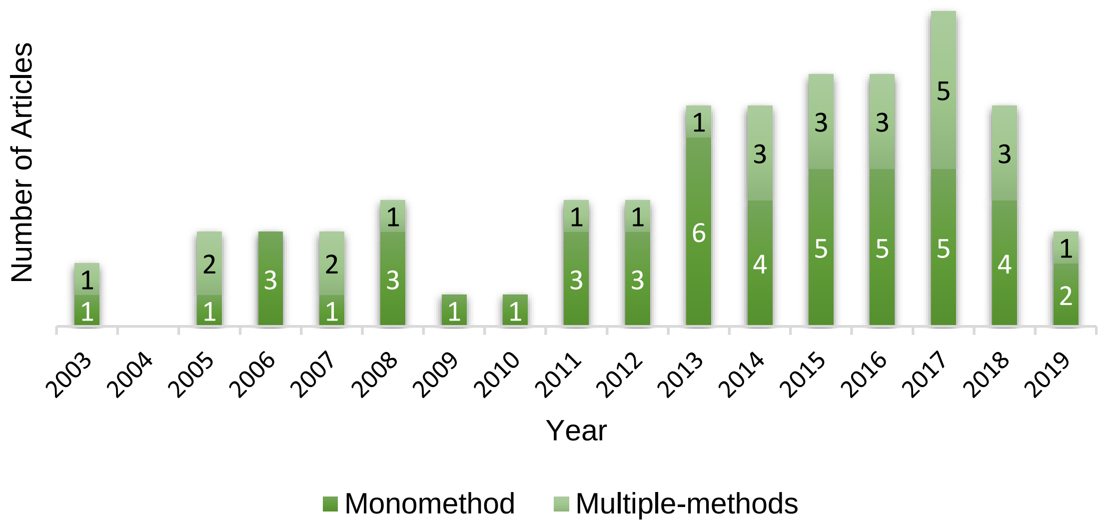


Figure 3-6 Distribution of articles according to the year of publication and methodology.

3.7.5 Clustering of Articles by Subtopic

An examination of all the papers collected in this systematic review revealed that they cover five subtopics related to airport passenger terminals: Airport Passenger Flow (APF), Airport Passenger Processing (APC), Airport Service

Level & Quality (ASQ), Airport Capacity & Demand Management (ACD) and Airport Terminal Operational Performance (AOP), as shown in Table 3-4. As noted in Table 3-4, some articles discussed one subtopic, while others discussed more than one subtopic. For example, Yeh and Kuo (2003), Kokkinou and Cranage (2013) and Rocha et al. (2016) discussed one subtopic, while Oostveen and Lehtonen (2017), Fayez et al. (2008) and Yoon and Jeong (2015) discussed more than one subtopic.

Table 3-4 Distribution of articles according to subtopic

Academic Journal Article (Papers)	APF	APC	ASQ	ACD	AOP
(de Barros, Somasundaraswaran and Wirasinghe, 2007; Bezerra and Gomes, 2016b, 2015; Bogicevic et al., 2013, 2017; Borille and Correia, 2013; Correia, Wirasinghe and Barros, 2008a, 2008b; Correia and Wirasinghe, 2007; Fodness and Murray, 2007; Gitto and Mancuso, 2017; Gonçalves and Caetano, 2017; Greghi et al., 2013; Huang et al., 2016; Magri Jr and Alves, 2005; Rendeiro Martín-Cejas, 2006; Tam, Lam and Lo, 2010; Yeh and Kuo, 2003)			X		
(Ahyudanari and Vandebona, 2005; Cavada, Cortés and Rey, 2017; Hsu, Chao and Shih, 2012; Janssen, Sharpanskykh and Curran, 2019; Kalakou, Psaraki-Kalouptsidi and Moura, 2015; Kokkinou and Cranage, 2013; Lee and Jacobson, 2011; Li et al., 2018; Park and Ahn, 2003; Pitchforth et al., 2015; Skorupski and Uchroński, 2018; Wu, Pitchforth and Mengersen, 2014; Xu et al., 2018; Yang and Lu, 2015)		X			
(Beck, 2011; Carvalho et al., 2018; Casado, Laguna and Pacheco, 2005; Ding, Liu and Xu, 2019; Felkel and Klann, 2012b; Fetisov and Maiorov, 2017; Kalakou and Moura, 2015; Kovács et al., 2012; Liu et al., 2018, 2019; Mayer, Felkel and Peterson, 2014; Unar, Seng and Abbasi, 2014; Wang, Yan and Wang, 2015; Yang, Li and Zhao, 2014; Zhong et al., 2017)	X				
(Castillo-Manzano and López-Valpuesta, 2013; Dorton and Liu, 2016; Gkritza, Niemeier and Mannering, 2006; Kneale, Baxter and Wild, 2014; MacLeod and McLindin, 2011; Majeske and Lauer, 2012; Oostveen and Lehtonen, 2017; Rio et al., 2016; Yu and Huang, 2014)		X	X		
(Adacher et al., 2017; Alodhaibi, Burdett and Yarlagadda, 2017; Casas, Casanovas and Ferran, 2014; Nikoue et al., 2015; Rauch and Kljajić, 2006; Trakoonsanti, 2016; Verma, Tahlyan and Bhusari, 2018)	X	X			
(Bezerra and Gomes, 2016a; Manataki and Zografos, 2009; Rocha et al., 2016)					X
(Wang et al., 2018; Xu et al., 2016)	X			X	
(Gelhausen, Berster and Wilken, 2013)				X	
(Fayez et al., 2008)	X	X	X		
(Kiyildi and Karasahin, 2008)		X		X	
(Kim, Kim and Chae, 2017; Zidarova and Zografos, 2011)			X		X
(Wu and Mengersen, 2013)		X	X	X	X
(Yoon and Jeong, 2015)			X	X	

APF Airport Passenger Flow
APC Airport Passenger Processing
ASQ Airport Service Level & Quality
ACD Airport Capacity & Demand Management
AOP Airport Terminal Operational Performance

Table 3-4 shows that 18, 15, 15 and 3 papers address ASQ, APC, APF and AOP, respectively. Moreover, 8, 7, 2 and 2 articles discuss APC and ASQ, APF and APC, APF and ACD and ASQ and AOP, respectively. Furthermore, 1 article discusses only ACD. On the other hand, there is a lack of papers on more than three subtopics.

3.8 Research Gap

Several academic and institutional research studies have been carried out in recent years with the aim of understanding the performance and future trends of the air transport industry. Airport congestion and crowding has been one of the key factors that has led many researchers to look for ways to improve performance at airport terminals to increase customer satisfaction (Ma et al., 2012; Moon, Yoon and Han, 2016). Concerning customer satisfaction, many similar types of research studies have focused on analysing passenger flow at airports (Correia, Wirasinghe and Barros, 2008a).

Numerous research studies related to the Hajj, in terms of the health, security, risk management and logistics aspects of the mass gathering, have been published. However, there has been a lack of scientific research in the field of transportation in the Hajj, especially regarding air transport and airports.

Unlike other research studies, such as Casas, Casanovas and Ferran (Casas, Casanovas and Ferran, 2014), Gonçalves and Caetano (2017) and Verma, Tahlyan and Bhusari (2018), this literature review focused more on passenger flow at arrival terminals where congestion and crowding often occur. Past literature reviews are still important and provide valuable information, but they do not identify, analyse and evaluate performance at arrival terminals from providers' and passengers' perspectives. Crowded airports and congestion at arrival terminals result from not only ineffective systems and operations but also the temporary needs of people that call for special operations at arrival terminals. Moreover, significant efforts have been made to use simulation models in studies of this problem, but there are still limited studies of congestion at airport terminals using integrated methods with simulation, including qualitative and quantitative methods, to display a cohesive view and different viewpoints.

Academics and airport institutions need to conduct further research to determine how passenger flow problems can be solved at both arrival terminals and departure terminals. In future research, the technological systems used at airports should be emphasised, since they play a key role in crowding alongside infrastructure (Ali, Kim and Ryu, 2016; Bontikous, Dieke-meier and Fricke, 2016; Rio et al., 2016).

Airlines must be passenger oriented to create a competitive advantage. Thus, airline management emphasises its expectations of and perspectives on service quality. Previous research on the performance of airport systems and airport environments has more generally analysed their impacts on customer satisfaction, time management and cost reduction at airports.

Very limited research has analysed the potential interactions between the flow of outbound and inbound passengers (Alodhaibi, Burdett and Yarlagadda, 2017), including the potential of inbound passengers to consume considerable personnel resources. For example, at airports' immigration and customs areas, the processing of outbound passengers may result in the delayed processing of inbound passengers. This demonstrates an obvious need to develop a model and optimise interactions within realistic terminal conditions. In addition, research in this sector has focused on improving customer satisfaction from the airport gate to the aircraft and from the aircraft to the airport gate. It is truly an important area of research, but more research needs to be done on the passenger-related causes of inefficiency at airports. For example, misunderstandings and passenger negligence at airports during peak times severely affect airport performance (Consumer Protection Group, 2009).

3.9 Summary

This chapter examined 75 articles published on the topic of the operation performance of airport passenger terminals between 2003 and 2019. Moreover, the collected papers were classified according to journal, year of publication, geographic region in which the study was conducted, subtopic and methodology used. The first objective of this research was mainly addressed: adopting data collection methods, identifying research gaps and providing a roadmap for future studies. Therefore, the next chapter clarifies the design and methodology for this study.

4 CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

This chapter looks in greater detail at the research design adopted to meet the research objectives laid out in the introduction chapter and presents the strategies applied in undertaking the study. It focuses on the researcher's philosophical considerations and the way they were applied in the research design. In addition, this chapter connects the initial chapters with the research findings and research discussion chapter. Moreover, it presents the background of the research design and provides a concise discussion on research philosophies, approaches and strategies adopted to meet the research objectives. It focuses on the different design aspects and the way in which they were incorporated to develop an effective study. To ensure the reliability and validity of this research, the procedures applied are explained in detail. A critical purpose of the chapter is to ensure that it can be replicated by clearly detailing each phase and design consideration. The chapter begins with an in-depth explanation of the research philosophy, which shows the different methodological options and perceptions of knowledge. This is then followed by a discussion on the data-collection and -analysis methods used in this research study. Finally, an overview of the proposed research framework of this study is provided to sum up the chapter.

4.2 Research process

Saunders, Lewis and Thornhill (2015) compare the research process to an onion with several layers. Each stage of the research process represents a layer of the research onion, as shown in Figure 4-1, and each stage of the research process comes with its own set of assumptions that affect the research process designed for the study. The research process moves from the outside to the inside of the research onion to include research philosophies, approaches, and strategies; time horizons; and data-collection techniques and procedures.

The first layer of the research onion, the research philosophy, assists the researcher in determining which research approach to adopt, why the approach should be adopted and what can be attained from using it (Saunders et al., 2015). The research philosophy aims to distinguish scientific from non-scientific research and to identify the procedures to be followed and the conditions to be met for the required scientific interpretation (Smith, 2000). The second layer, the research approach, involves the choice between deduction, induction and a combination of both to meet the research objectives. The third layer is the methodological choice includes researcher selection for research design with quantitative, qualitative or mixed methods and whether if he used mono, mixed, or multi-method to collect data. The fourth layer comprises the research strategy, an overall plan of how the research questions are to be answered (using a survey, a case study, an experiment or ethnography). The time horizon, which is the fifth layer, is related to whether a cross-sectional or longitudinal approach is used. Finally, in the sixth layer, the data-collection and data-analysis methods are discussed in terms of how they work to answer the research questions (Saunders et al., 2015).

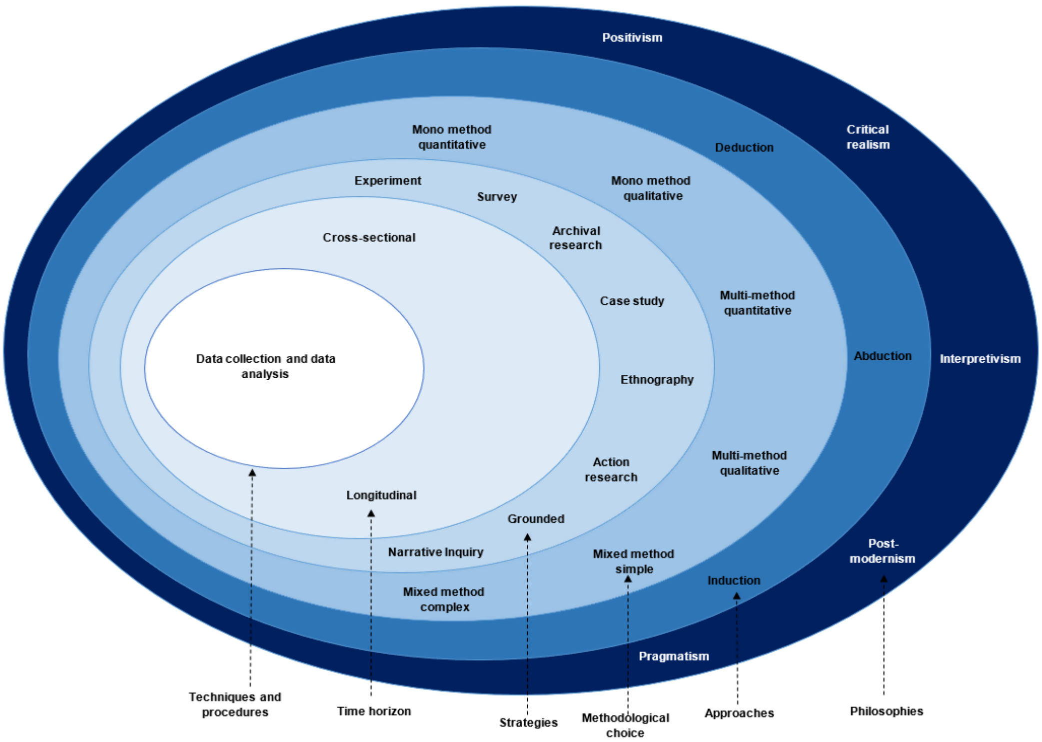


Figure 4-1 The research onion.

Source: Saunders et al. (2015).

4.2.1 Research philosophy

The first or outermost layer of the research process is the ‘research philosophy’, which is essentially an umbrella term for the development of knowledge and the meaning of that knowledge. In the research context, the term ‘philosophy’ refers to the nature of knowledge and the views held by the researcher in developing it. The research philosophy is the basic paradigm of knowledge that is used to determine the methodological choices made by the researcher (Saunders et al., 2015). The research philosophy adopted for any study comes with important assumptions about the way the researcher views his/her surroundings, and these philosophical assumptions affect the research strategy and the methods chosen for the study. To some extent, the research philosophy adopted is influenced by the practical considerations or limitations of the researcher. Another important influence in choosing the research philosophy is the researcher’s view of the relationship between knowledge and the process by which it is developed.

One of the most important aspects of the research philosophy is epistemology, which refers to considerations about social reality. One of the epistemological assumptions is positivism, which assumes an observable social reality with outcomes that involve law-like generalisations. A researcher taking this approach focuses on facts or reality and utilises highly structured methodologies involving hypothesis testing and statistical tools. Interpretivism, the second epistemological element, focuses on understanding human nature and the roles that people have in creating their social environments. In this case, the researcher relies on naturalistic methods of data collection, such as interviews or text analysis, and the research is mostly qualitative in nature. Realism is another aspect of epistemology that involves consideration of reality as presented by our sense of the truth. In this perspective, objects are believed to have a reality that exists independently from the human mind. This element is more related with positivism, since it considers reality independent from the observer.

The research philosophy is also considered in relation to ontology where the researcher may be a positivist, subjectivist or objectivist. The subjectivist considers social phenomena to be created by the actions and perceptions of social actors and revised through social interactions. The subjectivist relies on qualitative methodologies, since the aim is to understand issues as they are influenced by the research participants. At the other end of the continuum, objectivists believe social entities exist in a reality that is external to the actors involved (Kothari, 2013).

On the other hand, another research philosophy different from those mentioned above is pragmatism. It comes as no surprise that the word ‘pragmatism’ comes from the Greek root word ‘pragma’, meaning work, practice, or activity. Pragmatism, developed in the early 20th century by James, Pierce and Dewey, does not move far from this definition. It is based on life’s practical experiences and activities. Pragmatism is not a methodology like the other research philosophies; rather, it is a theory of truth (Morgan, 2014).

Furthermore, the pragmatism research philosophy can be termed as an anti-philosophy or a movement against the more traditional philosophical approaches (realism, idealism and naturalism), which are often based on speculation(Morgan, 2014). In addition, pragmatism is viewed as a midway point between idealism and naturalism. In the pragmatism approach, researchers have to find processes or approaches that help achieve their desired ends. Furthermore, the core value of this philosophy is that there is no permanent truth: things keep changing, and there is no permanent essence or identity. Truth is whatever works for the moment or rather whatever helps answer the research question. The only constant thing is change, everything is relative and there are no absolutes. Things need to be experienced and tested.

The pragmatism philosophical approach is looked upon as a practical, matter-of-fact and novel way of approaching and solving a problem. This philosophy involves using experimentation or actions to solve a problem. The pragmatism approach avoids time-consuming discussions and debates on concepts such as ‘truth’, ‘reality’ and ‘essence of knowledge’.

The pragmatism approach is determined to look at real flesh-and-blood issues that improve or make a difference in human life. One of the founders of this philosophical approach, Dewey, felt that there should be no separation between real life and research; that is, he considered research a careful and more thorough look at the problems life throws at us (Morgan, 2014).

Morgan (2014) outlines five main steps to the pragmatism philosophical approach: 1) Recognising a research problem; 2) Considering the nature of this particular problem; 3) Looking at suggested solutions; 4) Thinking about the likely effects of solutions; and 5) Taking action to tackle the problem.

In essence, the perceptions of the researcher about reality and knowledge determine the methodological considerations and decisions made. In addition, there are a number of reasons for choosing the pragmatism philosophy for the purpose of this study. The pragmatism approach was chosen to answer the following research question: How can we assess and develop the arrival processing and flow of pilgrims at HTs based on agents' perspective in this environment?. Second, the pragmatism approach was chosen due to the mixed-methodology research approach adopted by the researcher. According to the pragmatism philosophy, both qualitative and quantitative approaches can be included in a study to meet the research objective(s). Third, Third, the pragmatists believe that there is a single real world, but different people can have different perspectives of the real world(Saunders, Lewis and Thornhill, 2015). Hence, the researcher has investigated and studied the research problem based on different views according to pragmatic paradigm. Fourth, by adopting the pragmatism research philosophy and the mixed-methodology research approach, the researcher was not restricted to looking at only ontological and epistemological issues and could decide the best way to address a variety of different research questions. Fifth, it was thought that the pragmatism philosophical approach would help get to the crux of the matter rather than waste time on debating theoretical concepts.

4.2.2 Research approach

This subsection covers the second layer of the research onion, the research approach used in the study. As multiple methods research (MMR) was adopted, a combination of inductive and deductive reasoning was used to meet the research objectives.

The inductive approach is the opposite of the deductive approach, as the theory is the result of the research, which involves describing generalisable findings (Bryman and Bell, 2011). Trochim, Donnelly and Arora (2006) define induction as starting with the specific and ending up with the general. Furthermore, Creswell and Plano Clark (Creswell and Clark, 2007) define the inductive researcher as one who uses participants' views to construct broader themes and generate a theory. Inductive reasoning is based on learning from experience or collected data. Patterns are observed and recorded in order to reach conclusions. Moreover, the inductive research approach is usually adopted for qualitative research (Soiferman, 2010).

The strengths of inductive reasoning are as follows: it enables the researcher to work with a wide range of probabilities, it can fuel further exploration or research and it allows the researcher to err and start again. It is also only through more observations that researchers can determine whether their hypotheses are true. Hence, the inductive approach is used to meet the following research objective: to identify the characteristics of the flow of pilgrims through arrival terminal processes from the perspective of airport providers.

Conversely, the deductive approach is one of the scientific research approaches. Researchers have used the deductive approach to study many different phenomena, and it is a scientific approach with a great history. Furthermore, this approach employs a theory selection process in which one starts with a theory and then tries to decide if it applies to specific situations. In addition, Trochim et al. (2006) define the deductive approach as starting from the general and ending up with the specific. According to Creswell and Plano Clark (Creswell and Clark, 2007), the deductive researcher works from the theory to the hypotheses to the data in order to add or subtract from the existing theory. The deduction begins with patterns or regularities that are tested against observations. Therefore, the deductive approach allows the researcher to draw conclusions from propositions. According to Soiferman (2010) the deductive approach is the method most often used in quantitative research. This approach is usually used to explain relationships between concepts and variables and measure concepts quantitatively to generalise research findings.

Table 4-1 Differences between deductive and inductive approaches

Deductive Approach	Inductive Approach
• Based on scientific principles • Moving from theory to data • Need to explain causal relationship between variables • Collection of quantitative data • Application of controls to ensure validity of data • Operationalisation of concepts to ensure clarity of definition • Highly structured approach • Researcher independent from research process • Necessity to select samples of sufficient size to generalise conclusions	• Gaining understanding of meanings humans attach to events • Close understanding of research context • Collection of qualitative data • More flexible structure to permit changes in research emphasis as research progresses • Realisation that researcher is part of research process • Less concerned with need to generalise

Source: Saunders, Lewis and Thornhill (2009).

Many researchers have discussed the differences between the deductive and inductive approaches, and these are summarised in Table 4-1. The following differences between the two approaches are worthy of note: the starting point of the research, the time period in which hypotheses or proposals are developed and whether they are applied and the research objective (Spens and Kovács, 2006).

4.2.3 Methodological approach

For the purpose of this research study, a mixed-methods research approach was adopted. We start by looking at the definition of mixed-methods research: mixed-methods research is a research method ‘in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study’ (Tashakkori and Creswell, 2007, p. 4).

The mixed-methods research approach was adopted because of the pragmatism philosophy chosen to help meet the research objectives. The pragmatism philosophy supports the idea that the research results are more important than the research process. The pragmatism approach pushes for ‘a needs-based or contingency approach to research method and concept selection’ (Johnson and Onwuegbuzie, 2004, p.17), and this helps discover the best method to answer the research questions. According to this approach, research practicalities cannot be driven by theory or data exclusively, and thus, a combination of deduction and induction is needed (Morgan, 2014). Johnson and Onwuegbuzie (2004) stated that mixed-methods research recognises the usefulness of qualitative and quantitative research being used in a single study to maximise their strengths.

The mixed-methods research approach has been used in various research fields, such as social, behavioural and healthcare research. As highlighted in Creswell and Plano Clark (Creswell and Clark, 2007), qualitative and quantitative data can be combined in different ways depending on the area prioritised by the researcher. The most popular mixed-methods designs are the convergent parallel, explanatory sequential, embedded and exploratory sequential designs (Creswell and Clark, 2007), as shown in Figure 4-2.

The key characteristics of mixed-methodology research are as follows: collection and analysis of quantitative and qualitative data (Creswell, 2008). Second, the quantitative and qualitative data collection needs to follow standard procedures for developing robust research designs (selection criteria, proper sampling, appropriate sample size and use of multiple data sources) (Creswell, 2008).

Third, mixed-methods research involves the integration of quantitative and qualitative data through merging, connecting and embedding data (Creswell and Clark, 2007). Fourth, quantitative and qualitative data can be analysed together or independently and can be used simultaneously or sequentially.

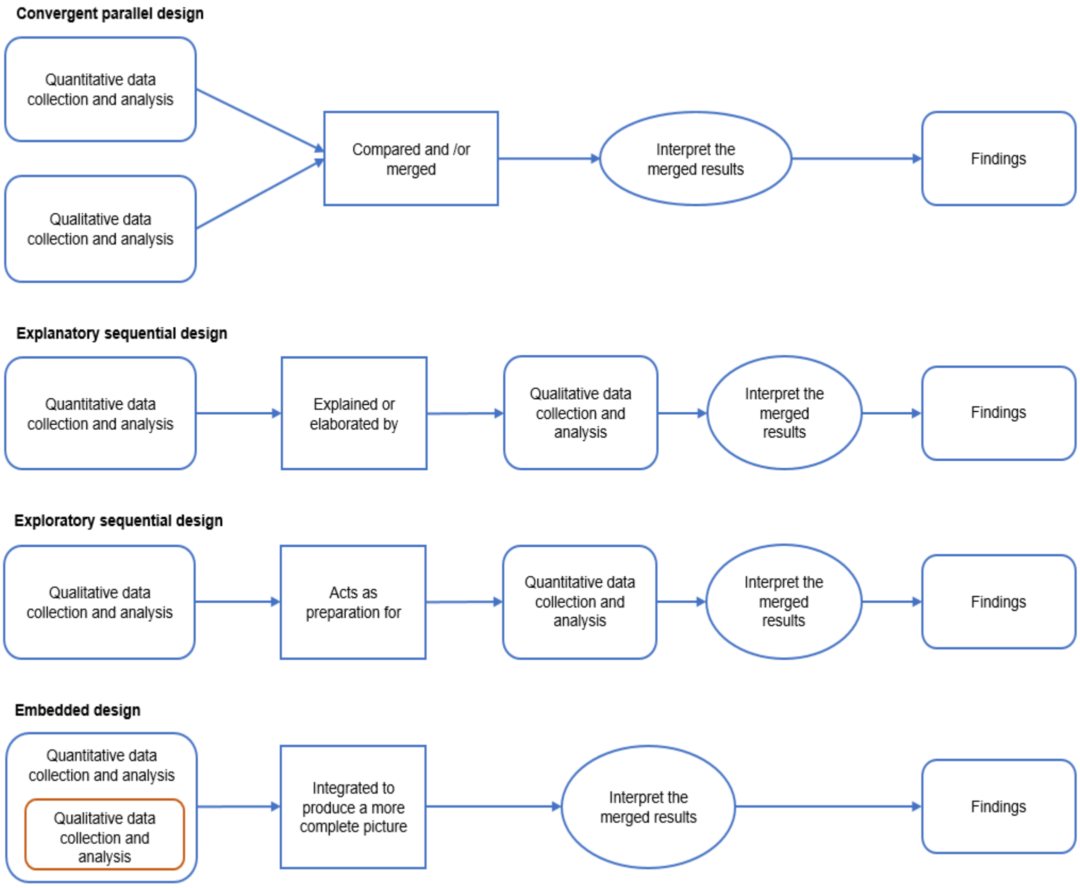


Figure 4-2 Four basic mixed-methods designs.
Source: Creswell and Plano Clark (Creswell and Clark, 2007).

The mixed-methodology approach makes use of quantitative and qualitative research methodology. Quantitative research allows the researcher to look at large amounts of data, uses the deductive approach for data analysis and incorporates positivist values. On the other hand, qualitative research emphasises words, emotions and feelings rather than quantification in the data-collection process. Qualitative data analysis uses an inductive approach and highlights how individuals interpret their world. This research makes use of the explanatory sequential design to meet the research objective.

4.2.4 Research strategy

As mentioned in the previous subsections, the pragmatic research philosophy and the mixed-methods research design are applied in this study. The mixed-methods research design is considered beneficial because each individual approach compensates for the weakness of the other to produce a more effective, realistic and comprehensive answer to the research question (Ivankova, Creswell and Stick, 2006). The research question is complex and involves different aspects associated with the use of systems for controlling the flow of passengers as well as the perceptions and experiences of passengers and airport employees involved in the process. The mixed-methods research design was considered essential for combining the different types of data that had to be collected in order to obtain a holistic view of the research issue. The researcher uses qualitative and quantitative methods in an explanatory research design to triangulate the collected data and outcomes of the research process. Thus, to meet the research objectives, the research strategy is a combination of quantitative (survey), qualitative (interviews) and experimentative (model building).

As mentioned previously, there are four main mixed-methods research designs, and these are listed in Table 4-2 and Figure 4-2. In the first, the concurrent design, the quantitative and qualitative fieldwork is carried out simultaneously, analysis is completed separately and the data are merged to see whether results present complementary or contradictory evidence (Creswell and Zhang, 2009). The second research design is known as the explanatory sequential design, where the initial phase is a quantitative survey followed by the qualitative phase, which helps explain the quantitative data results. This is a quantitatively driven two-phased research design (Creswell and Zhang, 2009).The third research design is the exploratory sequential design, where the first phase of research is qualitative, which helps improve the quantitative data collection. This is a qualitatively driven two-phased research design (Creswell and Zhang, 2009). Finally, the fourth type, known as the embedded sequential design, involves embedding a supporting and sometimes smaller database to enhance a larger study or database (Creswell and Zhang, 2009).

This study's research objectives involve different aspects associated with using systems for controlling the flow of pilgrims and pilgrims' and airport employees' perceptions and experiences. For the mixed-methods research design, the researcher uses sequential explanatory mixed methods to collect data and research process outcomes.

4.2.5 Time horizon

The fifth layer of the research onion is the time horizon used for this study. The time horizon refers to the length of time the fieldwork for the study covers. An important thing to consider when planning a research study is whether it is to be carried out at a particular point in time (a cross-sectional study) or at two or more intervals over a given period (a longitudinal study).

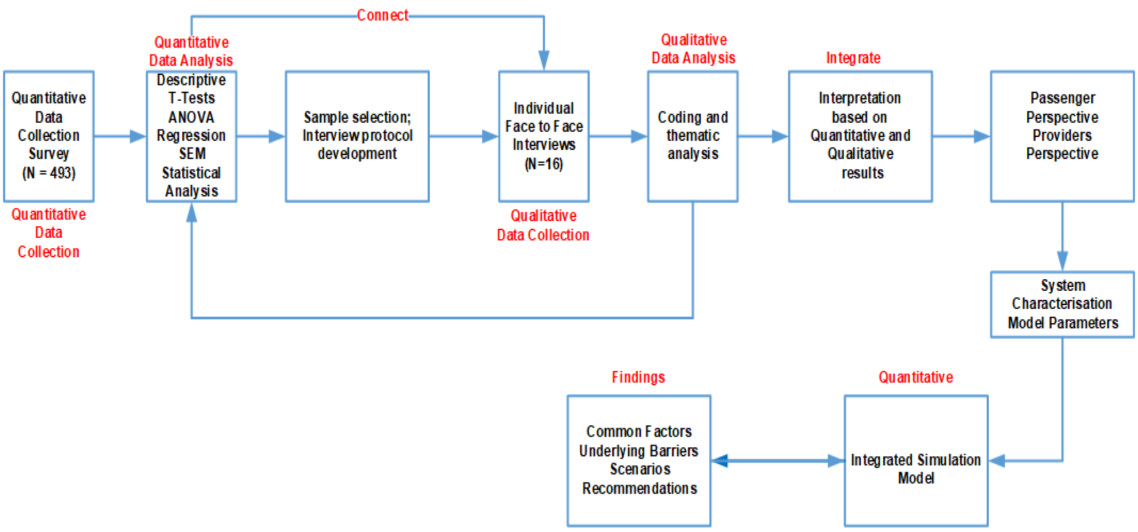


Figure 4-3 Visual model of research design and procedures (organised by author).

Table 4-2 Additional elements of four mixed-methods designs

	Concurrent design	Explanatory sequential design	Exploratory sequential design	Embedded sequential/ concurrent design
Type/example of mixed-methods question	Quantitative and qualitative results compared: Do the quantitative and qualitative results converge, diverge or present contradictory evidence?	Qualitative data collection helps explain quantitative results: How do the qualitative findings help to explain the quantitative results in more depth?	Initial qualitative exploration leads to improved quantitative data collection and results: Can the qualitative themes be generalised to a sample of a population?	A supportive database enhance a major database: How does qualitative data added to an experiment improve/enhance the experimental findings?
Suitable designs	Qualitative: grounded theory, case study Quantitative: survey, correlational experiment	Quantitative: survey, correlational experiment Qualitative: case study, grounded theory	Qualitative: case study, phenomenology Quantitative: survey, correlational experiment	Quantitative: correlational experiment, Qualitative: case study, phenomenology
Validity/ methodological issues	Unequal sample sizes; Divergent, contradictory information; Lack of parallel quantitative and qualitative measures	Inadequate selection of participants for follow-up; Inadequate use of quantitative results for follow-up	Inadequate use of quantitative results in qualitative follow-up; Using less-than-adequate rigorous procedures in quantitative follow-up (e.g. poor scale development)	Concurrent design (issues attendant to concurrent design, bias introduced); Sequential design (issues attendant to sequential design, bias introduced)
Advantages of design	Makes sense intuitively; Efficient for data collection; Provides multiple 'angles' on a problem	Easily conceptualised in phases; Manageable for single researcher; Quantitatively driven	Easily conceptualised in phases; Manageable for single researcher; Qualitatively driven	Permits use of qualitative within experimental designs; Improves major design (e.g. experiment, correlational study)
Disadvantages of design	Quantitative and qualitative results may diverge, be contradictory; Extensive data collection	Phases take time; Not qualitatively driven	Phases take time; Not quantitatively driven	Devalues supporting database in supporting role; New, underconceptualised

Source: Creswell and Zhang (2009).

In a longitudinal research design, data are collected across two or more time periods, and the subjects analysed are the same or comparable across the periods. This type of research design involves comparisons of data across different periods (Burton, 2000). Longitudinal research has more statistical power when the data are analysed. However, this approach is more time consuming and costly, and thus, it is used less often. In addition, people responding to the same research instrument repeatedly may change the characteristic being measured as a result of the practice they get in answering the questions (Leedy and Ormrod, 2014).

In the case of this study, it was decided that it would be carried out at a particular point that would serve as a snapshot providing a clear picture of the time at which the fieldwork was carried out, as it was felt this time horizon would help meet this study’s research requirements. Furthermore, due to the sensitive nature of the study (as it was conducted in airports, which tend to be high-security, sensitive areas), a longitudinal study was not viable, as it would have been expensive, time consuming and complicated in terms of the ethics involved. Furthermore, repeatedly obtaining permission from airport authorities and management would have been difficult.

The following section explains the research phases implemented to address the research issue and collect the necessary data. The design involves the collection of quantitative and qualitative data coupled with experimental data involving simulations of the passenger arrival processing system.

4.3 Measures of research validity

Making the right decision in evidence-based practices depends on the reliability of the tools and data used. That is, using reliable data and tools yields high-quality results and decisions. According to Robson (2002), the most common threats to research validity are the impact of the researcher's interaction in the data-collection environment on the participants' behaviour and responses, the respondent's bias due to the withholding of research information and the researcher's bias. The measures include trustworthiness of data, triangulation of data, reliability of instruments and validity of instruments.

4.3.1 Trustworthiness of data

Bryman (2016) defines trustworthiness as a measure of confidence that may determine the value of a research study. Generalisability and validity are the two main elements contributing to trustworthiness. Hence, the trustworthiness of qualitative research is based on its credibility, dependability, conformability and transferability, while the trustworthiness of quantitative research is based on its reliability, internal and external validity and objectivity.

Validity in research studies in various environments has two forms: internal and external (Robson, 2002). Internal validity is defined by the extent to which the observations made by the researcher are consistent with the theories included in the study. Moreover, when researchers spend a long time in the research environment, it contributes to the internal validity, and it is the basis for the context of the qualitative study (Lecompte and Goetz, 1982). Conversely, external validity is defined by the possibility of generalising the research study to another social situation, such as other organisations (Saunders et al., 2015). However, it is difficult to realise external validity with this type of research data (qualitative research).

4.3.2 Triangulation

Triangulation is a term used in qualitative, quantitative and mixed-methods research. Bryman (2016) defines triangulation as the use of more than one method or data source to study a social phenomenon, thus verifying its reliability through the results of other methods or data sources. In order to obtain high-quality research results, triangulation was used to further enhance the research (Decrop, 1999). Thus, collecting data using various methods and analysing it from different perspectives and angles eliminates any biases from the research findings and ensures that the data can be applied and the results can be generalised. Furthermore, Decrop (1999) states that the use of multiple methods or data sources enhances the researcher's ability to obtain more reliable information. Hence, it is clear that in triangulation, the data can be collected several times using different methods (Easterby-Smith, Thorpe and Lowe, 2002).

According to Denzin (1970), there are four types of triangulation: methodological, data, investigator and theoretical triangulation, as shown in Table 4-3.

Table 4-3 Types of triangulation techniques

Types of triangulation	Description
Methodological triangulation	'Collect data using multiple methods'
Data triangulation	'Collect data from multiple data sources to study it'
Investigator triangulation	'Assign more than one researcher to identify the problem and continue to study'
Theoretical triangulation	'Proceed with the research considering different perspectives'

Source: Denzin (1970).

This diversity of methods and data sources enhanced the quality and integration of information in this study. Hence, it helped to resolve the inherent limitations and obstacles of each approach used and boost the reliability of the results (Gray, 2004).

4.3.3 Validity

Researchers are keen to use one or several methods to collect quantitative data, qualitative data or both. This stage involves multiple steps, and there is potential for the quality and accuracy of the results of these research studies to be affected. Thus, studies on the validity of research and the quality of results have emerged. Smith (1991, p. 106) defined validity as 'the degree to which the researcher has measured what he has set out to measure'. Thus, validity in surveys is related to the quality of the tool in measuring the target to be measured. Furthermore, Kumar (2010, p. 177) explained the term validity as 'the concept of relevance and accuracy applied to the search process'. According to Denscombe (2014), using multiple methods to test the relationships between data helps to increase validity and accuracy.

There are two approaches to establishing the validity of a research instrument: logic and statistical procedures. Validation through logic is performed by asking questions related to the objectives of the study, while validation through statistical procedures involves calculating the correlation coefficients between questions and outcome variables (Kumar, 2010). As noted earlier, validity is divided into internal and external validity. Internal validity is related to how well research results match reality, while external validity refers to the degree to which research findings in other contexts and environments can be reproduced (Pellissier, 2007). In this research, a mixed-methods approach with multiple techniques and data sources was used for validity testing. Furthermore, this problem was analysed by considering multiple perspectives and cases to cover various aspects of the research. Thus, the findings were justified by numerous sources. Moreover, the accuracy of the research phases was verified to ensure that the research was relevant to the research objectives and the problem that it was looking to resolve.

4.3.4 Reliability

The concept of reliability is related to the consistency and stability with which we measure something. Kumar (2010) defined reliability as the degree to which an instrument consistently measures a concept. Reliability relates to the extent to which the research results are trusted (Ormston et al., 2014). Furthermore, Moser and Kalton (1989) defined reliability as the measure or test's ability to be trusted to the degree that the result of repeated measurements under constant conditions is the same.

Reliability measures are important tools necessary to evaluate research elements' and research tools' consistency, but they are insufficient. Several factors affect reliability, especially in social research. These include the instrument's regression effect, the nature of the interaction, the mood of interviewer and respondent, the physical setting and the wording of questions (Kumar, 2010). According to Ormston et al. (2014), the reliability of the results depends on two factors: potential repetition and interpretation of the original data. Therefore, a practical test of reliability involves trying to reproduce the results by repeating the study. In the correlation between validity and reliability, validity depends on reliability, and reliability is an essential component of quality control in research. In static design research, reliability is associated with the use of standardised research tools, such as tests and measurements, while in flexible design research, it is associated with the credibility of the methods and practices used in the research (Robson and McCartan, 2016).

On the other hand, there is an inverse relationship between the error in a research tool and reliability. Reliability is tested differently in qualitative research and in quantitative research, where unorganised and non-unified methods are used. Furthermore, Guba and Lincoln (1985) discussed and identified four criteria for qualitative researchers to build a model for testing validity and reliability: credibility, transferability, dependability and confirmability. Trochim and Donnelly (2006) compared these four criteria for the validity and reliability test proposed by Guba and Lincoln for qualitative research with equivalent criteria for quantitative research and deduced the following Table 4-4.

Table 4-4 Comparison of the validity and reliability criteria in qualitative and quantitative research

Criteria for judging quantitative research	Criteria for judging qualitative research
Internal validity	Credibility
Objectivity	Confirmability
External validity	Transferability
Reliability	Dependability

Source: Trochim and Donnelly (2006).

A mixed-methods approach focused on qualitative and quantitative data was used in this study. As indicated in Table 4-4, each type of data has specific features and criteria for reliability testing. Given the importance of validity and reliability testing to research quality and accuracy, the researcher used some of these criteria to conduct reliability testing based on data type. This is covered in more detail in Chapters 5 and 6.

4.4 Data-collection methods

Data collection is an important part of any research project. In addition, data-collection methods in scientific research can be defined as a set of structured and integrated steps and processes that are used to gather, examine and measure specific information to answer a research question. Therefore, many authors of research methodology books include specific sections devoted to data-collection methods, such as Saunders et al. (2009), Robson (2002) and Bryman (2016). Furthermore, sustainable knowledge enrichment in the research depends on the use of multiple methods of data collection (Robson, 2002). There are several popular data-collection methods, such as interviews, focus groups, observations, documents, surveys and questionnaires, experiments and literature reviews. The researcher chose data-collection methods that fit the nature of this research, and a summary of the advantages and functions of each of these methods is presented below.

- **Literature Review**

The literature review is an essential part of any research, as it makes a valuable contribution to every step of the research process. It also assists the researcher in setting the theoretical foundations of the research study, strengthens the researcher's knowledge base and helps to integrate the results with current and previous scientific research works (Kumar, 2010). According to Blaxter, Hughes and Tight (2010), a literature review can be interpreted as a concisely and routinely reproducible scheme for academics to classify, analyse and evaluate published research works. Furthermore, literature reviews can be carried out to interpolate/extrapolate historical trends in science as well as to compare intellectual arguments and lead to an understanding of a particular area of interest (Neuman, 2013).

Therefore, the use of a literature review to collect data and verify research gaps to achieve the desired result of this study’s first objective is highly beneficial. Based on that, the researcher conducted the literature review for this study in two stages. In the first phase, the researcher studied the literature to explore the scope of this research in general. While the researcher used the systematic literature review in the second phase to provide a deeper understanding of the performance of arriving passenger processing and determines the current state of the literature on this subject. Chapter 3 addresses mainly the first objective of this research and adopts these data collection methods to identify the research gaps to provide a roadmap for further study.

- **Documents**

Document collection and analysis is an efficient way of collecting data because records are accessible and realistic tools. Moreover, the advantages of documents include the lack of interference of individuals, the background information and broad coverage of data provided, familiarity and reliability and efficiency in terms of cost and time (Bowen, 2009). Therefore, several documents relevant to this research were collected, including technical documents, such as the IATA Airport Development Reference Manual (2014) and HTs Operation Manual, and regulations, such as Hajj Instructions Governing the Carriage of Pilgrims by Air (2019). Some statistical reports, such as the Statistical Reports for Hajj (2015, 2017, 2018) and HTs Statistical Report (2017), were also collected. Furthermore, the researcher used other types of documentation, such as technical reports, charts, white papers and legislative documents. All these documents were necessary to make an initial assessment of the system requirements by making use of historical data on HTs. In addition, other documents were used to show the state of the infrastructure and the way it is utilised in handling Hajj traffic as well as reveal the global standard of waiting time and space required for each passenger to avoid congestion.

- **Observations**

The observation technique in research is a means of collecting data through observing, and it is considered a participatory method where the researcher immerses him/herself in the environment of the participants or the chosen study environment. Observation data can be quantitative or qualitative and it can lead to the accumulation of internal knowledge (Neuman, 2013). Furthermore, observation methods are used when the purpose of the research is to measure external behaviour. Observation methods are used in several areas, including psychology, social sciences, biology and zoology, healthcare and medical sciences. There are two types of observations: structured and unstructured. Structured observations use specific variables according to a particular time and place. On the other hand, unstructured observations are conducted in an open style without specifying variables or objectives. The researcher used observation in the early stages of the research to identify the environment of HTs and the flow of pilgrims through processes in these terminals; gain knowledge of the system, external behaviour and infrastructure and acquire essential information about these terminals; and pinpoint the external operational problems. This helped the researcher develop a full conception of these airport terminals, which are different from those of any other airport, as mentioned earlier.

- **Questionnaire**

The questionnaire is one of the techniques of data collection employed in scientific research and surveys. It is a means for the researcher to design questions through which the researcher determines what s/he needs to know to answer the research questions. According to Kumar (2010), it is a list of questions written and prepared in advance on which the participants record their answers. Furthermore, it is defined as a method of data collection used to gather a set of quantitative or qualitative data that have correlations with two or more variables to detect correlation patterns (Kumar, 2010). Questionnaires are conducted by telephone, face to face or self-report (Robson, 2002). With the availability of the internet and other means available through social media or web-based platforms, the use of questionnaires for survey and study research has become easier and more widespread and diverse in terms of the demographics of geographically different places around the world. This makes it the preferred choice for many researchers.

The most important advantage of this method is its practicality: it is easy to collect a massive amount of data from a large number of participants in a short time, and it can be performed by one or any number of researchers. In addition, the questionnaires' results can usually be estimated quickly and easily by the researcher or by using a software package (Popper, 2002). Another advantage is that the results can be evaluated more scientifically and critically than those of other methods of analysis. On the other hand, there are disadvantages to this technique. Most importantly, it is insufficient to understand some forms of information (e.g. changes of emotions, behaviours and feelings), it lacks validity and accuracy, there is no way to know how honest the respondent is being and there is a level of unrecognised subjectivity (Popper, 2002). Another is the lack of opportunity for participants to express their additional ideas about the research topic because there are no follow-up questions.

The researcher collected data on the experiences of pilgrims with HTs, including issues they faced in these terminals (e.g. time taken to be cleared), LoS and recommendations for improvements at the terminals. A structured questionnaire was implemented face to face with the pilgrims during the Hajj season of 2017.

A total of 493 participants were selected randomly; that is, 302 responses were obtained from HTs at King Abdulaziz International Airport in Jeddah and 191 responses were obtained from HTs at Prince Mohammed Bin Abdulaziz International Airport in Medina. The questionnaire used for this study was generalisable, in that we obtained a statistically reliable sample on measures such as central tendency and variance. Full details of the advantages of these approaches and the sampling strategy, survey distribution and data analysis using the SPSS 25 software are discussed in Chapter 5.

- **Interviews**

The interview is a common technique for data collection in scientific research. According to Burns(1997, p.329), 'an interview is a verbal interchange, often face to face, though the telephone may be used, in which an interviewer tries to elicit information, beliefs or opinions from another person'. It is a qualitative research technique that involves conducting individual interviews with a limited number of participants (Boyce and Neale, 2006). Interviewing is a highly useful and effective research technique because of the interaction during the data-collection process, the direct nature of interviews and their flexibility in gathering detailed information about research questions. Moreover, interviews, especially face-to-face interviews, are considered one of the most accurate research techniques. On the other hand, in this type of data collection technique, the researcher should have a high level of interaction with the participants to help explain social behaviours(Gubrium and Koro-Ljungberg, 2005).

According to Robson (2002), there are three different forms of interviews: structured, semi-structured and unstructured. Structured interviews are conducted through a series of predetermined questions in a particular order and using a fixed language (Kumar, 2010; Robson, 2002). On the other hand, unstructured interviews usually contain informal and non-specific questions with minimal conformity to a particular style, format or arrangement of questions in advance (Robson, 2002). As a result, it is difficult to compare responses from different participants due to different question formats. The last form of interview is the semi-structured interview. It is considered a semi-flexible interview type, containing both structured and unstructured interview components. Furthermore, it contains predetermined questions and some parts of these questions or additional questions might be asked during the interview, which means the inquirer has freedom in word selection and alignment of questions to clarify and further expand certain issues (Burns, 1997; Cohen and Crabtree, 2006).

The researcher used interviews as one of the data-collection techniques in this research. In-depth data were collected from employees and management representing the authorities working in HTs. The employees engaged in face-to-face interviews where the researcher was interested in developing visual models of the multiple case analyses. The interviews included semi-structured questions that provided room for follow-up and clarification to ensure that data saturation could be reached. The employees included in the interviews were selected purposively by determining who was likely to have the most information regarding the performance of the system and its outcomes. Chapter 6 provides full details about this part and the benefits of using this technique in this study.

4.5 Overview of research methodology phases

4.5.1 First phase

The first phase was conducted in order to meet the first objective: ‘Understand the performance of arriving passenger processing and evaluate the current HT systems and processes’.

The first phase of the research involved determining the current state in relation to passenger arrival processing at crowded airports due to the presence of events such as the Hajj. This part involved an assessment of the situation in the area where the focus of the researcher was to evaluate the research requirements based on the available literature. The first phase of the research involved secondary research where the author focused on the systematic literature review. The systematic review included the evaluation of articles published between 2003 and 2019 focusing on peer-reviewed journals as sources to assess the state of the industry. The literature search also included technical and administrative publications on handling passenger flow. Hence, various keywords were used for the search, such as passenger arrival processing, passenger flow, airport management, airport charts, passenger terminal and HTs. Another aspect of this phase was assessment of the system requirements by use of historical data of the HTs. Furthermore, information from the air transport industry was used to show the state of the infrastructure and the way it is used in handling Hajj traffic. In addition, a search for secondary data focusing on the air transport industry and other agencies that may report this was undertaken focusing on the infrastructure situation as well as manuals and charts.

4.5.2 Second phase

The second phase was conducted in order to meet the second objective: ‘Identify the characteristics of the flow of pilgrims through arrival terminal processes from the pilgrims’ (users’) perspective’.

The second phase of the research involved the collection of secondary data obtained by the GACA of Saudi Arabia to evaluate and compare the airport operation capacity and actual events of arriving pilgrims during the Hajj season at HTs in Jeddah and Medina airports from 2013 to 2017. Here, the researcher determined the number of pilgrims arriving at peak and non-peak times during actual events and compared this with the evaluated operation capacity.

Then, data were collected using the questionnaire about pilgrims' experiences of HTs in both airports and analysed. Furthermore, this study's questionnaire was designed to define the experience of pilgrims in Hajj arrival terminal processes. Arriving pilgrims were approached at the HTs during peak or non-peak hours to gather different experiences and opinions. Pilgrims were contacted and asked questionnaire questions face-to-face at HTs to ensure that they still remembered the experience and enhance the transfer of their actual perceptions of these terminals' processes and services. Moreover, a higher quality sample could be attained, as body language, facial expressions and word choice were part of the analysis. A total of 493 participants were randomly selected during the Hajj season of 2018; that is, we obtained 302 responses from HTs at King Abdulaziz International Airport in Jeddah and 191 responses from HTs at Prince Mohammed Bin Abdulaziz International Airport in Medina. Hence, we obtained a statistically reliable sample on measures such as central tendency and variance, and thus, the questionnaire could be generalised.

At this phase, the authors used different statistical and multivariate analyses to test and study historical data on the arrival of pilgrims and the operational capacity of HTs in both airports as well as arriving pilgrims' perspectives. Thus, different factors, such as the number of attendants, time spent on passenger screening, quality of service and rate of customer flow, were evaluated using these analyses to show associations and determine whether there were significant causations(Saunders, Lewis and Thornhill, 2015) (Saunders, Lewis and Thornhill, 2015). Pilgrims' points of view about the processes in the arrival area of HTs in Jeddah and Medina Airports were also described to determine the characteristics of the flow of pilgrims from the users' perspective. This phase of research mainly helped meet the second research objective. Furthermore, additional details on this phase are provided in Chapter 5.

4.5.3 Third phase

The third phase was conducted in order to meet the third objective: ‘Identify the characteristics of the flow of pilgrims through arrival terminal processes from airport providers’ perspective’.

In this phase, the researcher developed a semi-structured interview protocol based on the literature review and results obtained from the quantitative analysis of passenger experience. The main objective of these interviews was to engage airport employees and management in evaluating management’s perceptions of the performance of passenger flow through arrival terminal processes and the outcomes achieved. Other objectives included explaining, interpreting and shedding light on the quantitative results.

Sixteen face-to-face interviews representing all organisations in both airports were performed and recorded after obtaining participant consent. The main benefits of using face-to-face in-depth interviews are as follows: the researcher can build a greater rapport with the participants; follow-up questions can be asked for clarification purposes; a higher quality sample can be attained; body language, facial expressions and word choice are part of the analysis; and few participants are needed for interviewing purposes (Steber, 2017). Audio recordings were transcribed verbatim for thematic analysis, which was done using NVivo v12. The analysis outcomes were themes and sub-themes associated with the service level provided for terminal passengers and the different issues faced by employees. Further information about this part is explained in Chapter 6.

4.5.4 Fourth phase

The fourth phase was conducted in order to meet the fourth objective: ‘To develop an integrated simulation model to evaluate the current HTs by applying what-if scenarios with the simulation model in order to identify the common factors and underline barriers and to help this study to determine suggested solutions and recommendation that facilitate the flow of pilgrims arriving at HT.

The fourth phase involved developing an integrated simulation model based on ABM and DES simulation using AnyLogic 8.5.1 by employing the current data collected. Appropriate data on HTs were collected with permission from the top management and GACA. This simulation model was applied to determine the most important variables, which were used to assess the potential outcomes from the system.

At this phase, the emphasis was placed on the study of the processes of HTs at peak and non-peak times by the simulation of the flow of pilgrims through these terminals. Furthermore, this phase studied the effect of the impeding factors on pilgrims' flow that the author concluded from Phase 1 (literature review), Phase 2 (users' perspective) and Phase 3 (providers' perspective). Moreover, it benefited from the simulation model to validate and develop an assessment tool based on IATA LoS matrix. Further information about this part is explained in more detail in Chapter 7.

4.5.5 Fifth phase

The fifth phase was conducted in order to meet the fifth objective: 'To develop and validate the integrated framework'.

In the final phase of this research, an integrated framework was developed for improving the arrival processing of pilgrims at HTs based on previous phases. As well as an emphasis on generalising to apply this framework with other international airports, especially crowded airport. The focus of this framework was to determine the most common factors affecting on the processes and pilgrim flow in the arriving domain at these terminals based on users' and providers' perspectives considering the current situation of the system during peak seasons such as the Hajj season.

Therefore, several solutions were proposed to facilitate the flow of pilgrims through HTs, thus reducing waiting times and bottlenecks and increasing pilgrims' satisfaction. These scenarios were translated and applied using the simulation model and what-if scenario analysis to determining influence factors and then suggesting solutions based on these factors. In the final stage of this phase, we present and explain the final framework.

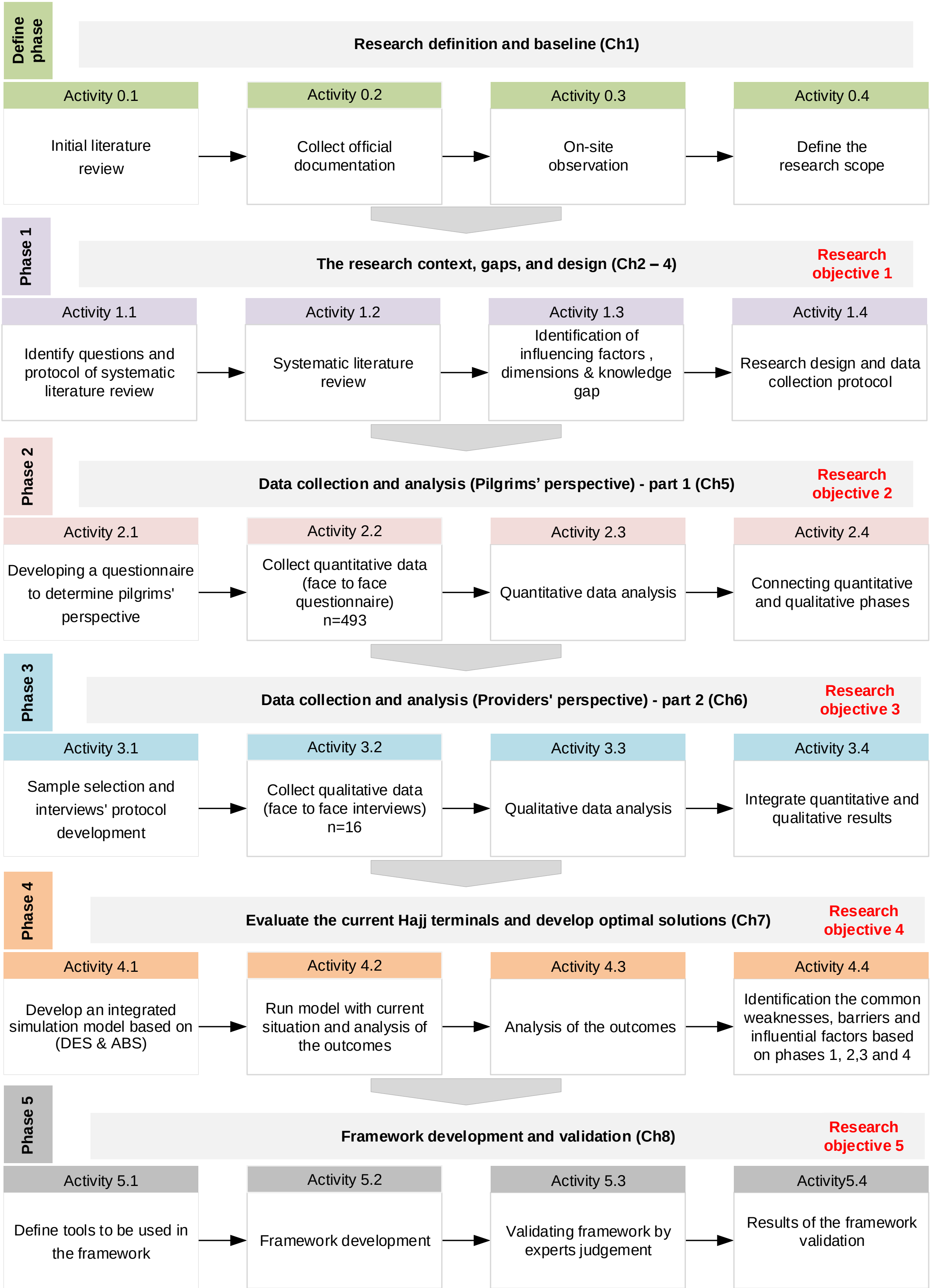


Figure 4-4 Overview of research methodology

4.6 Summary

To choose a proper methodology for research related to a particular project, the researcher must review the philosophical basis of scientific research and methodologies and be aware of how this choice affects the research questions, data type and results. Since there is no optimal methodology, the researcher needs to understand the limits and benefits of all research methodologies. Therefore, the researcher has reviewed the philosophies and methodologies of scientific research in general through this chapter to determine the proper methodology for achieving the aim of this research.

In conclusion, this chapter indicates the applicability of the research process that will be used to evaluate the alternatives for improving the efficiency of the passenger arrival processing system at HTs. Based on the nature and background of this research and the assessment of the available research philosophies in the literature, the author became convinced that the pragmatism philosophy is the most appropriate philosophy for this study. Hence, the design of this study is a flexible one based on sequential explanatory mixed methods. The mixed-methods approach applied here focuses on acquiring data from the employees, customers and industry and organisational figures and the simulation of the system as it is currently deployed. That is, it focuses on verification through a sequential integrated model of quantitative and qualitative methods and the realistic simulation of the environment of HTs to determine the areas that should be expanded and the way this should be addressed to enhance efficiency and effectiveness in addressing the needs of the many passengers attending the Hajj.

In addition, the researcher discussed the issues of validity, reliability, trustworthiness and triangulation as well as the stages of the research. The following chapter presents the results of a critical analysis of the arrival processing performance of HTs based on historical data and users' perspect

5 CHAPTER FIVE: QUANTITATIVE DATA ANALYSIS OF USERS' PERSPECTIVES AND HISTORICAL DATA

5.1 Introduction

This chapter seeks to identify the arrival of pilgrims and the operating capacity of HTs according to the quantitative analysis of users' perspectives and the historical data on the arrival of pilgrims. Therefore, this chapter consists of two main sections: the analysis of the annual arrival of pilgrims and the analysis of users' perspectives.

The first section focuses on the analysis of historical data. The historical data section is split into two subsections: annual pilgrims arriving at HTs and HTs' operating capacity according to annual arrival of pilgrims.

The second section of this chapter examines users' perspectives on the characteristics of the flow of pilgrims through arrival terminal processes in HTs. This section consists of two main subsections: 1) data-collection and analysis methods and 2) results.

The part on data-collection and analysis methods contains five sections: participants and procedure, sample and data collection, questionnaire design, data screening and data analysis. The results section contains seven subsections: general variables, pilgrims' perceptions of processes, additional time and total time spent, comparison of processes, interaction of pilgrims' human factors with system, correlation of waiting/processing time with pilgrims' evaluations and satisfaction and relationship between process evaluation and overall satisfaction. Each subsection delivers the results as concisely as possible while providing enough detail to enable the reader to understand precisely what was done in terms of the analysis of the data regarding users' perspectives on the flow of pilgrims through the arrival terminal processes.

5.2 Analysis of historical data

The aim of this section is to demonstrate the annual arrival of pilgrims utilising the historical data on the annual arrival of pilgrims from Jeddah and Medina Airports. The datasets describe the actual arrival of pilgrims and operation capacity for each airport annually from 2013 to 2017.

The first section employs historical data obtained from GACA Saudi Arabia. These data include the historical data for arriving pilgrims between 2013 and 2017 and the operating capacity information for the HTs at Jeddah and Medina Airports. Therefore, this section is made up of two main parts: annual growth of arriving pilgrims and operating capacity performance.

5.2.1 Analysis approach

The empirical analysis presented in this section is based on the annual growth of arriving pilgrims. Furthermore, it identifies and evaluates the annual arrival of pilgrims to disaggregate the annual data of arriving pilgrims obtained from GACA into hourly data of arriving pilgrims. Then, it compares the airport operating capacity (maximum capacity of pilgrims arriving per hour) and actual events (actual number of pilgrims arriving per hour) of the HTs at both airports to evaluate the airport operating capacity performance.

5.2.2 Results of historical data analysis

5.2.2.1 Annual growth of arriving pilgrims

To analyse the annual arrival of pilgrims, this subsection explores the number of pilgrims arriving at each airport from 2013 to 2017 and computes the annual growth. Therefore, this section illustrates and evaluates arrival trends to help show the demand and possible crowding phenomenon of HTs over time.

Figure 5-1 below illustrates the number of pilgrims arriving at the HT at Jeddah Airport from 2013 to 2017. It shows that there is a relatively stable trend from 2013 to 2015, while it decreases in 2016 and then increases in 2017.

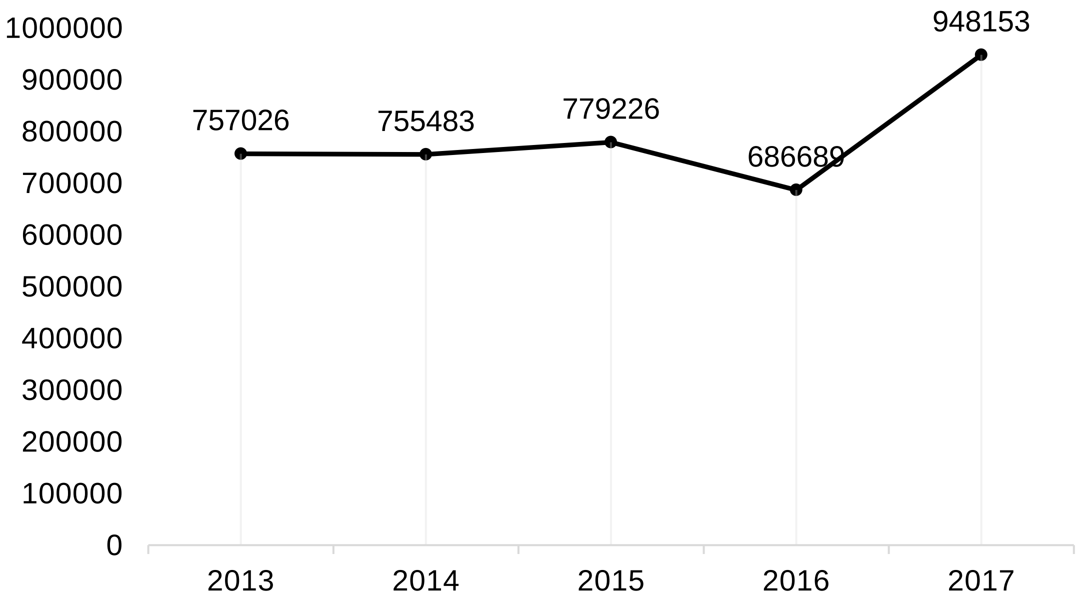


Figure 5-1 Total number of pilgrims arriving at HT - Jeddah Airport's 2013–2017

Figure 5-2 illustrates the number of pilgrims arriving at the HT at Medina Airport from 2013 to 2017. Despite a slight decrease from 2013 to 2014, the total number of pilgrims arriving at Medina Airport shows a positive trend over the years.

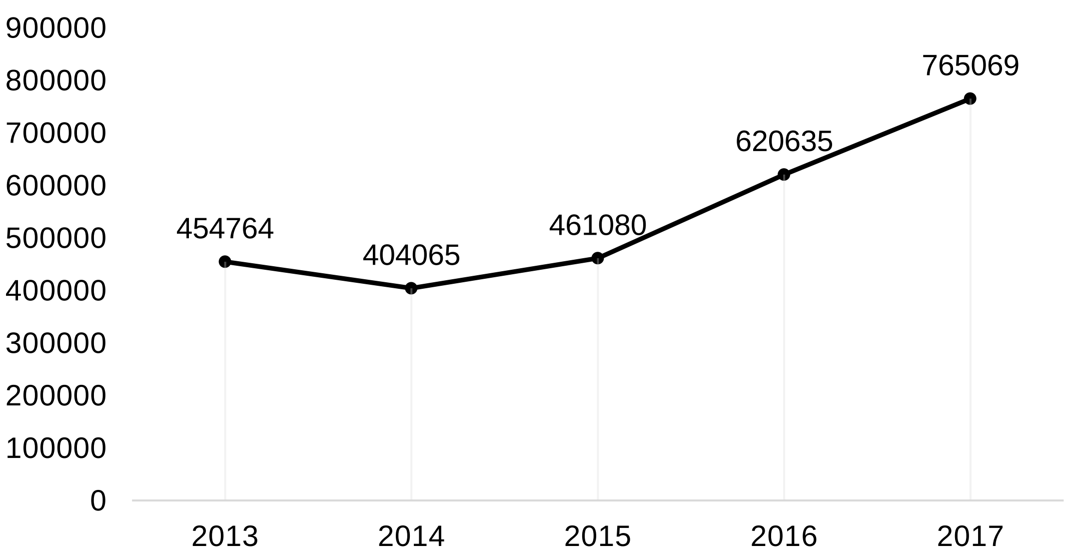


Figure 5-2 Total number of pilgrims arriving at HT - Medina Airport's 2013–2017

Hence, the annual growth rate of the total number of pilgrims arriving at Jeddah and Medina Airports is computed in Table 5-1 below. It can be noticed that the average annual growth rate of the total number of pilgrims arriving at Jeddah Airport from 2014 to 2017 is 7%, while that for Medina Airport is 15%.

Table 5-1 Growth rate of total number of pilgrims arriving at HTs - Jeddah and Medina Airports

Year	Jeddah Airport		Medina Airport	
	Total Pilgrims Arriving	Growth Rate	Total Pilgrims Arriving	Growth Rate
2013	757,026		454,764	
2014	755,483	0%	404,065	-11%
2015	779,226	3%	461,080	14%
2016	686,689	-12%	620,635	35%
2017	948,153	38%	765,069	23%

Furthermore, the descriptive statistics are computed to display the total number of pilgrims arriving at Jeddah and Medina Airports in the Hajj season. The total number of pilgrims arriving at Jeddah Airport from 2013 to 2017 is 3,926,577, while that for Medina Airport is 2,705,613.

Table 5-2 below shows that the average number of pilgrims arriving at Jeddah and Medina Airports annually is approximately 785,315 and 541,122 from 2013 to 2017, respectively. For Jeddah Airport, the average (approximately 785,315) is greater than the median (757,026), indicating that the total distribution is slightly positively skewed. In addition, the average number of pilgrims arriving at Medina Airport (approximately 541,122) is greater than the median (461,080), indicating that the total distribution is slightly positively skewed.

Table 5-2 Descriptive statistics of total pilgrims arriving at HTs

Descriptive statistics	Jeddah Airport	Medina Airport
Mean	785,315.4	541,122.6
Standard Error	43,572.1206	66,754.63398
Median	757,026	461,080
Standard Deviation	97,430.2235	149,267.8994
Range	261,464	361,004
Minimum	686,689	404,065
Maximum	948,153	765,069
Total Pilgrims 2013–2017	3,926,577	2,705,613

5.2.2.2 Evaluation of HTs' operating capacity based on arriving pilgrims

- Jeddah Airport

According to GACA (2017), the operating capacity of Jeddah Airport's HT is 1,500 pilgrims per hour. Moreover, the Hajj event at Jeddah Airport continues for approximately 37 days, which means the event at Jeddah Airport lasts 888 hours (37*24) and the airport can process roughly 1,332,000 pilgrims during that time.

Therefore, this study uses multidimensional cross-classified tables of counts of events based on two categories. The first category accounts for events in which the number of pilgrims is less than or equal to the operating capacity, and the second category accounts for events in which the number of arriving pilgrims exceeds the operating capacity over time (see Figure 5-3).

Of a total of 888 events over five years (actual operation hours), in an average of 696.6, the number of pilgrims was less than or equal to the operating capacity of Jeddah Airport (approximately 78% on average less than or equal to 1,500 per hour), and in 191.4 events, the number of pilgrims exceeded the operating capacity (approximately 22% greater than 1,500 per hour).

Figure 5-3 below is broken down by events to illustrate the actual events classification that accounts for total pilgrims arriving based on the operating capacity at Jeddah Airport.

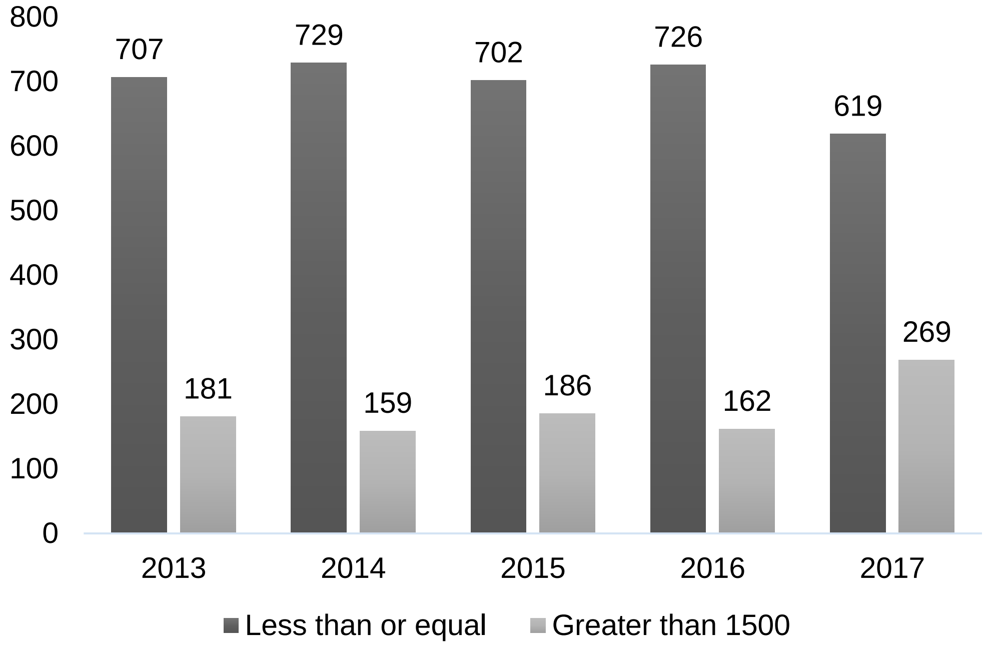


Figure 5-3 Classification summary of pilgrims' arrival events at Jeddah Airport

From the data in Figure 5-4, it can be seen that the majority of events for which demand exceeded the operating capacity at Jeddah Airport were between the 420th and 860th events of the Hajj over the five years.

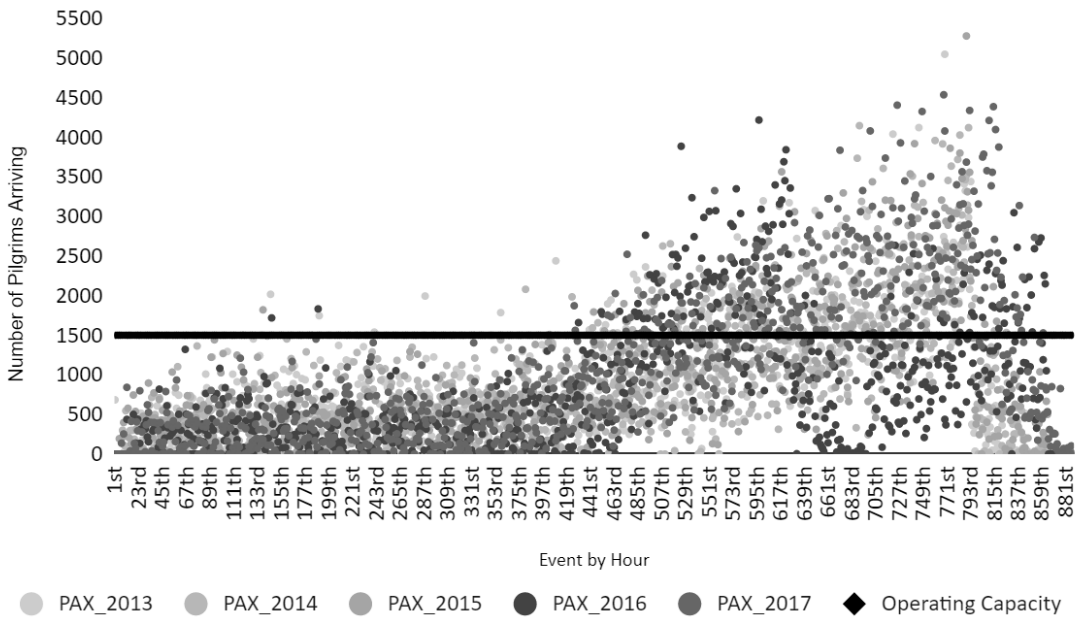


Figure 5-4 Average number of pilgrims arriving during Hajj season 2013–2017 with respect to operating capacity at Jeddah Airport

- Medina Airport

According to GACA (2017), the operating capacity of Medina Airport's HT is 1,200 pilgrims per hour. Moreover, the Hajj event at Medina Airport continues for approximately 36 days, which means the event lasts 864 hours (36*24) and the airport can process roughly 1,036,800 pilgrims during that time.

Figure 5-5 classifies the events related to the number of arriving pilgrims into two categories. The first category accounts for events in which the number of pilgrims is less than or equal to the operating capacity, while the second category accounts for events in which the number of arriving pilgrims exceeds the operating capacity over time.

Of a total of 864 events over five years (actual operation hours), in an average of 720 events, the number of pilgrims was less than or equal to the operating capacity of Medina Airport (approximately 83% on average less than or equal to 1,200), while in 144 events, the number of pilgrims exceeded the operating capacity (approximately 17% on average greater than 1,200 per hour). Figure 5-5 below is broken down by events to illustrate the actual events classification that accounts for total pilgrims arriving based on the operating capacity at Medina Airport.

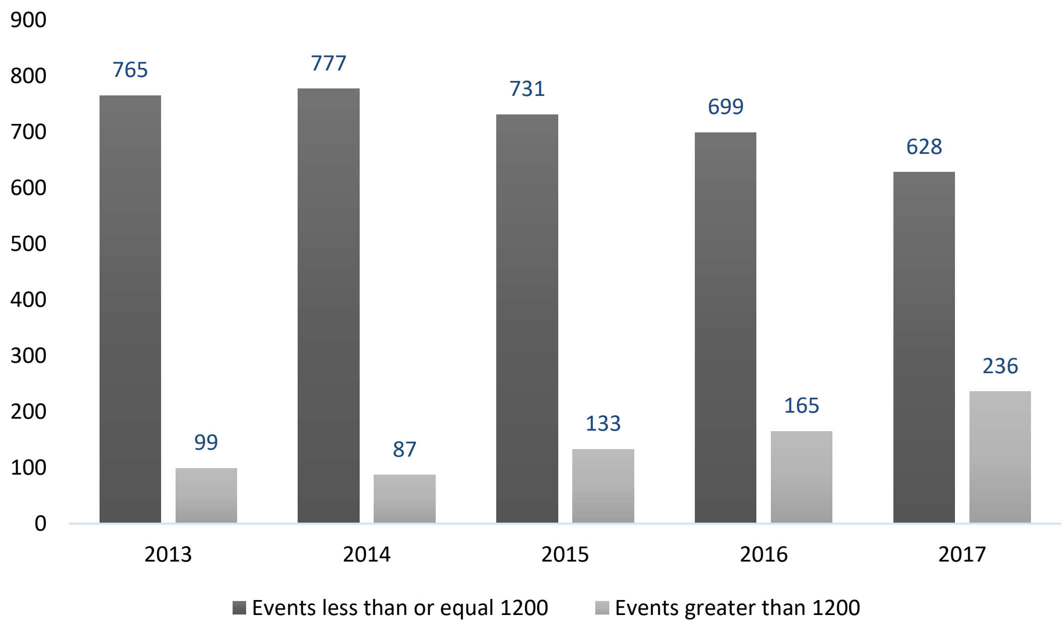


Figure 5-5 Classification summary of pilgrims' arrival events at Medina Airport

Figure 5-6 shows that most of the events for which demand exceeded the operating capacity at Medina Airport were between the 130th and 730th events of the Hajj over the five years.

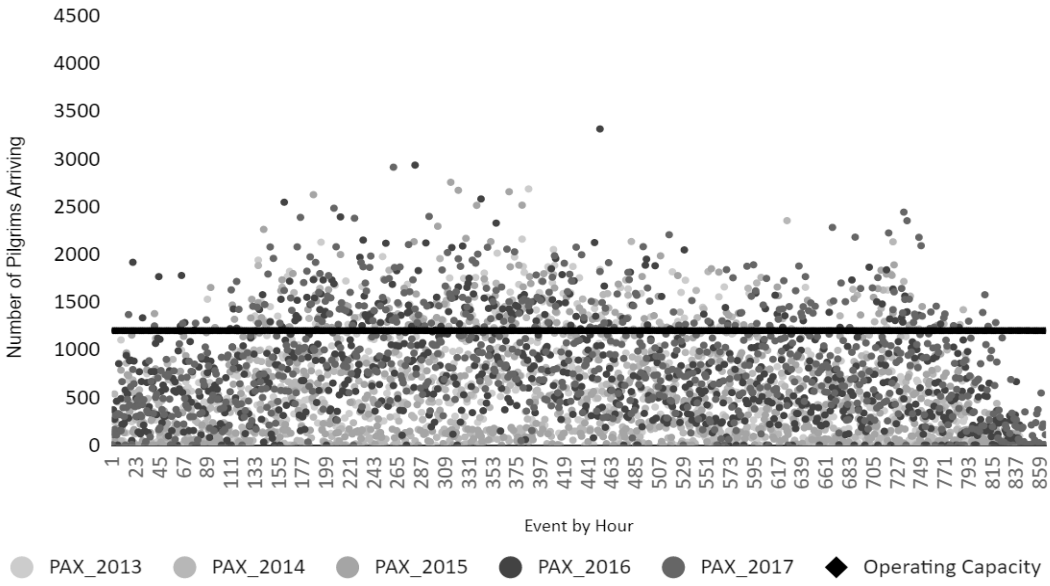


Figure 5-6 Average number of pilgrims arriving during Hajj season 2013–2017 with respect to operating capacity at Medina Airport

5.3 Analysis of users' perspectives

This section discusses pilgrims' experiences with HTs to determine the characteristics of pilgrims' flow through these arrival terminals from their point of view. This section focuses on the aspects of human/passenger factors, operational factors and other service-level standards and criteria to achieve its objective. Thus, this section consists of two main parts, 1) data-collection and analysis methods and 2) results, as mentioned above.

5.3.1 Participants and procedure

The participants in this paper were pilgrims arriving at Jeddah and Medina Airports during the Hajj season of 2018. This study considered various combinations of demographic and social variables. The analytical unit was the individual pilgrim. All participants in this study signed an informed consent form, as per the guidelines of the Cranfield University Research Ethics Committee (CUREC). CUREC granted approval to conduct this survey after requesting and investigating the aims, design, sample and other details of the survey to ensure all parts of the research complied with its regulations, policies and procedures and met the highest ethical standards.

5.3.2 Sample and data collection

Data were obtained by face-to-face questionnaire to gather responses from users of the HTs at Jeddah and Medina Airports at random. Pilgrims arriving at the HTs during both peak and non-peak hours were approached to gather diverse opinions. Moreover, contacting pilgrims at the HTs ensured that they still remembered the experience and enhanced the transfer of their real perceptions of these terminals' processes and services.

The target sample of this study was pilgrims arriving at the HTs at Jeddah Airport and Medina Airport. Following Acharya et al. (2013) and Bryman (2016), we collected the data for each airport based on the stratified sampling strategy. This was used to divide the study target sample into subgroups for each airport based on data history to ensure the collection of diverse experiences. The data history of the two airports showed that there were peak and non-peak times in terms of pilgrims' arrival. Consequently, we collected the data according to two main times, peak (daytime and nighttime) and non-peak (daytime and nighttime), completely randomly, as shown in Table 5-3. We collected 493 questionnaires: 302 responses from the HT at KAIA in Jeddah and 191 from that at Prince Mohammed Bin Abdulaziz International Airport in Medina.

Table 5-3 Stratified sample sizes for data collection

	Jeddah Airport				**Medina Airport**			
	Daytime		Nighttime		Daytime		Nighttime	
	Non-peak	Peak	Non-peak	Peak	Non-peak	Peak	Non-peak	Peak
Number of participants	70	78	49	105	36	63	41	51
	23%	26%	16%	35%	19%	33%	21%	27%
	302				191			
	493							

5.3.3 Questionnaire design

The questionnaire of this study was designed to explore pilgrims' experiences with the arrival processes of HTs. Therefore, following Driver and Johnston (2001), soft and hard attributes were emphasised to meet this objective. Soft attributes include interpersonal characteristics, such as employees' knowledge, helpfulness and fairness. Conversely, hard attributes include characteristics associated with the functions of the processes, such as waiting and processing time, processing efficiency and comfort of space during the processes. However, the attribute related to comfort of space was only applied to the processes of waiting to collect baggage and baggage collection. Based on the above, 29 questions were designed to evaluate the six arrival processes according to pilgrims' experiences and eight questions were designed to evaluate the HTs in general. On the other hand, two general questions on demand status and acceptable waiting time were created to investigate the effect of these two general attributes on pilgrims' perspectives of HTs.

5.3.4 Data screening

5.3.4.1 Descriptive analysis and demographics

In total, 302 respondents from the HT at KAIA in Jeddah and 191 respondents from the HT at Prince Mohammed bin Abdulaziz International Airport in Medina voluntarily answered all of the face-to-face survey questions. Seven demographic variables were included in the survey: gender, age, presence of a disability, Arabic language proficiency, experience with an international airport in the last five years, lifetime experience with HTs and travel party (arrived as part of a group or alone). Table 5-4 demonstrates the frequencies and percentage distribution of these seven demographic variables for the sample. As shown in Table 5-4, the majority of the pilgrims were males at both airports. Specifically, around 70% of pilgrims were males (69.1% at Medina and 72.5% at Jeddah), and only 30% were females.

Moreover, around 40% of the pilgrims belonged to the 50–64 age group. In both airports, pilgrims over 50 represented more than 50% of all surveyed respondents (around 66% in both samples). The cumulative proportion of pilgrims under 50 was around 34% at both Medina and Jeddah Airports. The average age of the pilgrims was 52.96 for the Jeddah sample and 53.15 for the Medina sample.

As shown in Table 5-4, only around 11% of pilgrims at Jeddah Airport and around 10% at Medina Airport reported having a disability. The majority of the respondents were non-Arabic language speakers (around 80.5% at Jeddah Airport and around 68% at Medina Airport). Nearly 40% of the pilgrims at Jeddah Airport had experience with an international airport, while only 11.5% of the pilgrims at Medina Airport reported that they had experience with an international airport in the last five years. The majority of the pilgrims at both airports reported that they did not have any experience with HTs (91.7% at Jeddah Airport and 94.2% at Medina Airport). Approximately two-thirds of the pilgrims at both airports arrived as part of a group (72.2% and 70.2% at Jeddah and Medina Airports, respectively). Thus, both samples had similar demographic characteristics, excluding experience with international airports. The sample of pilgrims from Jeddah Airport included a much greater proportion of experienced travellers compared with the sample from Medina Airport.

5.3.4.2 Missing data

Users evaluated the six arrival processes of pilgrims within HTs and performed an overall evaluation (OE) of the terminals. These processes included Health Inspection (HI), Passport Control (PC), Baggage Claim (BC), Customs Inspection (CI), Unified Agent Registration (UA) and Bus Connection (BS). Some variables related to pilgrims' assessments of the processes included the option 'Did not notice/use', which indicated user-missing cases for the variables. For example, the first process, HI, did not concern all pilgrims. Around 82.5% of the pilgrims (83.8% at Jeddah Airport and 81.2% at Medina Airport) reported that they went through HI. Thus, around 17.5% of respondents indicated that they 'did not notice/use' it.

Table 5-4 Demographic characteristics of sample

		Jeddah Airport		Medina Airport	
		Frequency	%	Frequency	%
Gender	Male	219	72.52	132	69.11
	Female	83	27.48	59	30.89
	Total	302	100	191	100
Age	Under 18 years old	2	0.66	0	0.00
	18–29 years old	14	4.64	9	4.71
	30–49 years old	87	28.81	56	29.32
	50–64 years old	133	44.04	84	43.98
	65 years or older	66	21.85	42	21.99
	Total	302	100	191	100
Disability status	Yes	33	10.93	19	9.90
	No	269	89.07	172	90.10
	Total	302	100	191	100
Arabic language proficiency	Arabic language	59	19.54	61	31.94
	Non-Arabic language	243	80.46	130	68.06
	Total	302	100	191	100
Experience with international airport	Yes	120	39.70	22	11.52
	No	182	60.30	169	88.48
	Total	302	100	191	100
Experience with HTs	Yes	25	8.28	11	5.76
	No	277	91.72	180	94.24
	Total	302	100	191	100
Travel party	Alone	84	27.81	57	29.84
	As part of a group	218	72.19	134	70.16
	Total	302	100	191	100

Furthermore, there were missing values for the variable related to pilgrims' assessments of BC in terms of availability of baggage carts/trolleys (about 10.60% of the pilgrims at Jeddah Airport). In addition, there were missing values for the pilgrims' evaluations of BS staff based on support tools for people with special needs. Therefore, approximately 22.9% of the pilgrims at Jeddah Airport and 30.9% at Medina Airport reported that they 'did not use it'. Moreover, there were missing values in this process for the variable evaluating BS staff based on courtesy/helpfulness, knowledge/expertise and fairness at Medina Airport (approximately 0.52%). Thus, this percentage of missing values was negligible. There were other missing values reported for overall terminal evaluations, but they were negligible at both airports.

Based on Hair et al. (2013), in this case, the Missing Completely at Random (MCAR) hypothesis was accepted for Jeddah and Medina Airports. Moreover, listwise deletion was used to investigate the relationships between the respondents' characteristics, processing times, pilgrims' evaluations of different aspects of the processes and development options, because the percentage of the missing values of the variables included in the analysis was small enough for the MCAR hypothesis to be accepted for both samples.

5.3.4.3 Normality and reliability

A normality test is a requirement for many statistical tests, including correlation, regression, t-tests and analysis of variance (ANOVA), where an underlying parametric testing assumption is that the data are normal (Mishra et al., 2019). In addition, in the case of multivariate data analysis, the normality is the main assumption, and it is evaluated by two main methods: graphical and numerical (Campbell, Machin and Walters, 2007). Benchmarking the shape of the data distribution for a particular item against the normal distribution curve can reveal the normality.

Usually, two parameters can be used to determine non-normal data: sample size and non-normal data distribution (Hair et al., 2013). The sample size parameter is of particular importance, where a large sample size has less error, higher statistical capacity and fewer issues related to non-normal data than a small sample. In addition, the central limit theorem states that violation of normality is not a major issue when the sample size is 100 or over (Altman and Bland, 1995). Regarding shape criteria, skewness and kurtosis are used to check if the shape follows a normal distribution (Kim, 2013).

This study's sample size, 302 in Jeddah and 191 in Medina, was sufficient to establish the normality of the data. Furthermore, the results demonstrated that the skewness and kurtosis for all factor scores ranged from -2 to +2, which indicates the insignificant departure of the scores' distribution from a normal distribution (Kim, 2013). Therefore, the t-test could be used to compare factors' scores between airports and within each airport.

On the other hand, the reliability of the constructs was tested using Cronbach's alpha. According to Awang (2012) and Hair at al. (2013), a Cronbach's alpha value of 0.6 or higher indicates a reliable level of internal consistency and a value of 0.7 or higher indicates high reliability. According to Table 5-5, all constructs representing pilgrims' internal evaluations of processes within the pilgrims' flow in HTs had high levels of reliability.

Table 5-5 Reliability of constructs (Cronbach's alpha) representing pilgrims' internal evaluations of arrival processes in HTs

		Airport	
Construct	N item	Jeddah	Medina
HI	4	0.859	0.730
PC	5	0.883	0.862
BC	4	0.781	0.850
CI	5	0.865	0.830
UA	5	0.920	0.782
BS	5	0.839	0.725
Pilgrims' overall experience (RE)	10	0.891	0.861

5.3.5 Data analysis

Different statistics were used based on the seven results subsections in this section, wherein the chi-squared test and t-test were applied to the analysis of the general variables. An unpaired t-test was also used to compare the pilgrims' average assessment of the different aspects for each arrival process across HTs at both airports. Within each airport, the ratings were listed in descending order based on average scores. The significance of the differences between scores with various ranks was tested for each airport using a paired t-test.

Furthermore, t-tests were applied to compare variables' scores within and between airports, while the chi-squared test was used to study the proportion of respondents who spent additional time and the total time spent at both airports. Furthermore, a one-way ANOVA and t-test were used with study the interaction of pilgrims' human factors with the system.

On the other hand, correlation and regression analysis were used to evaluate the relationships between the waiting and processing time and pilgrims' evaluations and satisfaction. Structural Equation Modelling (SEM) was later used to analyse the relationships between pilgrims' evaluations of each process within the flow of pilgrims in HTs and their overall satisfaction. The data were analysed using IBM SPSS 25.

5.3.6 Analysis of general variables

Four general questions related to the demand status, method of disembarkation, walk time from the gate to the first inspection point and maximum acceptable waiting time were asked at both airports. Table 5-6 indicates significant differences in demand status and method of disembarkation between the two samples.

Table 5-6 Frequencies and percentage distribution of pilgrims for demand status and method of disembarkation*

	Jeddah Airport		Medina Airport		Test of the differences in proportions	
	Frequency	Percent	Frequency	Percent	χ^2 statistics	p-value
Demand status						
Extremely High	51_a	16.89%	15_b	7.85%		
High	91_a	30.13%	46_a	24.08%		
Considerable	70_a	23.18%	60_b	31.41%		
Moderate	56_a	18.54%	40_a	20.94%		
Low	34_a	11.26%	30_a	15.71%	13.81	0.008
Disembarkation						
Bus	243_a	80.46%	39_b	20.42%		
Jetway	59_a	19.54%	152_b	79.58%	172.31	<0.001

Note: * - Each subscript letter denotes a subset of Hajj arrival terminals: categories whose column proportions do not differ significantly from each other at the .05 level.

The chi-squared test showed a significant difference in the pilgrims' distribution by demand status at the 0.05 level. The Z-test for proportions comparison indicated that the proportion of pilgrims with 'Extremely high' demand status was significantly (at the 0.05 level) higher at Jeddah Airport compared with Medina Airport. In addition, the proportion of pilgrims who reported their demand status as 'Considerable' was significantly higher at Medina Airport in comparison with

Jeddah Airport. All other differences across demand status between pilgrims at the two airports were statistically insignificant. There was an essential difference in the method of disembarkation: the majority of the pilgrims at Jeddah Airport (80.5%) reported using the bus for disembarkation, while this figure was only 20.4% at Medina Airport. This difference was highly statistically significant.

The average walk time [95% confidence interval] from the gate to the first inspection point was 6.27 [6.00 6.55] minutes (median time 5 minutes) for Jeddah Airport and 6.57 [6.27 6.87] minutes (median time 7 minutes) for Medina Airport. Both kurtosis and skewness had values ranging from -2 to +2 (0.60 and 1.31 for the Jeddah sample and -0.95 and -0.04 for the Medina sample), indicating insignificant departure of the data distribution from a normal distribution (Kim, 2013). The t-test was conducted to test the significance of the difference in the average walk times from the gate to the first inspection point between the airports. The results indicated no significant difference ($t=-1.42$, $p=0.155$).

The average acceptable waiting time was 27.17 [25.82 28.52] with a median time of 30 minutes for pilgrims at Jeddah Airport and 27.17 [26.01 28.34] with a median time of 25 minutes for pilgrims at Medina Airport. The t-test indicated no statistically significant differences in the average acceptable waiting time between the two airports ($t=-0.004$, $p=0.997$).

Thus, the two samples showed significant differences in the distribution of the pilgrims by demand status and method of disembarkation. However, the two samples of pilgrims had no statistically significant differences in the average walk time from the gate to the first inspection point or the average acceptable waiting time.

5.3.7 Pilgrims’ perceptions of processes

The pilgrims’ average ratings of the different aspects of each process’s staff were compared across airports using an unpaired t-test. Within each airport, the ratings were ranked according to average scores in descending order. The significance of the differences between scores with various ranks was tested for each airport using a paired t-test.

HI

Table 5-7Table 5-7 Test results of HI process rating exhibits the test results of the HI process ratings, which indicate that both samples have the same pattern. In addition, the highest score was found for staff courtesy/helpfulness followed by knowledge/expertise. The other variables, including waiting time and HI staff evaluated based on inspection efficiency, received the lowest scores. There were extremely statistically significant variations for all scores between the two airports. Furthermore, all scores of HI process variables at Medina Airport were higher than those at Jeddah Airport. For Jeddah Airport, the difference in average scores between staff courtesy/helpfulness and staff knowledge/expertise was highly statistically significant ($p<0.001$), while it was only slightly significant for Medina Airport ($p=0.059$). Moreover, the results of scores and t-tests indicated that differences between the scores based on staff characteristics and based on average waiting time were highly statistically significant for both airports (Jeddah: (H4 vs. H2: $p<0.001$; H5 vs. H2: $p<0.001$), Medina: (H4 vs. H2: $p<0.002$; H5 vs. H2: $p<0.005$)). In addition, all differences between the scores were statistically significant for both airports except at Jeddah Airport, where inspection efficiency (H3) and waiting time (H2) were statistically insignificant (H3 vs. H2: $p<0.158$). On the other hand, all elements in these processes, including waiting time (H2), inspection efficiency (H3), staff courtesy/helpfulness (H4) and knowledge/expertise (H5), had statistically significant differences in the average scores between Jeddah and Medina Airports (H2: $p<0.001$; H3: $p=0.012$; H4: $p=0.001$; H5: $p<0.001$). Therefore, it can be concluded that the waiting time is a weakness of the HI process at both airports.

Table 5-7 Test results of HI process ratings

Variables (Passengers' evaluations of HI staff based on…)	Rank		Average rating		Significance of difference in means	
	J	M	J	M	t-statistic	p-value
Waiting time (H2)	4	3	3.04	3.69	-5.571	<0.001
Inspection efficiency (H3)	3	4	3.1	3.34	-2.51	0.012
Courtesy/helpfulness (H4)	1	1	3.77	4.10	-3.266	0.001
Knowledge/expertise (H5)	2	2	3.55	4.00	-4.407	<0.001
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
H4 vs. H5			6.06	<0.001	1.906	0.059
H4 vs. H3			10.33	<0.001	7.6	<0.001
H4 vs. H2			10.77	<0.001	3.88	<0.002
H5 vs. H3			6.96	<0.001	6.512	<0.001
H5 vs. H2			8.03	<0.001	2.82	0.005
H3 vs.H2			1.42	0.158	-5.89	<0.001

J: Jeddah; **M**: Medina

PC

The second arrival process at HTs is PC. In this phase, the pilgrims were asked to evaluate this process based on waiting time (I1), processing time (I2) and inspection efficiency (I3), and two elements of the human factors related to this process were included: staff courtesy/helpfulness (I4) and knowledge/expertise (I5). As shown in Table 5-8, the pilgrims gave the lowest score for waiting time and the highest score for processing time.

In terms of human factor variables, the highest scores at both airports were given for staff knowledge/expertise. However, the results showed that inspection efficiency was ranked fourth at Jeddah Airport and second at Medina Airport. In addition, staff courtesy/helpfulness was ranked third at Jeddah Airport and ranked fourth at Medina Airport. All differences between the scores were statistically significant for Jeddah Airport (all: p<0.001, and I2 vs. I5: p=0.001). Meanwhile, at Medina Airport, all the differences between the average scores were significant (all: p<0.001), except those for staff knowledge/expertise (I5) and staff courtesy/helpfulness (I4) (I5 vs. I4: p=0.681). Furthermore, there were no statistically significant differences in the scores for processing time between Jeddah and Medina Airports (I2: p=0.118). All other elements, including waiting time (I1), inspection efficiency (I3), staff courtesy/helpfulness (I4) and knowledge/expertise (I5), had statistically significant differences in the average scores between Jeddah and Medina Airports (I1: p=0.03; I3: p=0.044; I4: p=0.005; I5: p<0.001).

Table 5-8 Test results of PC process ratings

Variables (Passengers' evaluations of PC inspection staff based on…)	Rank		Average rating		Significance of difference in means	
	J	M	J	M	t-statistic	p-value
Waiting time (I1)	5	5	2.10	2.31	-2.174	0.03
Processing time (I2)	1	1	3.36	3.51	-1.568	0.118
Inspection efficiency (I3)	4	2	2.65	2.85	-2.019	0.044
Courtesy/helpfulness (I4)	3	4	2.86	2.59	2.805	0.005
Knowledge/expertise (I5)	2	3	3.18	2.60	5.580	<0.001
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
I2 vs. I5			3.399	0.001	9.995	<0.001
I2 vs. I3			12.630	<0.001	7.150	<0.001
I2 vs. I4			7.831	<0.001	10.043	<0.001
I2vs. I1			-16.104	<0.001	13.832	<0.001
I5 vs. I3			-8.411	<0.001	-4.371	<0.001
I5 vs. I4			-5.789	<0.001	0.411	0.681
I5 vs. I1			-14.331	<0.001	4.694	<0.001
I3 vs. I4			-3.944	<0.001	4.579	<0.001
I3 vs. I1			-9.371	<0.001	7.459	<0.001
I4 vs. I1			-15.666	<0.001	4.283	<0.001

J: Jeddah; **M**: Medina

BC

The third arrival process at HTs is BC. In this phase, the pilgrims were asked to rate this process based on different attributes, including baggage collection waiting time (B2), level of comfort of space around carousels (B3), helpfulness of support staff (B4) and availability of baggage carts/trolleys (B5). The results of the BC process evaluation are presented in Table 5-9.

Waiting time was rated the lowest at both airports, similar to the two previous processes, while both airports had the highest average scores for the availability of baggage carts/trolleys and the helpfulness of support staff. The difference between Rank 1 and Rank 2 scores was also statistically significant at both airports (B4: $p<0.001$; B5: $p=0.044$). There were no differences in the pilgrims' assessments of the level of comfort of the space around the carousels between the two airports, and it was ranked third at both airports. Furthermore, the difference in ratings between the baggage collection waiting time and the level of comfort of the space around the carousels was insignificant for Medina Airport (B3 vs. B2: $p=0.136$). The pilgrims' evaluations of the baggage collection waiting time and the helpfulness of the support staff at Jeddah Airport were significantly lower than those at Medina Airport (B4 vs. B2, Jeddah and Medina: $p<0.001$). Moreover, the difference in ratings between the level of comfort of the space around the carousels and the helpfulness of support staff at Jeddah Airport was statistically insignificant (B4 vs. B2, Jeddah: $p=0.093$).

Table 5-9 Test results of BC process ratings

Variables (Passengers' evaluations of BC based on…)	Rank J	Rank M	Average rating J	Average rating M	Significance of the difference in means t-statistic	Significance of the difference in means p-value
Baggage collection waiting time (B2)	4	4	2.25	2.74	-4.325	<0.001
Comfort of space around carousels (B3)	3	3	2.98	2.82	1.448	0.148
Helpfulness of support staff (B4)	2	1	3.04	3.65	-5.628	<0.001
Availability of baggage carts/trolleys (B5)	1	2	3.57	3.36	2.025	0.044
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
B5 vs. B3			7.119	<0.001	5.673	<0.001
B5 vs. B4			7.071	<0.001	-4.014	<0.001
B5 vs. B2			16.113	<0.001	6.551	<0.001
B3 vs. B4			-1.687	0.093	-10.893	<0.001
B3 vs. B2			11.240	<0.001	1.497	0.136
B4 vs. B2			12.119	<0.001	12.378	<0.001

J: Jeddah; **M**: Medina

CI

The fourth arrival process at HTs is CI. In this phase, the pilgrims were asked to rate this process based on five aspects, including waiting time (C1), processing time (C2), inspection efficiency (C3), staff courtesy/helpfulness (C4) and staff knowledge/expertise (C5). The results of the CI process assessment are reported in Table 5-10. Based on these results, the ranking of these five aspects of the CI process in each airport was performed.

Staff courtesy/helpfulness was ranked the highest at Jeddah Airport, while it received the second-highest rank at Medina Airport. Staff knowledge/expertise was ranked second at Jeddah Airport and fourth at Medina Airport. Inspection efficiency was ranked fourth at Jeddah Airport and third at Medina Airport.

Processing time was ranked the highest at Medina Airport, while it was ranked third at Jeddah Airport. Finally, waiting time received the lowest ranking at both airports.

All differences between aspects' scores were statistically significant in the case of Jeddah Airport and excluding the difference in scores between staff knowledge/expertise and inspection efficiency in the case of Medina Airport (all at $p<0.05$ significance level except C5 vs. C3 at Medina Airport: $p=0.238$). All five aspects received higher ratings at Medina Airport than at Jeddah Airport (significance level $p<0.05$).

Table 5-10 Test results of CI process ratings

Variables (Passengers' evaluations of CI based on…)	Rank		Average rating		Significance of difference in means	
	J	M	J	M	t-statistic	p-value
Waiting time (C1)	5	5	2.46	2.71	-2.395	0.017
Processing time (C2)	3	1	3.14	4.08	-11.274	<0.001
Inspection efficiency (C3)	4	3	2.87	3.64	-7.588	<0.001
Courtesy/helpfulness (C4)	1	2	3.44	3.97	-5.984	<0.001
Knowledge/expertise (C5)	2	4	3.29	3.55	-2.524	0.012
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
C4 vs. C5			3.62	<0.001	6.812	<0.001
C4 vs. C2			4.56	<0.001	-2.016	0.045
C4 vs. C3			8.52	<0.001	5.544	<0.001
C4 vs. C1			13.49	<0.001	13.767	<0.001
C5 vs. C2			3.14	0.033	-7.735	<0.001
C5 vs. C3			5.89	<0.001	-1.183	0.238
C5 vs. C1			13.06	<0.001	9.972	<0.001
C2 vs. C3			8.20	<0.001	8.979	<0.001
C2 vs. C1			8.33	<0.001	13.377	<0.001
C3 vs. C1			5.18	<0.001	9.771	<0.001

J: Jeddah; **M**: Medina

UA

The pilgrims rated the UA process based on five attributes. Two aspects—waiting time (U1) and processing time (U2)—were related to hard attributes, while three—registration efficiency (U3), staff courtesy/helpfulness (U4) and knowledge/expertise (U5)—were related to soft attributes. The test results of the UA process evaluation are shown in Table 5-11.

These results indicate that the two samples had different patterns. Processing time scored highest at Jeddah Airport and ranked third at Medina Airport. Courtesy/helpfulness received high scores at both airports (ranked second at Jeddah and first at Medina). Waiting time ranked third at Jeddah Airport but received the lowest score at Medina Airport. Registration efficiency received the same rank (fourth) at both airports. Staff knowledge/expertise had the lowest score at Jeddah Airport but received a high score (ranked second) at Medina Airport. Waiting and processing time received higher scores at Jeddah Airport than at Medina Airport. Staff courtesy/helpfulness and knowledge/expertise received higher assessments at Medina Airport. The differences between these two airports in pilgrims' assessments of all aspects of the UA process were statistically significant, except that of registration efficiency was insignificant (U3: $p=0.78$).

Table 5-11 Test results of UI process ratings

Variables (Passengers' evaluations of UA registration based on…)	Rank		Average rating		Significance of difference in means	
	J	M	J	M	t-statistic	p-value
Waiting time (U1)	3	5	2.90	2.71	1.70	0.09
Processing time (U2)	1	3	3.14	2.84	2.56	0.01
Registration efficiency (U3)	4	4	2.80	2.77	0.28	0.78
Courtesy/helpfulness (U4)	2	1	3.01	3.48	-5.36	<0.001
Knowledge/expertise (U5)	5	2	2.77	3.19	-4.16	<0.001
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
U2 vs. U4			2.34	0.02	-5.98	<0.001
U2 vs. U1			5.44	<0.001	1.93	0.056
U2 vs. U3			6.02	<0.001	0.63	0.533
U2 vs. U5			6.65	<0.001	-3.30	0.001
U4 vs. U1			1.75	0.082	8.20	<0.001
U4 vs. U3			3.39	0.001	10.05	<0.001
U4 vs. U5			4.84	<0.001	5.85	<0.001
U1 vs. U3			1.69	0.093	-0.69	0.494
U1 vs. U5			2.248	0.025	-5.43	<0.001
U3 vs. U5			0.52	0.601	-8.05	<0.001

J: Jeddah; **M**: Medina

BS

Pilgrims evaluated the process of BS by rating six aspects, including processing time (S1), processing efficiency (S2), staff courtesy/helpfulness (S3), knowledge/expertise (S4) and two additional aspects related with human factors: fairness of BS staff (S5) and support tools for people with special needs (S6). Table 5-12 presents the test results of the BS process evaluation.

These results indicate that BS staff fairness received the highest rank for both airports followed by staff courtesy/helpfulness (ranked second for both airports). Staff knowledge/expertise occupied the middle positions at both airports, where it was ranked third at Jeddah Airport and fourth at Medina Airport. Processing efficiency and support tools for people with special needs received the lowest scores at both airports.

All differences in the scores between the different aspects of the BS process were significant for Medina Airport. Conversely, at Jeddah Airport, all the differences in the scores between the different aspects in this process were significant except processing time and staff knowledge/expertise, processing time and processing efficiency and staff knowledge/expertise and processing efficiency (S1 vs. S4: $p=0.83$; S1 vs. S2: $p=0.466$; S4 vs. S2: $p=0.643$). Processing efficiency and support tools for people with special needs received statistically significantly higher scores at Jeddah Airport than at Medina, while staff courtesy/helpfulness and knowledge/expertise received statistically significantly lower scores. The differences in the scores for processing time and staff fairness between airports were statistically insignificant (S1: $p=0.654$; S5: $p=0.738$).

Table 5-12 Test results of BS process ratings

Variables (Passengers' evaluations of BS staff based on…)	Rank		Average rating		Significance of difference in means	
	J	M	J	M	t-statistic	p-value
Processing time (S1)	3	4	2.785	2.733	0.449	0.654
Processing efficiency (S2)	6	5	2.745	2.345	4.173	<0.001
Courtesy/helpfulness (S3)	2	2	3.123	3.447	-3.704	<0.001
Knowledge/expertise (S4)	4	3	2.772	3.079	-3.180	0.002
Staff fairness (first in, first out rule) (S5)	1	1	3.712	3.737	0.335	0.738
Support tools for people with special needs (S6)	5	6	2.760	2.098	5.697	<0.001
Paired samples t-test results			t-statistic	p-value	t-statistic	p-value
S5 vs. S3			8.895	<0.001	5.745	<0.001
S5 vs. S1			11.937	<0.001	9.788	<0.001
S5 vs. S4			14.160	<0.001	11.232	<0.001
S5 vs. S6			16.297	<0.001	21.774	<0.001
S5 vs. S2			12.595	<0.001	19.89	<0.001
S3 vs. S1			4.621	<0.001	6.731	<0.001
S3 vs. S4			6.361	<0.001	6.418	<0.001
S3 vs. S6			9.387	<0.001	20.449	<0.001
S3 vs. S2			5.420	<0.001	16.391	<0.001
S1 vs. S4			0.250	0.83	-2.995	0.003
S1 vs. S6			6.189	<0.001	9.92	<0.001
S1 vs. S2			0.730	0.466	4.13	<0.001
S4 vs. S6			6.494	<0.001	15.001	<0.001
S4 vs. S2			0.464	0.643	10.646	<0.001
S6 vs. S2			-5.868	<0.001	-8.916	<0.001

J: Jeddah; **M**: Medina

5.3.8 General information about additional time spent and total time

In general, 89.4% of the pilgrims at Jeddah Airport reported that they spent additional time at the terminal/airport. The proportion of respondents who spent additional time at Medina Airport was significantly lower at 52.9% (χ^2=83.82, $p<0.001$). Of the pilgrims who spent additional time at the airport, the highest proportion at both airports indicated that they spent additional time after disembarkation (before immigration) and at the waiting area after the plaza, as shown in Figure 5-7.

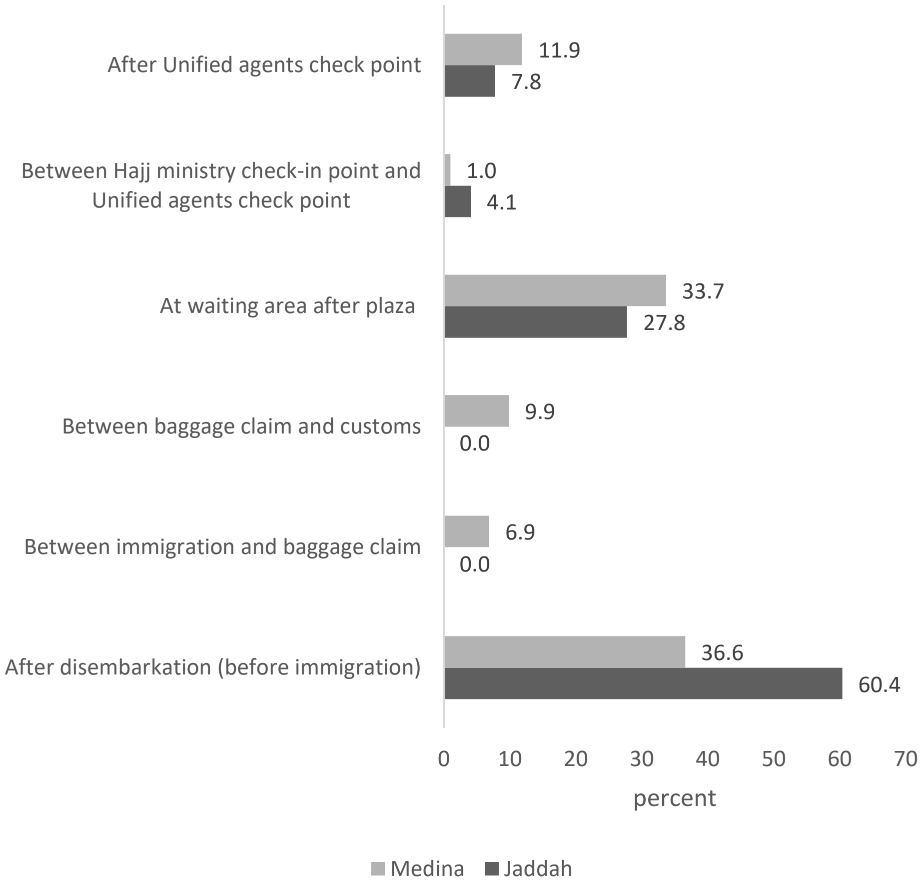


Figure 5-7 Percentage distribution of terminal locations where pilgrims spent additional time

However, at Jeddah Airport, the proportion of pilgrims who spent additional time after disembarkation was more than twice that of pilgrims who spent additional time at the waiting area after the plaza. At Medina Airport, this difference was not very large (36.6% vs. 33.7%). In addition, at Medina Airport, around 7% and 10%

of pilgrims reported that they spent additional time between immigration and baggage claim and between baggage claim and customs, respectively, whereas there were no such pilgrims at Jeddah Airport. The chi-squared test indicated that the differences noted above in airports' distributions of locations where pilgrims spent additional time were statistically significant (χ^2=57.58, p<0.001). Thus, each airport had its own specific areas where pilgrims spent additional time.

5.3.9 Comparison of processes

The pilgrims' Overall Evaluation (OE)s for each process were calculated as the average of the corresponding items, because this method of obtaining factor scores is considered acceptable for the majority of research situations (Tabachnick and Fidell, 2019). In these cases, it was suggested that pilgrims' perceptions of the processes were latent factors. Moreover, all variables with more than 50% missing values for both airports were excluded from the 'Passengers' OEs of HT facilities' construct.

Table 5-13 exhibits the test results of the evaluations of all processes and the OEs. Hence, the results in Table 5-13 show that HI obtained the highest ranks at both airports, and all differences between HI and other processes were statistically significant. CI was ranked second at both airports. BS was ranked third at Jeddah Airport and fifth at Medina Airport. BC was ranked fourth at Jeddah Airport and third at Medina Airport. UA was ranked fifth at Jeddah Airport and fourth at Medina Airport. Finally, PC received the lowest ranks at both airports. From Table 5-13, we can conclude that the processes at Medina Airport had distinct ranks, where the differences between the processes were significant, excluding the BS vs. UA pair, which had a statistically insignificant difference (BS vs. UA: p=0.427). The processes at Jeddah Airport had distinct ranks, where the differences between the processes were significant in most pairs except CI vs. BS, CI vs. BC, BS vs. BC, BS vs. UA, PC vs. UA and BC vs. UA (p=0.408, p=0.144, p=0.382, p=0.128, p=0.083 and p=0.400, respectively).

It should be noted that pilgrims' OE for HT facilities at Jeddah Airport was lower than their separate evaluations of the processes. At Medina Airport, two processes (HI and CI) had higher scores than the OE. In both cases, the OEs differed from the average scores of processes, indicating that the overall perception of HTs is more complex than a simple sum of the perceptions of all processes within the passenger flow and has a latent nature. OEs and evaluations for HI, BC and CI were significantly higher at Medina Airport than at Jeddah Airport. The differences in scores for PC, UA and BS between the two airports were statistically insignificant. In general, the majority of the scores at Medina Airport ranged from 3 (average) to 4 (good), except PC and BS, with scores between 2 (poor) and 3 (average). Meanwhile, the majority of the scores at Jeddah Airport ranged from 2 (poor) to 3 (average), except HI, CI and BS, with scores between 2 (poor) and 3 (average).

Table 5-13 Test results of users' evaluations of all processes

Variable	Rank J	Rank M	Average rating J	Average rating M	Significance of difference in means t-statistic	Significance of difference in means p-value
HI	1	1	3.37	3.77	-4.861	<0.001
PC	6	6	2.83	2.77	0.752	0.452
BC	4	3	2.96	3.14	-2.073	0.039
CI	2	2	3.04	3.59	-7.390	<0.001
UA	5	4	2.93	3.00	-0.792	0.428
BS	3	5	3.00	2.96	0.516	0.606
OE			2.58	3.29	-13.216	<0.001

Paired samples t-test results	Jeddah Airport t-statistic	Jeddah Airport p-value	Medina Airport t-statistic	Medina Airport p-value
HI vs. CI	5.060	<0.001	3.655	<0.001
HI vs. BS	6.881	<0.001	14.327	<0.001
HI vs. PC	8.846	<0.001	16.471	<0.001
HI vs. BC	8.492	<0.001	10.026	<0.001
HI vs. UA	7.845	<0.001	15.464	<0.001
CI vs. BS	0.828	0.408	13.026	<0.001
CI vs. PC	3.948	<0.001	12.897	<0.001
CI vs. BC	1.466	0.144	6.413	<0.001
CI vs. UA	2.111	0.036	11.334	<0.001
BS vs. PC	3.292	0.001	3.041	0.003
BS vs. BC	0.876	0.382	-2.671	0.008
BS vs. UA	1.526	0.128	-0.796	0.427
PC vs. BC	-2.778	0.006	-4.907	<0.001
PC vs. UA	-1.739	0.083	-3.558	<0.001
BC vs. UA	0.843	0.400	2.279	0.024

J: Jeddah; **M**: Medina

5.3.10 Interaction of pilgrims' human factors with system

5.3.10.1 Pilgrims human factors and waiting/processing time

The links between some pilgrims' human factors, such as age, presence of a disability, travel party, experience with international airports and experience with HTs, with process characteristics, such as waiting/processing time, and with overall satisfaction were investigated. A one-way ANOVA was conducted to test the differences among age groups. A t-test was used to compare the means among different groups of pilgrims across other demographic variables.

Gender

There were some significant differences in process characteristics between the two genders for Jeddah Airport. The average CI processing time was longer for males (4.68 min) than for females (4.05 min). Moreover, the additional time spent and the total time to finish all processes in the HT, from disembarkation to leaving the bus terminal, were longer for males (54.61 min and 332.32 min, respectively) than females (44.55 min and 301.66 min, respectively). All other differences were statistically insignificant. There were no significant differences between average process characteristics between males and females for Medina Airport. Therefore, there is only partial evidence suggesting that gender affects CI time, additional time spent and total time to finish all processes in the HT.

Age

The one-way ANOVA indicated that there were no differences in waiting or processing time among the age groups for pilgrims at Jeddah Airport (Table C-5 & Table C-6, Appendix C3). For pilgrims at Medina Airport (Table C-7, Appendix C3), there was a significant difference in the maximum acceptable waiting time ($F=3.963$, $p=0.009$). The pairwise tests (Table C-8, Appendix C3) indicated that pilgrims from the 18–29-year-old age group reported significantly longer maximum acceptable waiting times compared with pilgrims from the 50–64-year-old age group (difference 8.4 min, $p=0.016$). Furthermore, HI waiting time was longer for pilgrims from the 50–64-year-old age group compared with pilgrims from the 30–49-year-old age group (difference 2.49 min, $p=0.049$). All other differences in waiting or processing time among age groups were statistically insignificant. Thus, only one link between age and waiting/processing time (HI waiting time) and only for the Medina sample was found.

Experience with international airports

The t-test indicated no statistically significant difference between pilgrims at Jeddah and Medina Airports who had experience with international airports and pilgrims without such experience.

Experience with HTs

As shown in Table C-9 (Appendix C3), experience with HTs had a significant impact on average PC inspection processing time at Jeddah Airport ($t=-3.94$, $p<0.001$). The pilgrims experienced with HTs had a shorter average PC inspection processing time (3.8 min) compared with the non-experienced pilgrims (5.95 min). All other differences for Jeddah Airport as well as all differences in process characteristics between experienced and non-experienced pilgrims at Medina Airport were statistically insignificant.

Disability status

At Jeddah Airport, disability status (Table C-10, Appendix D) significantly affected only average walk time from the gate to the first inspection point ($t=3.06$, $p=0.004$). The pilgrims with a disability spent more time on average getting to the first inspection point (7.61 min) compared with pilgrims without a disability (6.11 min).

At Medina Airport, the influence of disability status on the duration of the processes was stronger (Table C-10, Appendix C3). Disability status had a significant effect on walk time from the gate until the first inspection point, HI waiting time, PC inspection waiting time, CI waiting time, UA registration waiting and processing time, BS time and the total time to finish all processes in the HT. In all the above processes, the pilgrims with a disability spent more time at Medina Airport compared with the pilgrims without a disability.

Travel party

As shown in Table C-11 (Appendix C3), travel party (alone or as part of a group) had no significant impact on the duration of any of the processes at Jeddah or Medina Airports.

Arabic language proficiency

The t-test (Table C-12, Appendix C3) indicated that pilgrims who spoke Arabic on average spent less time on HI (1.98 min) compared with pilgrims who did not speak Arabic (2.60 min) at Jeddah Airport ($t=-2.73$, $p=0.008$). However, such pilgrims had a longer baggage collection waiting time (27.36 min vs. 23.51 min) ($t=2.09$, $p=0.039$). All other differences in the average duration of the processes at both airports between pilgrims who spoke Arabic and pilgrims who did not speak Arabic were statistically insignificant.

Demand Status

The one-way ANOVA indicated that demand status had statistically significant relationships with the duration of all the processes at Medina Airport (Table C-16, Appendix C3). Pilgrims with a higher demand status had a longer walk time to the first inspection point, HI waiting time, PC waiting time, baggage collection waiting time, CI waiting time, UA registration waiting time, UA registration processing time, BS time and total time to finish all processes in the HT (Table C-13, Appendix C3).

A similar pattern was observed for Jeddah Airport, excluding the walk time to the first inspection point and HI processing time. The pilgrims with a higher demand status had a longer PC waiting time, UA registration waiting and inspection time, BS time and total time to finish all processes in the HT. For the other processes, the pattern was not as clear (the differences between some groups based on demand status were insignificant).

5.3.10.2 Links between passenger human factors and pilgrims' evaluations of system processes

Gender

The t-test indicated that females on average gave higher scores than males for OEs of HT facilities based on the ambiance of the arrival domain at the HT at Jeddah Airport (2.53 vs. 2.25) ($t=2.48$, $p=0.014$). Females also gave higher scores for OEs of HT facilities based on the cleanliness of restrooms/washrooms (WC) (2.83 vs. 2.58) ($t=2.63$, $p=0.009$). All other differences in the OEs of each process and terminal between gender groups were statistically insignificant.

Age

The ANOVA indicated that pilgrims' age in general significantly affected their evaluations of UA registration staff based on courtesy/helpfulness ($F=2.73$, $p=0.03$) at Jeddah Airport (Table C-18, Appendix C3). However, differences between age groups were unclear because pairwise comparisons indicated insignificant results.

A stronger effect of pilgrims' age on their evaluations was found for Medina Airport (Table C-19, Appendix C3). Pilgrims' age significantly affected their evaluations of CI staff based on inspection efficiency ($F=2.87$, $p=0.038$) and their evaluations of BS staff based on courtesy/helpfulness ($F=3.24$, $p=0.023$). In the case of CI efficiency, pilgrims from the 30–49-year-old age group gave a higher average score than pilgrims from the >65-year-old age group (difference 0.589, $p=0.022$).

Moreover, for Medina Airport, age significantly affected a number of pilgrims' OEs, including their OEs of HT facilities based on the comfort of waiting areas and seats ($F=4.09$, $p=0.008$). The pairwise comparison indicated that pilgrims from the 30–49-year-old age group and 50–64-year-old age group gave higher average scores than pilgrims from the >65-year-old age group. Moreover, for pilgrims' OEs of HT facilities based on information visibility/signs ($F=5.78$, $p=0.001$), the pairwise comparison indicated that pilgrims from the 30–49-year-old age group gave a higher average score than pilgrims from the 50–64- and >65-year-old age groups.

Furthermore, for pilgrims' OEs of HT facilities based on ease of navigating the terminal ($F=4.71$, $p=0.003$), the pairwise comparison indicated that pilgrims from the 30–49-year-old age group gave a higher average score than pilgrims from the >65-year-old age group. In addition, for pilgrims' OEs of HT facilities based on walking distance inside the terminal ($F=7.73$, $p<0.001$), the pairwise comparison indicated that pilgrims from the 30–49-year-old age group gave a higher average score than pilgrims from both older age groups.

For pilgrims’ OEs of HT facilities based on the cleanliness of the arrival domain at the HT (F=2.91, p=0.036), pilgrims from the 30–49-year-old age group on average gave a higher score than pilgrims from the >65-year-old age group. For pilgrims’ OEs of HT facilities based on the ambiance of the arrival domain at the HT (F=3.81, p=0.011), pilgrims from the 30–49-year-old age group on average gave a higher score than pilgrims from the >65-year-old age group.

Experience with international airports

For the Jeddah sample, pilgrims’ experience with international airports significantly affected their evaluations of CI and UA processes (Table C-21, Appendix C3). Thus, pilgrims’ evaluations of CI staff based on knowledge/expertise were significantly higher for experienced pilgrims (3.50) than non-experienced pilgrims (3.15) (t=2.69, p=0.008). The pilgrims’ evaluations of UA registration staff based on courtesy/helpfulness and knowledge/expertise were significantly higher for experienced pilgrims (3.19 and 3.03, respectively) than non-experienced pilgrims (2.89 and 2.60, respectively) (t=2.64, p=0.009 and t=2.99, p=0.003, respectively). In addition, the experienced pilgrims gave a higher average score for BS staff based on courtesy/helpfulness (3.35 vs. 2.97, t=2.72, p=0.007). On the other hand, experienced pilgrims’ OEs of HT facilities based on the help offered by and the ease of contacting the information service were higher (2.92 vs. 2.71, t=2.18, p=0.030).

For Medina Airport, no significant differences in processes’ scores between experienced and non-experienced pilgrims were found. However, experienced pilgrims gave higher average OEs of HT facilities than non-experienced pilgrims in two cases: ease of navigating the terminal (4.09 vs. 3.78, t=2.45, p=0.02) and ambiance of the arrival domain at the HT (4.09 vs. 3.70, t=3.71, p=0.001).

Experience with HTs

The t-test (Table C-22, Appendix C3) indicated two cases in which experience with HTs significantly affected the evaluations of the pilgrims at Jeddah Airport. In both cases, experienced pilgrims gave higher scores than non-experienced pilgrims. One case was related to the pilgrims’ evaluations of UA registration staff based on registration efficiency (3.32 vs. 2.75, t=2.06, p=0.04), while the other was related to pilgrims’ OEs of HT facilities based on the ambiance of the arrival domain at the HT (2.72 vs. 2.29, t=2.46, p=0.015).

On the other hand, at Medina Airport, pilgrims’ experience with HTs had a significant impact on their evaluations for BC, CI and PC processes. In all cases, experienced pilgrims gave higher scores than non-experienced pilgrims.

For the BC process, significant differences were found for pilgrims’ evaluations of BC based on the comfort of the space around the carousels (3.64 vs. 2.77, t=2.49, p=0.014) and pilgrims’ evaluations of BC based on the helpfulness of support staff (4.45 vs.3.60, t=2.32, p=0.021).

For the CI process, pilgrims’ experience with HTs had a significant impact on their evaluations of CI staff based on inspection efficiency (4.27 vs. 3.60, t=2.16, p=0.032), courtesy/helpfulness (4.45 vs. 3.94, t=1.98, p=0.049) and knowledge/expertise (4.27, 3.51, t=2.25, p=0.025).

For the PC process, pilgrims’ experience with HTs had a significant influence on their evaluations of PC inspection staff based on courtesy/helpfulness (3.36 vs. 2.54, t=2.35, p=0.020) and knowledge/expertise (3.36 vs. 2.26, t=2.28, p=0.024).

Moreover, the pilgrims’ experience with HTs had a significant influence on their OEs of HT facilities based on the courtesy/helpfulness of airport staff (3.86 vs. 3.46, t=3.67, p=0.002).

Disability status

While the pilgrims with a disability more negatively evaluated overall waiting time in all processes at both airports than pilgrims without a disability (1.27 vs. 1.65, t=-3.73, p=0.001 at Jeddah Airport and 1.68 vs. 2.38, t=-3.61, p=0.001 at Medina Airport). Furthermore, pilgrims with a disability gave lower scores than pilgrims without a disability for HT facilities based on support tools for people with special needs at both airports (1.34 vs. 1.82, t=-3.62, p<0.001 for Jeddah Airport and 1.37 vs. 2.13, t=-3.88, p<0.001 for Medina Airport).

At Jeddah Airport, pilgrims with a disability evaluated PC and BC processes and some overall facilities more negatively than passengers without a disability. In particular, significant differences were found for the following:

PC inspection staff based on inspection efficiency (2.73 vs. 3.08, t=-1.97, p=0.05), waiting time (1.85 vs. 2.27, t=-2.58, p=0.013) and courtesy/helpfulness (2.52 vs. 2.90, t=-2.11, p=0.035)

BC based on the availability of baggage carts/trolleys (3.12 vs. 3.63, t=-2.71, p=0.007)

Passengers' OEs of HT facilities based on information visibility/signs (2.48 vs. 2.80, t=-2.22, p=0.027)

At Medina Airport, pilgrims with a disability scored some aspects of HI, PC, UA registration and BS and some overall facilities more negatively than pilgrims without a disability. In particular, statistically significant differences were found for the following:

HI based on waiting time (3.13 vs. 3.76, t=-2.14, p=0.034) and HI staff based on inspection efficiency (2.75 vs. 3.44, t=-3.22, p=0.004)

PC inspection based on waiting time (1.84 vs. 2.37, t=-2.01, p=0.046)

UA registration based on processing time (2.16 vs. 2.91, t=-2.51, p=0.013)

BS staff based on efficiency (2.00 vs. 2.38, t=-2.08, p=0.048) and BS based on support tools for people with special needs (1.63 vs. 2.18, t=-2.40, p=0.018)

OEs of HT facilities based on the comfort of waiting areas and seats (1.68 vs. 2.18, t=-3.61, p=0.001) at Medina Airport

Travel party

The t-test (Table C-23, Appendix C3) indicated that pilgrims' travel party significantly affected only some aspects of the BC and UA registration processes at Jeddah Airport and the BS process at Medina Airport.

At Jeddah Airport, pilgrims who arrived alone gave lower scores than pilgrims who arrived as part of a group for BC based on baggage collection waiting time (2.02 vs. 2.33, t=-2.02, p=0.045) and for UA registration based on waiting time (2.65 vs. 3.00, t=-2.07, p=0.040). At Medina Airport, passengers who arrived alone evaluated the BS process based on staff fairness (first in, first out rule) more negatively than passengers who arrived as part of a group (3.56 vs. 3.81, t=2.10, p=0.039).

Arabic language proficiency

As shown in Table C-24 (Appendix C3), both airports showed a difference between pilgrims who spoke Arabic and pilgrims who spoke other languages in their evaluations of UA registration staff based on registration efficiency. The non-Arabic-speaking pilgrims gave higher scores (2.89 at Jeddah and 2.92 at Medina Airport) than the Arabic-speaking pilgrims (2.44 at Jeddah and 2.46 at Medina Airport) (t=2.35, p=0.019 for the Jeddah sample and t=2.64, p=0.009 for the Medina sample). The non-Arabic-speaking pilgrims gave on average higher scores for some processes than the Arabic-speaking pilgrims at Jeddah Airport. Statistically significant differences were found for the following evaluations:

Pilgrims' evaluations of HI staff based on inspection efficiency (3.16 vs. 2.79, t=2.13, p=0.035)

Pilgrims' evaluations of BC based on the comfort of the space around the carousels (3.08 vs. 2.58, t=-2.68, p=0.008) and the helpfulness of support staff (3.21 vs. 2.73, t=3.16, p=0.002)

Pilgrims' evaluations of BS staff based on efficiency (2.84 vs. 2.34, t=2.85, p=0.005) and knowledge/expertise (2.84 vs. 2.47, t=2.10, p=0.036)

Pilgrims' OEs of HT facilities based on ease of navigating the terminal (3.23 vs. 3.03, t=2.08, p=0.04) and walking distance inside the terminal (3.42 vs. 3.12, t=3.60, p<0.001)

For the Medina sample, the opposite tendency was found. For the following evaluations, the Arabic-speaking pilgrims gave on average higher scores than the non-Arabic-speaking passengers:

Pilgrims' evaluations of CI based on processing time (4.28 vs. 3.98, t=2.50, p=0.014) and pilgrims' evaluations of CI staff based on inspection efficiency (3.92 vs. 3.51, t=2.66, p=0.009), courtesy/helpfulness (4.21 vs. 3.86, t=2.76, p=0.006) and knowledge/expertise (3.80 vs.3.43, t=2.19, p=0.030)

Pilgrims' evaluations of BS staff based on courtesy/helpfulness (3.65 vs. 3.35, t=2.83, p=0.005)

Pilgrims' OEs of HT facilities based on courtesy/helpfulness of airport staff (3.75 vs. 3.36, t=3.42, p=0.001)

All other differences in evaluations between the investigated groups were statistically insignificant.

Demand Status

The ANOVA indicated that demand status significantly affected the evaluations of all pilgrims at Jeddah Airport (Table C-25, Appendix C3). At Medina Airport, the significance of the link between demand status and pilgrims' evaluations was found for the majority of cases, excluding such evaluations where the link between demand status and process characteristics' scores was insignificant (Table C-27, Appendix C3):

Pilgrims' evaluations of CI staff based on inspection efficiency and courtesy/helpfulness

Pilgrims' evaluations of UA registration staff based on courtesy/helpfulness and knowledge/expertise

Pilgrims' evaluations of BS staff based on courtesy/helpfulness

Pilgrims' evaluations of BS staff based on knowledge/expertise and fairness (first in, first out rule) and of BS based on support tools for people with special needs

Pilgrims' OEs of processing time of all processes and of HT facilities based on the quality of restaurant and eating facilities, information visibility/signs, help offered by and ease of contacting information service, ease of navigating the terminal, courtesy/helpfulness of airport staff and ambiance of arrival domain at HTs

The majority of pilgrims with higher demand status gave lower scores (Table C-27 & Table C-28, Appendix C3) for process characteristics and for HT overall.

5.3.11 Evaluation of correlation of waiting/processing time with pilgrims' evaluations and satisfaction

A p-value of <0.05 was set as the indicator of significance of the link between waiting/processing time and pilgrims' evaluations of each aspect of the processes.

HI process

As shown in Table 5-14, waiting time had a negative influence on pilgrims' evaluations of each aspect of the HI process at both airports, excluding pilgrims' evaluations of HI staff based on knowledge/expertise for which the link was found to be statistically insignificant for Medina Airport.

Table 5-14 Relationships between waiting/processing time and pilgrims' evaluations of HI process

	Jeddah sample				Medina sample			
	Waiting time		Processing time		Waiting time		Processing time	
	β	p	β	p	β	p	β	p
Pilgrims' evaluations of HI based on waiting time	-0.441	<0.001	-0.208	0.062	-3.081	<0.001	-0.088	0.445
Pilgrims' evaluations of HI staff based on inspection efficiency	-0.222	<0.001	0.045	0.693	-0.687	<0.001	0.011	0.923
Pilgrims' evaluations of HI staff based on courtesy/helpfulness	-0.178	<0.001	-0.456	<0.001	-0.096	<0.001	-0.336	0.007
Pilgrims' evaluations of HI staff based on knowledge/expertise	-0.215	<0.001	-0.413	<0.001	-0.091	0.144	-0.243	0.045
HI process average score*	-0.861	<0.001	-0.192	0.002	-0.795	<0.001	-0.136	0. 091

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

Processing time had a significant and negative impact on pilgrims' evaluations of HI staff based on courtesy/helpfulness and knowledge/expertise at Jeddah Airport and on pilgrims' evaluations of HI staff based on courtesy/helpfulness and knowledge/expertise at Medina Airport. Increases of both waiting and processing time significantly and negatively affected the OE of the HI process and staff at both airports.

PC process

As shown in Table 5-15, increases of both waiting and processing time for the PC process significantly and negatively influenced pilgrims' assessments of all aspects of the process and the average PC process score at both airports.

Table 5-15 Relationships between waiting/processing time and pilgrims' evaluations of PC process

	Jeddah sample				Medina sample			
	Waiting time		Processing time		Waiting time		Processing time	
	β	p	β	p	β	p	β	p
Pilgrims' evaluations of PC inspection based on waiting time	-0.52	<0.001	-0.094	<0.001	-0.131	<0.001	-0.683	<0.001
Pilgrims' evaluations of PC inspection based on processing time	-0.013	0.007	-1.503	<0.001	-0.039	<0.001	-1.835	<0.001
Pilgrims' evaluations of PC inspection staff based on efficiency	-0.051	<0.001	-1.044	<0.001	-0.056	<0.001	-0.299	0.003
Pilgrims' evaluations of PC inspection staff based on courtesy/helpfulness	-0.095	<0.001	-0.307	<0.001	-0.054	<0.001	-0.35	<0.001
Pilgrims' evaluations of PC inspection staff based on knowledge/expertise	-0.021	<0.001	-1.225	<0.001	-0.061	<0.001	-0.339	0.001
PC process average score*	-0.639	<0.001	-0.735	<0.001	-0.596	<0.001	-0.436	<0.001

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

BC process

As shown in Table 5-16, increases of waiting time for the BC process significantly reduced all passengers' scores for all aspects of the process and the average score.

Table 5-16 Relationships between waiting time and pilgrims' evaluations of BC process

	Waiting time			
	Jeddah sample		Medina sample	
	β	p	β	p
Pilgrims' evaluations of BC based on baggage collection waiting time	-0.253	<0.001	-0.728	<0.001
Pilgrims' evaluations of BC based on comfort of space around carousels	-0.109	<0.001	-0.722	<0.001
Pilgrims' evaluations of BC based on helpfulness of support staff	-0.102	<0.001	-0.292	<0.001
Pilgrims' evaluations of BC based on availability of baggage carts/trolleys	-0.038	<0.001	-0.188	<0.001
BC process average score*	-0.764	<0.001	-0.815	<0.001

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

CI process

The regression analysis indicated that all coefficients of waiting and processing time were significant at the 0.05 level and negative, as shown in Table 5-17. Thus, increases of waiting and processing time for the CI process had a negative effect on all passengers' evaluations related to this process.

Table 5-17 Relationships between waiting/processing time and pilgrims' evaluations of CI process

	Jeddah sample				Medina sample			
	Waiting time		Processing time		Waiting time		Processing time	
	β	p	β	p	β	p	β	p
Pilgrims' evaluations of CI based on waiting time	-0.657	<0.001	-0.197	<0.001	-0.443	<0.001	-1.303	<0.001
Pilgrims' evaluations of CI based on processing time	-0.019	0.001	-1.661	<0.001	-0.074	<0.001	-0.287	0.001
Pilgrims' evaluations of CI staff based on inspection efficiency	-0.026	<0.001	-3.849	<0.001	-0.047	0.014	-0.229	0.006
Pilgrims' evaluations of CI staff based on courtesy/helpfulness	-0.047	<0.001	-0.468	<0.001	-0.054	0.008	-0.203	0.018
Pilgrims' evaluations of CI staff based on knowledge/expertise	-0.06	<0.001	-0.388	<0.001	-0.095	<0.001	-0.404	0.001
CI process average score*	-0.579	<0.001	-0.732	<0.001	-0.498	<0.001	-0.462	<0.001

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

UA registration process

As shown in Table 5-18, waiting and processing time significantly and negatively influenced all pilgrims' evaluations of the UA registration process for both airports, excluding the evaluations of UA registration staff based on courtesy/helpfulness of pilgrims at Medina Airport. The impact of both waiting and processing time on this evaluation was statistically insignificant.

Table 5-18 Relationships between waiting/processing time and pilgrims' evaluations of UA process

	Jeddah sample				Medina sample			
	Waiting time		Processing time		Waiting time		Processing time	
	β	p	β	p	β	p	β	p
Pilgrims' evaluations of UA registration based on waiting time	-0.886	<0.001	-0.238	<0.001	-0.156	<0.001	-0.286	<0.001
Pilgrims' evaluations of UA registration based on processing time	-0.174	0.001	-0.591	<0.001	-0.793	0.001	-1.69	0.001
Pilgrims' evaluations of UA registration staff based on registration efficiency	-0.101	<0.001	-0.131	<0.001	-0.037	<0.001	-0.068	0.001
Pilgrims' evaluations of UA registration staff based on courtesy/helpfulness	-0.083	<0.001	-0.101	<0.001	-0.011	0.278	-0.022	0.282
Pilgrims' evaluations of UA registration staff based on knowledge/expertise	-0.101	<0.001	-0.116	<0.001	-0.025	0.015	-0.045	0.026
UA process average score*	-0.874	<0.001	-0.884	<0.001	-0.645	<0.001	-0.632	<0.001

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

BS process

As shown in Table 5-19, an increase in processing time had a significant negative impact on all passengers' scores for the BS process at Jeddah Airport. For Medina Airport, an increase in processing time significantly and negatively influenced passengers' scores related to BS based on time and efficiency as well as the average score for the BS process. The impact of an increase in processing time on all other passengers' evaluations related to BS staff was statistically insignificant.

Table 5-19 Relationships between processing time and pilgrims' evaluations of BS process

	Processing time			
	Jeddah Airport		Medina Airport	
	β	p	β	p
Pilgrims' evaluations of BS based on processing time	-0.434	<0.001	-0.161	<0.001
Pilgrims' evaluations of BS staff based on processing efficiency	-0.100	<0.001	-0.036	<0.001
Pilgrims' evaluations of BS staff based on courtesy/helpfulness	-0.049	<0.001	-0.01	0.316
Pilgrims' evaluations of BS staff based on knowledge/expertise	-0.075	<0.001	-0.012	0.218
Pilgrims' evaluations of BS based on staff fairness (first in, first out rule)	-0.03	<0.001	-0.019	0.078
Pilgrims' evaluations of BS based on support tools for people with special needs	-0.038	<0.001	-0.015	0.202
BS process average score*	-0.785	<0.001	-0.458	<0.001

β: Coefficient; ρ: p-value
* Standardised coefficients for linear regression are reported

OEs of HTs

The regression analysis results related to the relationships between the pilgrims' evaluations of HT overall and the total time to finish all processes in the HT, from disembarkation to leaving the bus terminal, are reported in Table.

According to Table 5-20, an increase in the total time to finish all processes in the HT had a significant negative impact on all pilgrims' OEs of the HT at Jeddah Airport, but at Medina Airport, it had a significant negative impact on pilgrims' evaluations of the HT terminal related to time and efficiency.

Moreover, at Medina Airport, an increase in the total time had a negative impact on pilgrims' OEs of HT facilities based on the following:

- Special needs and disabilities support service
- Comfort of waiting areas and seats
- Information visibility/signs

- Walking distance inside the terminal

The relationships between the total time and pilgrims' other evaluations of the HT at Medina Airport were statistically insignificant.

Table 5-20 Relationships between processing time and pilgrims' evaluations of OEs of HTs

	Processing time			
	Jeddah Airport		Medina Airport	
Pilgrims' OEs of…	β	p	β	p
Waiting time for all processes	-0.018	<0.001	-0.038	<0.001
Processing time for all processes	-0.014	<0.001	-0.004	0.021
HT facilities based on cleanliness of WC	-0.018	<0.001	-0.004	0.051
HT facilities based on special needs and disabilities support service	-0.007	<0.001	-0.008	0.002
HT facilities based on comfort of waiting areas and seats	-0.015	<0.001	-0.005	0.004
HT facilities based on information visibility/signs	-0.015	<0.001	-0.004	0.024
HT facilities based on help offered by and ease of contacting information service	-0.013	<0.001	-0.002	0.173
HT facilities based on ease of navigating the terminals	-0.011	<0.001	-0.002	0.241
HT facilities based on walking distance inside terminal	-0.008	<0.001	-0.004	0.039
HT facilities based on courtesy/helpfulness of airport staff	-0.010	<0.001	-0.003	0.125
HT facilities based on cleanliness of arrival domain at HT	-0.021	<0.001	-0.006	0.007
HT facilities based on ambiance of arrival domain at HT	-0.022	<0.001	-0.002	0.225

β: Coefficient; ρ: p-value

5.3.12 Process evaluation and overall satisfaction

SEM modelling was used to test the significance of the relationships between the pilgrims' evaluations of each process within their flow in HTs and their overall satisfaction. The process approach was used to model pilgrims' overall satisfaction. Within this approach, overall passenger satisfaction was associated with the perception of each process within the passenger flow based on waiting time, processing efficiency and staff attitudes.

The two-stage approach proposed by Anderson and Gerbing (1988) was used. In the first stage, a measurement model that included all constructs depicted in Figure 5-8 with all possible correlations was tested to check the reliability and validity of the constructs. In the second stage, SEM according to the framework shown in Figure 5-8 was applied to test the significance of the paths.

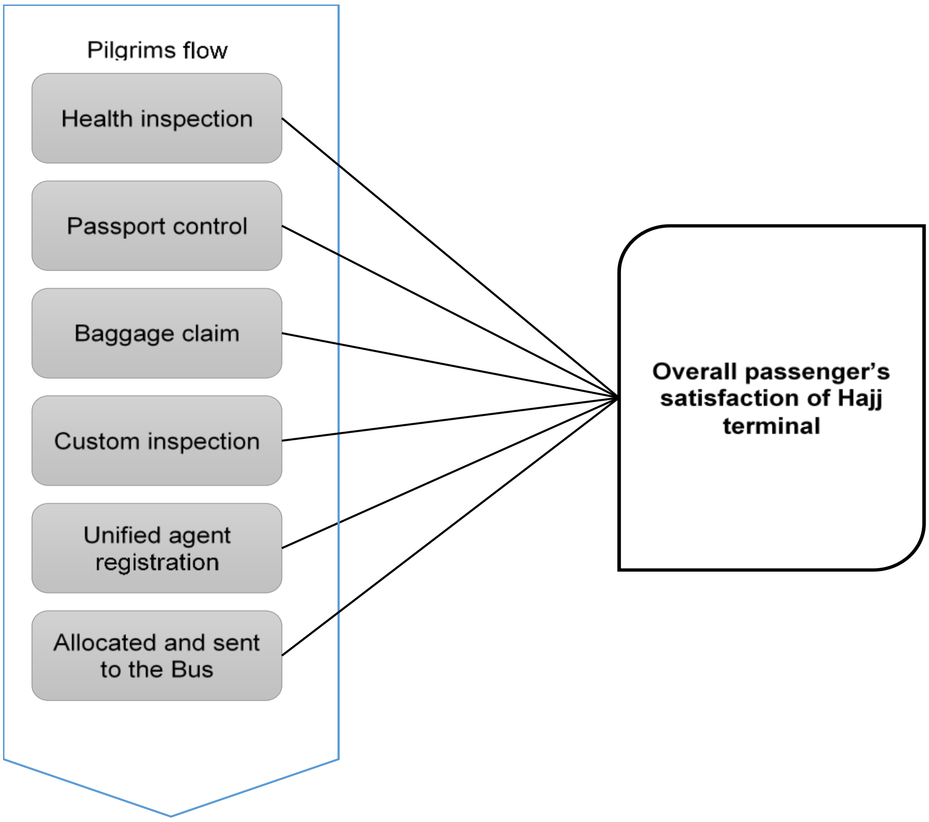


Figure 5-8 Conceptual framework for SEM model

The sample from Jeddah Airport was used for measurement model development and validation. Then both Jeddah and Medina samples were used to test the invariance of the model. The size of both samples (302 for Jeddah Airport and 191 for Medina Airport) was adequate for SEM considering that a minimum sample size of around 200 observations is recommended for these purposes (Kline, 2015). The estimation of the model was conducted using the Amos 25 tool (direct maximum likelihood methods) for handling missing data (Allison, 2003).

The initial measurement model included seven constructs (Figure 5-9,Table 5-21): perceptions of HI, PC, BC, CI, UA and BS and pilgrims' overall experience with the HT (RE). The initial measurement model included 35 observed variables. Six constructs represented pilgrims' perceptions of each process, and one construct represented pilgrims' satisfaction with the HT service overall. The majority of constructs were comprised of two groups of items: those related to the process's waiting/processing time and those related to pilgrims' perceptions of the staff within each process. Considering this, the errors of items that belonged to one group were correlated to distinguish different groups of items within each construct. For the HI process, only one item was related to processing time perception, while for the BC and RE processes, all items represented different aspects of the perceptions of the processes.

Table 5-21 Process of measurement model improvement

Step	Removed item	Reason
Based on correlation matrix		
1	C1, B5, S5	Correlation with items from scale <0.4, high correlation with items from other scales
2	B3	High correlation with items from scale RE (>0.7)
Based on loading values		
1	C1	Lowest loading at step 1 (0.262)
2	S6	Lowest loading at step 4 (0.478)

First, the measurement model fit was estimated using widely used criteria for model fit indices (e.g. $\chi 2/df < 3$, Tucker-Lewis index (TLI) >0.90, comparative fit index (CFI) >0.90 and root mean square error of approximation (RMSEA) <0.08) (Awang, 2012; Kline, 2015). The results indicated the poor fit of the model considering CFI=0.870, TLI=0.833, RMSEA=0.091 and $\chi 2/df=3.49$. Then, a correlation matrix was investigated. Three items were excluded due to low average correlations with items from the same scale (<0.04) and simultaneously high correlations with items from other scales (Table 5-21), and one was excluded due to very high correlations with items from another scale (RE) ($r \approx 0.7$). After this, the results indicated acceptable model fit (CFI=0.916, RMSEA=0.079, $\chi 2/df=3.86$, TLI=0.891). The investigation of the discriminant validity using the correlations between the constructs indicated that the BS construct had high correlations with two other constructs: RE ($r=0.900$) and BC ($r=0.898$), indicating significant overlap between constructs because $r>0.85$ (Awang, 2012). In addition, it suggested that perceptions of the last process in the terminal were 'dissolved' in the overall perception of the HT facilities.

Therefore, the BS construct was removed from the model. The final measurement model after adjustment is displayed in Figure 5-10. After this, the measurement model was estimated. One loading had a value smaller than 0.5 and thus was removed from the model (Hair et al., 2013). All procedures related to item removal were performed step by step, following Awang (2012). In total, five items were removed from the model (Table 5-21). After removing the five items and the BS construct, the final measurement model indicated acceptable fit ($\chi 2/df=2.84$, TLI=0.900, CFI=0.923, RMSEA=0.078). All loadings were highly statistically significant ($p<0.001$) and had values larger than 0.5. Moreover, only one loading had a value less than 0.6, indicating one 'problematic item' (Awang, 2012), and 19 of 26 items had values larger than 0.7, indicating 'ideal items' according to Hair et al. (2013). Harman's single factor test (Podsakoff et al., 2003) indicated no common factor bias (common variance extracted by a single factor was 41.38%).

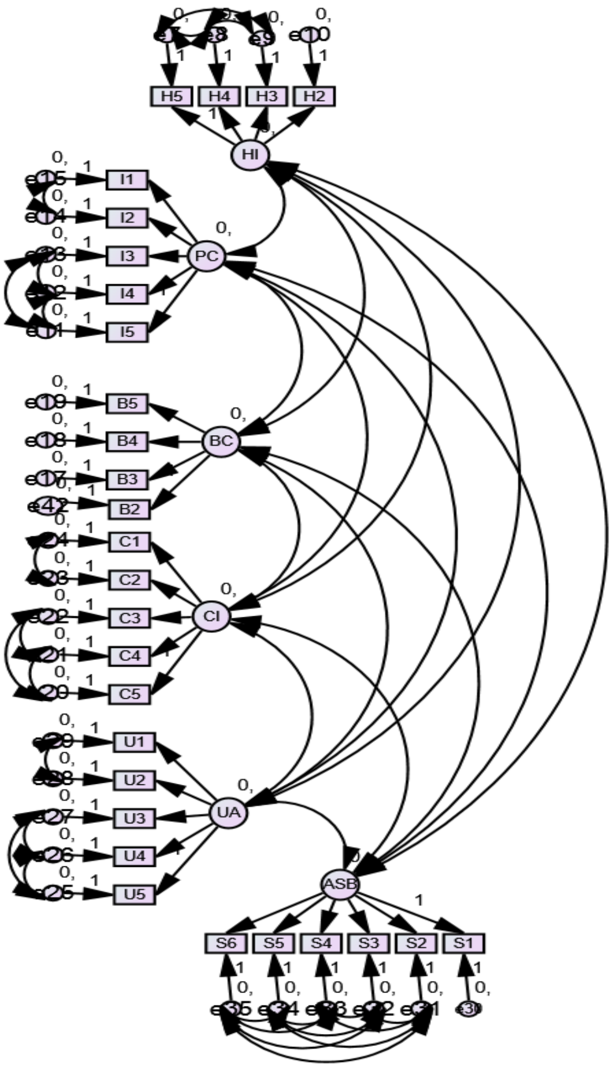


Figure 5-9 Initial measurement model

Then, the reliability, convergent validity, construct validity and discriminant validity of the model were examined (Awang, 2012). To investigate reliability, Cronbach's α and composite reliability (ω) were estimated. As shown in Table 5-22, all scales had Cronbach's α values of 0.73–0.93, exceeding the level (0.70) recommended by Nunnally (1978). Moreover, all ω values were larger than the value (0.70), indicating acceptable composite reliability (Fornell and Larcker, 1981).

Table 5-22 Standardised loading, Cronbach's α, composite reliability and AVE for constructs of final measurement model

	Standardised loading	Cronbach's alpha based on standardised items	Composite reliability	AVE
HI		0.859	0.85	0.60
H5	0.678			
H4	0.555			
H3	0.968			
H2	0.835			
PC		0.88	0.89	0.62
I5	0.662			
I4	0.719			
I3	0.815			
I2	0.872			
I1	0.851			
BC		0.732	0.74	0.59
B2	0.677			
B4	0.85			
CI		0.836	0.92	0.75
C5	0.638			
C4	0.726			
C3	1.267			
C2	0.684			
UA		0.92	0.91	0.68
U5	0.861			
U4	0.747			
U3	0.826			
U2	0.845			
U1	0.842			
Experience with HT facilities		0.932	0.93	0.70
RE1	0.834			
RE2	0.866			
RE3	0.692			
RE4	0.803			
RE5	0.931			
RE6	0.888			

The average variance extracted (AVE) and values of factor loadings were investigated to explore convergent validity. As shown in Table 5-23, all constructs had AVE values exceeding the acceptable level of 0.5 (Hair et al., 2013). As noted above, only one loading value was less than 0.6, and the majority of the loading values were higher than 0.7. Therefore, the model indicated acceptable construct validity. To test the construct validity, model fit indices were examined following Awang (2012). As the measurement model fit was acceptable, the construct validity of the measurement model was supported. To test discriminant validity, the correlations between the constructs were examined. As shown in Table 5-23, the correlation coefficients between all constructs had values less than the acceptable level of 0.85, indicating no significant overlap between the constructs and supporting discriminant validity (Awang, 2012).

Table 5-23 Discriminant validity summary*

	HI	PC	BC	CI	UA	RE
HI	**1**					
PC	0.449	**1**				
BC	0.693	0.535	**1**			
CI	0.078	0.100	0.145	**1**		
UA	0.669	0.560	0.771	0.212	**1**	
RE	**0.613**	**0.511**	**0.830**	**0.160**	**0.810**	**1**

* All correlation coefficients are significant at the <0.001 level

Table 5-23 indicates that HI, PC, BC, CI and UA have positive correlation coefficients with RE. Thus, the perception of each process positively correlated with the overall perception of the HT facilities. As all loadings are significant, all items displayed in Table 5-22 have positive links with perception of the corresponding process.

The measurement model displayed in Figure 5-10 was estimated using the Medina Airport sample. The results indicated very close to acceptable fit ($\chi 2/df=2.29$, TLI=0.863, CFI=0.895, RMSEA=0.082). All regression weights and the majority of the covariances were significant at the 0.05 level, and all covariances were significant at the 0.01 level. Therefore, the configural invariance suggested that the same baseline model (presented in Figure 5-10) should be assumed for both samples. The estimation of the configural model indicated acceptable fit ($\chi2/df=2.56$, TLI=0.887, CFI=0.913, RMSEA=0.056). Thus, the equivalence of the factor structure across groups was supported. Then, to examine the metric invariance, the loadings were constrained across groups, and the new constrained model was estimated. The constrained model indicated nearly acceptable fit ($\chi2/df=2.83$, TLI=0.868, CFI=0.895, RMSEA=0.061). However, the difference in fit indices exceeded the suggested maximum level. That is, ΔTLI=0.019, ΔCFI=0.018 and ΔRMSEA=0.005 exceeded the acceptable levels of <0.01, <0.01 and <0.015, respectively. Thus, the invariance of the factor structure was supported, but the metric invariance (invariance of the loading) was not supported. This indicates that the importance of the different aspects of the processes to passenger perception differed between the two airports.

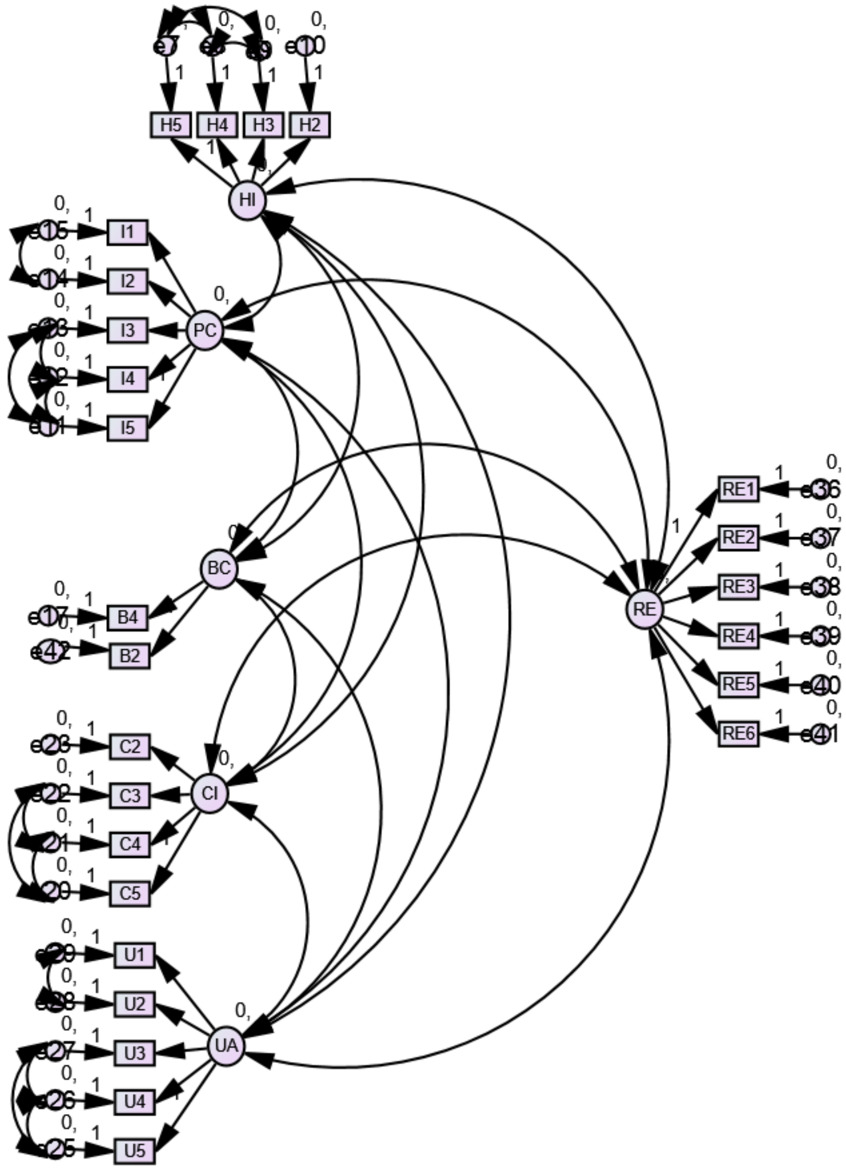


Figure 5-10 Final measurement model

5.4 Summary

This chapter presented the results of the analysis of historical data on the pilgrims that arrived at the HTs at Jeddah and Medina Airports from 2013 to 2017. It also presented the results of the analysis of users' evaluations of the arrival processing performance at HTs. The source and method of data collection for each analysis were included, and all methods of analysis used in this section were discussed.

The results of the analysis of historical data indicated the fluctuation of demand and the presence of a peak time at the HTs at both airports representing 20% of the total pilgrim arrival period. Therefore, there was a negative impact on the LoS and the arrival processing performance at these terminals. The results of the historical data on pilgrims arriving at the HT at Jeddah Airport between 2013 and 2017 showed that there was stability in the direction of demand growth in the first three years (2013 to 2015), a decline in the fourth year 2016 and then a slight increase in 2017. Conversely, at the HT at Medina Airport, there was a positive trend in demand growth every year. Hence, the average annual growth rate in the number of arriving pilgrims at Jeddah Airport and Medina Airport was 7% and 15%, respectively. In addition, the results indicated that the number of arriving pilgrims exceeded the operating capacity of these terminals at both airports for approximately 20% of the total pilgrim arrival hours. As a result, many operational issues occurred during peak times, such as processing delays, long waiting times, poor service, overcrowding and pilgrim congestion.

On the other hand, the second part of this chapter concerning the analysis of pilgrims' perceptions of their flow through the arrival processes of HTs indicated several key results:

- The analysis of the general variables revealed significant differences between the two airports in terms of the distribution of the pilgrims by demand status and method of disembarkation. Conversely, there were no statistically significant differences between the two airports in average walk time from the gate to the first inspection point or average acceptable waiting time.

- The results of the analysis of pilgrims' perceptions of the six arrival processes at the HTs at Jeddah and Medina Airports showed significant differences between the evaluation scores for each process and its aspects. These processes and aspects were ranked in descending order according to average scores, which helped to identify the lowest-scoring processes and the aspects with the most negative impact on performance in these processes. The results showed that PC had the lowest score and that waiting time was the most critical aspect of the majority of processes at both airports. Moreover, the most critical aspect related to staff was efficiency and staff knowledge/expertise. Furthermore, researchers and operators of HTs can use the results of this analysis to create a matrix from the evaluation tables of each process to help to identify the weaknesses and strengths of these terminals.
- The analysis of the additional time and total time spent by pilgrims in arrival processes at HTs revealed that most of the pilgrims who participated in the survey at Jeddah Airport reported that they spent additional time at the terminal/airport. On the other hand, the proportion of respondents who spent additional time at Medina Airport was significantly lower than that at Jeddah Airport. Furthermore, the results indicated that the pilgrims at the two airports spent additional time in different locations (after disembarkation (before immigration), waiting area in plaza, etc.). In addition, the proportion of pilgrims who spent additional time after disembarkation was greater than that who spent additional time in the waiting area in the plaza.
- Also, many test and analysis the author take into consideration in this chapter including interaction between pilgrims' human factors and process characteristics, links between pilgrims' human factors and pilgrims' evaluations of the system processes, correlations of the waiting/processing time with pilgrims' evaluations and satisfaction and the correlation of total time to finish all processes in the HTs with pilgrims' OEs.

- Finally, the result of SEM analysis of test the significance of relationships between pilgrims' evaluations of each process within their flow HTs showed that most processes, including HI, PC, BC, CI and UA, had positive correlation coefficients with RE.

Consequently, all results of the analysis of historical data and the quantitative analysis were discussed in this chapter to identify the characteristics of the flow of pilgrims from the passengers' point of view. The results of the qualitative analysis, reflecting the characteristics of the flow of pilgrims from the providers' perspective, are presented in the next chapte.

6 CHAPTER SIX: QUALITATIVE DATA ANALYSIS OF PROVIDERS' PERSPECTIVES

6.1 Introduction

As discussed in the research methodology chapter, the interview tool was used to collect qualitative data and thematic analysis was employed to analyse the data to achieve the third objective of this research. In addition, the interview tool was used to determine the service providers' viewpoints on the characteristics of the flow of pilgrims through arrival processes at HTs. It was also employed to reveal the views and beliefs of the service providers in HTs and obtain in-depth information about them. Therefore, this tool was necessary to examine and understand the perspectives of authorities and stockholders working in the HTs. On the other hand, the application of this tool was time consuming and presented some difficulties, such as translation, which were able to be overcome. According to Alshenqeeti (2014), interviews are oral encounters, usually face-to-face, in which the interviewer seeks to expose the beliefs and opinions of the participant regarding the phenomenon to be studied.

Hence, thematic coding and analysis, one of the traditional analytical methods for qualitative data, was used to analyse these interviews. In addition, NVivo 12 software was chosen to analyse and code the interviews.

The next section examines and discusses the type of interview selected for this research and explores the sample, participants and steps taken to reach the final analysis.

6.2 Data collection and sampling

Semi-structured interviews were conducted with participants working at HTs at Jeddah and Medina Airports, including airport operators, GACA, the Ministry of Hajj and Umrah, ground services companies, the Ministry of Health, customs, the General Cars Syndicate and the General Directorate of Passports. An official invitation was issued to these organisations at both airports to ask their representatives to participate in this study. These entities were informed that their data would be protected under the United Kingdom Data Protection Act (1998). These organisations nominated participants who could best represent their views on this phenomenon. All participants belonged to these firms’ top management and had an academic background in this type of study. The participants had on average about 15 years’ experience.

Before starting the interviews, the participants were asked to review a form on their rights of data protection and anonymity as mentioned above and provide consent if they wanted to participate in the interview. Sixteen face-to-face interviews were conducted at both airports representing all organisations: ten at Jeddah Airport and six at Medina Airport. Interviewing was ceased when the saturation point was reached and no more new concepts, codes or themes appeared, based on the theoretical saturation method (Charmaz, 2006). Interviews were performed and recorded after obtaining participant consent. Audio recordings were transcribed verbatim for thematic analysis. It was preferred to keep interviews as open as possible in order to obtain new ideas, notes and viewpoints. All interviews were combined to obtain multiple views. Table 6-1 demonstrates the descriptive information on the interview participants.

6.3 Interview design strategy

As mentioned in the research methodology chapter, the main objective of these interviews was to identify the characteristics of the flow of pilgrims through arrival terminal processes from the perspective of providers. Some of the questions of these interviews were designed and adopted based on the results of the quantitative study in the previous chapter. Other questions were designed based on observations that were recorded by the researcher during the monitoring phase of the HTs’ systems and environments in the 2018 Hajj season. Four collections of questions were used in these interviews, as shown in Table 6-2.

Table 6-1 Information on interview participants

Participant	Airport	Position	Experience
R1	KAIA	General Supervisor	6 Years
R2	KAIA	Assistant Director	10 Years
R3	KAIA	Head of International Aviation Baggage Services	10 Years
R4	KAIA	Head of Computer Department	10 Years
R5	KAIA	Supervisor	17 Years
R6	KAIA	Director	30 Years
R7	KAIA	Assistant Director	11 Years
R8	KAIA	Director	36 Years
R9	KAIA	General Manager	17 Years
R10	PMBAI	Assistant Director	7 Years
R11	PMBAI	Head of Passenger Department	29 Years
R12	PMBAI	Coordinator of Patient Quality	8 Years
R13	PMBAI	General Manager	24 Years
R14	PMBAI	Head of Computer Department	11 Years
R15	PMBAI	General Manager	5 Years
R16	KAIA	Director of Hajj and Umrah	22 Years

KAIA: King Abdulaziz International Airport at Jeddah

PMBAI: Prince Mohammed Bin Abdulaziz International Airport at Medina

6.3.1 First collection

The aim of this collection was to uncover in-depth details about all firms and organisations working in HTs and understand the regulations in these terminals. Hence, the participants were asked to describe their organisations, including backgrounds, roles/tasks and all third parties working under them. They were also asked to describe their backgrounds and responsibilities in their organisations. In addition, two other questions addressed the level of coordination between agencies and stockholders in these terminals and information on the steps involved in the processing of pilgrims inside HTs.

Table 6-2 Collections of key interview questions

1. To know in-depth details about all firms and organisations working in Hajj terminals and understand the regulation in these terminals.	
	General question participant in his/her organisations including (background, roles/tasks, third party firm)?
	General question about participant (background, responsibility)?
	General question about steps and processing that should be taken by the pilgrim inside the terminals?
	General question about the level of coordination between agencies and stockholders in these terminals (concerning: operations, solve problems, and development?
2. To examine and describe the level of service in each process in these terminals based on two dimensions (time, space) according to IATA Airport Development Reference Manual (2014) based on providers perspective.	
	Based on information and records about last Hajj season:
Time:	What is the longest, shortest and average time taken by the pilgrim to complete all processes from the disembarkation to leave the terminals via buses?
	What is the maximum, minimum and average time that need from the pilgrim to finish the register and check-in at each process including waiting and processing time?
Space:	Describe the congestions phenomena in the arrival area at Hajj terminals during Hajj season.
	What the crowded area (at any process)?
	What the time is recorded high peak and congestions during Hajj season?
	What are in your opinion the most important solutions for long waiting and congestion of pilgrims?
3. To examine and identify impeding factors, weaknesses and problems affecting operational capacity in Hajj terminals to characterise the flow of pilgrims through arrival terminal processes from the perspective of airport providers	
	Main questions about to understand underlying reasons for delays and long waiting time in arrival processes at Hajj terminals
	Give load impact to these factors and barriers in order to rank it (score out of 100%)
	Questions about the frequent problems and difficulties, pilgrims claim that you face in arrival terminals during Hajj season
	How many percentages of pilgrims with special needs based on total arrival pilgrims in these terminals?
	Questions about pilgrims with special needs in Hajj terminals:
	How many percentages of pilgrims with special needs based on total arrival pilgrims in these terminals?
	How the level of accessibility for these pilgrims?
	What problems and difficulties they face in these terminals?
	Are they considered an obstacle to seamless the flow of pilgrims?
4. General open questions for future work	
	What is the most important point that you advise researchers and developers to care for in order to improve the work progress in Hajj terminals?
	Any other comments or suggestions ?

6.3.2 Second collection

Based on the IATA Airport Development Reference Manual (2014), this set examined and described the LoS in each process in these terminals based on two dimensions; time and space. Thus, the participants were asked about the longest, shortest and average time taken by pilgrims to complete each process and to finish all processes. Other questions covered congestion phenomena in these terminals. The participants were also asked a general question about their opinion on the most important solutions to the problems of pilgrims' long waiting times and congestion.

6.3.3 Third collection

This set, considered the most substantial part of the interview, tried to identify and examine impeding factors, weaknesses and problems affecting operational capacity in HTs to characterise the flow of pilgrims through arrival terminal processes from the perspective of airport providers. Therefore, this collection included questions about underlying factors affecting pilgrims' flow, delays and long waiting time in arrival processes at HTs. Moreover, the participants were asked to give these factors scores out of 100% in order to rank them. The participants were also asked about the frequent problems and difficulties in these terminals. The participants were also asked questions about pilgrims with special needs.

6.3.4 Fourth collection

The aim of this set was to ask open, general questions to collect other comments that were not mentioned in the previous sections. An additional goal was to gather other suggestions and advice from service providers in HTs regarding issues and problems in these terminals in order to improve them.

6.4 Inter-rater reliability

Generally, to ensure the quality and accuracy of any type of data, a reliability test of the data should be applied. Researchers often use different methods to test the quality of the text/coding and consistency of the translation/text to ensure the accuracy and reliability of qualitative data. According to Schreier (2012), the reliability of interviews can be achieved by using two independent coders to independently code a unit or interview and then comparing the results of the two coders and the researcher and verifying the percentage of results matching. This method is called reliability testing by comparison across persons. The reliability of codes can be illustrated by the consistency between coders and auditors, where identical degrees of specific variables are provided to different coders. They are important, as they verify whether the data collected represent these variables. There are different variants of inter-rater reliability analysis, but percentage agreement is one of the most common tests used on this type of data (McHugh, 2012).

Reliability testing was applied in this section of the research in two stages: the transcription and translation stage and the coding stage. In the first stage, two people were randomly assigned to verify the transcription and translation of interviews independently. The quality, accuracy and consistency of the text and translation of these interviews were concluded based on the opinions of the auditors. In the second stage, two raters were assigned to code two randomly selected interviews independently. The initial codes of the first and second raters showed 77% and 83% agreement with the researcher's codes, respectively. Moreover, any contradictions or conflicts were discussed, and the final themes and codes were decided.

As shown in Figure 6-1, the number of new codes generated was high with the first participant. Then, there was a decrease in the number of new codes generated with the increase in the number of participants until it fell rapidly to zero after the tenth participant. Thus, this was the saturation point and no new codes were generated in the final six interviews. Therefore, this study was considered to have sufficient reliability (O'Reilly and Parker, 2013; Walker, 2012).

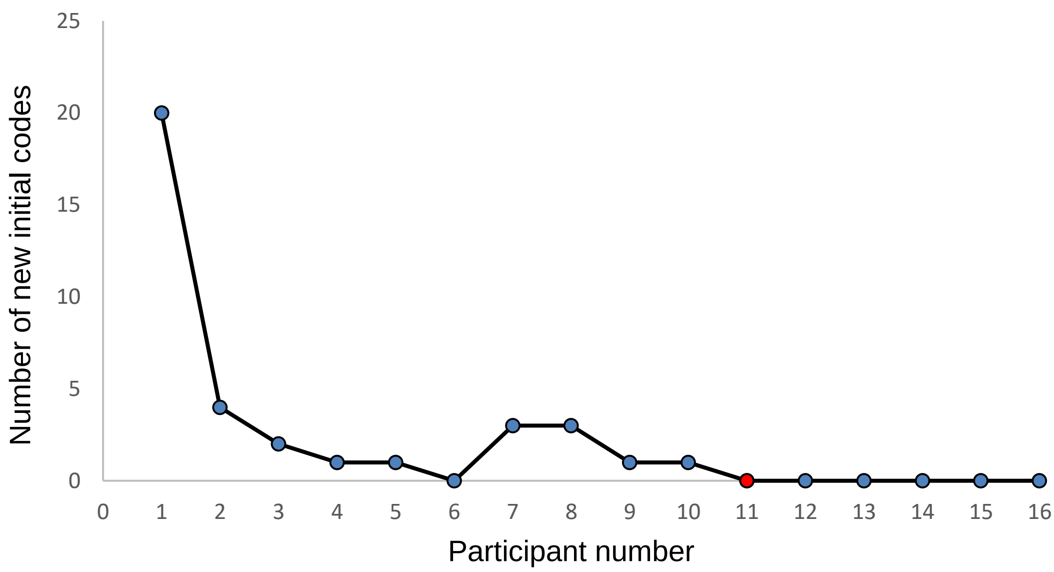


Figure 6-1 Number of new codes as HT provider interviews progressed

6.5 Data analysis

As mentioned in the methodology chapter, thematic analysis was used to analyse the semi-structured interviews. According to Bryman (2016), thematic analysis is one of the most common analysis methods used with qualitative data. In addition, thematic analysis is a process for determining, analysing and reporting patterns within qualitative data (Braun and Clarke, 2006). It is the most flexible type of qualitative data analysis, especially in social studies, as it allows the researcher to choose the theoretical framework (Carpenter and Suto, 2008). Thus, it allows the researcher the flexibility to describe the data comprehensively. One of the important things the researcher should remember when using thematic analysis is to keep the methods as translucent as possible to improve the strength and clarity of the findings.

Several steps were performed to prepare the interview data for analysis, as shown in Figure 6-2. In the first step, all 16 interviews were transcribed and translated from audio recordings into text data. In the second step, the 16 interviews were translated from Arabic into English, resulting in over 51,000 words. Then, all the text data were imported into NVivo 12 coding and qualitative data analysis software for further analysis.

Attempts were also made to maintain the transparency of the analysis procedure and increase the clarity of the results. Hence, following Braun and Clarke (2006), six steps were used to develop the thematic analysis: become familiar with the data, generate initial codes, search for themes, review themes, define themes and write and interpret the results. In the first step, the interview text was read several times to ensure immersion in the data. During this stage, some preliminary notes were taken and ideas were developed before beginning coding.

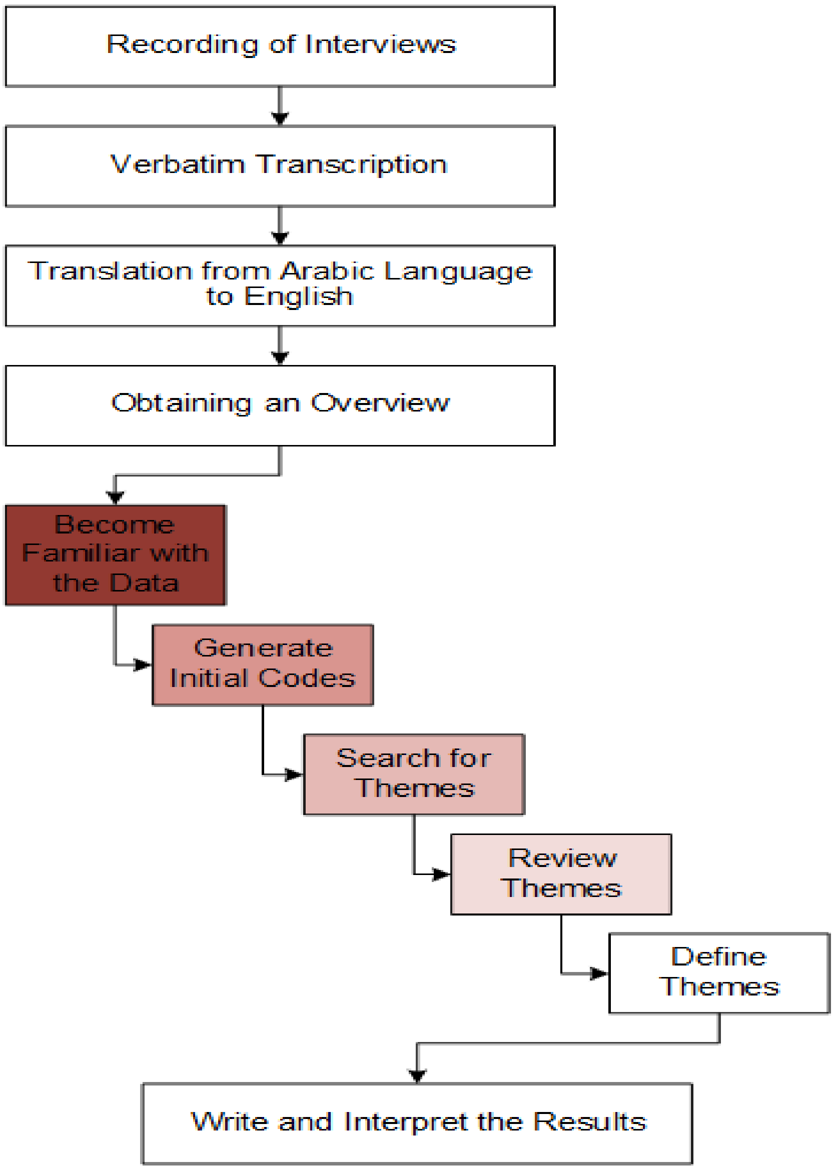


Figure 6-2 Qualitative thematic analysis process

Then, in the second step, initial codes were generated. According to Carpenter and Suto (2008, p.116), codes are 'shorthand labels - usually a word, short phrase or metaphor - often derived from the participants' accounts, which are assigned to data fragments defined as having some common meaning or relationship'. Furthermore, codes play a fundamental role in explaining these data due to the large amount of qualitative data provided. Coding was performed systematically with NVivo 12 software, as mentioned above. In this step, over 547 initial data fragments, including words, lines and segments, were generated from the interviews. Then, similar codes and fragments were grouped together conceptually to generate categories. Hence, this step resulted in 36 initial codes, as shown in Figure 6-3.

1	Age
2	Cultural issues
3	Disability and health issues
4	Language
5	Level experience
6	Level of knowledge and education
7	Cultural issues
8	Irresponsibility
9	Language proficiency
10	Level of knowledge and training
11	Human fatigue
12	Layout and signs issues
13	Capacity allocation issues
14	Lack of flexibility to increase desks or path
15	Type of queue and flexibility
16	Low level of the infrastructure inside the halls
17	Limited parking for buses
18	Shortage in the officers desks and paths
19	Accessibility of special needs people
20	Baggage collection policy
21	Accumulation of the luggage
22	Segregation of pilgrims' baggage
23	Duration of processing time
24	Interference and sequence in the processes
25	Lack of improving the procedures of processing
26	Plenty of processes and repetition of registration
27	Mixed flight (Mail flight)
28	Flight punctuality and bad scheduling
29	Biometric system of identification issues and support
30	Lack of integrated systems
31	Lack of tracking system
32	Lack of using future tools and technology
33	Low level of information technology infrastructure
34	Cooperation of the missions
35	Human resource allocation and scheduling
36	Communication with outside organisations

Figure 6-3 Initial codes

The third step was to look for themes, concentrating on a wider theme level to sort the various codes into potential themes. The maps tool in NVivo 12 and the constant comparison of the data with the data were used to complete this step. Through this process, two hierarchical levels of themes were produced. Then, in the fourth step, the themes were refined by reviewing the coded data and themes in the previous steps. This step aimed to check whether there was a coherent pattern and level of arranging data forms in terms of codes and build a thematic map. The fifth step used ongoing analysis to refine the details of each theme and whole analysis to create definitions and names for each theme. In the last step, the final analysis was completed while taking care to provide sufficient evidence and vivid examples from our data and the final report was written. Hence, this process resulted in 15 sub-themes and 5 main themes, as shown in Figure 6-4. The following section explains the results in detail.

6.6 Results

The following sections provide in-depth details on participants' views on each of the five main components investigated: human factors, infrastructure factors, operational factors, technical factors and organisational factors.

6.6.1 Human factors

6.6.1.1 Human factors – Pilgrims

Operators often had little control over the task demands imposed on them by the system. The effects of systems on the operators who worked within them constituted another seminal influence on human factors. These effects, whether couched in such system concepts as efficiency, safety and system integrity or in such human concepts as stress, boredom, health and well-being, were mediated by general differences between categories of people, such as their age or experience, and by differences between individuals, such as their capabilities, adaptability or tolerance (Hopkin, 2017).

Human factors were investigated from two perspectives: pilgrims and service providers. The human factors related to pilgrims included age, cultural issues, presence of disabilities/health issues, language and communication, experience level and level of knowledge and education.

- **Age**

The results of the interviews on human factors showed that participants had difficulties in dealing with elderly pilgrims.

> ***R16****: The difficulty of dealing with old pilgrims (...).*

Upon delving into the nature of these difficulties, it became clear that the participants faced difficulties in communicating with this group of pilgrims and in completing their security measures, such as obtaining fingerprints.

> ***R10**: As you know, most pilgrims are old, so it is difficult to read their fingerprints.*

The results also showed that there were difficulties in communication between workers in the Hajj organisations and the elderly due to age, language and cultural differences. The difficulties increased in the absence of representatives of delegations or translators who facilitate the translation and communication process.

> ***R10**: However, as I mentioned earlier, many of the pilgrims are old, their education levels are low, they do not know our language and they speak their local languages (...) Sometimes, there is difficulty in communicating with them because of the language, and that leads to delays, as we need to find someone who can help to translate among the employees in the airport of the same nationalities or the members and deputies of missions of these countries.*

> ***R12:** The most important difficulty we face is the difficulty of dealing and communicating with many pilgrims due to the difference in language as well as the low educational level, as the majority of them are old.*

Moreover, the results showed that the elderly pilgrims need special treatment, as some of them suffer from difficulty in movement and use assistive tools such as wheelchairs. Thus, dealing with them takes time due to their special situation.

In conclusion, some obstacles appear due to the different levels of education of workers and pilgrims and the fact that some of them are illiterate. Moreover, the period of Umrah is easier for workers, since most such pilgrims are from young groups who realise the importance of cooperating with workers and the significance of adhering to security directives and other instructions.

> ***R6**: This means that their social traits differ, as the Umrah performer is younger, of better economic and educational status, but the Hajj performer is poorer, older and socially simpler to the extent that he can sometimes be given brochures by a telecom company in the airport, and he may hold them*

and throw away his passport (...) So, he is too simple to know the importance of the passport (...) I am not talking about one person but more than 85% (...).

- **Cultural issues**

The results showed that there are several obstacles due to the absence of a travel culture among foreign pilgrims, as pilgrims often travel in groups. Thus, it is necessary to deal with them as a group, and this causes problems in some cases. For example, if a person has a problem with the identification system at PC, all members of the group are forced to wait until he completes his procedures. This problem also leads to congestion and makes it difficult for security to deal with other pilgrims.

> ***R8**: The problem is caused by the pilgrims themselves because of their culture, especially those from specific nationalities, who instead of taking their baggage individually and going to the Inspection Device gather and cause congestion as they wait for others from their group; they want to go in groups and this congestion hinders the workers' progress (...).*

The culture of community also plays a fundamental role in this aspect, as some pilgrims are self-organised, even if they are in groups, while other individuals cause a kind of confusion and overcrowding.

> ***R8**: There is an effect of national culture on how they comply with and follow the instructions and regulations. As I told you, Indonesians and Malaysians are like a watch (...) You can even pass them in the queues in front of passport control, whereas you cannot do this with people from other nationalities.*

Furthermore, the culture of pilgrims is reflected in their behaviours and reactions during crises, such as crowding and accidents: some of them help to alleviate the severity of the crisis, while others make matters worse by following their own ideas or imitating others.

> ***R11****: All services and facilities are sufficient and effective, and there is no shortage. However, the behaviour of many pilgrims in terms of imitation and moving as a group affects the workers' progress (...). For example, if one pilgrim enters the toilet, many pilgrims will follow him, and then they will come to the inspection point all at once, which causes disruption and work pressure.*

- **Disabilities and health issues**

The results showed that there are special facilities for pilgrims with special needs, but they need to be developed and improved in order to better meet the requirements of people with special needs and not subject them to waiting and embarrassment.

> ***R1****: As in all airports, a designated vehicle takes them from the plane, and then they are accompanied by a worker responsible for those with special needs (...). However, this point needs to be developed, and these people need assistance because we really face such embarrassing situations.*

The percentage of pilgrims with special needs is high and the amount of equipment is insufficient for dealing with them, which impedes the pilgrims' flow and causes delays at certain points, such as the BS point.

> ***R6****: (...) the percentage of the disabled among pilgrims is high (...).*

The participants stated that the allocation of a special arrival path for pilgrims with special needs facilitates the work. In addition, assigning a road for them and providing them with buses and cars for transport facilitates the process of transporting them and reduces the waiting time and the space needed.

> ***R4****: I recommended a special track, cars and even buses for pilgrims with special needs to serve this group to avoid delaying other passengers and groups.*

The results showed the need to develop procedures for medical examinations for the detection of epidemics and other diseases, as these checks are carried out on board sometimes or at special checkpoints, and this increases the waiting period at a time when the elderly and pilgrims with special needs may be exhausted.

> ***R12****: All pilgrims go through the health inspection [point], but the procedure differs based on the pilgrim's country of origin and the instructions of the World Health Organization in terms of diseases prevalent in each country (...) For instance, those from polio-endemic countries or countries where Yellow Fever is prevalent should also be subject to another measure conducted on the plane or at an inspection point, and that leads to some delays during the disembarkation process and at the health inspection point.*

- **Language and communication**

The results confirmed the existence of several signboards to guide pilgrims and help them reach their destination. However, many of these pilgrims do not understand the used languages, as many of them come from countries that do not speak Arabic, English or even Persian.

> ***R2****: (...) as an operational requirement for the terminal in every airport, there must be directional signboards, whether they are digital or conventional (...) They are available in HTs (...) In our experience in these terminals, we found these signboards have a positive effect on processes and guide the pilgrims who can read English or Arabic, but these pilgrims make up a small percentage of all pilgrims. We have already mentioned that a high percentage of the pilgrims are illiterate or do not speak or read the languages used in the signboards at HTs, which are Arabic and English.*

The results showed a connection between being elderly and communication problems as well as problems arising from language and cultural differences. The staff encounter many elderly people who speak only their local languages, have no interpreters and have no previous travel experience, making it difficult for them to comply with instructions. All of these factors increase the burden on workers and the time needed to complete the arrival procedures for these groups of pilgrims.

***R14**: We struggle with cultural differences, failure to comply with organisational instructions as well as the language barrier, as many of them are old and their education level is low. This affects the level of organisation upon their arrival at the airport and their departure.*

- **Experience level**

Each traveller passes through many processes, such as having their passport stamped, obtaining travel tickets as well as completing security and medical checks. Workers in the field of Hajj and Umrah noted that all of these processes are easier and faster with travellers who have previous experience.

***R8**: Of course, experience and education are very important, as the educated person who has experience is different from the villager who has no idea about the airport's operations, and we struggle with such people of some nationalities who need guidance (...) The percentage of arriving pilgrims whose education level is low and who have no idea about airports is high.*

It was also noted that the procedures are easier with educated individuals with previous travel experience, as their cooperation facilitates the work and reduces the waiting time.

***R1**: (...) you know that the majority of pilgrims who come here are old, and most of them come from villages, not cities, and they are uneducated (...) Also, as we mentioned earlier, the culture and the level of education of the pilgrims are influential factors.*

A large percentage of pilgrims do not have any experience travelling via air transport, which means it is their first time dealing with arrival processes at an airport. Thus, this is considered one of the factors influencing the movement of pilgrims through the arrival processes at the HTs.

- **Level of knowledge and education**

As noted previously, the pilgrims' degree of knowledge and education contributes significantly to the process of completing the procedures for arriving pilgrims. It is easy for educated pilgrims to deal with workers, and they can comply with the procedures by reading the instructions and guidance provided.

It can be said that human factors contribute greatly to the completion of the processes and procedures of arriving pilgrims, as culture, knowledge, level of education and language influence the cooperation between pilgrims and workers in the Hajj and Umrah organisations.

6.6.1.2 Human factors - Providers

While the previous section dealt with the human factors related to pilgrims, this section investigates the human factors of service providers. These factors include language proficiency, cultural issues, sense of responsibility, level of knowledge/training and human fatigue.

- **Language proficiency**

Language proficiency is an integral part of communication between workers at terminals and arriving pilgrims. Having adequate language proficiency hastens the processing of arrivals and decreases the waiting time (Pandey and Shukla, 2019).

The interviews showed that workers' knowledge of multiple languages facilitates the handling of pilgrims, and the results also showed that employees who speak English work faster and are more capable of dealing with pilgrims.

> ***R10****: As I mentioned, language is considered a barrier, but many of the employees speak English well, and this can be used with pilgrims who do not speak Arabic but speak English (...) However, as I mentioned earlier, many of the pilgrims are old, their education levels are low, they do not know our language and they speak their local languages, which many of the employees do not know, and this is a problem (...) In such cases, we must ask for help from some of the employees, but this is not a sufficient solution (...).*

The results also showed that workers who speak one language face difficulties in dealing with pilgrims upon their arrival.

> ***R12**: The most important difficulty that we face is the difficulty of dealing and communicating with many pilgrims due to the difference in language as well as the low educational level (...) The problem of language here is that you deal with many nationalities and different languages (...) For instance, you can receive pilgrims from some countries who speak different languages. To face this difficulty, we use illustrated publications to show the main procedures at the monitoring point. We also seek the help of their missions and those who can speak Arabic or English from the same group, and this is considered a human factor that increases the time needed.*

The results also showed that employees who do not speak English face difficulties in dealing with English-speaking pilgrims. Moreover, employees who do not speak English face difficulties in dealing with technical issues with computer programs as well as devices, as most of the devices and equipment work in the English language.

The interviews also showed that the use of multilingual informative signs and visual effects helps to facilitate communication between workers and pilgrims and overcome language barriers.

- **Cultural issues**

The cultural harmony among the workers at terminals and their positive perceptions of each other are significant, and they contribute to the work efficiency and ensure good treatment for all arriving persons (Teperi and Leppänen, 2011).

The interviews revealed that cooperation between the workers themselves, as well as cooperation with Hajj organisations, facilitates cooperation with pilgrims, increases harmony in work and improves performance. In addition, individual work affects the overall output of work and affects the work with pilgrims.

> ***R14**: Cooperation between agencies is important (...) When there is cooperation between all bodies working in the HTs, they all want to serve and help each other in their work, but the problem lies in working separately rather than together.*

It was noted that the participants from the top management of the agencies are interested in blaming other agencies instead of thinking about the problem and ways to cooperate and reach a solution. This revealed a culture-related phenomenon that was widespread among the participants in these interviews.

> ***R6**: As for bad maintenance, I'll not get into details. Why don't they use a better system? Why are we in the current situation? These questions should be asked to other operating agencies. But there is a solution: other parts of the airport are available. The western tents of the airport are empty.*

> ***R10**: Regarding the baggage, there is a recurring problem of delays in the baggage carousel (...) but sometimes it's because of customs (...).*

- **Sense of responsibility**

The seriousness of employees and their sense of responsibility are among the most important factors contributing to improved work outcomes, especially in dealing with other individuals, such as pilgrims. The results showed that some difficulties appear in the work because of the irresponsibility and lack of seriousness of some HT employees.

> ***R15**: Regarding the human factors related to employees, we face difficulties, but they are individual cases resulting from a lack of seriousness of some employees (...).*

- **Level of knowledge and training**

Like all other professions, the training and knowledge of HT workers contribute to improving productivity at work. Moreover, knowledge and training are among the most important factors contributing to improving the processing time and quality of services provided at airports in particular.

> ***R7**: Of course, the level of knowledge factor is generally influential in any environment, but in the airport, it is very important to employees and it affects the LoS. Therefore, I advised all bodies in HTs to increase the level of training when I found many agencies in these terminals hiring a lot of*

> *fresh people without training because they were focusing on cost, not performance (...).*

The employees' level of knowledge and training contributes to the work outcomes as well as the accuracy of data entry and management. Moreover, a high level of training is needed for dealing with computer programs and machines used at the airport.

> ***R1**: Some information may be recorded incorrectly by some employees or change at the last moment and not appear in the system, which causes big problems in bus transport. This was particularly true in the last year, because the Electronic Track Program was still new and we needed to improve our third-party work force by training, especially in this system, to increase their level of knowledge.*

- **Human fatigue**

There is a direct relationship between human fatigue and the number of employees and the duration of work. Moreover, the quality of the work environment and the amount of pressure experienced by employees affect their performance and productivity.

> ***R10**: Compared with the work assigned to us and the number of pilgrims we receive, I can say that we have a shortage of human resources, and that leads to pressure on my employees, long shifts and employee fatigue (...)*

The interviews revealed that the time period directly affects the performance and productivity of employees, as there are certain periods in which pressure increases and influences the employees in terms of rest periods, work pressure and human fatigue.

6.6.2 Infrastructure factors

The existence of proper infrastructure helps to facilitate the work, pilgrims' flow and reception of visitors as well as reduce the burden on workers at the reception halls (Teperi and Leppänen, 2011).

6.6.2.1 Capacity issues

- **Capacity allocation and planning issues**

The results indicated that the capacity of the terminals is an important aspect for facilitating the flow pilgrims through inbound processes.

> ***R1****: The capacity of the terminal is one of the biggest impediments that we face.*

The employees emphasised the significance of increasing the capacity of the terminals and not reducing their capacity, as planned by the airport management. In addition, the interviews revealed the need for studying the flow of arrivals.

> ***R2:*** *Next year, we will reduce the capacity; that is, the airport management decided to change it from 3,800 to 1,850 for arrivals and 1,700 for departures. Hence, they will reduce it by almost 50% to avoid the problem of incorrect allocation of resources due to poor planning and scheduling. However, I recommend studying that to determine the optimal operating capacity to arrive at a good performance LoS and less waiting time (...).*

> ***R8:*** *The capacity of the terminals is okay, but it needs to be improved, especially at peak times, or we need to decrease the number of people arriving per hour (...).*

Moreover, it is clear that the airports have backup plans, and this is a good indicator of the advanced planning mechanisms followed by the management of airports. Such plans are designed to be enacted to deal with emergencies and to receive any unscheduled planes.

> ***R7:*** *We always have a backup plan for such cases in peak times because we need any area for operation (...) We are forced to use the area for arriving planes. This leads us to take action to decrease the capacity in order to receive these unscheduled planes and impose sanctions on them (...) It is better to decrease the capacity to accommodate these flights and avoid operational problems.*

Finally, according to the interviewed employees, the terminals are designed well, but their capacity needs to be increased, as they are small given the number of arriving pilgrims. In addition, the passport check counters need to be increased and repositioned in more appropriate places.

> ***R9:*** *The design of the terminals is good, and in my view, they are streamlined and have no problems, but their capacity is small compared to the number of pilgrims arriving at them, especially during the last few days (...) More passport check counters (...) are needed, or maybe there are enough but the locations are inappropriate.*

6.6.2.2 Flexibility in terminals

- **Lack of flexibility to increase number of desks/paths**

The terminals are not flexible in terms of increasing the number of counters and desks, which would smooth the arrival process.

> ***R10****: (...) there have been many proposals of solutions (...) For example, they could design flexible terminals to contain pilgrims during peak times in a way that allows increasing the number of counters and paths.*

Moreover, advanced queuing systems could improve the performance of workers and decrease the waiting time.

> ***R16****: There are different types of queuing systems, but we used the simplest one due to the lack of capacity and flexibility and the design and narrowness of the terminals (...).*

- **Type of queuing system and flexibility**

The results showed that all Hajj and Umrah organisations used a simple traditional queuing system (i.e., a single-queue system). This system may cause overlapping or confusion.

> ***R12**: Regarding the health monitoring point, the one-queue system is applied, which, I think, is the most suitable in order to avoid any overlapping or confusion, as procedures differ from country to another.*
>
> ***R15**: We use the one-queue system in getting pilgrims into buses (...).*

6.6.2.3 Infrastructure efficiency

- **Low level of infrastructure inside halls**

The interviewed participants reported a low level of infrastructure inside the terminal halls. Moreover, they reported that this affects the quality of services provided and increases the waiting and processing time. Some pilgrims complain to the workers about the long waiting time.

> ***R7**: Yes, the processing time is affected by the shortage of facilities in the internal halls at HTs (...). On the other hand, many pilgrims complain about the long wait at passport control and the shortage in facilities inside the lounges, such as toilets (...).*

- **Limited parking for buses**

One of the problems that increases the waiting time is the limited amount of bus parking. It hinders the pilgrims' movement and the operations at the HTs.

> ***R4**: Surely, the limited amount of bus parking has a big negative effect on pilgrims' movement and the operations at HTs, and this factor is due to the limited infrastructure (...).*

Furthermore, there are not enough available bus stops, and there is a need to increase the number of bus stops.

> ***R15**: Currently, we have 90 stops for buses, and this is not enough. The airport operator has to increase the number of bus stops in the near future.*

- **Shortage of officers' desks and counters**

There are not enough officers' desks and counters, and this influences the delivery of services and processing of pilgrims.

> ***R14**: There are currently about 30 counters in the arrival terminal, and there are about 16 in the HT and 30 in the departure terminal. There are also temporary counters that are set up in certain cases, for a total of between 76 and 80 counters. They serve the purpose, but there are not enough, as we have expansion plans.*

Moreover, there is a need to utilise modern technological techniques to accelerate the reading of fingerprints and recording of pilgrims' data.

> ***R10**: It's important to find technological solutions to accelerate fingerprint reading and identify pilgrims, especially those for whom fingerprint reading is difficult.*

- **Layout and signage issues**

The results showed that there is a need to update the design of the terminals where regulating pilgrims' flow and completing the procedures are difficult or impractical. In addition, the signs used need to be developed and introduced in various languages and colours.

> ***R1**: If it had been better designed and laid out, it would have meant faster achievement and development. The design of terminals enabling easy access to facilities is an important factor. The poor design is one of the existing obstructions, especially in the plaza area, and it needs development (...) If it were painted with a certain colour or organised by colours, for example, we could inform the pilgrims upon going out to follow the green colour, for instance. Colours are a common language in the world.*

6.6.3 Operational factors

This section investigates the factors related to operations, considered to have a great impact on the smoothness of work in these terminals, from the service providers' viewpoint. These factors include accessibility and issues related to baggage collection, processing and demand and capacity.

6.6.3.1 Accessibility

- **Accessibility for people with special needs**

Many types of equipment and facilities are needed to facilitate access for pilgrims with special needs, but these facilities are too small and they need development so that all pilgrims with special needs can obtain adequate service and avoid any problems or embarrassment.

> ***R1****: There are means to support special needs pilgrims, but they do not meet pilgrims' expectations and they need substantial improvement, especially when boarding buses. That means we have a shortcoming in terms of the accessibility of the facilities of HTs for special needs pilgrims (...) For example, here in the plaza, there is nothing at all to support this group. They are all individual endeavours, and we face problems and embarrassing situations as a result (...)*

6.6.3.2 Baggage collection issues

- **Baggage collection policy**

Managing and organising baggage is one of the processes that delays the processing of pilgrims and increases the waiting time due to the weak mechanisms being applied by the airlines (they do not sort the baggage systematically) as well as the mentality of arriving pilgrims who want to receive their baggage directly.

> ***R3****: The problem we mostly face, as ground services, is that airlines do not separate the baggage of pilgrims (...). King Abdulaziz Airport has three terminals: the Northern Terminal, the Southern Terminal and the Hajj*

Building (...) When a flight arrives here, they don't sort out the baggage, or if they do, the information may not be clear. As a result, the baggage of pilgrims is moved to the Northern Terminal and the baggage of non-pilgrims comes to us in the HT. This is one of the most common problems we face (...) when flights build up in the terminal due to the passport control or the terminal for whatever reason. For example, imagine 13 flights build up before passport control, some of which may have arrived 40 minutes, 30 minutes, one hour or three hours ago (...) Let us suppose that all of them are waiting for their baggage to be unloaded. Here, we have six baggage carousels in the HT. As you can see, each carousel has two sides. Let us say there have been three flights and we could not unload their baggage because the six baggage carousels are full. Then they send us another ten flights. This causes congestion, which leads to the accumulation of the pilgrims' baggage and long waits.

Furthermore, when passengers travel with numerous pieces of baggage, it puts pressure on the services and increases the processing time, as more time is needed to collect and sort the baggage. This means that the airlines play a key role in managing the baggage accumulation problem.

***R5**: When we have additional baggage, there is pressure on the services. The second problem is separating the baggage of Hajj flights from that of normal flights. This affects us after passport control, not before. The passengers keep on waiting for their baggage. This is an on-going problem.*

- **Baggage accumulation**

Some interviewed staff reported the accumulation of baggage as a common phenomenon in HTs.

***R2**: There is accumulation and congestion of the luggage at the baggage claim area (...)*

Sometimes, pilgrims delay the receipt of their bags, and thus, luggage accumulates, and when one of the pilgrims comes to receive his/her bag, it requires more time to get the bag. This affects the work system and increases the time needed to complete the procedures for the rest of the pilgrims.

> ***R3****: Baggage build-up occurs when a passenger delays receiving his baggage, but why the delay? It's either due to passport control or congestion in the terminal (....)*

> ***R13:*** *(...) If it is busy and passengers are waiting for a long time without finishing the passport check, baggage will start to accumulate and stack up on the carousels, and if it reaches a certain limit, they will stop, and labourers will unload it from the carousels (...) This problem always happens at peak times.*

- **Segregation of baggage of pilgrims/non-pilgrims in mixed flights**

The segregation of pilgrims' baggage from that of non-pilgrims in mixed flights is considered one of the most frequent and influential problems, especially at peak times, and a major reason for the long wait for baggage claim and baggage accumulation.

> ***R7****: (...) our problem is what we call regular mail flights (mixed flights), which is concerned with trading agreements between the Kingdom's government and external governments. These register regular passengers for trading purposes and not Hajj or Umrah. What happens is that instead of having planes dedicated to Hajj only, they add regular passengers, as the number of pilgrims is less than the capacity of the plane (...) So, the problem of the regular mail flights is that the number of passengers can only be known after the plane arrives at Jeddah Airport (...) Moreover, after the arrival of the plane, the ground services companies face a problem. They may know that the baggage in this plane will go to the Southern or Northern Terminals, but then they receive directions to resend the pilgrims' bags to the HT. Moreover, King Abdulaziz Airport is considered one of the biggest airports in the Middle East, and there are long distances between the Southern and Northern Terminals and the HT. The baggage from one flight can be distributed among the three terminals, which is a big problem. These*

reasons and others lead to congestion (...) Thus, you will find that passengers are delayed because of separating the baggage and transferring them to other terminals that are a long way from the HT. So, there is also an excuse.

After passing through the PC point, the passengers have to wait for their baggage. Sometimes, the baggage of pilgrims and other passengers becomes mixed up and leads to problems.

6.6.3.3 Processing issues

- **Processing time**

The workers reported that the time required to process one pilgrim varies. Sometimes, it takes 3–10 minutes, while other times, it can take up to 30 minutes. The standard processing time is 2 minutes, according to one of the senior workers.

> ***R2**: Our minimum technical requirement (MTR) for processing time should not exceed 2 minutes, but sometimes, it reaches 3–10 minutes, and this affects the workers' progress and pilgrims' flow.*

Considerable efforts have been made to decrease the processing time by increasing the number of counters dedicated to completing the pilgrims' procedures.

> ***R5**: There will be an increase in this of between 24 and 44 counters, which are now approved, and this will occur before the Hajj season to ensure that there are enough for the procedures. However, if you provide 300 counters, and the procedures are slow and the processing time is high, the situation will be as it is; there will only be a slight change.*

The results also showed that the problem might be a result of pilgrims arriving in groups and the lack of adequate organisation in the airport to facilitate their arrival.

> ***R10**: (...) the problem lies in travellers coming in groups, but we have two terminals. If there is congestion in one of them, we will open the other terminal, which has many tracks. This helps to speed up the passengers' flow. The percentage of pilgrims who waited for a time longer than usual was 15–20%.*

Furthermore, using manual registration processes increases the waiting time, as some pilgrims wait a long time in the buses before moving to the next destination. This problem mostly happens during peak times.

> ***R15**: Another problem facing us is pilgrims waiting in buses for a long time as a result of the manual registration of pilgrims by the United Agents Office (…) We have a delay, but it is a small percentage at peak times. However, we have a standard; that is, if the bus stops for more than two hours, this is considered a long delay. Sometimes, this reaches five hours, which is considered to be due to the driver's lack of effort, especially at noon, as it is very hot here, so noontime is tiresome for drivers (...) But the traditional manual method is still used in getting pilgrims into buses and registering them, which has significant negative effects (...).*

- **Interference in process sequence**

There is a need for greater coordination and distribution of time between the stages for processing pilgrims, as the results showed that a delay in one of the stages affects the rest of the processes and consequently causes a delay in the system as a whole.

> ***R15**: They have an effect because they are considered one system, and any delay in a certain point affects other points. One of these is the lack of commitment of airlines to the schedules specified by the Authority of Civil Aviation, a matter that causes the congestion of pilgrims and long waits at many points, such as the point at which they are transported and moved into buses.*

- **Lack of improvement of processing procedures**

The results showed that the traditional procedures used by organisations in receiving, transporting and processing the pilgrims greatly reduces the quality of services and increases waiting time as well as affects the pilgrims' impressions.

> ***R7****: There are old procedures that the agencies do not want to develop. For example, the passenger gets out, sits in the waiting area (plaza), collects his baggage, sorts it out, returns to the distribution point before the buses and takes his baggage again to the bus (...) They complain about the long wait at passport control, shortage of facilities inside the terminals and long wait in the plaza area.*

There is an urgent need to improve the current equipment and technologies and take advantage of the digital development witnessed in the tourism and travel sector to facilitate and accelerate the reception and processing of pilgrims.

> ***R12****: (...) based on the current situation, I advised them to think of updating and developing advanced electronic systems to ease the work and procedures and accelerate the flow process in HTs, especially with the increasing numbers of pilgrims and Umrah performers during the coming years, according to Kingdom Vision 2030. In addition, I advised them to think of improving services and reducing the operational costs along with increasing efficiency.*

- **Numerous processes and repetition of registration**

According to the results, numerous processes and repetition of registration affect the progress of workers in the HTs, increasing human resources used, wasted time and processing/waiting time. Moreover, the results indicated that the presence of a group leader facilitates the work and speeds up the process of collecting passports and registering pilgrims as well as completing their procedures.

> ***R1****: They sort out the passports through their group leader. This makes it very easy for them, or the mission already knows those in the coming flight. However, it is only at the point of identification and allocation of buses after*

the pilgrims are moved onto the bus that their passports are taken for another registration in order to obtain a list of names and not for a screening process. I know this is repetition of registration, but this registration is very important, as this list will be given to the bus driver for official use and identification outside the airport (i.e. the security checkpoints to show them that these are pilgrims according to the list).

***R4**: In fact, the difficulties are huge in terms of the large numbers of people during the Hajj season and the numerous procedures that the pilgrims go through, starting from getting out of the plane to reaching the loading area or bus area. These procedures are all linked with each other (...) However, the technological factor is the problem and the core of the issue. The reason is that it requires reading pilgrims' passports from the United Agents Office. If we suppose that each passport reading takes almost half a minute or 45 seconds, and there are about 45 pilgrims on each flight, then we will need 20–25 minutes just for reading and issuing the transport list. This number is huge, and this means wasting a lot of time for repeated registration and other frequent processes (...).*

***R12:** Organisational factors have a strong effect on the workers' progress, the most significant of which are poor flight scheduling, the repetition of the pilgrims' registration processes and the lack of a unified system.*

6.6.3.4 Fluctuation of demand

- **Mixed flights**

The results showed that there are mixed flights called regular mail flights that cause major problems for ground services companies in terms of separating and distinguishing the baggage of pilgrims and non-pilgrims. All these issues cause delays in the process of receiving and collecting luggage, lead to the loss of luggage and increase the processing time of arrival processes at these terminals.

Moreover, the results showed that the lack of distinction between regular travellers and pilgrims causes confusion in the process of receiving pilgrims, and accordingly, it is recommended to separate pilgrims and regular travellers.

> ***R2**: What is not taken into account is that you receive both regular passengers and pilgrims on regular flights, so you can't know who is inside the plane, especially with the mixed flights. Thus, this is what causes confusion in operation.*

- **Late flights and poor scheduling**

The workers suffer due to late flights and poor scheduling, as this puts pressure on them due to the large number of passengers. It is also considered a major cause of congestion and bottlenecks and a negative influence on wait and processing time for arrival processes in HTs, especially in the late pilgrim arrival period.

> ***R1**: We've suffered from late flights and poor scheduling, especially during the last two years. For example, during the early period, there is no pressure, but sometimes you find more flights arriving than scheduled (…).*

> ***R3**: We even observed that in the last year, they said that there were more flights or, in general, there were more pilgrims. Also, we found that there was poor scheduling. This is an important thing. For example, let's suppose that at 3 pm, you have eight arrival flights, at 5 pm, you have one flight and at 8 pm, you have six flights. So, is that poor scheduling? Yes, that is poor scheduling, and it is a reason for congestion.*

Employees recommended that airlines reschedule flights and start transporting passengers earlier.

> ***R2**: Based on my knowledge, the airlines should schedule their flights from the first of Dhu al-Qadah (Hijri /Islamic calendar) and start transporting, but most airlines do not abide by their schedule, and some airlines have slots they do not use.*

6.6.4 Technical factors

This section investigates the factors related to technical issues, considered factors affecting the smoothness of the work in these terminals, from providers' perspectives. These include factors related to the biometric identification system, new technology and information technology (IT) infrastructure.

6.6.4.1 Biometric system

- **Biometric system issues and support**

It was noted that the majority of the problems facing workers in this area are due to the deterioration of the fingerprints of the elderly, which hinders the process of registering pilgrims and completing their security checks.

> ***R16****: At the passport registration point, the officers find it difficult to read the fingerprints of older people and other persons due to the deterioration of their fingerprints.*

> ***R1:*** *(...) Some of the pilgrims have fingerprint problems, especially the elderly, manual labourers and craftspeople. They face this problem in reading and recognition because their fingerprints may have been deteriorated.*

In addition, this problem leads to delays in the registration process at PC for such pilgrims. Therefore, it increases the registration time and waiting time, which negatively affects the procedures in these terminals.

> ***R2:*** *One of the problems facing us in the arrival processes is the time taken for each pilgrim to register and check-in at passport control using fingerprints. The biometric fingerprint is a necessary security requirement in every country. The problem we face is the difficulty of reading the fingerprints of some pilgrims, especially those whose prints have deteriorated, such as elderly pilgrims. Regardless of how many times we repeat the fingerprinting process, they do not show up. Some of them may have diabetes and things like that, so their fingerprints are deteriorated as*

you know (...) However, the difficulty we face in Hajj, as I told you, is the fingerprinting (...) We find that the fingerprinting is the main reason for the long waiting time and impedes the pilgrims' flow at HTs. So, there were directions to find solutions to this problem.

6.6.4.2 New technology availability

- **Lack of integrated systems**

The absence of integrated communication systems impedes the workflow, as the United Agents Office spends a great deal of time reading the passport data and recording the pilgrims' information. If there were an integrated system, the data could be stored automatically and the processing could be done much faster.

> ***R1****: Another obstacle is the lack of integration of information through a unified system of arrival procedures (...) The pilgrims will be delayed until they find a solution because of the lack of communication with the other bodies (...) This leads us to identify another obstacle, which is the lack of integration of information through a unified system with regard to arrival procedures.*

An integrated system of information between agencies would prevent wasting time in repeating the processes of registering pilgrims at each point.

> ***R15****: Integration, conformity and coordination in work among agencies working in HTs are the most important points that have a positive effect. Furthermore, an integrated system of information between agencies would save time by avoiding repeating the processes of registering pilgrims at each point. This is the most important way to facilitate and speed up the flow of passengers in HTs in general.*

- **Lack of tracking system**

The workers indicated that a tracking system is desperately needed for tracking, monitoring and following up the pilgrims inside the terminals. This will help the workers trace the pilgrims and follow up on their condition and activity.

> ***R5**: There is no tracking system to locate pilgrims and help in case of missing pilgrims inside terminals (...) The problem is that they travel as groups, and if this doesn't change, we will continue facing the problem, because if any person has a problem and you cannot locate him, the whole group will wait for him.*

- **Lack of modern tools and technology**

Using modern technology contributes largely to the workflow at airport passenger terminals in general. This is what HTs need, as they lack many of the modern techniques currently used worldwide, as reported by most of the interviewed workers.

> ***R8**: Self-service is great technology. I believe that if applied at HTs, it will help to improve the processing time and pilgrims' flow, especially for the educated pilgrims with experience with international airports. There was an idea under study by passport control, and now it's applied to Saudi citizens (…) I agree with any technology used as long as it is useful and fast.*

The workers reported that technology developments should include developing security measures, PC, a tracking system and so on.

> ***R9**: By continuously using technology instead of providing all services to the pilgrims at one time while they are in the airport, they can be distributed in their countries at different intervals. (...) In brief, I recommend introducing technology and distributing operations throughout the travel process, such as registering the passenger in the passport control of his country before leaving so that when he arrives, he will be the same as a local passenger.*

6.6.4.3 IT infrastructure

- **Low level of IT infrastructure**

The level of IT infrastructure influences the processing of pilgrims and waiting time, where the speed of completion of procedures at some registration points at these terminals depends on the speed of information transfer and communication between the information centre and registration points. Thus, all these activities, such as biometric checks, PC, integration of involved organisations and improved device speed/data transfer capacity, are needed for a high level of IT infrastructure. Some participants indicated that there is a weakness in the level of IT infrastructure at HTs.

> ***R7****: The MTR or Minimum Technical Requirement is the time taken for each operation in the HT (...) The MTR is linked with the conditions of the resources available (...) Hence, an operating agency not complying with the MTR and not performing its duties in full leads to congestion, and the capacity starts to go down (...) (for example, the MTR in passport control after the application of fingerprinting is not fulfilled (...)) I am not a technician, but if the servers were upgraded and we had a high level of information technology infrastructure, we could get back to the MTR.*

> ***R11****: The technological factors and level of information technology infrastructure, including the speed of devices used in inspection, communicating with other agencies and recording as well as the transfer of data, such as the fingerprinting device used in passport control, via the network, and its connection with the National Information Centre, had an adverse effect on the arrival processes of pilgrims, and that led to congestion cases and long waits for pilgrims.*

6.6.5 Organisational factors

This section investigates organisational factors from providers' perspectives. These factors include cooperation issues, human resource issues and communication issues with other agencies inside and outside HTs.

6.6.5.1 Cooperation

- **Cooperation of missions**

The results showed that there is full and complete coordination and cooperation between the organisations working in the Hajj sector and governmental organisations, as well as all parties involved in the process of managing the Hajj and Umrah season.

***R10**: We don't have any problems with communication and coordination with other agencies and sectors working in the HT at Medina Airport, whether governmental or non-governmental. Inside the terminal, we have the Joint Operations Office where all sectors are present and we have a delegate there (...).*

The successful coordination and cooperation between the involved organisations is supported by various governmental agencies.

***R7**: The role of the Operation Centre is under the supervision of the operating company. The role of the Guidance and Control Centre is coordinating with all agencies. There are more than 23 government and national agencies in the HTs, dedicated to serving the guests of Allah's house.*

However, some challenges and problems have arisen in terms of coordination and cooperation with some outside agencies, such as certain Arab and African countries' missions.

***R1**: (...) there are coordination and harmonisation between us and other bodies. There is a Joint Operations Office, where all bodies meet to discuss the daily operational problems and challenges (...) No procedure is performed or initiative conducted without referring to the Ministry of Hajj for approval (...) This was the only problem that we faced in the last year, but inside the airport itself, the response between all bodies is very quick; the Operator, Civil Aviation Authority, Health Department, Customs and Immigration all respond. We face difficulties and problems in coordination with relevant bodies outside the airport (...) The missions of some countries were very cooperative, such as Indonesians and Malaysians, while some were not very cooperative, such as some Arab states' missions, some African missions and those of some Southern Asian states, such as India, Bangladesh and Pakistan, but less than Arab states' and African missions. Therefore, we face the most problems with pilgrims whose missions are not cooperative.*

6.6.5.2 Human resource issues

- **Human resource allocation and scheduling**

The workers complained about the unbalanced work shifts, where some of them felt tired, especially the elderly and those whose job was unloading baggage. Unbalanced shifts resulting from human resource shortages and poor allocation plans lead to human fatigue in some cases and, thus, impede the workers' progress.

> ***R2**: There is a lack of balance in the scheduling of workers in HTs during the pilgrims' arrival period, especially at peak periods, and that leads to human fatigue. We looked into the employees and found out that some employees want to work for 12 hours, but some of them, especially those unloading baggage, are old and can feel tired easily, but they cooperate with each other.*

> ***R3**: The tasks assigned to me are ensuring all operational locations of HTs are covered in terms of baggage service and providing an adequate number of staff on every shift. Of course, King Abdulaziz Airport works on a shift system: there is the morning shift, the afternoon shift and the night shift – and staff must be allocated to all areas that need baggage service (...) The lack of human resources and poor worker allocation may be reasons for the weakness in the services provided (...).*

Moreover, the results showed that there were issues related to human resources, including poor allocation and planning resulting from late flights and poor scheduling.

> ***R1**: Late flights and poor scheduling negatively affect our plan for human resource allocation and scheduling.*

> ***R12**: (...) However, we often face difficulty during the Hajj season owing to the lack of human resources, as there is not sufficient support.*

6.6.5.3 Communication

- **Communication with inside/outside agencies**

As with coordination and cooperation with other agencies, there have been no difficulties in communicating with other agencies within HTs. However, there have been problems in communicating with relevant bodies outside the HTs.

> ***R1**: I do not think that there is a big problem with communication with relevant agencies inside HTs, but we face difficulties and problems in communication with relevant bodies outside the airport.*

6.7 Summary

This chapter presented an analysis of the results of the evaluation of the efficiency of arrival processing for HTs based on service providers' point of view. The data collection source and analysis methods for this section were included, and all findings were analysed using NVivo 12 plus. The results of the analysis of providers' perspectives on pilgrims' flow through the arrival processes of HTs indicated several factors and sub-factors that have an effect on the workflow at these terminals, as shown in Figure 6-4.

Consequently, these findings will be discussed in Chapter 8 to understand their meaning, and the conclusion will relate these findings to previous studies. Furthermore, an integrated simulation model for HTs to evaluate the current situation of these terminals will be developed and presented and additional solutions to facilitate the flow of pilgrims within these terminals will be studied in the next chapter. Thus, an evaluation of HTs' efficiency of arrival processing based on the systems of these terminals will be presented

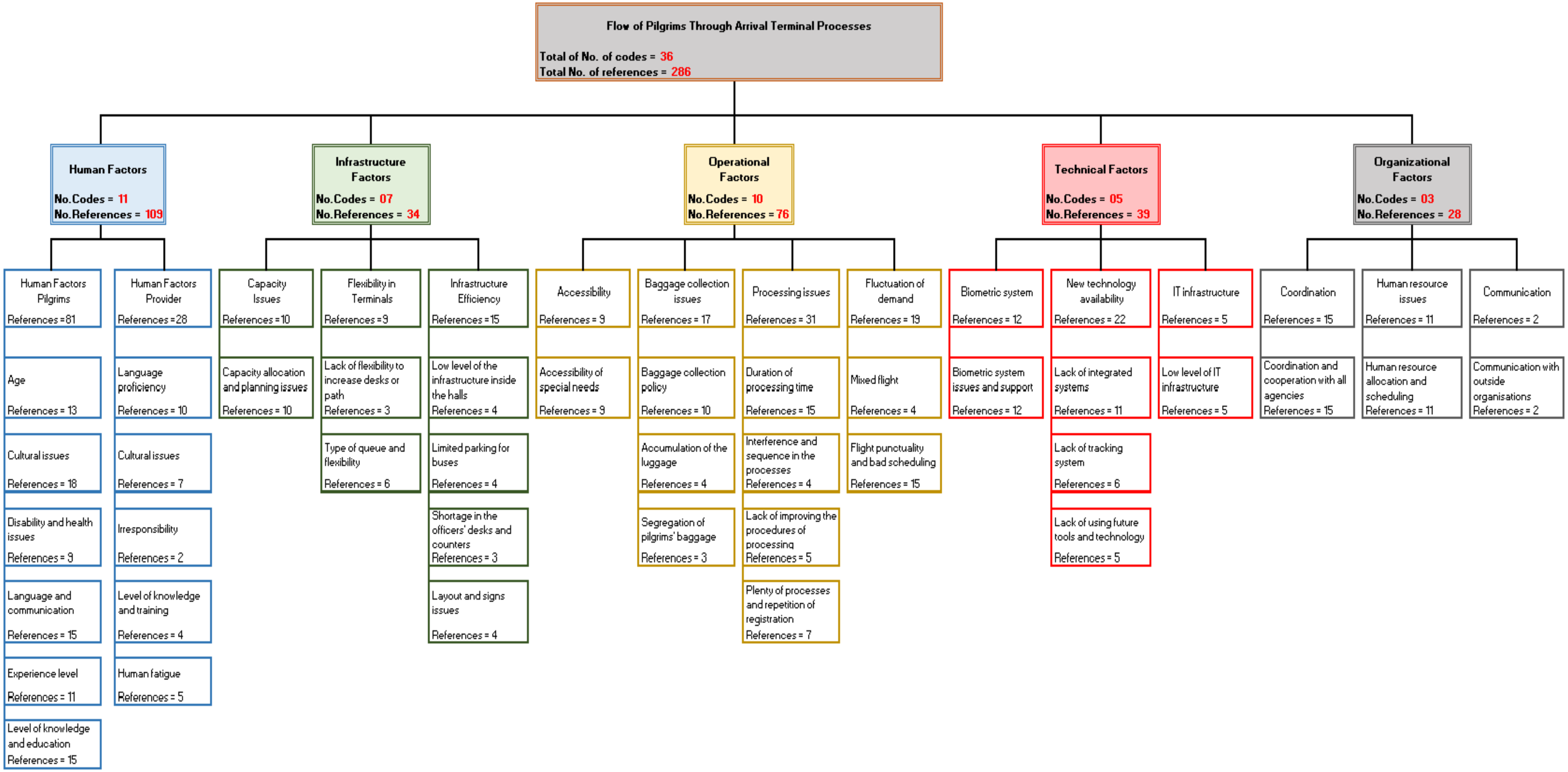


Figure 6-4 Mind map, code creation and theme definition

7 CHAPTER SEVEN: DEVELOPMENT OF INTEGRATED SIMULATION MODEL TO EVALUATE CURRENT HTS

7.1 Introduction

In the development of any model, especially simulation models, the process of merging and integrating more than one method gives it inclusiveness and robustness. However, few researchers have developed and presented such models with airport studies (Casas, Casanovas and Ferran, 2014). Therefore, here, an integrated simulation model based on ABM and DES is developed to investigate and study the flow of pilgrims arriving at HTs, as mentioned in Chapter 4. Thus, the characteristics of the flow of pilgrims through arrival terminal processes can be identified based on HT system observation in order to develop solutions that facilitate the flow through arrival terminal processes. In addition, this model is used to ensure that different scenarios can be considered to show how the system would operate under different circumstances (Mujica, Laubrock and Piera, 2012; Verma, Tahlyan and Bhusari, 2018) and fulfil the fourth objective of this research.

Based on objective four, it was necessary to explore and research a powerful and flexible tool through which an integrated simulation model could be developed. Moreover, it needed to have the ability to translate all the components of this complex system into the simulation model being developed in order to study this problem. Therefore, AnyLogic 8.5 was chosen as the tool to develop the integrated simulation model for this problem.

Therefore, this chapter consists of three main sections: 1) the characteristics of pilgrims' flow at HTs, 2) an integrated simulation model for HTs and 3) a case study of the HT at KAIA in Jeddah.

7.1 Characteristics of pilgrims' flow at HTs

As mentioned previously in the literature review, airport terminals are divided into departure and arrival lounges, and each section has its own activities and processes. Therefore, airport terminal passengers are classified into three types based on the activities that they carry out and the processes through which they pass: arriving passengers, departing passengers and transiting passengers. However, HTs differ from other international airport terminals around the world, as mentioned in the second chapter. That is, HTs are specific airport terminals for the arrival and departure of Muslim people from all over the world who come to visit holy places and mosques during the Hajj and Umrah events. Thus, these terminals have their own protocols, features and processes, as shown in Figure 7-1. Moreover, these terminals are closed areas and only employees and passengers are allowed to enter them, unlike other airport passenger terminals, which are open to all people. The arrival processes of HTs are explained in detail in the second chapter of this study.

A comparison of HTs and those of other international airports in terms of passenger flow and processes in the arrival lounge reveals that the inbound processes in international airports start with disembarkment and allocation to specific terminal gates. Then, all passengers are directed to the first process, which is PC. After that, the passengers take their luggage from the BC area and head to the third process, which is CI. Thereafter, the passengers complete all the required registration and inspection processes and can move to the arrival hall to leave the airport.

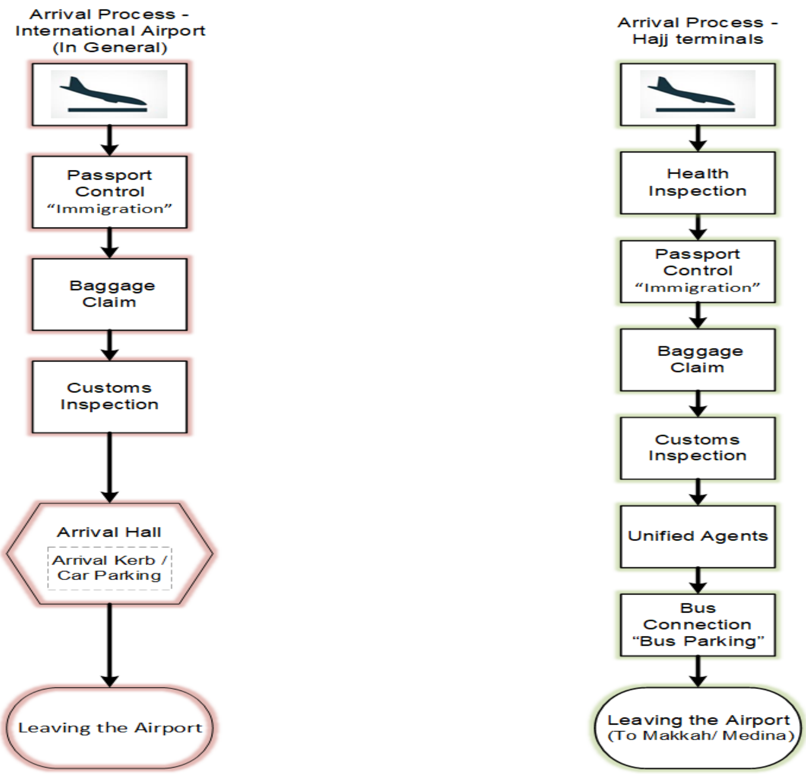


Figure 7-1 Comparison of arrival passenger flow within general international airport terminals and HTs.

The first process that pilgrims pass through when they arrive at HTs is the HI point. Then, the pilgrims head to the second point in these terminals, which is the point of PC registration. After that, they collect their luggage from the BC area. Thereafter, the pilgrims head to the last point in the internal halls of these terminals, which is CI. Then, the pilgrims move to the plaza area (external halls), through which they go through two processes: the registration point at the UA office and the BS point. After that, the pilgrims leave these terminals for Mecca or Medina depending on their plans. Hence, it is clear that there are more arrival processes in HTs than in other international airports. Moreover, the passenger flow within these terminals is more complex than that at other international airports. In addition, based on the information obtained from the participants in the qualitative study in Chapter 6, there is repetition of the registration process in several arrival processes in HTs. Thus, pilgrims spend more time completing all of the arrival processes in these terminals compared to in other international airport terminals.

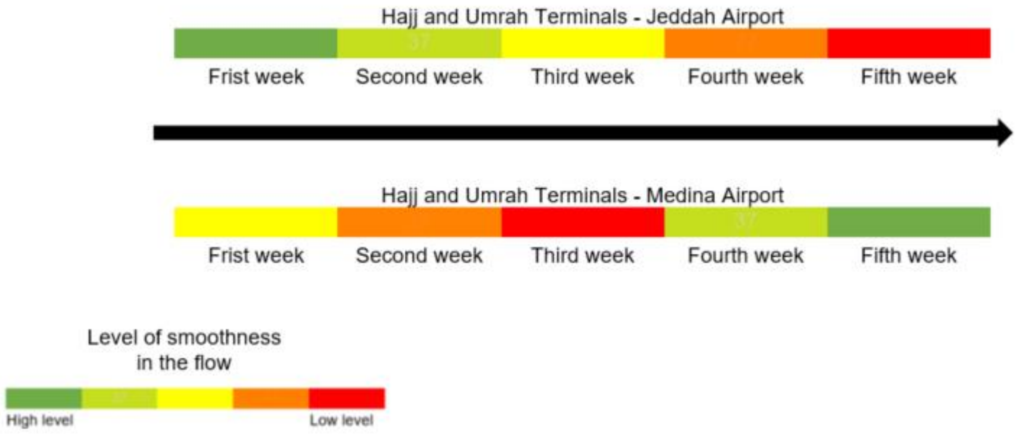


Figure 7-2 Level of smoothness of flow of pilgrims through arrival processes at HTs.

On the other hand, there are more characteristics of and information about the flow of pilgrims through these terminals to be clarified. These characteristics and information were obtained based on the historical data of arriving pilgrims that were reviewed and analysed in Chapter 5, the qualitative information collected and analysed in Chapter 6 and the author's observations of the pilgrims' flow system during the collection of quantitative data in the Hajj of 2017. It was found that the level of smoothness of the flow of pilgrims through the arrival processes in these terminals varies according to the date and time of pilgrims' arrival. As mentioned earlier, the arrival period in the Hajj season is 37 days in the HT at Jeddah Airport and 36 days in that at Medina Airport, starting with the first of the month of Dhu al-Qadah (Hijri/Islamic calendar). Therefore, the flow at the HT at Jeddah Airport is smoother at the beginning of the season, and the level of smoothness decreases with time until the end of the season. Conversely, the level of smoothness of the flow at the HT at Medina Airport starts at an average level and decreases with time until the third week, at which point it increases until it reaches a higher level in the last week of the arrival period, as shown in Figure 7-2. Hence, it is clear that there is an inverse relationship between the number of pilgrims arriving and level of smoothness of the flow of pilgrims through arrival processes.

Figure 7-3 illustrates that there is a difference between processes in terms of the time required for the pilgrims to wait and finish each process. For example, at the HT at Jeddah Airport, the longest waiting time is at the PC point where pilgrims wait between 20 minutes at times of low-level crowding and 260 minutes at times of peak crowding. This is followed by the registration process with the UA office, where pilgrims spend between 30 minutes at times of low-level crowding and 260 minutes at times of peak crowding, and so on with the other processes. Unfortunately, there were no accurate data on the waiting times of pilgrims for the arrival processes at the HT at Medina Airport available to create a value stream mapping (VSM) chart like that for Jeddah Airport. However, the author's observations and the quantitative data collected from some pilgrims revealed similar trends in terms of the time required for the pilgrims to wait and finish each process at the HT at Jeddah Airport with a difference only in the longest process. Moreover, the flow is influenced by some human, organisational and operational factors, as mentioned in Chapter 6.

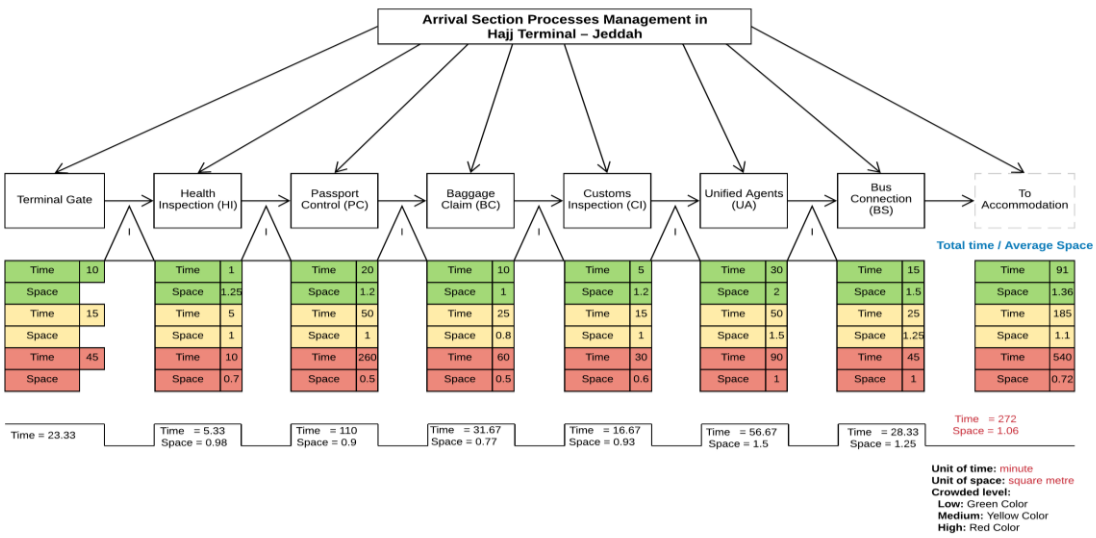


Figure 7-3 VSM chart for arrival processes at HT - Jeddah Airport in Hajj season 2017.

Source of data: GACA office at HT - Jeddah Airport

A review of the data, information and characteristics of the flow and processes in the arrival area of the HTs discussed in the current and previous chapters shows that there is a lack of information and characteristics needed to build a complete simulation model for the HT at Medina Airport. Therefore, the next subsection focuses on developing an integrated simulation model for the arrival area of the HT at Jeddah Airport. Moreover, the model has been designed to be flexible so that it can be adapted in the future to model any arrival processes at any airport. Thus, it will be beneficial in the future to develop a model for studying the arrival processes at the HT at Medina Airport when the necessary information and data are available for this terminal.

7.2 Integrated simulation model for HTs

In building and developing any simulation model, one, two or multiple popular simulation methods, such as system dynamics (SD), ABM and DES, are integrated and used. Each of these methods works at a particular range of abstraction levels (Borshchev, 2013), as shown in Figure 7-4.

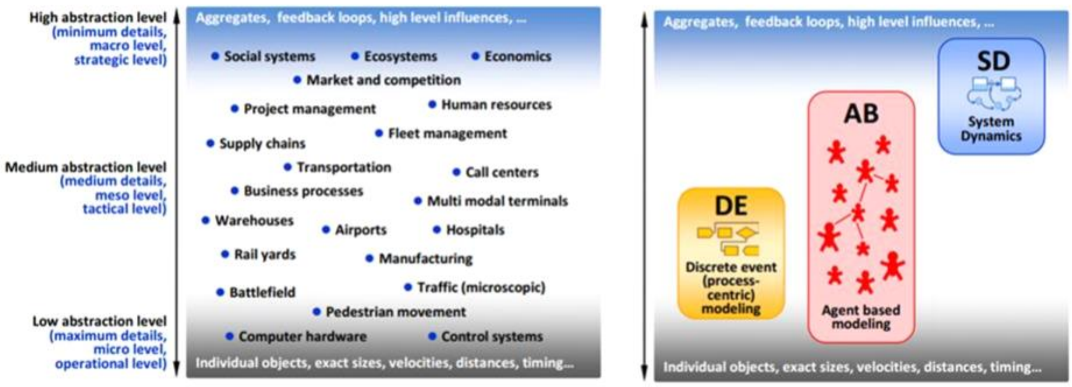


Figure 7-4 Applications and methods in simulation modelling with different abstraction levels.

Source: Borshchev (2013)

The modelling process is based on abstraction, simplification and analysis; thus, the modelling for any system depends on that system's type and characteristics. This is expressed in Poli's (2013, p.142) definition of a complex system: 'Complex problems and systems result from networks of multiple interacting causes that cannot be individually distinguished [and] … must be addressed as entire systems'. Airport terminals offer one of the world's greatest real examples of places that can be seen as complex systems. As airports have multiple agents and stakeholders with different attributes, there is only information about global dependencies, and the system is described as processes. Thus, two or three methods have to be combined to describe such a complex environment. For complex system cases, Borshchev (1998) developed a more flexible tool, AnyLogic, to enable the combination of SD, DES and ABM. Therefore, here, an integrated simulation model is built and developed for arrival processes at HTs. This model integrates ABM and DES, as mentioned above.

To start building an integrated simulation model for arrival processes at HTs, the sequence of these processes discussed earlier and shown in Figure 7-5 must be examined.

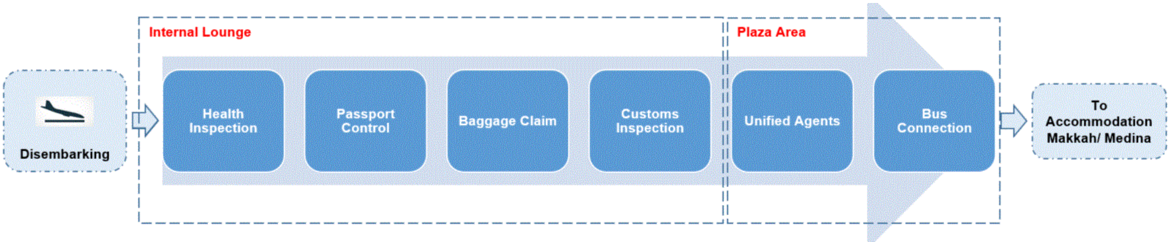


Figure 7-5 Arrival processes at HTs.

Inbound flight characteristics are the most important components of any simulation model, and they refer to the information required to establish a flow system of the arrival processes at HTs. These characteristics include flight schedules, pilgrims' characteristics and process characteristics, as shown in Figure 7-6. The input information of inbound pilgrims can be created using some data on these characteristics. It also involves using some additional data related to the distribution of pilgrims to the lounges and gates. Then some of these data must be stored and an Excel spreadsheet created including arrival time, flight code, lounge code, gate code, number of pilgrims, number of pieces of baggage and information on pilgrims' demographics. The next section discusses the process of disembarkment from the aircraft and allocation and distribution of pilgrims to the lounges based on the HT at Jeddah Airport only, because the required information about the terminal at Medina Airport is lacking.

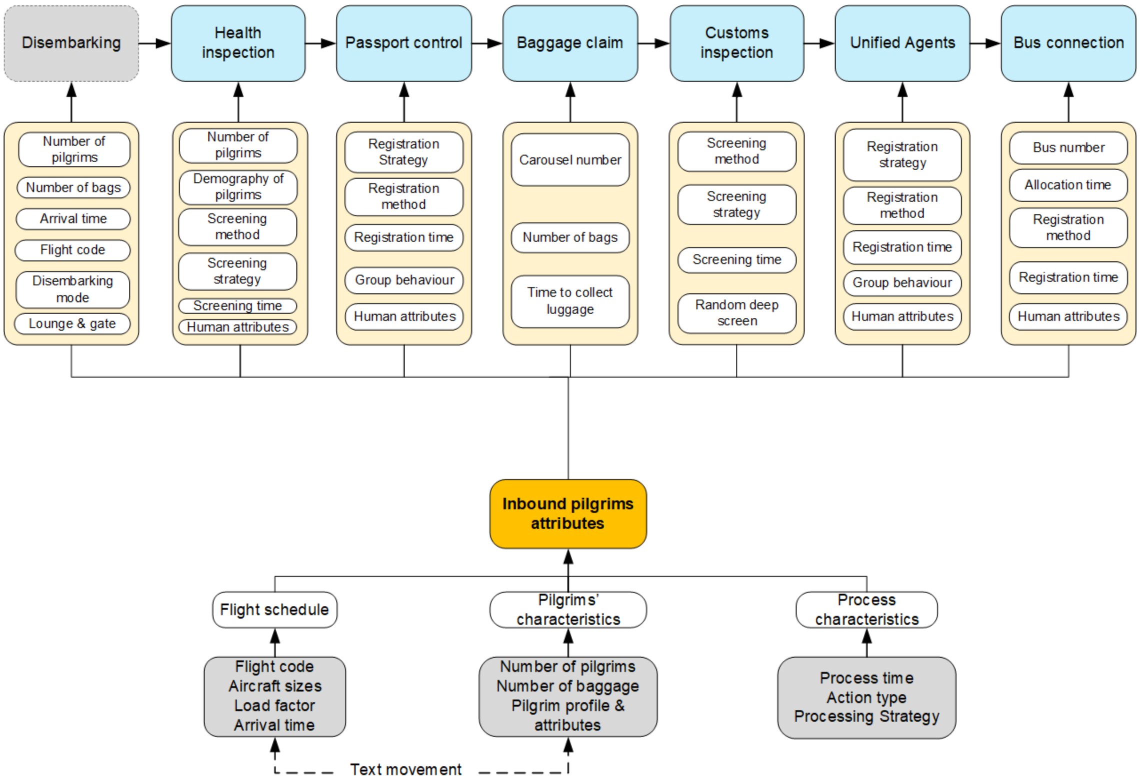


Figure 7-6 Input characteristics of integrated simulation model for pilgrims' flow through arrival processes at HT.

7.2.1 Disembarking from the aircraft

According to Borille and Correia (2013), few researchers have focused on the process of disembarkation, and thus, there is no approach for evaluating the factors affecting it. Therefore, there is no procedure to develop a simulation model for this process, especially after the IATA (2014) developed recommended standards for arrival services, as shown in Figure 7-8. Some elements influence the operation of this process and subsequent processes, and they are considered part of the necessary information for the simulation model's input data. These elements are flight code, aircraft size, load factor, facility configuration, arrival time and pilgrim profile. The input data for the simulation model are determined through the information of these elements, as shown in Figure 7-7. Through the flight code, aircraft size, load factor and pilgrim profile, the number of pilgrims, pieces of baggage and people with special needs for each flight can be determined. Additionally, from the flight code, aircraft size, arrival time and facility configuration, the parking for each flight, disembarking mode, interval between flights and gate through which pilgrims will disembark to the lounge can be defined. Based on all this information, the disembarking processing time and time required to send baggage to the conveyor belt can be set, and the lounges with pilgrims disembarking from airplanes can be identified. As some of these data were not available, the data provided by the airport administration were used, which is considered the minimum requirement of the integrated simulation model.

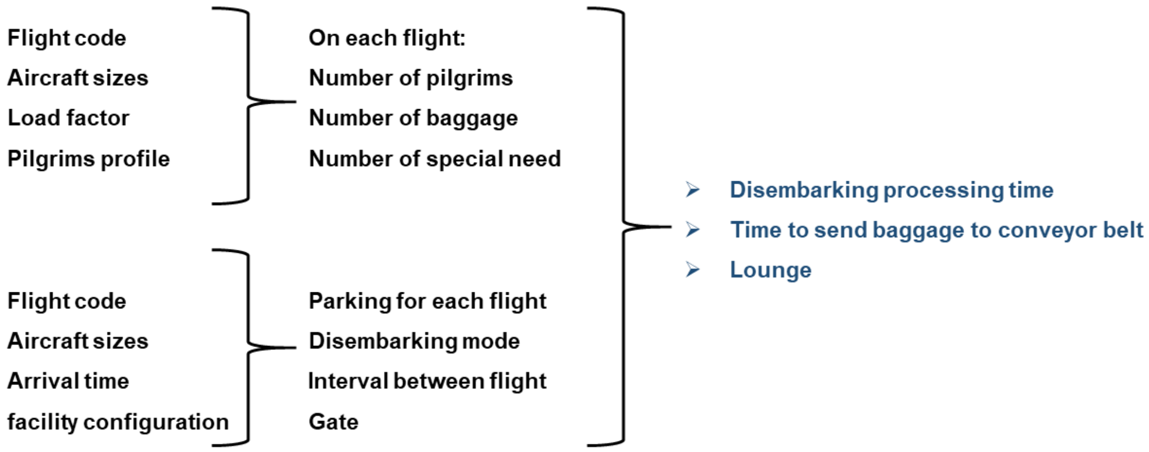
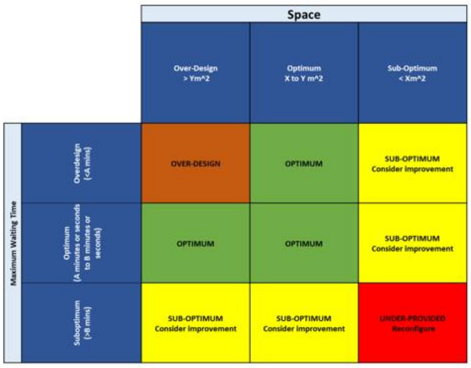


Figure 7-7 Hierarchical configuration of elements and data inputs.

An examination of the historical data of the pilgrims arriving at the HT at Jeddah Airport from 2013 to 2017 revealed fluctuations in arrival patterns during the pilgrim arrival period. The number of flights increases from the third week until the peak is reached in the fifth week (last week). Therefore, there is a steady increase in the number of pilgrims arriving, which greatly affects the arrival operations in this terminal, increases the crowding of pilgrims and generates bottlenecks during those periods, as mentioned in Chapter 5. Hence, the data obtained from the airport administration have been stored, and an Excel spreadsheet including flight code, arrival time, number of pilgrims, gate and lounge has been created. Input for HI is discussed in the following subsection.



Level of Service	Space	Time
Overdesign	Excessive or empty space.	Overprovision of resources.
Optimum	Sufficient space to accommodate the necessary functions in a comfortable environment	Acceptable processing and waiting times
Suboptimum	Crowded and uncomfortable	Unacceptable processing and waiting times

Figure 7-8 New LoS concept (space–time diagram).

Source: (IATA, 2014)

7.2.2 HI module

The HI process is not present in any many international airport arrival terminals as an independent process as the HTs. Thus, it distinguishes the arrival area of HTs from those of general international airports, as mentioned earlier. Therefore, HI processes are explained in more detail in this section, including screening of pilgrims and the physical environment. Since the HI process is not a primary inbound process, there is a lack of examples of simulated models for this process in the literature. Thus, the building of a simulated model for this process relies on information and data that the author gathered and obtained from observations of this process and interviews conducted with representatives of the authorities overseeing this process.

The interviews with HI administrators at the HTs at Jeddah and Medina revealed that, in making the screening protocol for this inspection point, they depend on lists and information issued by the World Health Organisation (WHO), which are updated periodically. The inspection and screening protocol in this process includes the required checks and vaccinations for every pilgrim based on the region and country of origin, as diseases and epidemics spread in some countries and regions based on the health and economic conditions and disease control programmes of those regions.

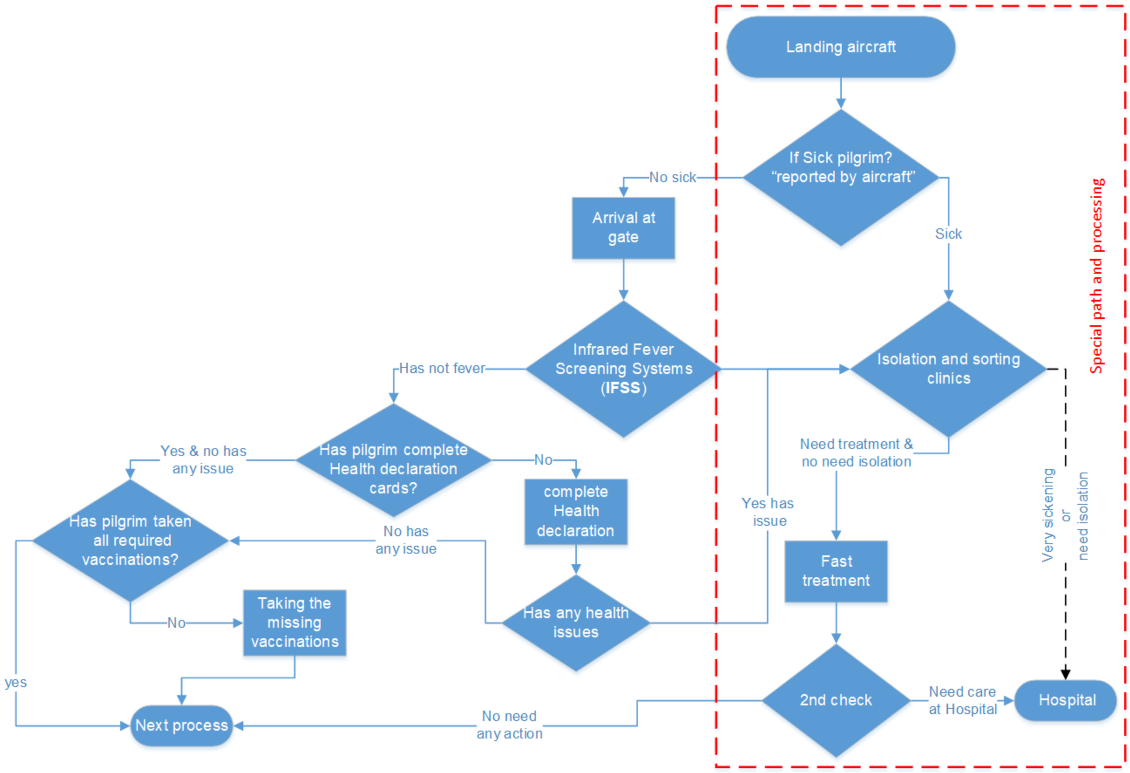


Figure 7-9 Flowchart of HI process at HTs.

Source: Created by the author based on information collected from HMC in HTs.

The process of HI begins before the aircraft lands. When the aircraft crew reports sick pilgrims or pilgrims suspected of being sick, they disembark these pilgrims across a unique path, as shown in Figure 7-9, while healthy pilgrims are disembarked through the gates to each lounge according to the path and plan specified for each flight. Here, the focus is on modelling the process of HI for healthy pilgrims who disembark through the gates to each lounge. In contrast, the flowchart of the special path of HI processing, as shown in the red box in Figure 7-9, is ignored. The HI process in the lounge begins with the Infrared Fever Screening System (IFSS) to check for pilgrims who have a fever, as shown in Figure 7-10. After using the IFSS to screen the pilgrims for fever, the process of checking if pilgrims have completed the health declaration cards begins. Finally, the necessary vaccinations for each pilgrim are checked and missing vaccinations are given. The data obtained from interviews with participants representing the firms working at HTs revealed that the processing time of each aircraft in HI is between 15 and 35 minutes (mean 25 minutes). In addition, it was found that the probability of the aircraft crew reporting a sick pilgrim or a pilgrim suspected of being sick is 0.2% for each flight. Through the above information and flowchart, the data entity relationships for the HI process are mapped out and then translated into the AnyLogic simulation model.

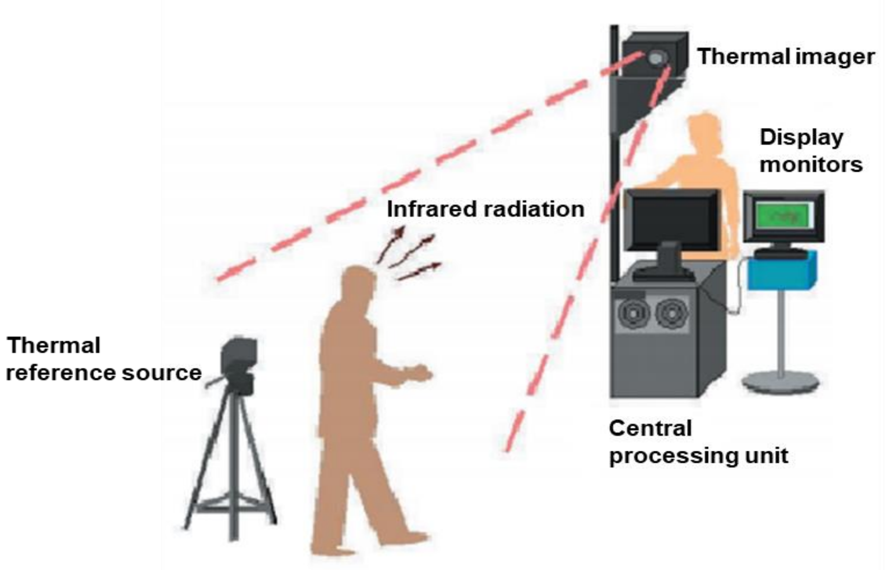


Figure 7-10 Common setup of IFSS.

Source: (Tan et al., 2004)

7.2.3 PC module

Most governments around the world have introduced numerous robust systems for verifying passenger identities at airports and border ports to ensure an orderly entry for visitors to any country, stop criminal traffic and prevent the spread of infectious diseases and illegal immigration (Yang and Lu, 2015). According to Doc, I.C.A.O., 9303 (2006), Saudi Arabia is using machine-readable passports and a biometric identification system to identify international passengers at border control, as with most governments around the world. PC is the main process in each international airport, as passports are the gateway to the world.

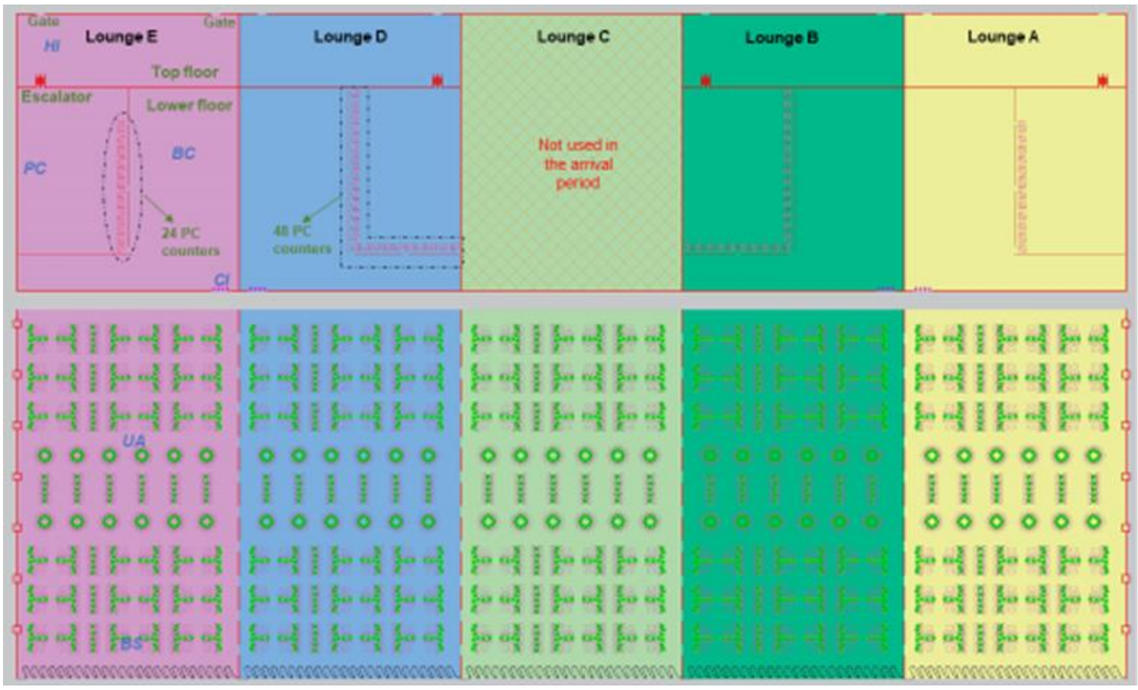


Figure 7-11 Layout of HT at Jeddah Airport.

As shown in the layout of the HT at Jeddah Airport in Figure 7-11, there are five lounges, A, B, C, D and E, and this terminal works with a flexible operational plan. This terminal operates as an arrival terminal during the pilgrims' arrival period and as a departure terminal during the period in which pilgrims return to their home countries. Pilgrims are disembarked to lounges A, B, D and E during the arrival period. Each lounge has two gates, and these gates and HI are located on the upper PC registration level, while PC registration is located on the lower level. Thus, when pilgrims complete the HI process and there are less than 20 pilgrims in each PC queue, they are directed to move to the PC registration area on the lower level by way of an escalator (average speed 1.12 m/s). Pilgrims wait in this area for PC registration for long periods during peak times. Moreover, according to Fruin (1971) and the limited area of PC registration processing, the assumed spacing between pilgrims in the queues of this process in the simulation model is between 0.25 and 0.5 m.

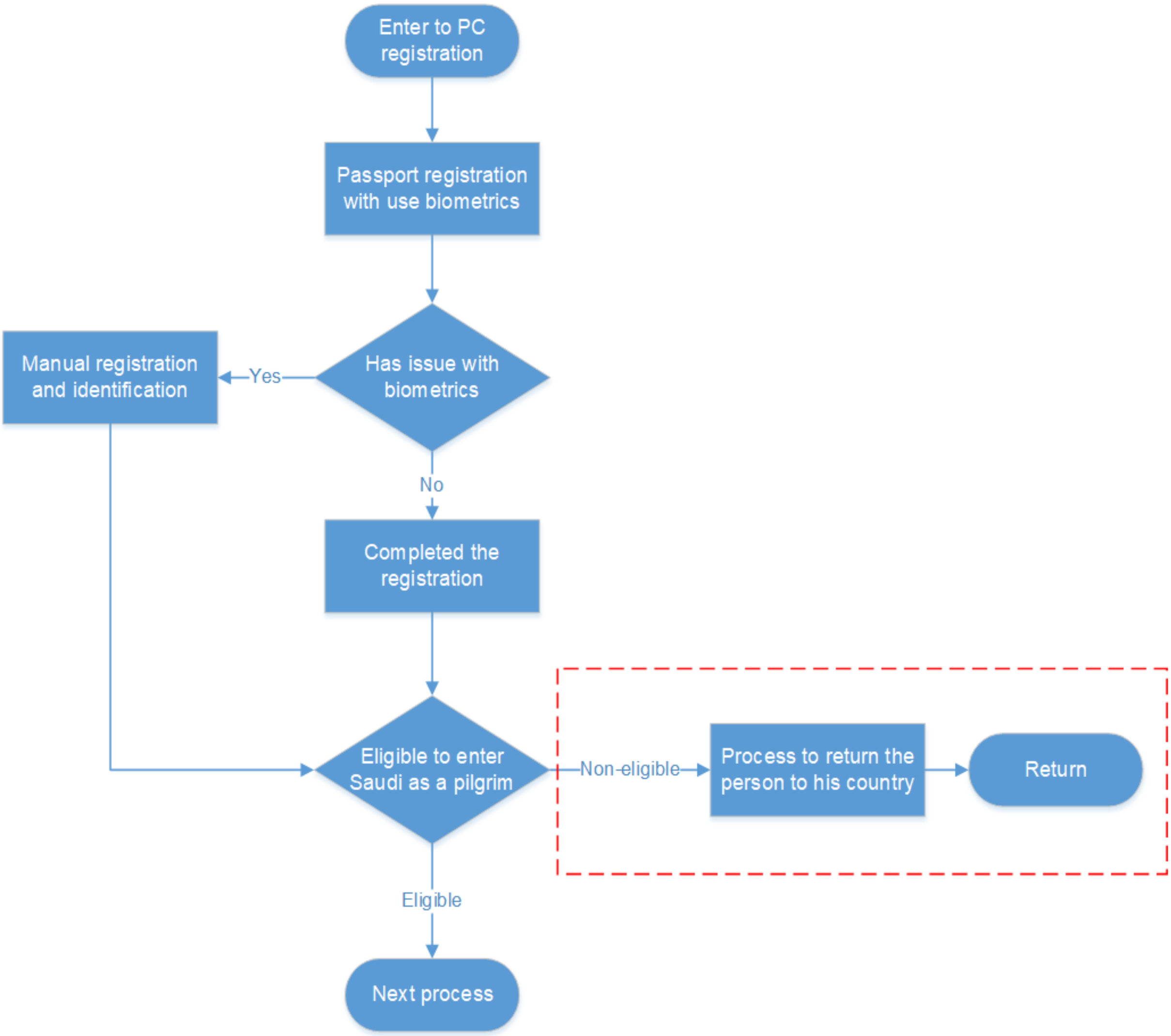


Figure 7-12 Flowchart of PC process at HTs.

Furthermore, PC is the second stage of the inbound process in the HTs, and it occurs after the HI process. Figure 7-12 illustrates the process of PC registration at HT immigration counters. The PC registration process at these terminals uses a collection of single-queue single-server systems, as shown in Figure 7-13. The HT at Jeddah Airport only allows 20 pilgrims in each queue at each PC counter. Lounges A, B, D and E contain 24, 48, 48 and 24 PC counters, respectively.

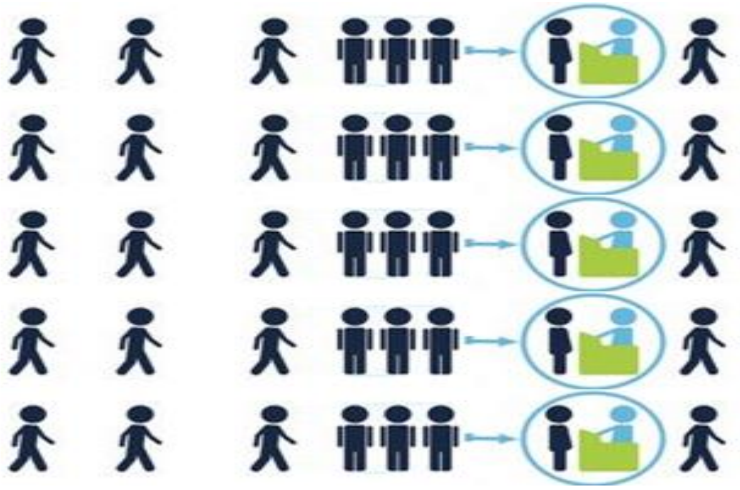


Figure 7-13 Collection of single-queue single-server systems.

The PC process begins with analysing pilgrims' passports and fingerprints to check if they have a valid visa and are eligible to enter Saudi Arabia as pilgrims. If the immigration officer reads the pilgrim's fingerprints without any issues, s/he completes the registration procedures. Alternatively, if the immigration officer has issues with reading the pilgrim's fingerprints, the pilgrim is directed to the manual registration and identification process. Furthermore, through the PC registration process, the validity of the pilgrim's visa and his/her eligibility to enter Saudi Arabia as a pilgrim are verified. Therefore, if the pilgrim is eligible, the registration procedures are completed, and the pilgrim is transferred to the next process. Conversely, if the pilgrim is not eligible, the officer transfers the pilgrim to special procedures for verification or returns the pilgrim to his/her country. Here, the focus is on modelling the PC process without the special procedures in the red box, as shown in Figure 7-12. In addition, all major elements and processing facilities of the PC registration process are summarised in Table 7-1.

Table 7-1 Summary of major elements and processing facilities of PC registration process

Elements and processing facilities of PC registration process	Values
Probability pilgrim has issues with fingerprints	0.1–0.12
Probability pilgrim has issues with visa check	0.005
Maximum processing time	8 minutes
Minimum processing time	3 minutes
Mean processing time	5 minutes
Spacing between pilgrims in queues	0.25–0.5 m

7.2.4 BC module

The baggage carousel belts are located after the PC registration area in HTs, as with most international airports. Usually, the time required for travellers to receive their baggage depends on the speed with which the luggage is sent from the aircraft to the baggage carousel belts. The data collected by the author from the representatives of the authorities working in the HT at Jeddah Airport revealed several factors affecting the time required to send the luggage from the aircraft to the baggage carousel belts, including the distance between the aircraft apron and the HT and the type of passengers on the flight (i.e. all pilgrims or mixed).

It was found that the shortest time recorded for pilgrims to collect luggage was 10 minutes and the longest time was 45 minutes, while the mode and mean were both 20 minutes. Additionally, it was noted that most pilgrims bring more than one bag. Moreover, the phenomenon of the accumulation and crowding of pilgrims in this area had to be taken into account in the simulation model. That is, some pilgrims waited for other pilgrims who they travelled with on the same flight before completing the PC registration process. It is important to model this behaviour due to its impact on the BC area, average walk speed in this area and CI queues. In addition, another phenomenon affecting the BC process and the next process that appears during peak periods when pilgrims wait a long time before the PC registration process is that of the accumulation of luggage in the BC area. All major elements and processing facilities of the BC process are summarised in Table 7-2.

Table 7-2 Summary of major elements and processing facilities of BC process

Elements and processing facilities of BC process	Values
Probability pilgrim must wait after PC process	0.25
Maximum waiting time to collect luggage	45 minutes
Minimum waiting time to collect luggage	10 minutes
Mean waiting time to collect luggage	15 minutes
Distribution of number of bags	Uniform (1,2)

7.2.5 CI module

As shown in the layout of the HT at Jeddah Airport, the CI area is located at the exit gates from the lounges to the external halls (plaza area) with four queues and checkpoints in each lounge. Thus, there are 16 CI checkpoints and 16 queues with 16 baggage x-ray machines. The CI module is considered one of the main processes in the arrival domain at HTs, as with general arrival terminals at international airports worldwide. However, the inspection strategy in this module at HTs and all other Saudi international airports differs from that at airports in other countries. The CI procedure at Saudi airports requires all arriving passengers from outside Saudi Arabia, whether they are visitors, pilgrims, residents or citizens, to pass through the customs checkpoint, and a random selection strategy is not used as it is in some countries.

Figure 7-14 illustrates the CI process at HTs. The process of CI begins with screening the pilgrims' luggage using x-ray machines to ensure that it does not contain any prohibited substances. If the contents of the pilgrim’s luggage are clear and it does not contain any prohibited substances, the pilgrim is transferred to the next step. Conversely, if the contents of the pilgrim’s luggage are not clear and it contains (or is suspected of containing) any prohibited substances, the pilgrim is directed to manual inspection. In addition, in manual inspection, if the contents of the pilgrim’s luggage are clear and it does not contain any prohibited substances, the pilgrim is transferred to the next step. Otherwise, the pilgrim is transferred with his/her luggage to the special procedure for these cases, as shown in the red box of Figure 7-14. Therefore, the focus here is on modelling the regular process depicted in Figure 7-14 while neglecting the details of the special procedure. It was found that the shortest CI processing time was 0.5 minutes, the longest time was 5 minutes and the mode and mean were both 1.5 minutes. Furthermore, the major elements and processing facilities of the CI process are summarised in Table 7-3.

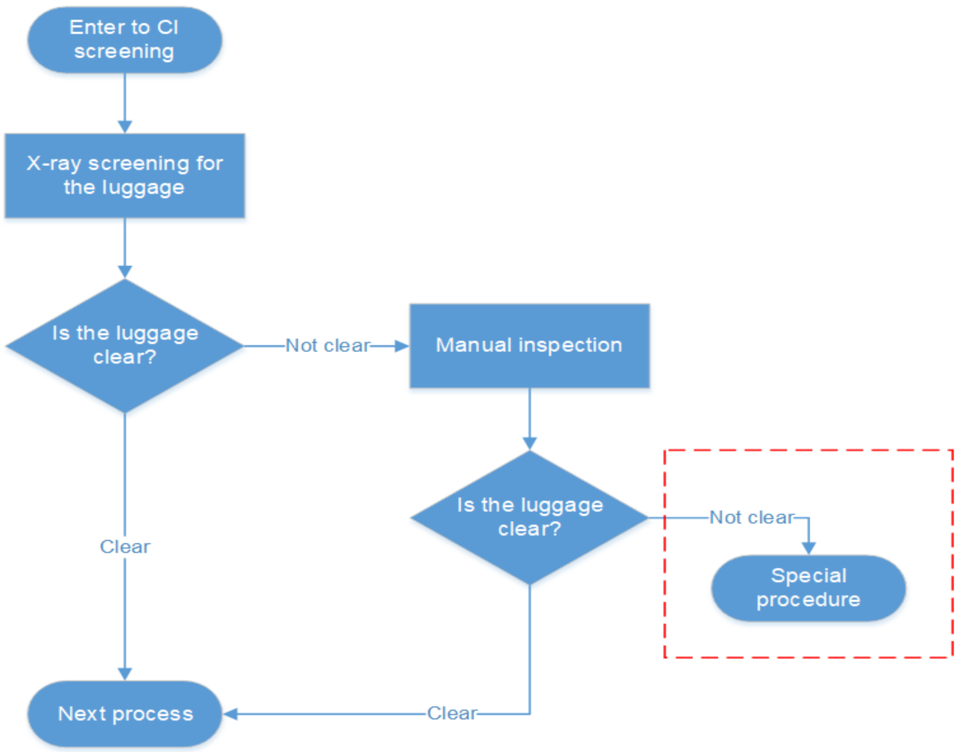


Figure 7-14 Flowchart of CI process at HTs.

Source: Created by the author based on information collected from CI administrators.

Table 7-3 Summary of major elements and processing facilities of CI process

Elements and processing facilities at CI process	Values
Probability pilgrim is directed to manual inspection	0.08
Maximum processing time	3 minutes
Minimum processing time	0.5 minutes
Mean processing time	1.5 minutes
Distribution of number of bags	Uniform (1,2)

The UA and BS processes do not exist in the arrival area of any international airport terminal around the world except HTs. Moreover, in these two modules, pilgrims are registered and classified according to their temporary accommodation and then distributed to buses that take them to their accommodation.

7.2.6 UA registration module

The UA office is a nongovernment agency working under the Ministry of Hajj and Umrah, and it is responsible for delivering services to pilgrims ranging from reception at HTs to assistance with returning to their home countries, as mentioned in Chapter 2. For example, it is responsible for guiding pilgrims in reaching their accommodations in the cities, finalising their registration and paying the Tawafa Establishment service fees. Therefore, the process of UA begins with the allocation of a waiting area to collect the pilgrims who came on the same flight. Then, their registration is completed and their payment of the Tawafa Establishment service fees is checked. Thereafter, they are distributed into groups according to the location of their accommodation in the holy places at Mecca and Medina. Finally, these groups of pilgrims are directed to the next process, which is BS. Figure 7-15 illustrates the sequence and details of this process.

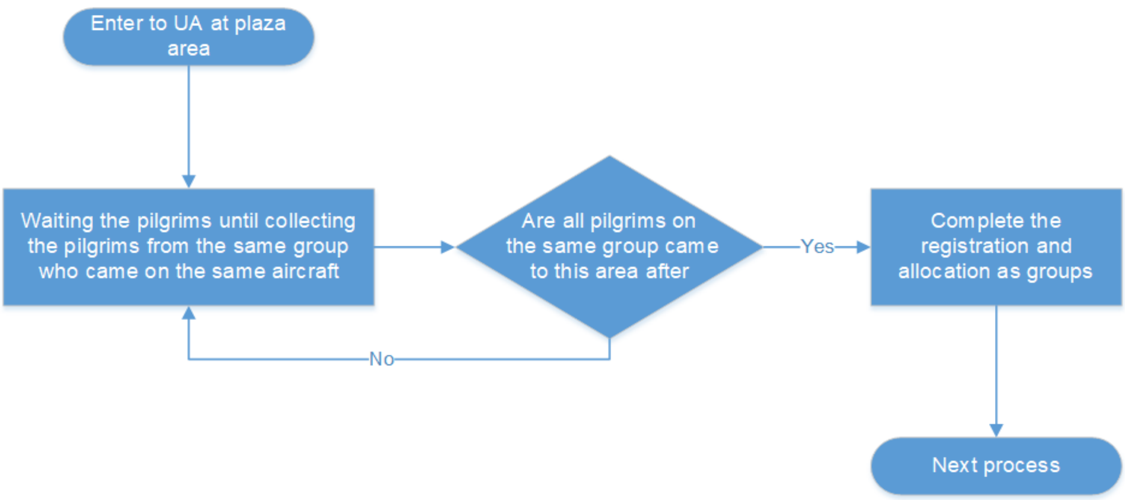


Figure 7-15 Flowchart of UA process at HTs.

Source: Created by the author based on information collected from UA administrators.

This process depends on the sequence of previous processes and the total time taken by each group of pilgrims who came on the same flight in previous processes. Thus, the wait in this process is very long, which causes great dissatisfaction among some pilgrims, especially because it does not have an efficient cooling system, as mentioned in Chapter 5. It was found that the minimum processing time for the UA process was 0.5 minutes and the maximum processing time was 2 minutes, while the mode and mean were both 1 minute. It was also found from the interviews with those responsible for this module that a small number of pilgrims usually have issues with registration in this process (e.g. did not pay the Tawafa Establishment service fees and need more time in this process). The major elements and processing facilities of the UA process are summarised in Table 7-4.

Table 7-4 Summary of major elements and processing facilities of UA process

Elements and processing facilities of UA process	Values
Probability pilgrim has issues that mean s/he 'needs more time'	0.02
Average number pilgrims per group	Uniform (200,300)
Maximum processing time	2 minutes
Minimum processing time	0.5 minutes
Mean processing time	1 minute

7.2.7 BS module

The HTs do not allow pilgrims to use any method of transport other than buses to reach their accommodations in Mecca or Medina to avoid causing crowding in these holy cities and other problems. Therefore, the responsibility of transporting pilgrims between both air and seaports and their accommodations close to sacred Hajj sites in Mecca and Medina is assigned to a nongovernment agency working under the Ministry of Hajj and Umrah. Thus, the BS module is responsible for the process of distributing pilgrims to the buses. Each bus contains 50 pilgrims to be transported to their accommodations in Mecca or Medina according to their plans. As previously mentioned, this agency is the General Cars Syndicate and is responsible for the BS process in the HTs at both airports. This is the last of the modules required to complete the arrival procedures within HTs. It is located in the last part of the external halls (plaza area) of the terminal.

After the pilgrims finish the UA registration process and move to the BS process as a group who came on the same flight, then this process begins with distributing this group of pilgrims to the buses. Next, pilgrims are sent to buses after the passports of the pilgrims on each bus are collected and delivered to an employee to register pilgrims and issue an electronic transport list. Then, the passports are returned to the pilgrims and an electronic transport list is handed over to the bus driver who leaves the airport and drives to the pilgrims' accommodations. The qualitative and observational data revealed that the minimum processing time for this process was 20 minutes and the maximum processing time was 45 minutes, while the mode and mean were both 30 minutes. The major elements and processing facilities of the BS process are summarised in Table 7-5.

Table 7-5 Summary of major elements and processing facilities of BS process

Elements and processing facilities of BS process	Values
Number of pilgrims per bus	50 pilgrims
Maximum processing time	45minutes
Minimum processing time	20minutes
Mean processing time	30minutes

7.2.8 Other input parameters

Important parameters to consider when building any simulation model based on ABM are the actions and interactions of agents, whether individual or collective entities. A critical example of the actions and interactions of agents inside the terminal building is passenger walking speed. Thus, the walking speed of pilgrims inside the HT at Jeddah Airport was assumed based on the layout of the terminal and the existing literature (Fruin, 1971; Liu et al., 2018; Willis et al., 2004; Young, 1999).

As mentioned in the fifth and sixth chapters, an examination of the layout of the lounges of the HT at Jeddah Airport clearly shows that the facilities and spaces and the width of the corridors are limited, especially after the PC process area.

Based on the above paragraph, the average walking speed of the pilgrims inside this terminal building was assumed to be 0.80 m/s. Moreover, the average speed with which the pilgrims descend from the upper-level to the lower-level PC registration using the staircase was estimated to be 0.50 m/s. In contrast, the average speed of the escalators was estimated at 1.17 m/s. Given the phenomenon by which pilgrims waited for other pilgrims that came on the same flight, the pilgrims' walking speed was slow after the PC registration process. Hence, the average walking speed in this area was estimated to be 0.60 m/s. All the major elements and other input parameters of agents in the HT at Jeddah Airport are summarised in Table 7-6.

Table 7-6 Summary of major elements and other input parameters of agents in HT at Jeddah Airport

Elements and other input parameters	Values
Average walking speed of pilgrims inside terminal building	0.75 m/s
Average speed at which pilgrims descend from upper to lower level using staircase	0.50 m/s
Average speed of escalators	1.17 m/s
Average walking speed of pilgrims after PC registration process	0.60 m/s
Average walking speed of pilgrims in plaza area	1.00 m/s

Furthermore, the scenarios and assumptions that have been applied in the simulation model are reviewed to study and analyse the results. Based on the observations of the terminal system and data collected from the interviews, some parameters were added and entered to the simulation model based on three scenarios to study and evaluate the HTs at Jeddah Airport and determine the factors affecting its operation. Therefore, the inputs and parameters for each scenario were defined separately in addition to the inputs and characteristics that were defined and explained in the previous subsections of this chapter.

- First scenario: the simulation model was applied according to the previous entries and data without adding or changing any parameters.

- Second scenario: the fact that 25–30% of pilgrims do not have any experience in air travel or experience with arrival processes at international airports (i.e. it is their first time travelling by air and their first time using the HT at Jeddah Airport) was taken into consideration. Hence, the simulation model was applied according to the previous entries with this assumption (25% of pilgrims lack experience with airports) added.
- Third scenario: the same as the second scenario with the following new assumption added: a percentage of pilgrims has problems with the process of fingerprint recognition, where 10% of them have poor fingerprints and 2–3% of them have lost their fingerprints.

Table 7-7 illustrates the details of the assumptions for the scenarios.

Table 7-7 Details of assumptions for scenarios

Scenario	Inexperienced pilgrims	Pilgrims with poor fingerprints	Pilgrims with no fingerprints
1	None	None	None
2	0.25	None	None
3	0.25	0.10	0.025

7.3 Simulation results and analysis

This section discusses the results of the integrated simulation model for the HT at Jeddah Airport. In order to demonstrate the capabilities of the model, each of the scenarios mentioned above is considered separately. Since the simulation model is an integrated model including DES and ABM, it is necessary to use the pedestrian library, as shown in Figure 7-16 and Figure 7-17. Running any model containing this library requires a high-performance computer. Thus, AnyLogic 8.5.2 simulation software was used to develop this integrated model, and the model was run using AnyLogic Cloud. Thus, the simulations were run independently in each scenario, and the length of each run was 1,800 minutes. The results of each scenario will be reviewed independently, and then the results for all three scenarios will be analysed and compared.

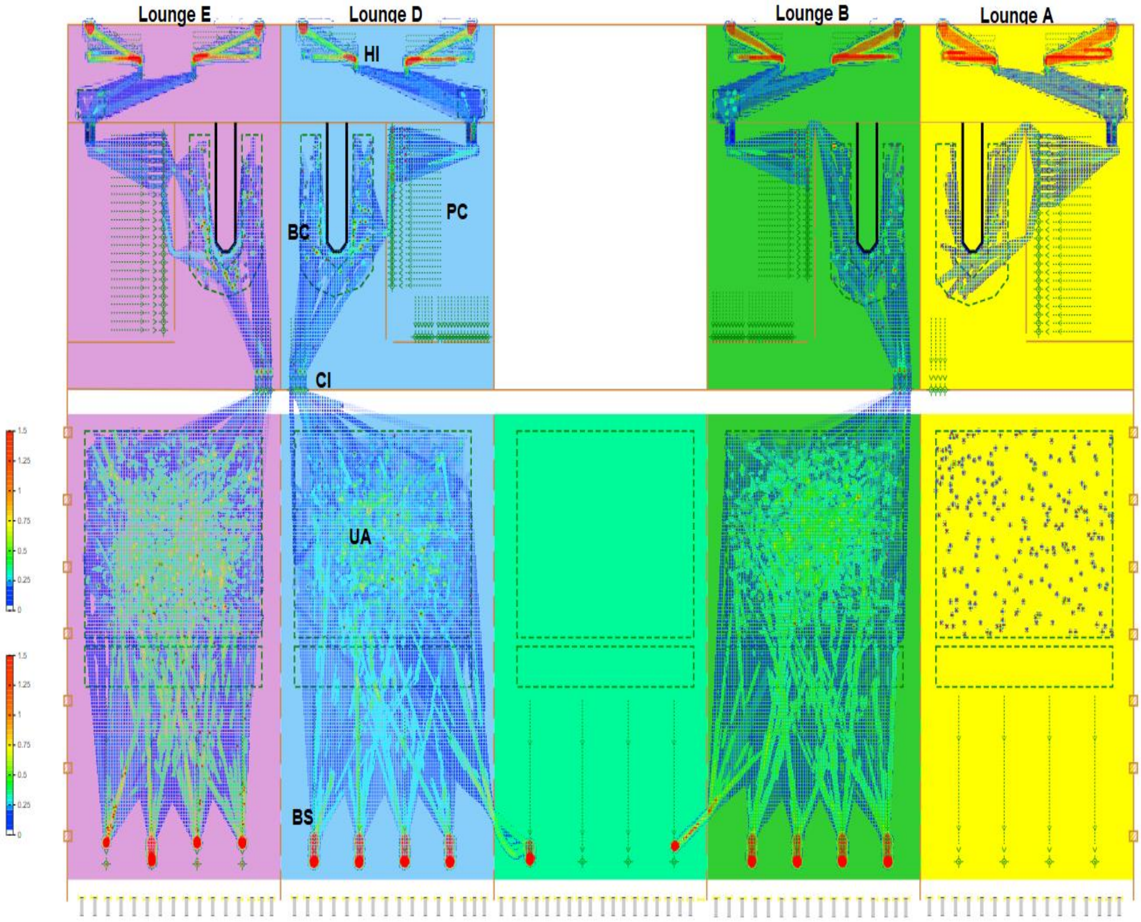


Figure 7-16 Density map of pilgrims' movement via arrival processes at HT at Jeddah Airport.

Therefore, this section is organised as follows: Section 7.3.1 presents the results of the first scenario, Section0 presents the results of the second scenario, Section7.3.3 presents the results of the third scenario and Section7.3.4 provides a comparison between the actual data and results of the simulation and a comparison of the results of the three scenarios and their analysis.

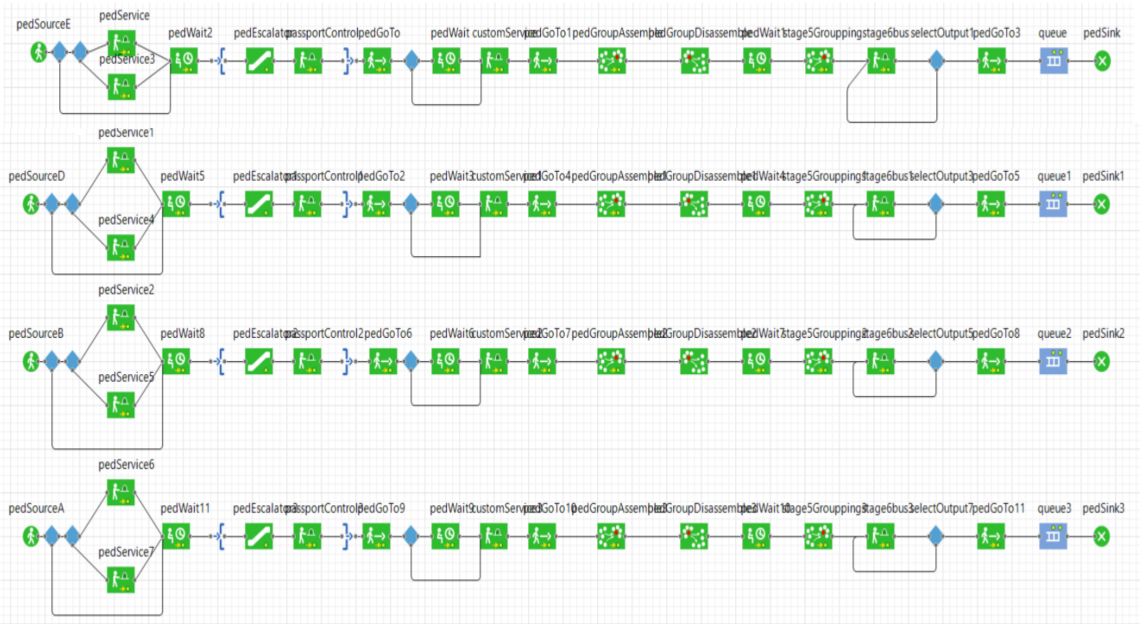


Figure 7-17 HT integrated simulation model logic.

7.3.1 Description of first scenario results and analysis

Since previous chapters have shown that the pilgrims' arrival pattern at the HT at Jeddah Airport is an essential aspect and influencing factor, this pattern in Figure 7-18 must be examined and the peak points must be reviewed before starting to describe the results. According to Figure 7-18 and as discussed earlier, the pilgrims' arrival pattern at the HT at Jeddah Airport illustrated that 40% of pilgrims arrived in the last two weeks of the arrival period, while 60% of pilgrims arrived in the first three weeks of this period. Based on this, it was noticed that this pattern was similar in all lounges, in that there was an increase in the number of pilgrims beginning with the middle of the third week until it arrived at a peak point in the fifth week, at which point it began to decline in the last days of the arrival period. On the other hand, the pilgrims were distributed in the lounges of the HT at Jeddah Airport based on the facilities and capacity of each lounge; for example, Lounges D and B had more PC counters than Lounges A and E.

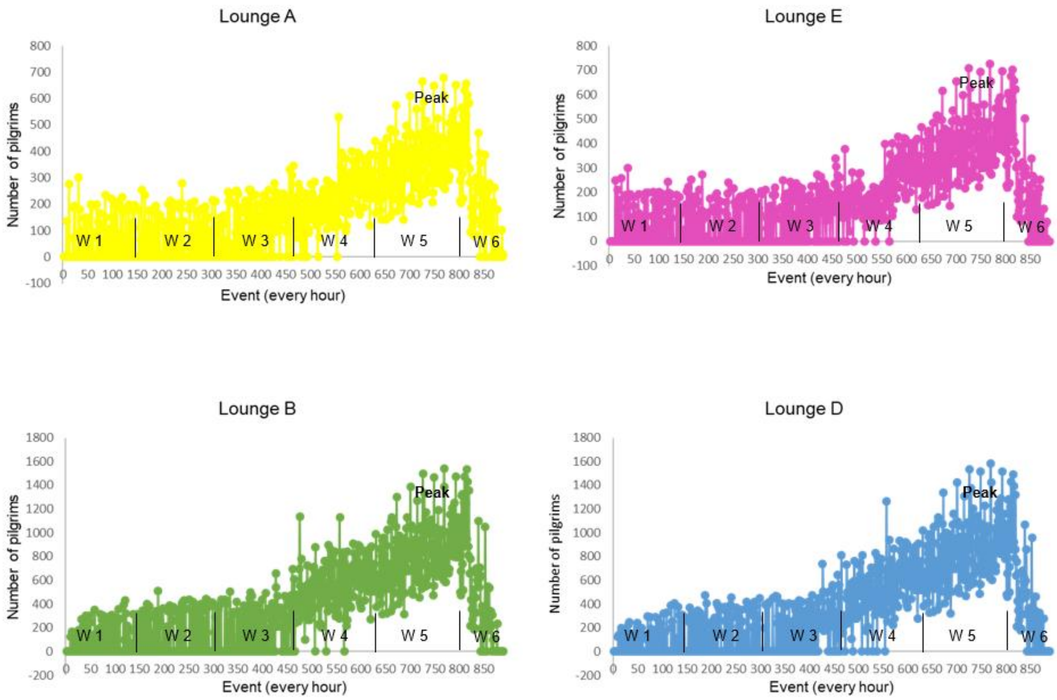


Figure 7-18 Pilgrims' arrival pattern at HT at Jeddah Airport.

Note: The arrival period for the Hajj is 37 days, which means there are 888 events (888 hours) during this period.

The results of the simulation model for the first scenario illustrated that there is variation in waiting times and queues between the lounges as well as processes. The waiting time results also showed that the maximum waiting time for HI, PC, BC, CI and UA is 23, 139, 45, 13 and 57 minutes, respectively. However, the average waiting time is 5.18, 32.26, 24.93, 2.78 and 39.96, respectively. In addition, at some times, there was no waiting time in these processes, except BC and UA, which had minimum waiting times of 10 and 30 minutes, respectively. Figure 7-19 illustrates the variation between these processes in the average waiting time for each event (hour) where most pilgrims have to wait a long time at PC but only a short time at CI. Moreover, a similarity in the average waiting time histograms was noticed for the HI, PC and CI processes.

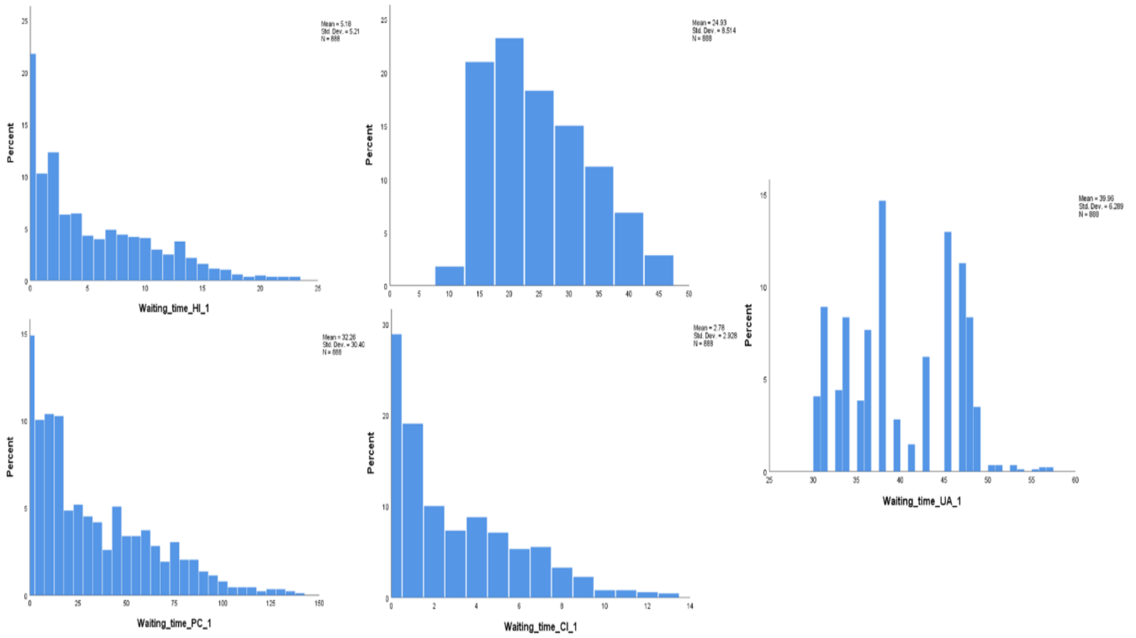


Figure 7-19 Histograms of average waiting time for each event (hour) at HI, PC, BC, CI and UA processes – first scenario.

On the other hand, Figure 7-20 demonstrates that there is an increase in the queue length at PC in the fifth week in Lounges A and E, while there is an increase in the queue length at CI in the fourth and fifth weeks in Lounges B and D. There is a sharp peak in the queue length at PC in the fifth week in Lounges A and E, while there are several peaks in the queue length at CI in the third, fourth and fifth weeks in Lounges B and D. Thus, the increases in the queue length occurred in the periods when there were increases in the number of pilgrims arriving in the HT. In addition, Figure 7-19 and Figure 7-20 illustrate the pilgrims' patterns in each lounge based on the number of pilgrims waiting in queues and the average waiting time of pilgrims in an hour.

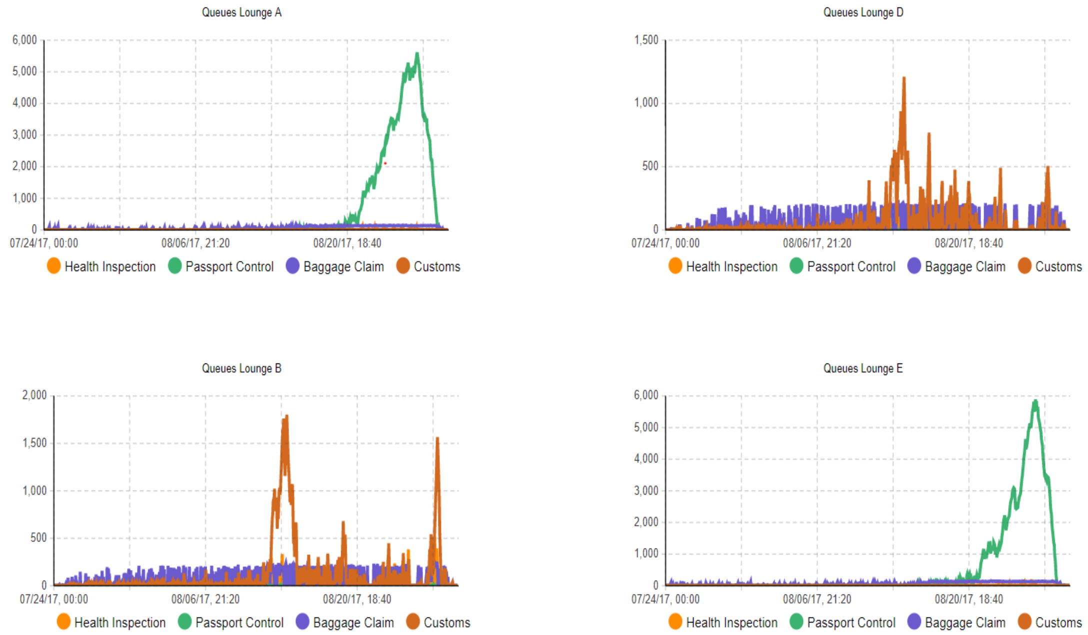


Figure 7-20 Queue length for processes at each lounge – first scenario.

Furthermore, to know the extent of the difference in the performance of processes among the lounges, the following critical question had to be answered: is there a statistically significant difference in queue length for the processes based on lounge? Therefore, the Kruskal–Wallis test was used to answer this question, as suggested by Conover and Iman (1981). The results indicated that there was a statistically significant difference in queue length for HI, PC, BC and CI based on an alpha value of 0.05 ($\chi2(3) = 122.36$, $p < .001$, $\chi2(3) = 192.95$, $p < .001$, $\chi2(3) = 23.95$, $p < .001$ and $\chi2(3) = 192.85$, $p < .001$, respectively), as shown in Table 7-8 and Figure 7-21.

Table 7-8 Kruskal–Wallis rank sum test for queue length at HI, PC, BC and CI by lounge - first scenario

Process	Lounge	Mean Rank	*χ2*	*df*	*p*
HI	A	1685.51	122.36	3	< .001
	B	1878.47			
	D	1848.70			
	E	1693.33			
PC	A	1944.53	192.95	3	< .001
	B	1623.23			
	D	1578.31			
	E	1959.93			
BC	A	1845.00	23.95	3	< .001
	B	1773.08			
	D	1645.87			
	E	1842.05			
CI	A	1576.57	192.85	3	< .001
	B	2060.28			
	D	1924.93			
	E	1544.22			

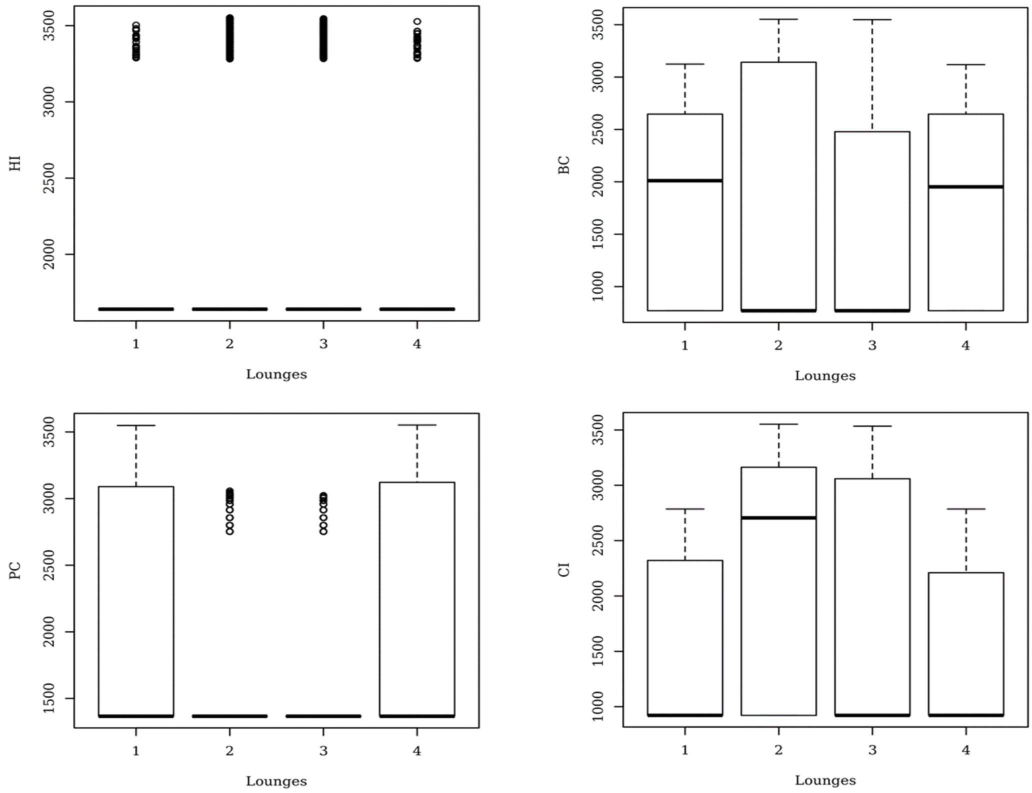


Figure 7-21 Ranked values of queue length at HI, PC, BC and CI by lounge - first scenario. (Lounge 1 = A; Lounge 2 = B; Lounge 3 = D; Lounge 4 = E**)**

Figure 7-22 illustrates the utilisation rates for the key processes inside the lounges, including HI, PC and CI. It is noticed that the utilisation rates for PC and CI are close together with a slight difference, where the utilisation rate of PC is higher than that of CI in Lounges A and E. Conversely, in Lounges B and D, there is a greater difference between these two utilisation rates, with that of CI being higher than that of PC. However, the utilisation rate of HI is the lowest in all lounges, ranging between 0 and 0.2. Moreover, all utilisation rates for these processes, especially the PC and CI processes, rise in the last two weeks of the arrival period at all lounges, as shown in Figure 7-22. Hence, this indicates that the utilisation rates increased significantly during the periods in which the number of arriving pilgrims increased. Therefore, the relation between the utilisation rate, queue length and average waiting time at each process needs to be discussed to determine the influencing factors. This is done in the discussion chapter.

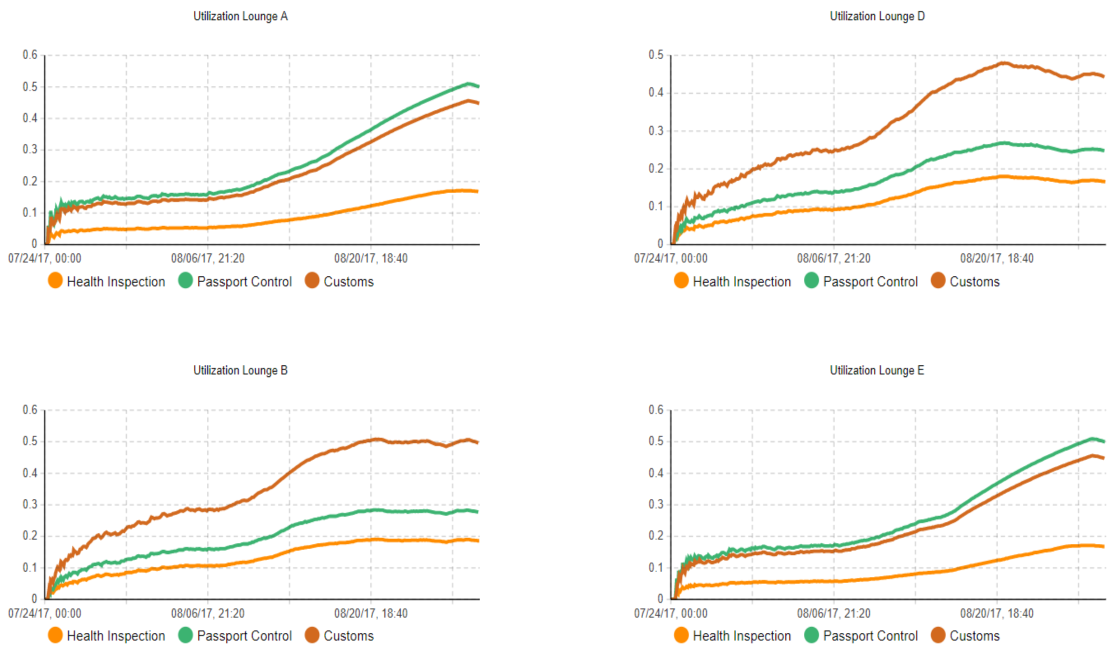
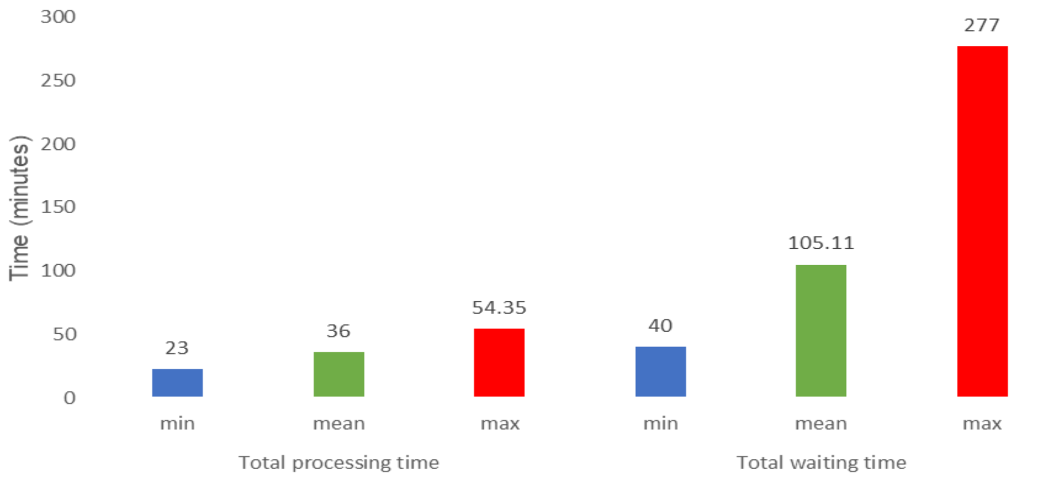


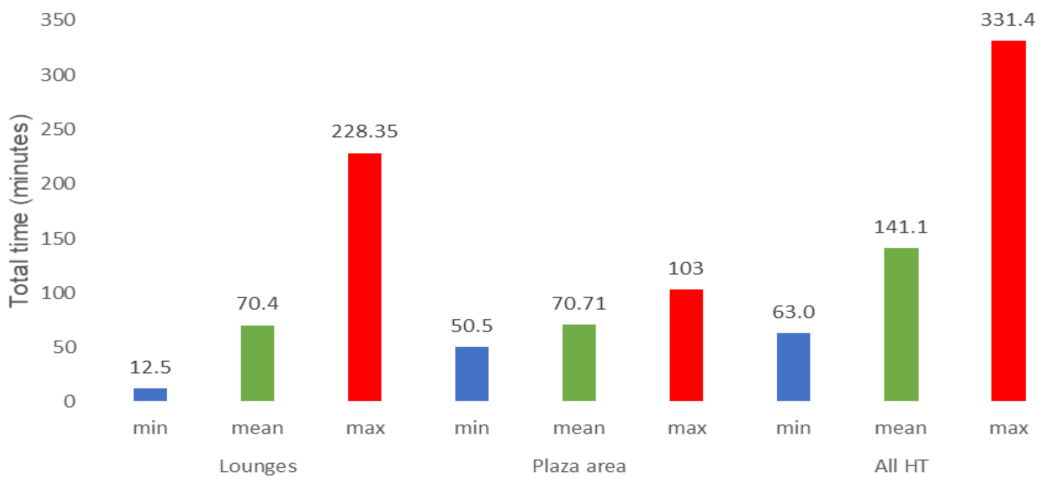
Figure 7-22 Utilisation rates for HI, PC and CI processes – first scenario.

An examination of the simulation results for this scenario reveals that the average waiting time for the pilgrims ranges between 40 and 277 minutes, while the mean is 105.11 minutes. However, the processing time of the pilgrims varies from 23 to

54.35 minutes, while the mean is 36 minutes. Therefore, the total time taken by the pilgrims to finish all processes in the lounges ranges between 12.5 and 228.35 minutes, while the mean is 70.40 minutes. Moreover, the total time taken by the pilgrims to complete all processes in the plaza area is between 50.50 and 103 minutes, while the average is 70.71 minutes. Accordingly, the maximum total time required by pilgrims to complete all arrival processes at the HT at Jeddah Airport is 5.5 hours, and the minimum total time is 1 hour, while the average total time is 2.4 hours, as shown in Figure 7-23.



a. The maximum, minimum and mean of waiting and processing time



b. The maximum, minimum and mean of total time

Figure 7-23 Descriptive data for processing, waiting and total time based on results of first scenario for HT at Jeddah Airport.

Finally, this section discusses the results of the tool developed to measure the LoS for the processes in the lounges at the HT based on two dimensions, the optimum space per pilgrim and waiting time at each process, as suggested by the IATA (2014). This tool is the density map developed based on the IATA LoS matrix, which is divided into four colours according to the two dimensions mentioned above, each of which gives an indication of the LoS and corrective action, as shown in Figure 7-24.

		Space		
		Over-Design > Ym^2	Optimum X to Y m^2	Sub-Optimum < Xm^2
Maximum Waiting Time	Overdesign (<A mins)	OVER-DESIGN 3	OPTIMUM 2	SUB-OPTIMUM Consider improvement 1 Y-1
	Optimum (A minutes or seconds to B minutes or seconds)	OPTIMUM 2	OPTIMUM 2	SUB-OPTIMUM Consider improvement 1 Y-2
	Suboptimum (>B mins)	SUB-OPTIMUM Consider improvement 1 Y-3	SUB-OPTIMUM Consider improvement 1 Y-4	UNDER-PROVIDED Reconfigure 0

Figure 7-24 IATA LoS matrix.

Source: (IATA, 2014)

Figure 7-25 illustrates the density map of the HI, PC, BC and CI process areas for all lounges in this scenario. Each block of four rows represents a process in the four lounges; for example, the first four rows starting from the top of this figure represent HI in Lounges A, B, D and E, respectively. Additionally, most of the processes in the lounges are located in the yellow area of the matrix, which means that they have long waiting times or shortages in terms of space per pilgrim. Thus, these processes located in the yellow area of the matrix need procedural improvements. On the other hand, the CI process has all colours of the LoS matrix except red, but most parts are blue. Consequently, this process does not need improvement on most days, as the blue and green colours cover most of the rows of the density map for this process in all lounges. Hence, this indicates that, on most days, this process does not suffer from congestion problems or long waiting times. The BC process is located in the yellow area of the matrix at all times. Therefore, these processes suffer from congestion problems or long waiting times and need improvement in the procedures involved in sending the baggage from the aircraft to the baggage conveyor belt in the lounges. Furthermore, the PC process has all colours of the LoS matrix, but most parts are yellow. However, the red colour appears in the middle of the fifth week in this process in Lounges A and E. An examination of Figure 7-20 and Figure 7-25 shows that the red colour of the density map for PC in Lounges A and E is located at the same point as the sharp peak of long queues. Consequently, this suggests that there is a strong relationship between the high increase in the number of pilgrims arriving in Lounges A and E and the appearance of the red colour in the density map of the PC process. Thus, during the fifth week of the arrival period in Lounges A and E, the PC process suffers from massive congestion and long waiting times.

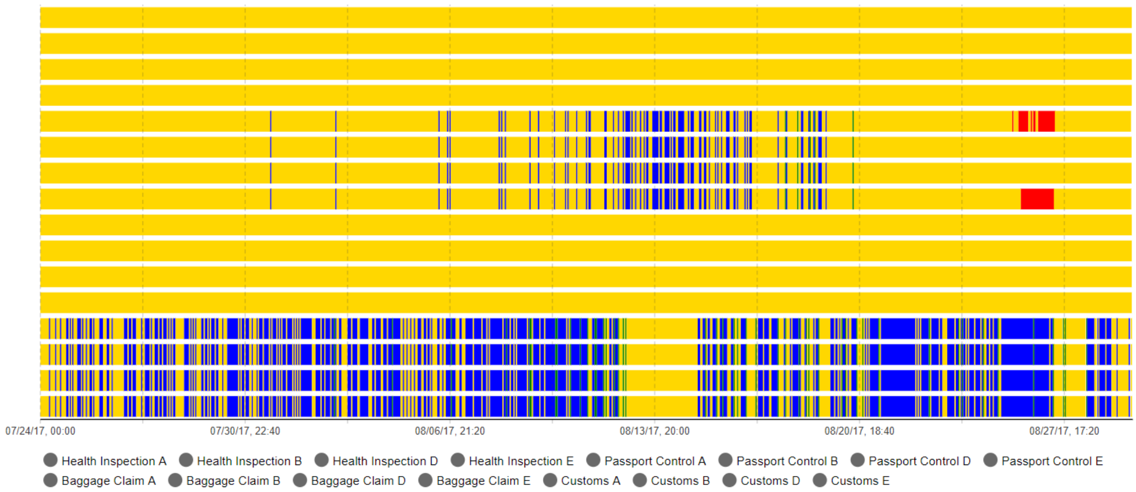


Figure 7-25 Density map for all lounges of HT – first scenario.

7.3.2 Description of second scenario results and analysis

This section illustrates the results of the second scenario as the previous section explained the results of the first scenario for the simulation model of the HT at Jeddah Airport. The results of the second scenario show that there are differences in waiting times and queue length between lounges and processes. Furthermore, the maximum waiting time for HI, PC, BC, CI and UA is 26, 233, 45, 30 and 75 minutes, respectively. Moreover, the average waiting time is 6.13, 54.62, 25, 6.62 and 42.45, respectively. At some times, there was no waiting time in these processes, except BC and UA, which had minimum waiting times of 10 and 30 minutes, respectively. Figure 7-26 shows that the histograms of the average waiting time for each event at the processes in the second scenario are similar to those in the first scenario. However, there is a difference in the average waiting time between the scenarios; that is, the waiting time in the second scenario is higher than that in the first scenario.

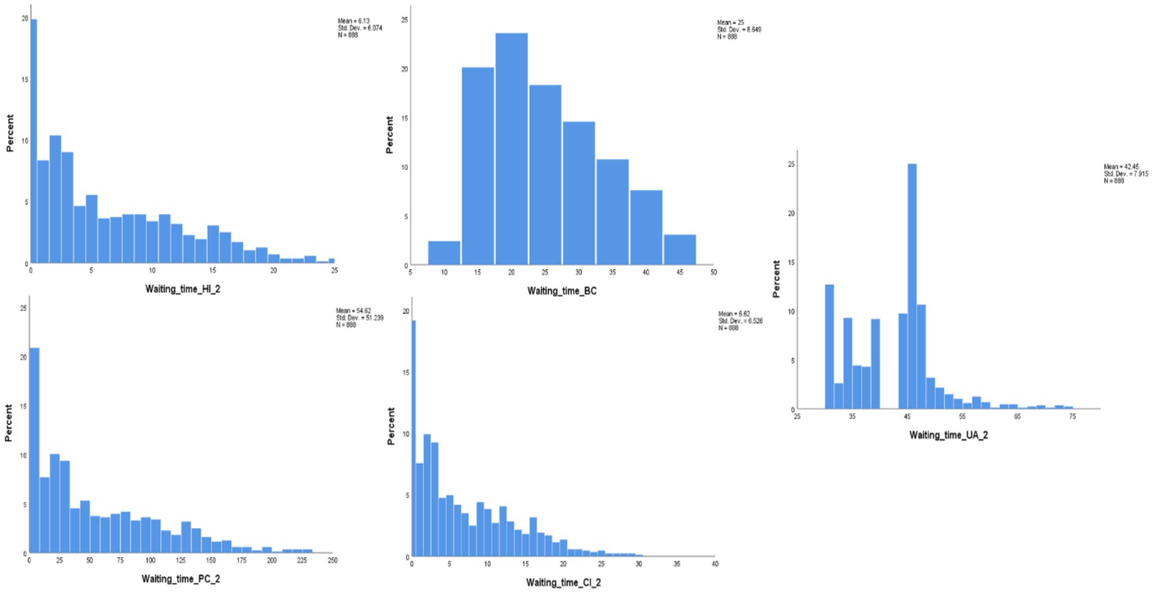


Figure 7-26 Histograms of average waiting time for each event at HI, PC, BC, CI and UA processes – second scenario.

On the other hand, Figure 7-27 indicates that the queue length at PC increases in the fifth week in Lounges A and E. Moreover, the queue length at CI in Lounges B and D increases at the end of the third week until it declines in the middle of the fourth week, and it repeats this behaviour at the end of the fifth week with a shorter queue length. Thus, it becomes clear that the curves for the second scenario in the figure of queue length are somewhat similar to those for the first scenario, but the queue length for the second scenario is twice that of the first scenario. Furthermore, there is a sharp peak in the queue length at PC at the end of the fifth week for Lounges A and E. Additionally, there are several peaks in the queue length at CI in the third, fourth and fifth weeks in Lounges B and D. Therefore, the increases in queue length occur in the periods in which the number of pilgrims arriving at the HT increase, as in the first scenario. Moreover, Figure 7-26 and Figure 7-27 show the accumulation patterns of the pilgrims in each lounge based on average waiting time and number of pilgrims waiting in the queues at each stage.

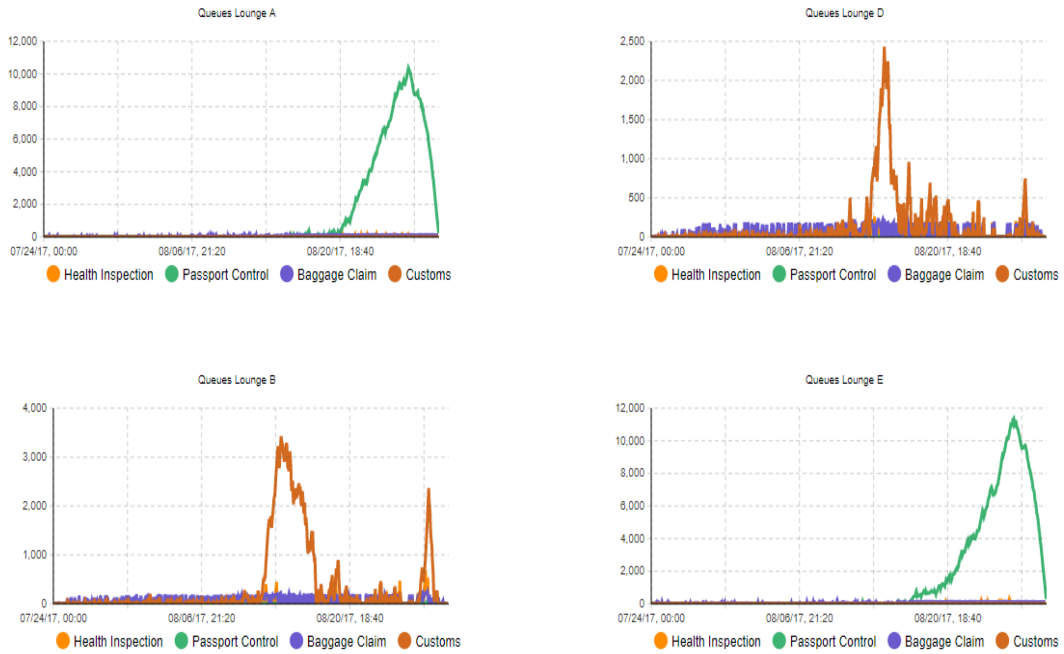


Figure 7-27 Queue length for processes at each lounge – second scenario.

The difference in the performance of processes based on the queue length among the lounges in the first scenario was tested using the Kruskal–Wallis test. Therefore, this test was repeated in the second scenario, and the results showed that there was a statistically significant difference in queue length for HI, PC, BC and CI based on an alpha value of 0.05 ($\chi2(3) = 125.73$, $p < .001$, $\chi2(3) = 229.97$, p < .001, $\chi2(3) = 14.02$, $p < .003$ and $\chi2(3) = 251.91$, $p < .001$), respectively, as shown in Table 7-9 and Figure 7-28.

Table 7-9 Kruskal–Wallis rank sum test for queue length at HI, PC, BC and CI by lounge – second scenario

Process	Level	Mean Rank	*χ2*	*df*	*p*
HI	1	1663.28	125.73	3	< .001
	2	1909.37			
	3	1856.55			
	4	1676.8			
PC	1	1983.04	229.97	3	< .001
	2	1603.73			
	3	1532.24			
	4	1986.99			
BC	1	1822.47	14.02	3	0.003
	2	1810.32			
	3	1669.31			
	4	1803.9			
CI	1	1518.73	251.91	3	< .001
	2	2108.18			
	3	1951.55			
	4	1527.54			

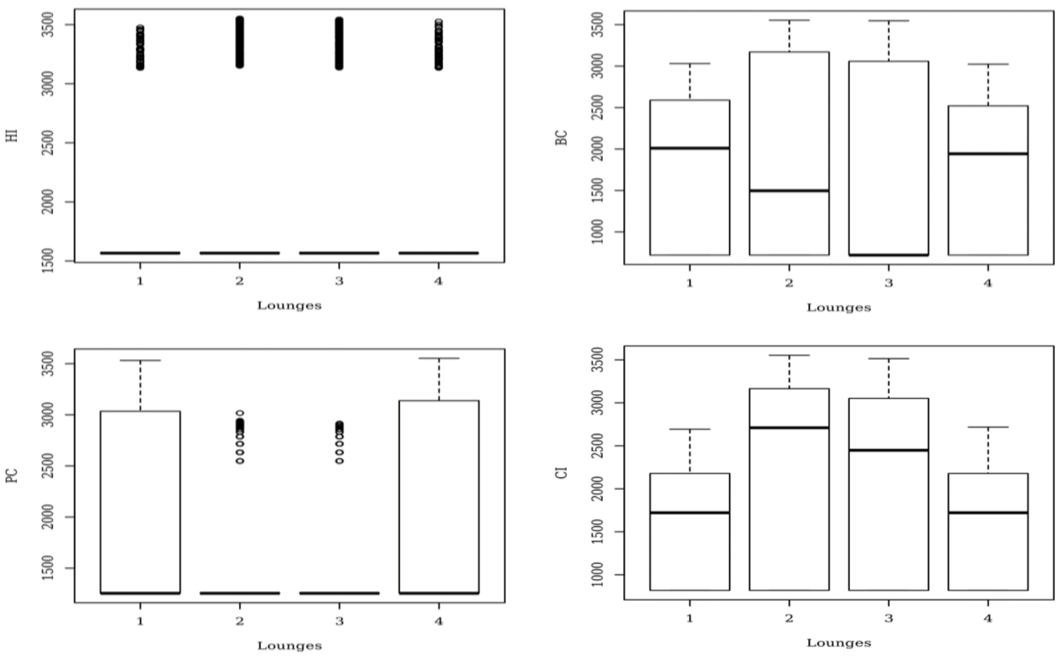


Figure 7-28 Ranked values of queue length at HI, PC, BC and CI by lounge – second scenario.

Figure 7-29 depicts the utilisation rates for the critical processes inside the lounges, including HI, PC and CI, in the second scenario. The utilisation rates for PC and CI are higher than that of HI and close, with that of PC being slightly higher than that of CI, in Lounges A and E. Conversely, there is a big difference between the utilisation rates of PC and CI, with that of CI being significantly higher than that of PC, in Lounges B and D. However, the HI utilisation rate is the lowest in all lounges, where it ranges from 0 to 0.2. In addition, all utilisation rates for these processes, particularly the PC and CI processes, increase sharply over the last two weeks of arrivals in all lounges, as shown in Figure 7-29. Thus, the behaviour of the curves in Figure 7-29 suggests that the rate of utilisation increases significantly during the period in which the number of arriving pilgrims increases. Furthermore, the utilisation rate curves in Figure 7-29 show that there is a similarity between the behaviour of these curves and that of the curves in the first scenario, with a rise in this rate in all processes at all lounges in the second scenario. Consequently, these findings are discussed in the discussion chapter to determine the influencing factors.

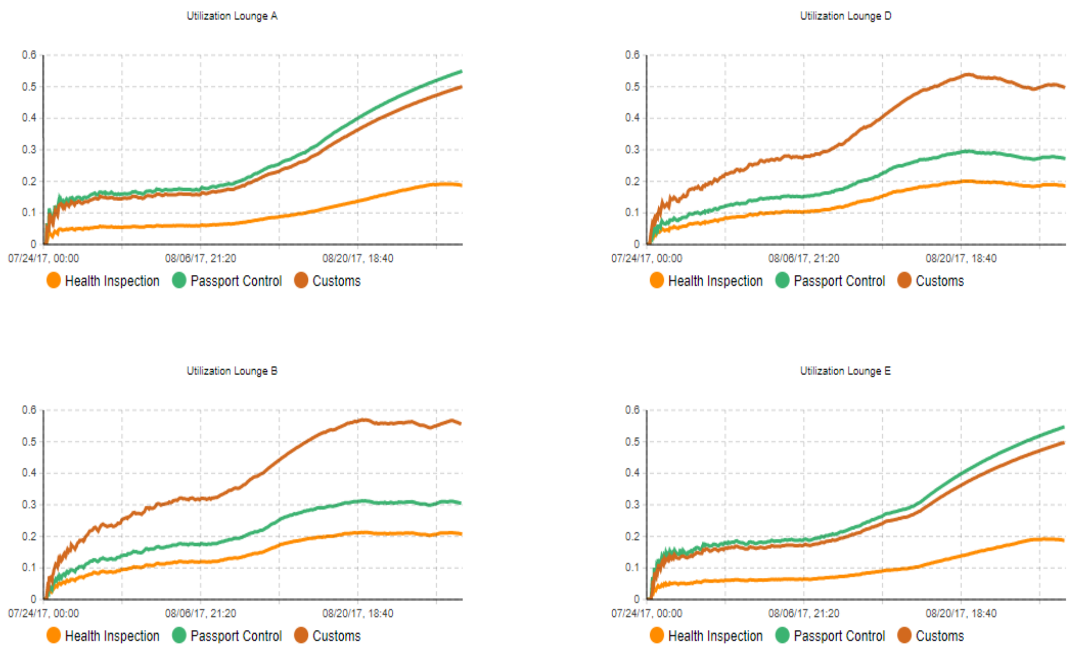
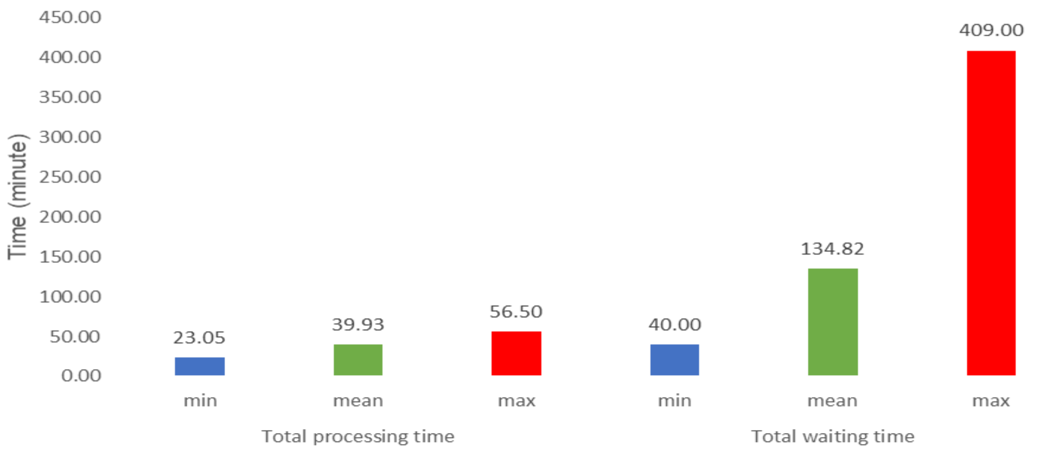
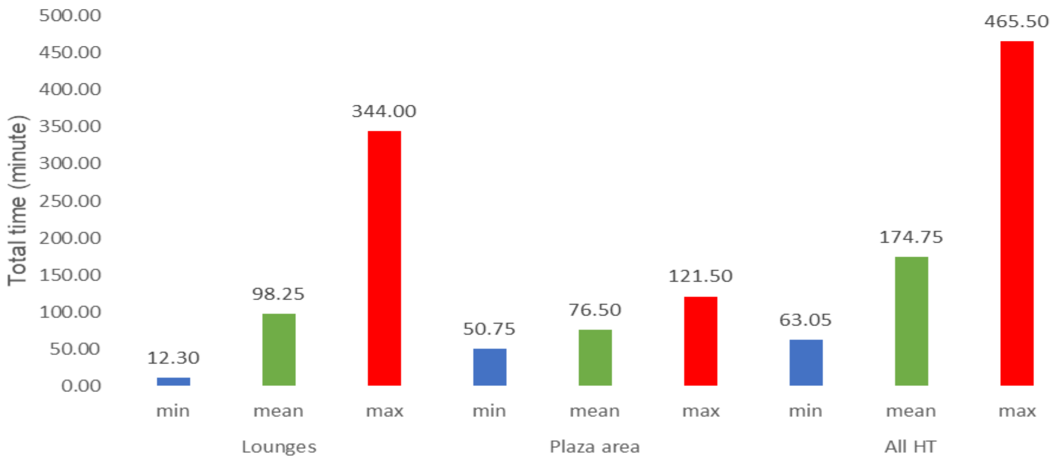


Figure 7-29 Utilisation rates for HI, PC and CI processes – second scenario.

An examination of the simulation results for the second scenario shows that the average waiting time for the pilgrims ranges between 40 and 409 minutes, while the mean is 134.82 minutes. Moreover, the processing time for the pilgrims varies between 23.05 and 56.5 minutes, while the mean is 39.93 minutes. Thus, the total time to complete all processes in the lounges ranges from 12.3 to 344 minutes, while the mean is 98.25 minutes. Additionally, the total time for the pilgrims to complete all processes in the plaza area ranges between 50.75 and 121.5 minutes, while the mean is 76.5 minutes. Based on these figures, the total time required by pilgrims to complete all arrival processes at the HT at Jeddah Airport ranges between 1.05 and 7.76 hours, while the mean is 2.91 hours, as shown in Figure 7-30.



a. The maximum, minimum and mean of waiting and processing time



b. The maximum, minimum and mean of total time

Figure 7-30 Descriptive data for processing, waiting and total time based on results of first scenario for HT at Jeddah Airport – second scenario.

On the other hand, this result demonstrates that the times in the second scenario increased without exception. Consequently, all scenario results need to be studied and compared to learn about the differences between these results in more detail.

At the end of this section, the results of the density map tool for this scenario will be discussed, as shown in Figure 7-31. As mentioned for the first scenario, this tool consists of 16 rows, and every block of four rows indicates a process in all four lounges. These indicators appear in one of the four colours explained in the first scenario for each event during the arrival period. Figure 7-31 demonstrates that the second scenario's density map varies greatly from the first scenario's density map in terms of PC and CI; that is, the yellow and red colours increased while the green and blue colours decreased. Thus, it indicates that there is an increase in waiting times and a decrease in the level of space between pilgrims, which leads to congestion and crowding. On the other hand, HI and BC have the same amount of yellow in both scenarios, indicating that they are suffering from long waiting times or lack of space between pilgrims. Thus, these two processes require procedural improvements in all lounges. In addition, the density map demonstrates that the PC process in Lounges A and E has a greater impact in the second scenario than the first and that the second scenario suffers from longer waiting times and longer periods of congestion than the first scenario. Hence, the red colour is a critical indicator that PC needs to be widely studied to determine influencing factors. Furthermore, Figure 7-31 reveals that the CI process has all colours of the LoS matrix except red, but the yellow colour has increased for this process in this scenario, especially in the third and fifth weeks. Thus, it seems that the CI process suffers from congestion problems or long waiting times in some periods in the second scenario. In addition, the second scenario's density map shows that the PC process is negatively affected in this scenario in Lounges A and E, while the CI process is negatively affected in all lounges. By contrast, the HI and BC processes are not affected in any lounges, and they exhibit the same behaviour as the first scenario's density map.

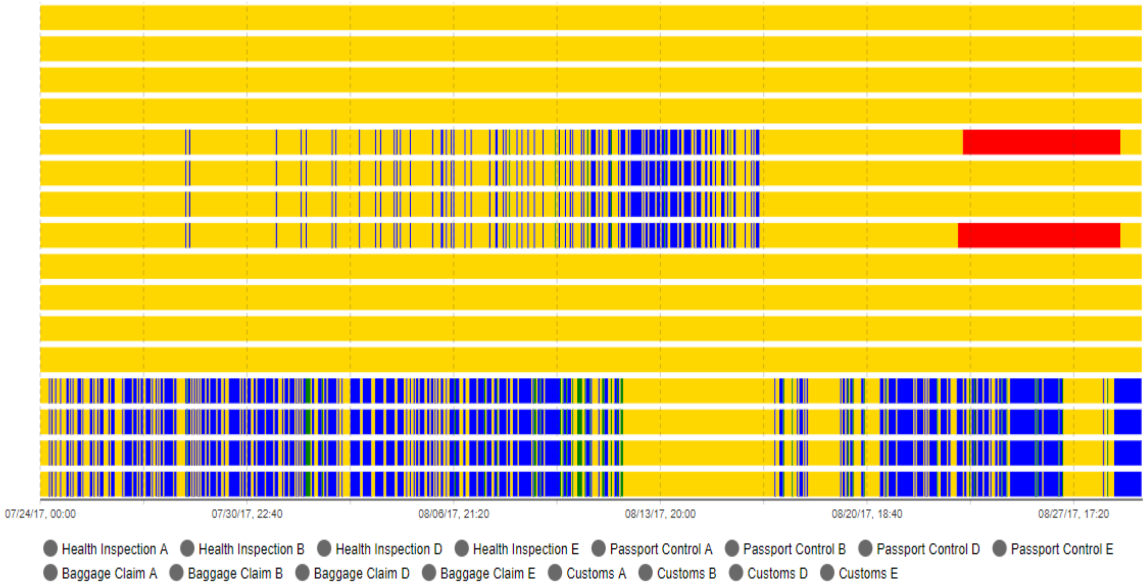


Figure 7-31 Density map for all lounges of HT – second scenario.

7.3.3 Description of third scenario results and analysis

This section demonstrates the results of the third scenario as the previous sections described the results of the first and second scenarios for the simulation model of the HTs at Jeddah Airport. The findings for this scenario indicate that, as described in the first and second scenarios, there are differences in waiting times and queue lengths between lounges and processes. In the comparison, HI, PC, BC, CI and UA have a maximum waiting time of 29, 325, 45, 29 and 97 minutes, respectively, while they have an average waiting time of 8.64, 107.29, 26.5, 6.17 and 46.78, respectively. On the other hand, the HI, PC and CI processes have no waiting time, while the BC and UA processes have minimum waiting times of 10 and 30 minutes, respectively. Figure 7-32 displays the histograms of waiting time at the processes, which show the slight difference in the behaviour of the histograms for waiting time between this scenario and the first and second scenarios. In addition, there is a difference in the length of waiting time between the scenarios; that is, the third scenario has higher waiting times than the first and second scenarios for most processes.

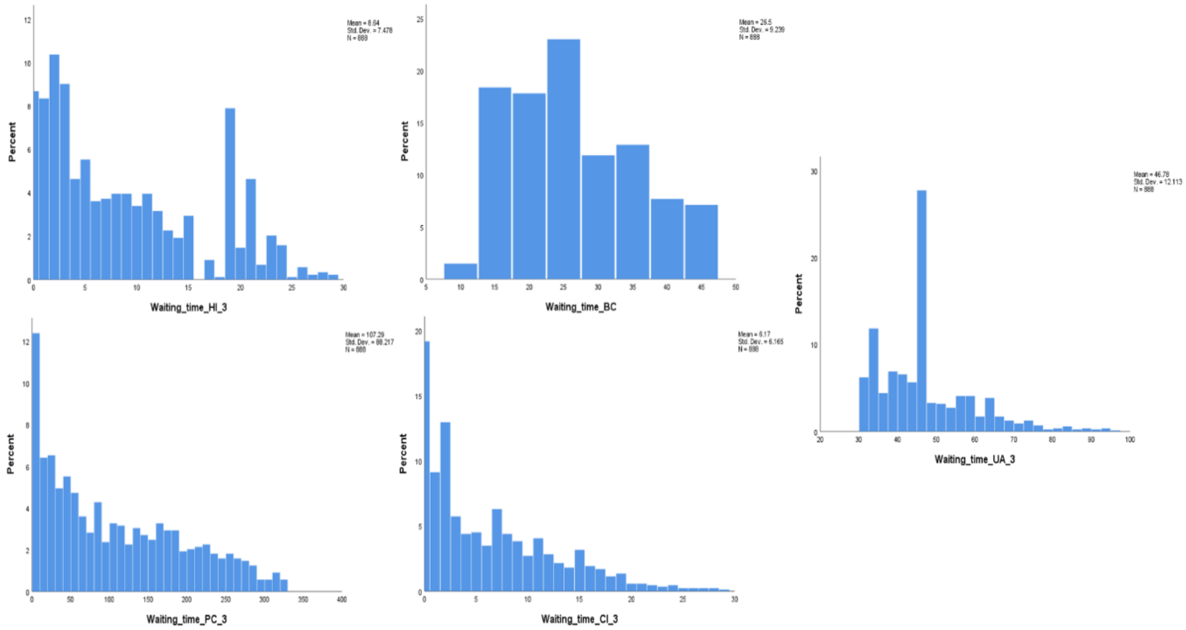


Figure 7-32 Histograms of average waiting time for each event at HI, PC, BC, CI and UA processes – third scenario.

On the other hand, Figure 7-33 illustrates that the behaviour of the queue length curves for processes inside the lounges in this scenario is similar to that in the previous scenarios with a difference in the queue length. Thus, the queue length in the third scenario is greater than that in the first and second scenarios. In addition, the queue length in PC increases in the fifth week in Lounges A and E, while that in CI in Lounges B and D increases at the end of the third week until it declines in the middle of the fourth week. Moreover, there is a sharp peak in the queue length curves for the PC process at the end of the fifth week in Lounges A and E. However, the HI and BC processes in all lounges have lower queue lengths, but in Lounges B and D, the BC process queues are longer than the HI queues. Based on Figure 7-32 and Figure 7-33, the patterns of pilgrim accumulation in each lounge based on the average waiting time and the number of pilgrims waiting in the queues at each stage were found.

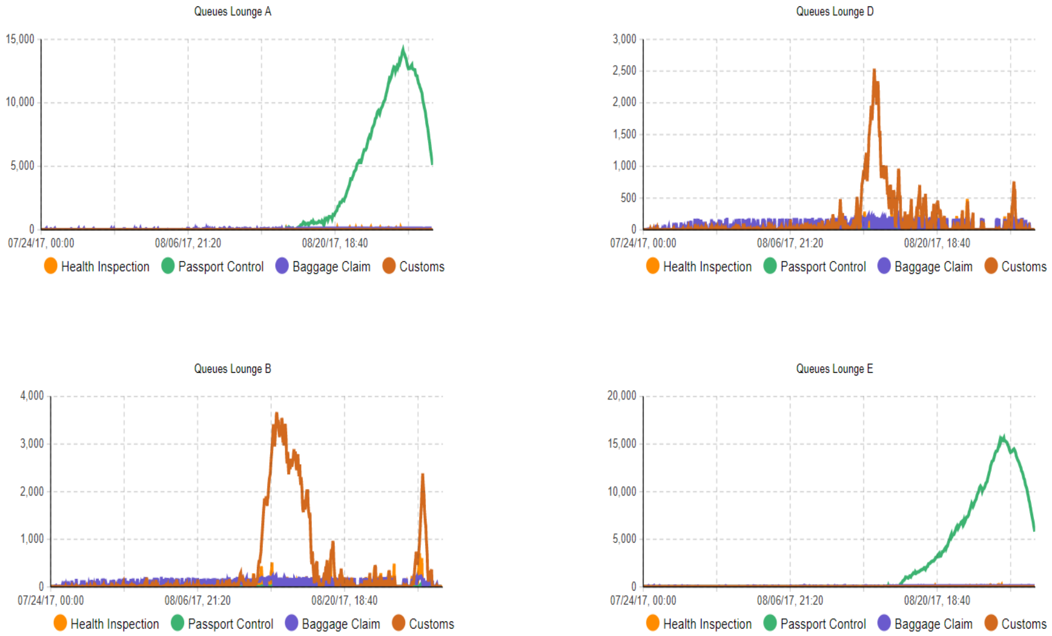


Figure 7-33 Queue length for processes at each lounge – third scenario.

On the other hand, the Kruskal–Wallis test was applied to examine the variance in the performance of processes between the lounges based on queue length, as with the first and second scenarios. The results revealed a statistically significant difference in queue length for HI, PC, BC and CI based on an alpha value of 0.05 ($\chi2(3) = 123.98$, $p < .001$, $\chi2(3) = 252.43$, $p < .001$, $\chi2(3) = 12.62$, $p = .006$ and $\chi2(3) = 307.59$, $p < .001$), respectively, as shown in Table 7-10 and Figure 7-34. Therefore, in all scenarios, there is a difference in the performance of processes between the lounges, as mentioned earlier.

Table 7-10 Kruskal–Wallis rank sum test for queue length at HI, PC, BC and CI by lounge – third scenario

Process	Level	Mean Rank	χ^2	*df*	p
HI	1	1665.61	123.98	3	< .001
	2	1910.37			
	3	1854.11			
	4	1675.9			
PC	1	2009.81	252.43	3	< .001
	2	1588.86			
	3	1516.94			
	4	1990.38			
BC	1	1804.8	12.62	3	0.006
	2	1826.29			
	3	1675.6			
	4	1799.31			
CI	1	1503.21	307.59	3	< .001
	2	2139.67			
	3	1974.25			
	4	1488.87			

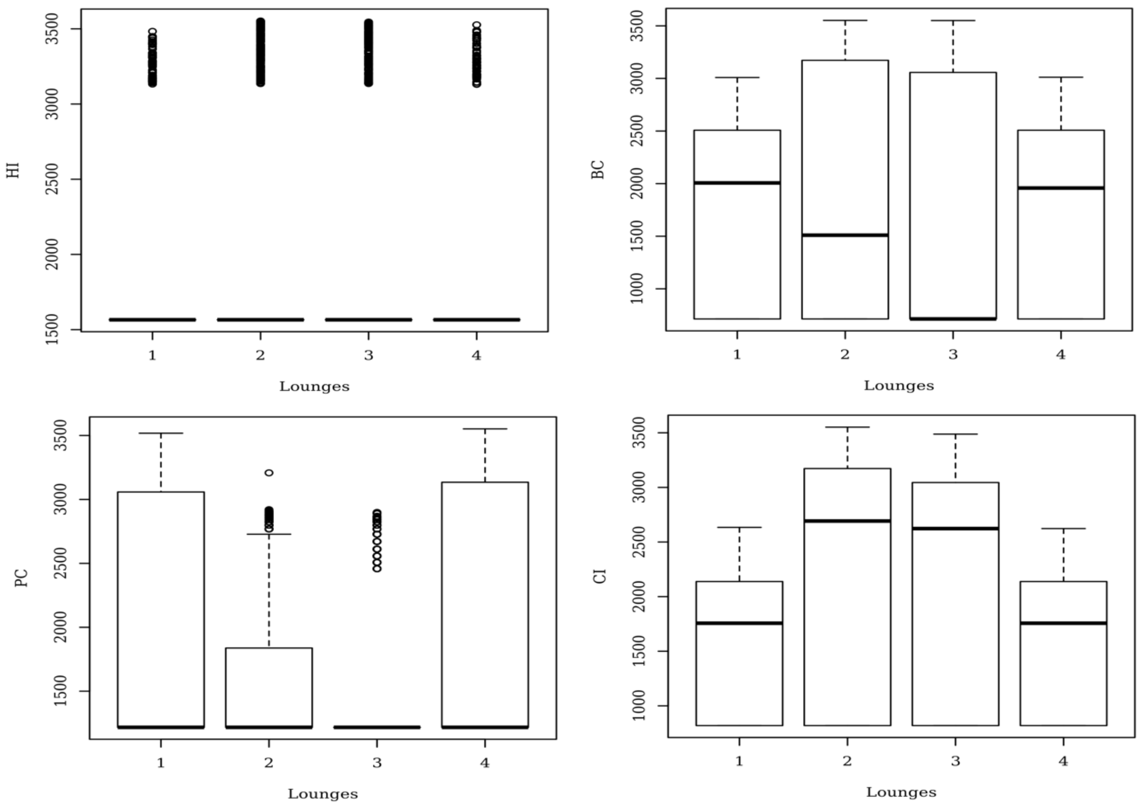


Figure 7-34 Ranked values of queue length at HI, PC, BC and CI by lounge – third scenario.

Figure 7-35 illustrates the utilisation rates for important processes inside the lounges, including HI, PC and CI, in this scenario. Based on these rates, it was found that the utilisation rate curves in this scenario are similar to those of the second scenario. Hence, it was concluded that the utilisation rate behaviour was not affected by changes between the second and third scenarios. Still, there was a slight difference in the rate between the first scenario and the last scenario.

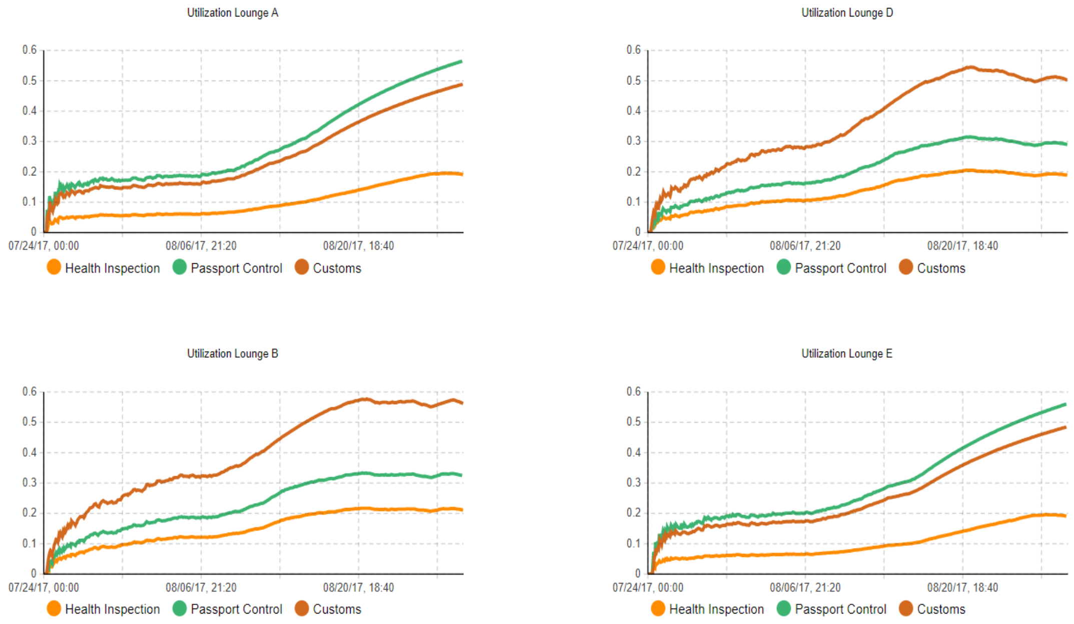
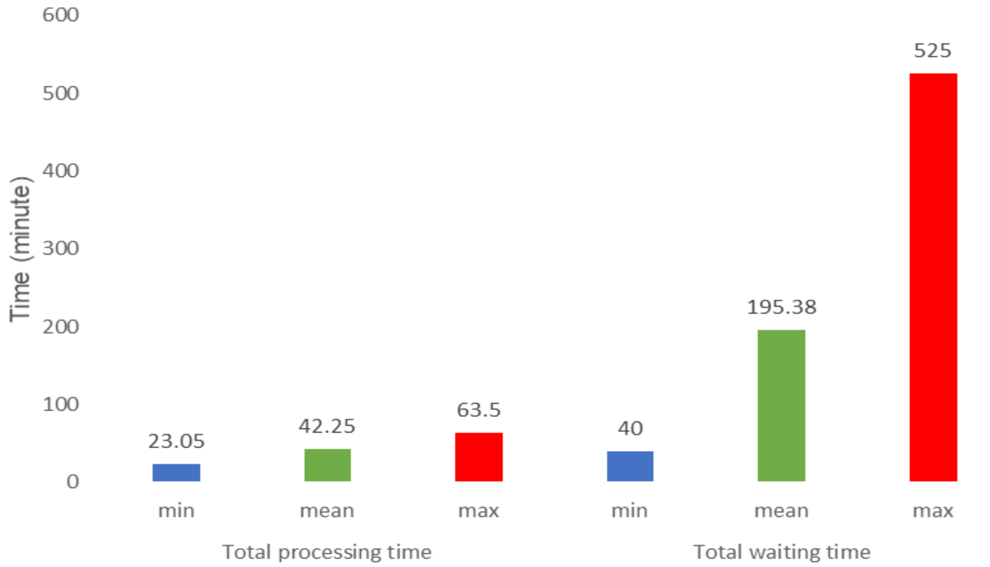


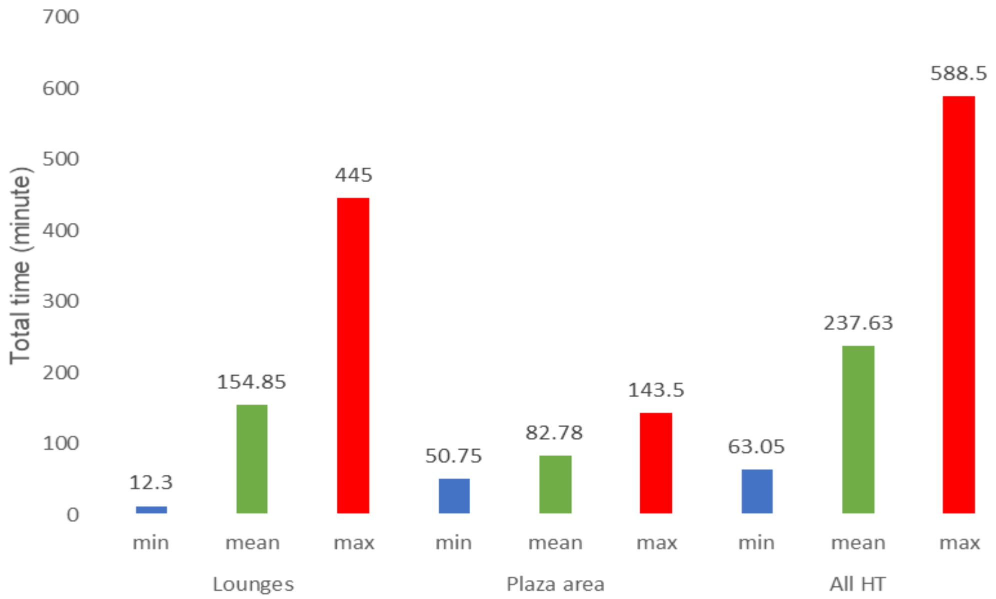
Figure 7-35 Utilisation rates for HI, PC and CI processes – third scenario.

Furthermore, the overall time measurement results for the third scenario are summarised in Figure 7-36. According to the results, the average waiting time for the pilgrims ranges between 40 and 525 minutes, while the mean is 195.38 minutes. Additionally, the processing time for the pilgrims ranges between 23.05 and 63.5 minutes, while the average is 42.25 minutes. On the other hand, the total time for the pilgrims to complete all processes in the lounges ranges from 12.30 to 445 minutes, while the mean is 154.85 minutes. In addition, the total time for the pilgrims to complete all the processes in the plaza area ranges between 50.75 and 143.5 minutes, with an average time of 82.78 minutes. Hence, the total time required by pilgrims to complete all inbound processes at the HT at Jeddah Airport varies between 1.1 to 9.8 hours, while the mean is 4.0 hours, as shown in

Figure 7-36. A comparison of the time measurement results of the three scenarios revealed that there are no significant differences in the minimum values for waiting, processing and total time. At the same time, there are substantial differences in the maximum and mean values of the time measurement results.



a. The maximum, minimum and mean of waiting and processing time



b. The maximum, minimum and mean of total time

Figure 7-36 Descriptive data for processing, waiting and total time based on results of first scenario for HT at Jeddah Airport – third scenario.

Finally, the density map results for this scenario are presented, as shown in Figure 7-37. A comparison of the density maps of this scenario and the second scenario reveals that there is a similarity in the density map indicator for all processes at all lounges except the PC process in Lounges A and E, where the red colour indicator appears for a greater number of events in this scenario than in the second scenario. This indicates that the assumptions made in the third scenario had a negative impact on the LoS, especially the PC process in Lounges A and E. Therefore, the next section includes a broad discussion of this phenomenon.

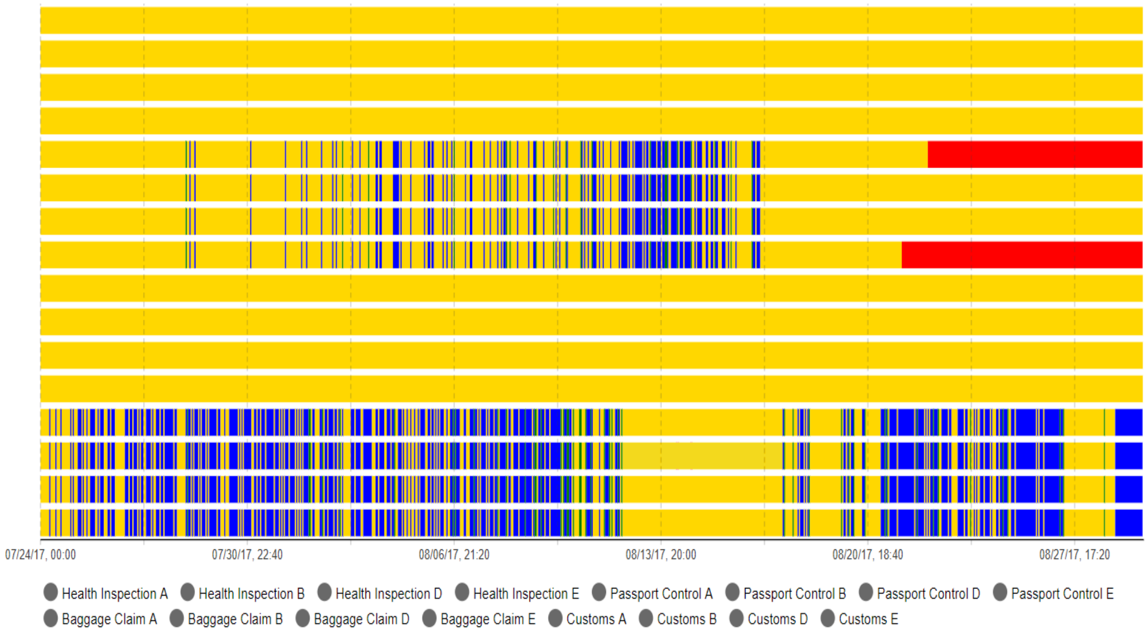


Figure 7-37 Density map for all lounges of HT – third scenario.

7.3.4 Results analysis and comparison

7.3.4.1 Validation of integrated simulation model

This section addresses the process of validation of this integrated model using verification and comparison with the real data of the HT at Jeddah Airport because the environment of inbound processes in this terminal differs from that in general international airport terminals in terms of configurations and processes and because there is a lack of research on them. Thus, this validation process requires observations to be made and data to be collected from the airports, which is a time-consuming and extensive task (Kirk et al., 2012). Moreover, surveillance cameras can provide accurate real data on waiting, processing and total times inside the HT, but these were inaccessible to the researcher for security reasons. Therefore, the data necessary to carry out this validation were able to be obtained by observing this environment as well as from the quantitative and qualitative research conducted in the previous phases of this study. On the other hand, the results of the third scenario with the real data are used to perform this validation, as they represent the real environment of this terminal.

Table 7-11 illustrates comparisons of the waiting time at each process in the third scenario and the real data of the HT at Jeddah Airport. There is a difference between the simulation results and actual data in all processes' maximum and average values, except BC's maximum value. Hence, the relative errors range between 0.00% and 24.53%. Moreover, the reason for the variation in the values of relative errors between the processes may be a difference in policies at HTs compared to general international terminals. For example, there may be additional checks or procedures, including security or health checks (Ma, 2013). Accordingly, we conclude that this model produces high-quality accurate results.

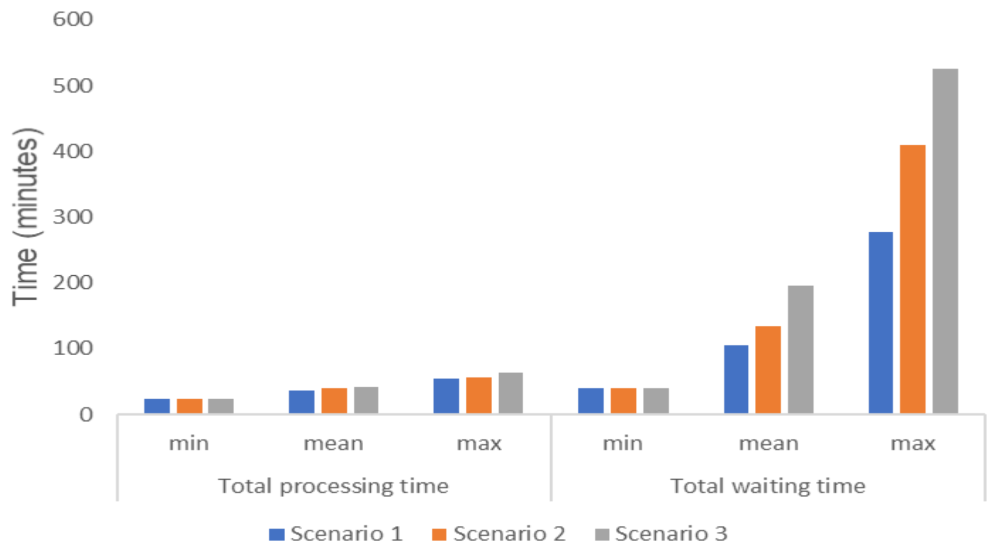
Table 7-11 Comparisons of HI, PC, BC, CI and UA waiting time and BS processing time between simulation results and real data at inbound processes - HT Jeddah Airport

Process		Waiting time			Processing time		
		Actual	Simulation	Relative error	Actual	Simulation	Relative error
HI	Max	35	29.00	20.69%			
	Average	10	8.64	15.74%			
PC	Max	330	325.00	1.54%			
	Average	90	107.29	16.12%			
BC	Max	45	45.00	0.00%			
	Average	20	26.50	24.53%			
CI	Max	25	29.00	13.79%			
	Average	5	6.17	18.96%			
UA	Max	90	97.00	7.22%			
	Average	45	46.78	3.81%			
BS	Max				42	45	6.67%
	Average				30	35	14.28%

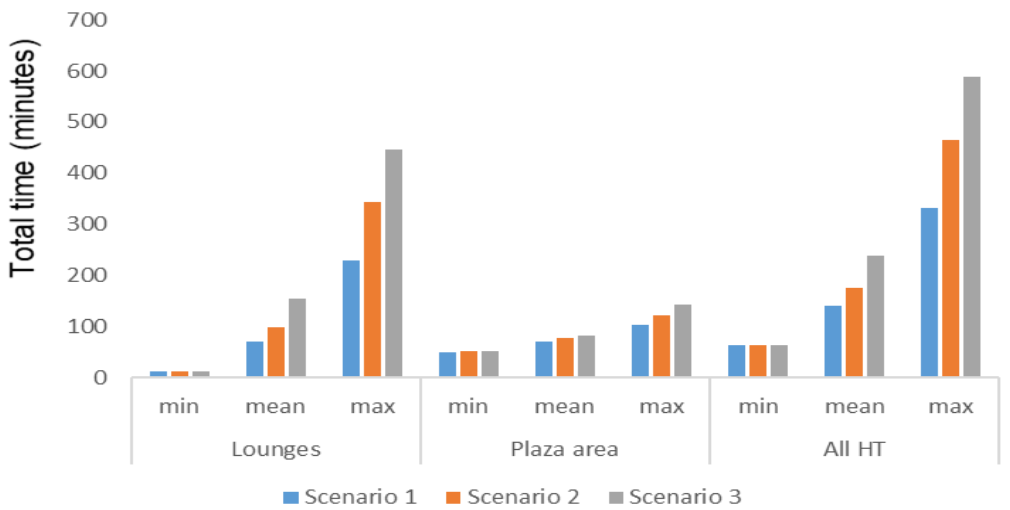
7.3.4.2 Comparison of results of scenarios

A review of the results of the three scenarios reveals that there are differences between them at the process and domain levels as well as at the general level in terms of waiting time, queue length, total time and level of congestion. Hence, there are differences in the LoS between them, which appeared in the density maps. Figure 7-38 clarifies the differences between the three scenarios in the time factor, including domains of the HT. Moreover, there is variation in terms of the size of differences: some are large, while some are very slight.

Finally, to determine the extent of the difference between all three scenarios in terms of waiting time at the HI, PC, CI and UA processes, a nonparametric alternative to the one-way ANOVA that does not share the ANOVA's distribution assumptions is used (Kruskal–Wallis rank sum test) (Conover and Iman, 1981). The results of this test were significant based on an alpha value of 0.05 and showed that the mean waiting times at HI, PC, CI and UA were significantly different between scenarios, with those of the third scenario being the highest, as shown in Table 7-12 and Figure 7-39.



a. The maximum, minimum and mean of waiting and processing time



b. The maximum, minimum and mean of total time

Figure 7-38 Comparison of three scenarios according to time factor.

The results in this subsection show that the assumptions that were made in the scenarios affected the time factor and optimum space for each pilgrim at the various processes. Thus, the total waiting time in the second scenario is 75% higher than that in the first scenario, while the total waiting time in the third scenario is 28% higher than that in the second scenario, as shown in Figure 7-38. On the other hand, there is no big difference between all scenarios in terms of processing time, as shown in Figure 7-38. In addition, there is high variation between all scenarios in terms of total time and queue length, as shown in Figure

7-38. Moreover, there are variations between scenarios in the density map, where the red and yellow indicators appear more in the third scenario than in the first and second scenarios. Thus, this finding indicates that there is an issue with the space factor in the HT.

Table 7-12 Kruskal–Wallis rank sum test for waiting time at HI, PC, BC and CI by scenario

Process	Level	Mean Rank	χ^2	*df*	p
HI	Scenario1	1178.13	107.17	2	< .001
	Scenario2	1277.25			
	Scenario3	1542.13			
PC	Scenario1	1000.49	389.94	2	< .001
	Scenario2	1281.42			
	Scenario3	1715.59			
BC	Scenario1	1046.91	187.73	2	< .001
	Scenario2	1495.44			
	Scenario3	1455.16			
CI	Scenario1	1107.88	148.09	2	< .001
	Scenario2	1338.83			
	Scenario3	1550.79			

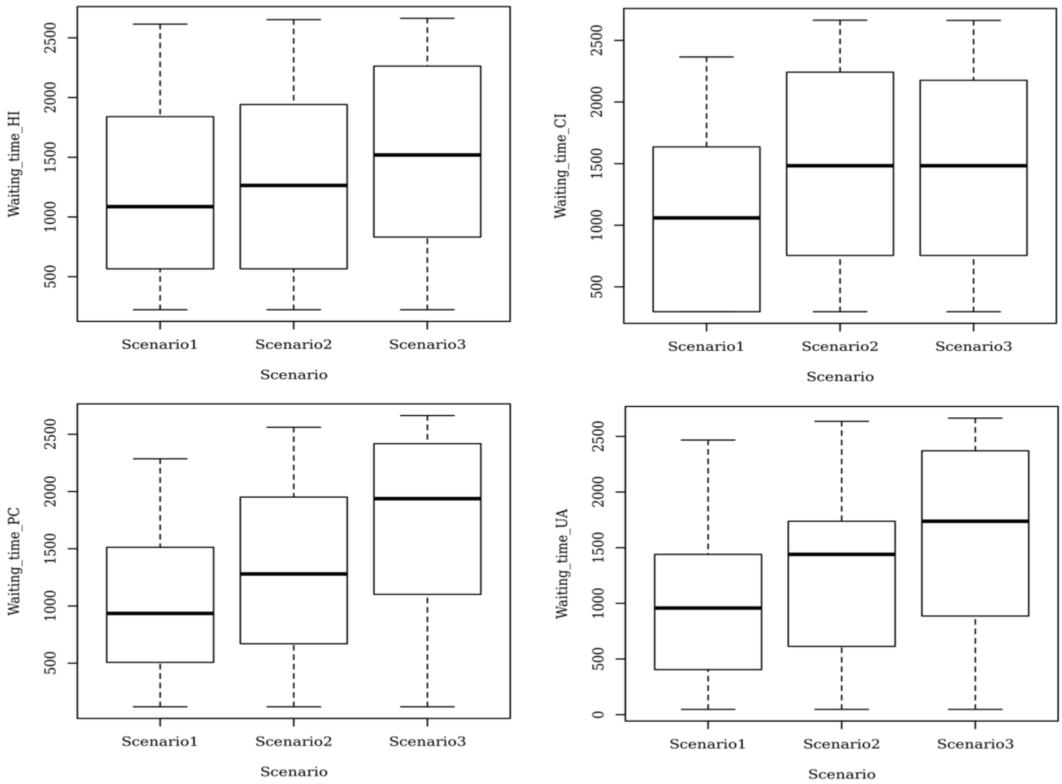


Figure 7-39 Ranked values of waiting time at HI, PC, CI and UA by scenario.

7.4 Summary

This chapter presented an analysis of the results of the integrated simulation model developed by the author to evaluate inbound processes for HTs based on the system point of view. This chapter started by explaining the characteristics of pilgrims' flow through these terminals. Then, this model's practical background, aim and characteristics were explained. Additionally, all processes and modules within the HT, including the parameters and assumptions for each process, were reviewed and discussed. Subsequently, the development phases of this model and the way in which these parameters and assumptions were translated into this model were briefly explained.

Three scenarios in the HT at Jeddah Airport were demonstrated in detail. In each scenario, the output results were discussed by focusing on the analysis of multiple criteria at each process, including the following:

- Histogram of waiting time
- Queue length with a comparison of the performance of processes between the four lounges based on queue length by using the Kruskal–Wallis rank sum test
- Utilisation rate for HI, PC and CI processes
- Time factor, including waiting, processing and total time based on the domains of the terminal with a comparison between them

Then, the results of the density map tool that the author developed based on the IATA LoS matrix were presented to determine the LoS for each process at each lounge based on two dimensions: time factor and optimum space for each pilgrim.

At the end of this chapter, the simulation model was validated by comparing the results of the model with real data to ensure the quality and reliability of the model results. Finally, the results of all scenarios were compared by using a nonparametric alternative to a one-way ANOVA. Consequently, the next chapter will first discuss these findings and the results of other chapters to understand the outcomes and link them to previous studies and then discuss the final framework of this research.

8 CHAPTER EIGHT: RESEARCH DISCUSSION AND INTEGRATED FRAMEWORK

8.1 Introduction

Chapter 8 aims to demonstrate and discuss findings affecting the flow of pilgrims and arrival processing performance at HTs for the development of an integrated framework in this chapter. The framework can be used to evaluate and improve the flow of inbound pilgrims at HTs.

One of the most difficult challenges facing operations and services at congested airports is maintaining the appropriate operational level. Congestion is a phenomenon that arises as a result of an imbalance between airport demand and capacity. Therefore, it causes operational failure and prevents the delivery of acceptable services, negatively affecting passengers’ perceptions. Examples of direct negative impacts include slow processing, long queues and waiting times, high levels of crowding and low LoS and passenger satisfaction, especially for travellers arriving after long trips. Furthermore, the inbound domain in international airports is considered the area most affected by this phenomenon. The HTs at both the Jeddah and Medina Airports, where millions of pilgrims arrive annually during a specific period in the Hajj season, suffer from such congestion.

As mentioned in Chapter 3, there is a growing interest in developing frameworks that serve functions in many tasks related to airport industry development. One of these functions is the evaluation of LoS and quality at airports. Thus, many organisations interested in the airport industry have worked to develop frameworks to improve ASQ (e.g. ACI), assess airport LoS (e.g. IATA) and create a list that can be used to evaluate and improve services at airports (e.g. Transportation Research Board (TRB)).

Furthermore, many researchers have worked on developing frameworks with different goals. For instance, Fodness and Murray (2007), Bezerra and Gomes (2016) and Zidarova and Zografos (2011) have worked on developing frameworks related to ASQ, and Lemer (1992) and Bezerra and Gomes (2015) have developed frameworks related to evaluating performance in airports. In addition, Alodhaibi, Burdett and Yarlagadda (2017) worked on developing a framework to model the flow of passengers in airports. Finally, Pitchforth, Wu and Mengersen (2014), Sohn, Kim and Lee (2012, 2013) and Wattanacharoensil, Schuckert and Graham (2015) have worked on developing frameworks on different aspects of airports.

Chapter 3 mentioned that there is a lack of research focused on inbound processes at airports, particularly crowded airports like those with HTs. Moreover, no framework has been developed for improving arrival processing at airports. Thus, this chapter aims to develop an integrated framework that researchers and airport operators can adopt to improve the arrival processing of pilgrims at HTs. To achieve the aim, this chapter first presents the integrated framework and then validates the framework by expert judgement.

8.2 Integrated framework

This section discusses the proposed integrated framework based on the methodology of this study presented in Chapter 4. When developing the proposed framework, the details of airports with HTs were considered to ensure the framework's suitability for such airports with the possibility of generalising it to other international airports. The purpose of this framework is to obtain an accurate assessment of HTs that reflects the points of view of all players in this environment, including passengers and service providers, as well as the HTs system indicators. Accordingly, the proposed framework serves to evaluate HTs and determine the influencing factors and obstacles.

This framework consists of four stages, as shown in Figure 8-7 1) identification of attributes of passenger flow through terminal arrival processes from users' perspectives, 2) identification of attributes of passenger flow through terminal arrival processes from providers' perspectives, 3) evaluation of terminal arrival processes using a simulation model and 4) deep analysis of all findings to determine common influencing factors and barriers.

8.2.1 Stage 1: Identification of attributes based on users' perspectives

At both airports, pilgrims were surveyed to understand how they rate aspects of their arrival process experience, including waiting and processing time, process efficiency in terms of time, level of staff helpfulness and perceived level of staff knowledge and awareness. The results revealed weaknesses in the processing systems of both airports that were not apparent to airport operators. Previous research studies have focused on the arrival experience and measured overall passenger satisfaction. However, this part of the study examines the arrival experience through measuring satisfaction at the more granular level of passenger ratings for a series of attributes recorded at different stages of the arrival process. This allows for a more accurate and meaningful analysis, and it is more effective at identifying weaknesses in the services offered to pilgrims.

A diverse range of responses was received from pilgrims arriving at both terminals during peak and off-peak periods and none more so than in terms of their willingness to wait and their definition of an acceptable waiting time. Based on quantitative data intended to identify and characterise pilgrims' flow through airport arrival processes from pilgrims' points of view, a problematic review matrix for all processes and aspects was created by performing a descriptive analysis, comparing the means and ranking the variables, as shown in Table 8-1. This approach differs from the previous literature (Ashford, 1988; Correia, Wirasinghe and Barros, 2008a; Correia and Wirasinghe, 2007, 2008; Gonçalves and Caetano, 2017), as each arrival process was evaluated and analysed independently to determine its characteristics and problems based on users' views. Furthermore, this approach determines the issues and characteristics of each process more precisely.

Table 5-13 illustrates that PC was rated the lowest at both airports. The literature, unfortunately, does not provide any insight into the arrival passenger experience at the more granular level of PC (ACI, 2013; Chao, Lin and Chen, 2013; Wiredja, Popovic and Blackler, 2015; Yen, Teng and Chen, 2001). UA was also found to be especially problematic at Jeddah Airport, and BS was found to causes difficulties at Medina Airport. Given that these two processes are unique to HTs, references to comparable research in the literature on the arrival experience of airport passengers could not be identified. The literature on the departure experience (e.g. Bezerra and Gomes (Bezerra and Gomes, 2015), Correia, Wirasinghe and Barros (2008b), Fodness and Murray (Fodness and Murray, 2007), Gonçalves and Caetano (2017)) and the arrival experience (e.g. Borille and Correia (2013)) highlights the factor of time, or more specifically waiting time, as a significant driver of experience.

The findings also revealed that staff courtesy/helpfulness was particularly poor for BC at both Jeddah and Medina Airports. Wiredja, Popovic and Blackler (2015) noted that staff courtesy is an especially relevant service attribute in passengers' arrival/immigration experience. Indeed, this aspect is considered to be a particularly important factor affecting passenger satisfaction in general (ACI, 2013; Bezerra and Gomes, 2015; Correia, Wirasinghe and Barros, 2008b; Fodness and Murray, 2007; Gonçalves and Caetano, 2017).

The group of pilgrims with special needs requiring mobility support and assistance is especially significant with respect to the Hajj. Yet, in spite of its importance as a user segment, both airports received particularly low scores in BS with regard to accessibility for people with special needs. This was clearly observed, as no bus ramps were made available to support this category of pilgrims (i.e. they were manually lifted onto buses). This takes a long time and it is not an ideal method in terms of keeping the pilgrims safe. This aspect is especially important, as it can leave those pilgrims requiring mobility support feeling frustrated and isolated while impeding their speedy transfer.

Furthermore, some researchers have discussed and evaluated facilities and support for people with special needs in airport passenger terminals, such as Ostveen and Lehtonen (2017), who discussed the accessibility requirements of people with disabilities at European automated border control. They found that there has been an improvement in the facilities and assistance for this type of passenger at the airports in the European region in the last decade but that self-service and automated border control is not feasible in the current situation.

Additionally, there has been no proposal for European governments to introduce new facilities to border control systems to enable this category of passenger to use self-service and automated border control. This gives the impression that the aspect of access and facilities for pilgrims with special needs at the HT at both airports is an important factor and that there is a weakness in this aspect that requires significant improvement and greater attention. Meanwhile, staff knowledge/expertise, another human factor, was classified as most problematic only with the CI process at Medina Airport. Fodness and Murray (2007) listed this as an important ASQ theme.

Based on the results of pilgrims' experience, it was concluded that the performance of the HT at Medina Airport surpasses that at Jeddah Airport in most of the processing elements, as shown in Figure 8-1. Perhaps the difference in performance between the two terminals is due to the different management and planning strategies, as the operators differ.

Table 8-1 Problematic review matrix for arrival processing in HTs based on users' perspectives.

Jeddah Airport	Process	Least problematic	Somewhat problematic	Most problematic
Least problematic	Health Inspection	Staff courtesy/helpfulness	Staff knowledge/expertise	Inspection efficiency Waiting time
	Customs Inspection	Staff courtesy/helpfulness Staff knowledge/expertise	Processing time	Inspection efficiency Waiting time
Somewhat problematic	Bus Connection	Staff fairness Staff courtesy/helpfulness	Processing time Staff knowledge/expertise	Tools for people with special needs Processing efficiency
	Baggage Claim	Availability of baggage carts/trolleys	Availability of support staff/helpfulness	Comfortable space around carousels Waiting time
Most problematic	Unified Agents	Processing time Staff courtesy/helpfulness	Waiting time	Processing efficiency Staff knowledge/expertise
	Passport Control	Processing time Staff knowledge/expertise	Staff courtesy/helpfulness	Processing efficiency Waiting time
Medina Airport	Process	Least problematic	Somewhat problematic	Most problematic
Least problematic	Health Inspection	Staff courtesy/helpfulness	Staff knowledge/expertise	Waiting time Processing efficiency
	Customs Inspection	Processing time Staff courtesy/helpfulness	Inspection efficiency	Staff knowledge/expertise Waiting time
Somewhat problematic	Baggage Claim	Availability of support staff/helpfulness	Availability of baggage carts/trolleys	Comfortable space around carousels Waiting time
	Unified Agents	Staff courtesy/helpfulness Staff knowledge/expertise	Processing time	Processing efficiency Waiting time
Most problematic	Bus Connection	Staff fairness Staff courtesy/helpfulness	Staff knowledge/expertise Processing time	Processing efficiency Tools for people with special needs
	Passport Control	Processing time Inspection efficiency	Staff knowledge/expertise	Staff courtesy/helpfulness Waiting time

Pilgrims' satisfaction is driven by time factors, including waiting, processing and inspection time, and service factors, including courtesy and expertise. Through the survey in the HTs at both airports, the pilgrims evaluated all processes except BS according to the following dimensions: waiting time, inspection time, staff courtesy and staff expertise. Table 8-2 illustrates the average scores across several process elements for both airports. The most pressing challenge by a significant margin at both terminals appears to be waiting time. The highest average rating is recorded for staff courtesy at both terminals, followed by expertise and then inspection time.

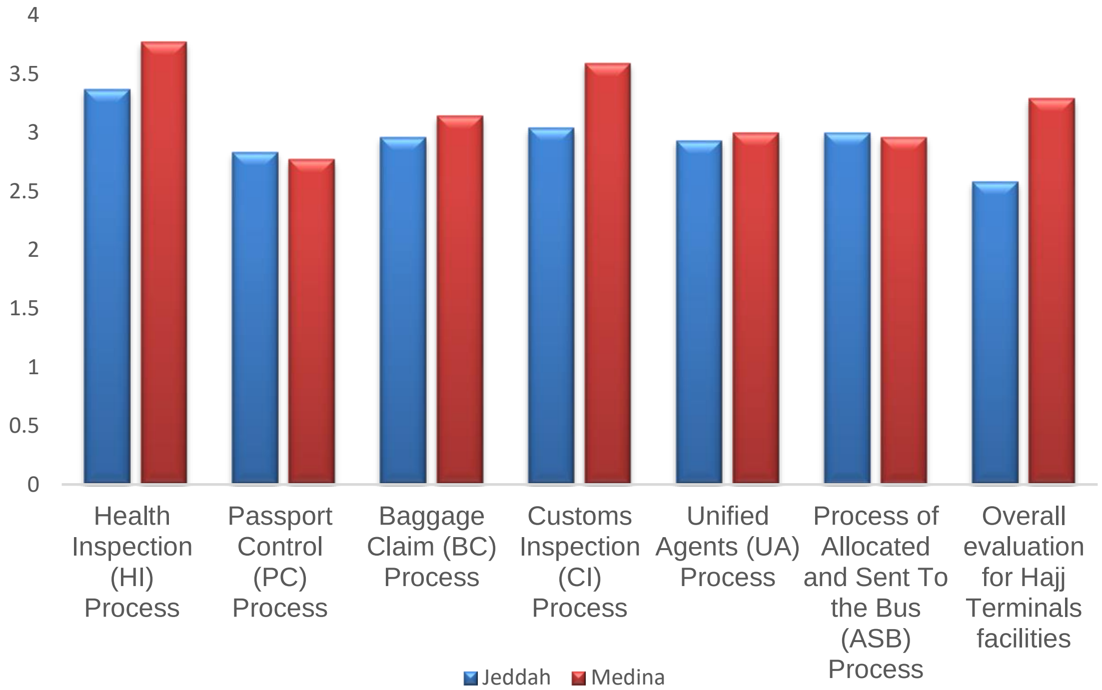


Figure 8-1 Pilgrims' average experience scores by service at HTs at Jeddah and Medina Airports

Table 8-2 Pilgrims' average waiting time, inspection time, staff courtesy and staff expertise scores at HTs at Jeddah and Medina Airports (Scale out of 5.00)

	Jeddah	Medina
Waiting	2.55	2.83
Inspection	3.00	3.19
Courtesy	3.24	3.52
Expertise	3.11	3.28

When a particular process area becomes crowded, the pilgrims are instructed to wait in the waiting area before the queues of the process. This results in long waiting times at arrival processes, such as PC, UA and BS, at the HTs at both airports. Usually, this phenomenon appears with PC in the HTs at both airports. This additional waiting time can reach five hours in the HT in Jeddah Airport, while it can reach three hours in the HT at Medina Airport.

The results demonstrated that most of the pilgrims who participated in the survey of this study at the HT at Jeddah Airport reported having spent additional waiting time. Furthermore, the proportion of respondent pilgrims who spent additional waiting time at Medina Airport was significantly lower than that at Jeddah Airport. In addition, the results indicated that the pilgrims at the HTs at both airports spent additional waiting time in two different locations: before PC and in the plaza area. Moreover, the proportion of pilgrims who spent additional waiting time before PC was greater than that who spent additional waiting time in the plaza area.

Many researchers have discussed the issue of waiting time and how it affects LoS and passenger satisfaction at security screening, such as ACI (2011), Graham (2005), Humphreys et al. (2002) and Kramer, Bothner and Spiro (2013). In addition, many researchers have explored the topic of check-in waiting time and its effects on LoS and passenger satisfaction, such as ACI (2011), Graham (2005), Humphreys et al. (2002), Chen and Chang (2005), Correia et al. (2008b), Fodness and Murray (2007) and Kramer, Bothner and Spiro (2013). Nevertheless, this phenomenon may not be present in other airports, so no previous studies have discussed it. Consequently, it is considered one of the problems affecting passenger satisfaction and LoS in HTs, and it requires extensive study.

On the other hand, the finding of the interaction between pilgrims' human factors and process characteristics showed that there were significant differences in process characteristics depending on human factors. Moreover, a link between pilgrims' human factors and pilgrims' evaluations of the system processes demonstrated the statistically significant effect of some characteristics of human factors on the assessment of processes and the OE of HTs that justified in Chapter 5. Accordingly, it is clear that the human characteristics and factors had an impact on pilgrims' evaluations of the arrival processes as well as their interactions with the processes in these terminals.

The results of the analysis and evaluation of the correlations of the waiting/processing time with pilgrims' evaluations and satisfaction showed a significant link between time and pilgrims' evaluations of each aspect of the processes. There were statistically significant correlations for most aspects but insignificant correlations for other aspects. This result supports previous research on the relationship between passenger satisfaction and LoS, including the factor of waiting and processing time, such as ACI (2011), Graham (2005), Humphreys et al. (2002), Chen and Chang (2005) and Kramer, Bothner and Spiro (2013).

Furthermore, the findings of the analysis of the correlation of total time to finish all processes in the HT with pilgrims' OEs demonstrated that an increase in the total time to complete all processes had a significant negative impact on all OEs at Jeddah Airport. Conversely, at Medina Airport, an increase in the total time to complete all processes had a significant negative effect on the assessment of special needs and disabilities support services, comfort of waiting areas and seats, information visibility/signs and walking distance inside the terminal. In addition, it had a significant negative impact on pilgrims' evaluations of the aspects related to time and efficiency at Medina Airport.

Lastly, the findings of SEM to test the significance of relationships between pilgrims' evaluations of each process within their flow in HTs showed that most processes, including HI, PC, BC, CI and UA, had positive correlation coefficients with OE. Thus, the perception of each process positively correlated with the overall perception of the HT facilities. In addition, it suggests that the perception of the final process in the terminals was 'dissolved' in the overall perception of HT facilities.

8.2.2 Stage 2: Identification of attributes based on providers' perspectives

This subsection completes the preceding section in terms of explaining the results of the study. This subsection addresses and discusses the findings of Chapter 6, which was focused on evaluating the efficiency and determining the characteristics of inbound processing at HTs based on the points of view of providers. As mentioned earlier, the method of thematic analysis was employed by using NVivo 12 tools to analyse 16 interviews. This analysis resulted in 36 codes obtained from 286 references. Thus, through this analysis, a hierarchy of thematic coding based on the views of providers was reached. Moreover, 5 main factors and 15 sub-factors were obtained. The results showed that this part of the study resulted in five types of factors: human, infrastructure, operational, technical and organisational factors.

8.2.2.1 Discussion of findings on human factors

The first of these factors, human factors, relates to both pilgrims and employees in these terminals. It is one of the influencing factors in the services sector, particularly in the airport services sector. As mentioned above, there are human factors related to pilgrims and others related to employees in these terminals. Therefore, the results of these subfactors are discussed separately.

Through 81 references, six codes considered to be human factors associated with pilgrims were found: age, culture, health status/disability, communication and language, level of airport experience and level of education and knowledge. The first of these factors is the age of pilgrims, as a large proportion of pilgrims are elderly. As mentioned earlier, this factor was mentioned 13 times in the interviews, where the participants noted that the age factor had a clear impact on the progress of pilgrims through inbound processing. For example, there was difficulty in dealing with elderly pilgrims in terms of completing their procedures.

In addition, the employees noted having difficulty in dealing with the elderly in terms of following the instructions, as many of them lack language proficiency and thus struggle to follow instructions. Furthermore, there is the difficulty of reading the fingerprints of elderly pilgrims, as many of their fingerprints are damaged due to disease, age and harsh occupations. On the other hand, a high percentage of elderly people over the age of 79 have a hearing, visual, mobility or mental impairment that affects their health status (Chang and Chen, 2011, 2012a). Therefore, the other human factor associated with age in some cases is health status/disability. This factor was mentioned three times in the interviews, and thus, it is one of the factors with the fewest references. Additionally, it was found that the percentage of pilgrims with special needs is high and the amount of equipment to deal with them is insufficient, which impedes the flow of pilgrims and causes delays at certain points, such as BS. Moreover, there are supportive tools and special facilities for this group of pilgrims, but there are some shortcomings, and improvements are needed to reduce waiting times (e.g. providing more tools to help them, such as ramps, electric carts and wheelchairs). A number of researchers have discussed the age and disability factors for airport travellers (Brunetta, Righi and Andreatta, 1999; Chang and Chen, 2011, 2012b; Wolfe, 2003).

Wolf (2003) reported that several issues arise in airports due to the elderly's unique needs. Furthermore, Chang and Chen (2012) discussed the problems faced by elderly and disabled passengers in airport facilities. These include issues with reading signs and hearing flight information among the elderly, issues with getting lost in the airport among the mentally impaired and issues with standing in queues for extended periods or walking long distances in the airport terminal among passengers with mobility problems. This is one of the problems of the HT at Jeddah Airport, where there are shortages of bathrooms in lounges. Thus, this problem means pilgrims must wait a long time to use the bathrooms before PC.

Finally, many participants recommended allocating a special path for elderly pilgrims and pilgrims with special needs, as it would facilitate and improve their flow and that of other pilgrims. In addition, they recommended improving the HI procedure for this category of pilgrims.

Another human factor related to pilgrims is the factor of language and communication with service providers and employees. The communication and language barrier is one of the most important factors and a cause of many issues in the HTs. The participants stated that many pilgrims are elderly, are uneducated, use local languages that are not common or internationally recognised and do not understand the common languages used in HTs, such as English, French, Spanish, Persian or Arabic. This leads to delays in the completion of procedures for pilgrims. Moreover, many pilgrims fail to follow the instructions shown on the instruction boards or signs because they do not know the language in which the instructions are written. This factor had 15 references in the interviews. Hence, this is another indicator of its importance. The communication and language factor is one of the important factors mentioned early in the literature on service quality. For example, Zeithaml, Berry and Parasuraman (1988) mentioned it as one of 10 dimensions of service quality. Recently, with the advancement of the IT, machine learning and artificial intelligence research, some airports, such as Incheon International Airport, have resorted to automatic translation techniques. While this represents progress, it still has deficiencies, such as the inaccuracy of translations and the limited number of languages covered.

Furthermore, the culture factor is one of the important human factors affecting passengers' perceptions of services and their satisfaction. This factor has been discussed in the literature, especially regarding ASQ, by a number of researchers. For example, Keillor et al. (2007), Woodside et al. (2011) and Pantouvakis (2013) have indicated that different national or cultural characteristics can have a significant effect on consumers’ satisfaction with the service provided. Additionally, according to Rendeiro Martín-Cejas (2006), initial experiences with air transport are services provided through airport facilities, which have an impact on passengers’ perceptions of the overall quality of services. However, Ganglmair-Wooliscroft and Wooliscroft (2013) conducted a study concerned with testing different cultures and measuring these passengers' satisfaction with and perceptions of the quality of the procedures. Pantouvakis and Renzi (2016) explored the interaction of millions of inbound passengers from different nationalities and cultures with services at the airport and noted their different perceptions of these services. In addition, they recommended considering this cultural diversity when developing services in order to raise the quality and the satisfaction of passengers and promote sustainable competitiveness in services. HTs are considered complex environments with multicultural users, as the pilgrims come from all over the world and represent almost every country. The results of this study showed that issues arise due to cultural differences. For example, travellers from some cultures tend to move in groups, imitate each other and behave in irregular ways. Consequently, this leads to crowding and impedes the flow of pilgrims within the processes of these terminals. In contrast, some pilgrims from more conformist cultures have a desire to follow guidelines and instructions, which facilitates the completion of their procedures. Accordingly, the decision-makers and operations companies at HTs and missions should work to improve the culture of travel for pilgrims by offering guidance to increase their awareness. Moreover, they should work to improve the services and consider cultural diversity among pilgrims to raise the level of satisfaction among them.

Additional human factors of pilgrims include level of education and knowledge and level of experience with air transport and international airports. These are considered essential factors influencing LoS at HTs, and they can lead to the emergence of obstacles to pilgrims' flow and delay procedures. The level of education and knowledge factor and the level of experience factor were repeated in the interviews 15 and 11 times, respectively. These two factors have been mentioned in research studies related to services, measurement of quality level and user satisfaction as sociodemographic variables, such as Oyewole (2001) and Aksoy, Atilgan and Akinci (2003). Therefore, it was concluded that the level of education and knowledge influences the speed of completing arrival processing and ease of dealing with employees. That is, pilgrims with more education and knowledge are better able to follow the instructions, which makes it easier to complete their procedures in a shorter period. Furthermore, pilgrims with previous experience with international airports complete their procedures more quickly, move through the airport more smoothly and sometimes help translate for other pilgrims who lack experience and have issues with language. Consequently, these human factors contribute either positively or negatively to the processing procedures and pilgrims' flow through HTs, as culture, education/knowledge, language and experience influence cooperation between pilgrims and employees in this environment.

The previous section discussed the results of the human factors related to pilgrims, while this section discusses the results of the human factors of employees and their importance. Through the results, the five most important human factors related to employees influencing the services at HTs were found: language proficiency, cultural issues, level of knowledge/training, sense of responsibility and human fatigue.

The communication factor is considered one of the most important factors mentioned by researchers interested in the quality of services, but it has been identified as a dimension of quality to evaluate the services sector (Zeithaml, Berry and Parasuraman, 1988). Several studies have discussed the importance of language proficiency for airport staff who are on the front lines facing passengers, but most of this research has been focused on proficiency with the English language as a common language worldwide (Bitner, 1992; Cutting, 2012; Fodness and Murray, 2007; Molla Gebre, 2016).

HTs are complex environments serving ethnically diverse pilgrims representing different countries and speaking different languages. Moreover, some of these pilgrims are unable to speak the common languages, as their proficiency is low and they are only fluent in their local languages. Therefore, the employees find it difficult to deal with them, and they wait for translators from the missions or other agencies, which increases the processing and waiting times. Accordingly, the training and education of employees in multiple common languages facilitates the handling of pilgrims and procedures. On the other hand, it is difficult to cover all the languages of the world. Therefore, it is necessary to provide an adequate number of translators from countries' missions, to use multilingual media signs and visual effects or use new translation techniques that cover the most common languages in the world as well as to work on developing new solutions to this problem.

Furthermore, the factor of culture and related issues is considered to have one of the greatest impacts on the workflow, in both the industrial and service sectors. According to Kirschenbaum et al. (2012), airport employees are the same as those in other working environments in that they have different cultural backgrounds that affect their decisions and workflows. Many studies have discussed values and organisational culture and their impact on work environments in terms of safety, quality, security and health. For instance, Birch (2018) studied how San Francisco International Airport can develop a distinct service culture through actively engaging with users and creating relevant training modules. Additionally, Hoback (2018) focused on the impact of cultural change on the workflow in terms of innovation and the generation of ideas. Thus, many studies aimed at better understanding employee culture in the airport environment can be found in the literature, but unfortunately, there is a lack of studies in the area of employee culture at HTs.

As mentioned in the results of the qualitative study, harmony among employees has a positive and motivating effect on the workflow, which improves the quality of service and performance. In addition, the results showed that the individual's output in this environment has an influence on the overall output. On the other hand, during the research, a phenomenon that has a negative effect on the workflow was observed. This phenomenon, a preoccupation with placing blame on others instead of working to solve problems, is linked with the culture of employees and organisations in HTs. Consequently, this phenomenon has an underlying negative impact on procedures, workflows and performance.

Furthermore, among the human factors associated with employees that affect performance and LoS at HTs is a sense of responsibility and seriousness. Babaita, Ispas and Pirjol (2008) found that seriousness increases guests' confidence in the hotel service industry. Therefore, this aspect is essential in the services sector, especially for employees who are on the front lines and facing the public. The results of the qualitative study revealed that this is one of the factors exerting a significant influence on the HT environment, as there is a link between the high processing performance of employees who have a strong sense of responsibility and seriousness and pilgrim satisfaction. Therefore, two of HT service providers indicated that there are difficulties in some processes that negatively affect the workflow due to the lack of seriousness and sense of responsibility of some workers. Additionally, the opinion of service providers on this issue was confirmed by some of the pilgrims during the quantitative collection data phase.

Likewise, the knowledge and training of employees is important, as it helps them understand their roles and procedures and thus speeds up and facilitates the procedures for arrival processing in HTs. This factor has been widely discussed in the literature (Andriessen, Van Gulijk and Ale, n.d.; Boff, Kaufman and Thomas, 1986; Cutting, 2012; Jain, Aidman and Abeynayake, 2011). The results indicated that the employees in HTs could be categorised into two groups. The first one had a high level of knowledge, as they had received extensive training, and they were characterised by completing the processing of pilgrims with a high level of quality. In contrast, the second one had a low level of knowledge, as they had not received training, which led to delays and a low level of performance. Moreover, it was found that the members of the second group tended to be part-time and temporary employees hired for the Hajj season. Thus, they had weaknesses in terms of loyalty and a sense of belonging to their organisation in addition to a low level of knowledge. Consequently, these two groups had clear effects on the HT's LoS and procedures: a positive impact from the first group and a negative impact from the second group.

One factor was mentioned five times by the interview participants. This factor, fatigue due to long working hours and work stress, is related to employee efficiency and performance. Harma (1993) stated that errors and poor work quality increase in environments where this phenomenon is widespread among employees. Moreover, employee fatigue has been studied extensively and found to be highly correlated with poor efficiency and decision-making in more than one field (Hockey, 1986; Webster, Richter and Kruglanski, 1996). According to Jain and Aidman (2011), fatigue is associated with work environments in which long shifts are common. However, there are individual differences between workers in terms of responses to such environments, where some of them are less prone to fatigue (Harma, 1993). Accordingly, the results of the qualitative analysis indicated that there is a direct relationship between human fatigue, number of employees and shift length. In addition, the impact on the quality of the HT environment was observed, and employees' stress was noticed. This affected their performance and productivity, especially in peak periods. This was obvious to the participants, as some HT staff suffered from this phenomenon, and it induced poor performance among some, such as luggage handling workers.

Based on the findings of human factors, a causal loop diagram was developed following Forrester (1961), Rosnay (1979), Sterman (2000) and Haraldsson (2004) to clarify and visualise the problems caused by these factors and their impact on the HT system. Figure 8-2 explains the interactions and relationships between the human factors of agents in HTs, including pilgrims and employees, and variables of LoS (time factors, space factors and level of pilgrim satisfaction). In addition, these relations are positive or negative based on the direction of impact. For instance, the language factor may have a negative impact on LoS while in causal loop indicated it to be a positive sign, which increased the processing time.

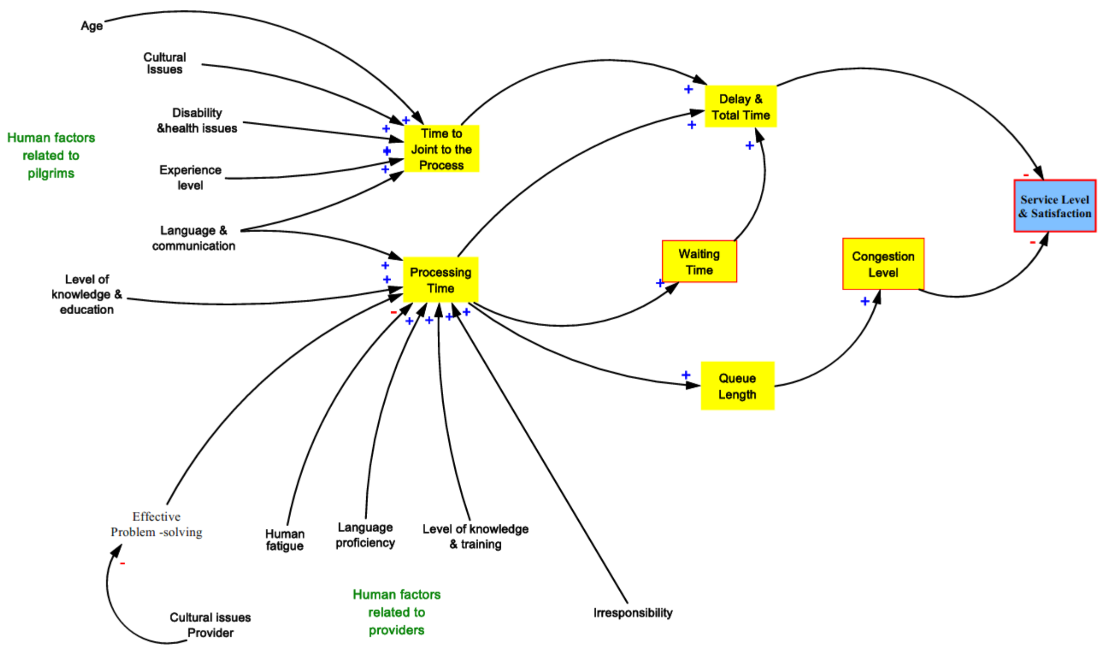


Figure 8-2 Causal loop diagram of interactions between human factors and LoS variables.

8.2.2.2 Discussion of findings on infrastructure factors

The second group of factors identified from the qualitative data analysis are the infrastructure factors. These factors are highly influential, because adequate infrastructure helps to facilitate the work and improve the performance of an operation, especially in the airport sector. Thus, there has been significant interest in the literature in the last three decades in the subject of airport infrastructure and capacity (Ashford, Mumayiz and Wright, 2011; Hamzawi, 1992; McCullough and Roberts, 1979; Rodrigue, 2016). The participants addressed these factors in the interviews 34 times. Thus, seven codes were created from which three factors were deduced: capacity issues, flexibility in terminals and infrastructure efficiency.

Capacity issues are one of the major challenges faced by companies and authorities responsible for airport management and operation. Hence, these organisations evaluate and analyse the component of airport capacity along with the demand variable to achieve the optimal operating capacity. This task requires organisations responsible for managing and operating airports to plan measures and solutions to satisfy excess demand in the short term, as well as to plan long-term decisions, such as assessing the need for expansion of the airport infrastructure, and generally, taking these decisions is complicated, costly and time consuming (Ashford, Mumayiz and Wright, 2011).

A number of researchers have discussed the types of capacity of airports. For instance, Rodrigue (2016) divided airport capacity into two types: static capacity—which is related to the area, estimated by square meters, and does not change—and dynamic capacity, which is related to the infrastructure of human resources and technology. On the other hand, Nõmmik and Antov (2017) defined the dynamic capacity of an airport terminal as the ability to receive a certain number of passengers in a specific period of time. According to this definition, it is measured by the number of passengers in a specific period of time and therefore depends on the LoS matrix. Thus, the dynamic capacity will consider the queue as a dynamic length. A number of researchers have discussed the issue of airport passenger terminal capacity and its link to LoS, such as Ashford (1988), Hamzawi (1992), McCullough and Roberts (1979), Young and Wells, (2011), Kazda and Caves (2015), Rodrigue (2016), Nõmmik and Antov (2017) and Jacquillat and Odoni (2018).

The participants of the providers made it clear that the capacity of HTs is a critical aspect facilitating the flow of pilgrims. In addition, they emphasised the importance of increasing rather than limiting the capacity of these terminals. Furthermore, the interviews revealed the need for continuous study and analysis of the extent of compatibility between the capacity of HTs and the flow of pilgrims. Finally, according to the study participants, the terminals are well designed, but their capacity must be increased, as they are small given the vast number of arriving pilgrims.

Flexibility is another important factor related to infrastructure at HTs. That is, there is a lack to flexibility in terms of increasing the number of counters, offices and paths to facilitate the processing of inbound pilgrims and face the challenge of peak demand as temporary solutions. It was found that the design and capacity of these terminals did not support this aspect of flexibility. Consequently, the queue systems cannot be changed at these terminals to improve work performance, procedures and pilgrims' waiting experience.

Another important factor related to infrastructure efficiency discussed by HT service providers is the shortages of the facilities of the internal lounges, such as bathrooms. This leads to long waits for those looking to use these facilities, which affects workflows in these terminals. On the other hand, the capacity of airport passenger terminals is affected by the number of people and the amount of time they spend at the terminals, and it depends on the characteristics of the ground transportation used to access and egress the airport passenger terminals (Kazda and Caves, 2015). Unlike other passenger terminals at international airports, access to HTs is only allowed via buses of the General Cars Syndicate supervised by the Ministry of Hajj and Umrah in coordination with the GACA and terminal operators. Consequently, there is another infrastructure factor related to ground transportation outside the terminals, which is the shortage of parking spaces for buses. This factor negatively affects pilgrims' waiting time and level of satisfaction. Other infrastructure factors related to the process of PC are the shortage of counters and the poor/slow fingerprint readers used to identify pilgrims during their registration. These two factors have a significant impact on the processing at PC and other processes at HTs.

The results of the qualitative analysis on service providers' perspectives also revealed that there is a need to redesign HTs and change their layout to support flexibility and temporary solutions to any future growth in demand as well as facilitate the flow of pilgrims. Another critical factor in raising LoS is the signs and guidance boards, as studied and discussed by many researchers, such as Correia et al. (2008b), Barros et al. (de Barros, Somasundaraswaran and Wirasinghe, 2007), Chen and Chang (2005), Fodness and Murray (2007), Graham (2005), Humphreys et al. (2002), Lubbe et al. (2011) and Yeh and Kuo (2003). This aspect needs to be greatly improved in HTs by introducing advanced technology that uses artificial intelligence and machine learning, such as automatic translators covering multiple languages. Moreover, the colours approach and special needs signage should be used to support pilgrims with special needs and those who cannot read.

The theoretical basis for the causal loop diagram was discussed in the previous section, and another diagram has been developed for infrastructure factors, as shown in Figure 8-3. This diagram illustrates positive and negative interactions and relations between infrastructure factors, including capacity issues, flexibility in terminals and infrastructure efficiency, and variables of LoS (time factors, space factors and level of pilgrim satisfaction in HTs). The time factors include time to join the processes, waiting time, processing time and total time. Furthermore, the space factors include queue length and level of crowding. As discussed above, there is a lack of data to verify this diagram.

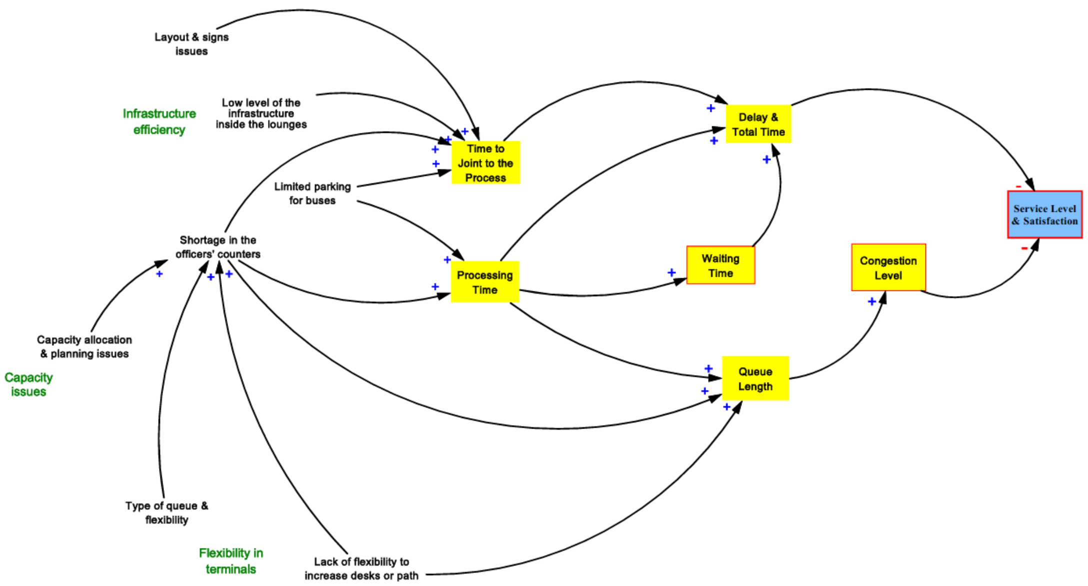


Figure 8-3 Causal loop diagram of interactions between infrastructure factors and LoS variables.

8.2.2.3 Discussion of findings on operational factors

This section discusses the third group of factors identified from the qualitative data analysis: operational factors. Operational factors in every industry, including the service and production sector, are essential factors linked to performance. Therefore, these factors have a significant influence on LoS, passenger flow and passenger satisfaction in the airport sector. The participants addressed these factors 76 times in the interviews. Thus, 10 codes were created from which four factors were deduced: accessibility, BC issues, processing issues and fluctuation of demand.

Accessibility is one of the important aspects of airport terminal performance. This aspect includes ground transportation options, availability of parking facilities and other tools that help passengers to move inside the airport terminals, such as trolleys, electric carts and ramps for people with special needs. Great attention has been paid to this dimension in the literature, and many studies have discussed airport accessibility, such as ACI (2011), Graham (2005), Humphreys et al. (2002), Correia et al. (2008b), Fodness and Murray (2007), Lubbe et al. (2011), Yeh and Kuo (2003), Nõmmik and Antov (2017), Wiredja, Popovic and Blackler (2015), Tsai, Hsu and Chou (2011) and Bogicevic, Yang, Bilgihan, and Bujisic (2013). According to the results of the qualitative analysis, some of the participants in the interviews explained that there are deficiencies in terms of accessibility for special needs pilgrims at HTs and noted that this aspect needs improvement and development. Thus, this finding confirms the finding from the users' perspective analysis in which some pilgrims noticed a weakness in terms of types of equipment and stated that support tools are needed to facilitate access for pilgrims with special needs inside these terminals. Furthermore, it is in line with the study of Oostveen and Lehtonen (2017), which examined the accessibility of automated border control systems at European airports for special needs passengers.

Another factor considered to have a significant impact on operations and service level at HTs is BC issues. Baggage check-in and claim are critical processes at airports, and their performance has an impact on LoS and level of passenger satisfaction. Therefore, many researchers have discussed this aspect; for instance, Correia and Wirasinghe (2010) discussed how to provide a practical methodology to assess LoS in the airport BC area. Furthermore, Hafizogullari, Bender and Tunasar (2003) discussed the impacts of security measures to check luggage in the departure area, including overcrowding and long delays in procedures. Yoon and Jeong (2015) developed an alternative approach to decide which baggage carousel belts need to have their capacity expanded. On the other hand, Ronzani and Correia (2015) examined the influence of demand and airport characteristics on LoS at the airport BC area. Based on that, it was concluded that the BC process is one of the most important aspects of arrivals due to its great impact. According to the qualitative data on providers' perspectives and coding in Chapter 6, this factor was concluded based on three codes: BC policy, baggage accumulation and segregation of baggage of mixed flights.

Some issues related to the aspect of BC policy were found based on the opinions of the service providers. One of these issues is the fact that there are some problems in the matter of managing and organising the BC process. Another issue is the culture and mentality of pilgrims, especially in the case of inexperienced pilgrims in the event of the loss or delay of luggage. That is, they often refuse to move to the next process based on the promise that they will receive their luggage at their accommodation later. Thus, they wait for a long time, which causes congestion in the area of this process. Moreover, some pilgrims take many pieces of luggage, which increases the load on the baggage carousel belts, and the accumulation of baggage on these belts increases the processing time and the time needed to collect and classify it. All of these issues were identified as reasons for the accumulation of luggage and congestion in the BC area, which leads to crowding in the next process, customs, and increases the waiting time at this process. In addition, one of the most influential problems in this process is the segregation of pilgrims' baggage from that of non-pilgrims in mixed flights, which leads to long waits for BC and baggage accumulation. All these issues lead to low levels of LoS and pilgrim satisfaction.

On the other hand, there is another factor related to the processing at HTs. This factor is critical, since it is related to the processes in HTs, which are the main components of the arrival domain at these terminals. This factor was mentioned in the interviews 31 times, and it resulted in four codes: processing time, interference in process sequence, lack of improvement of processing procedures and numerous processes/repetition of registration. These four aspects, especially processing time and processing procedures, have received attention in the previous literature, such as Pitchforth et al. (2015), Verma, Tahlyan and Bhusari (2018), Alodhaibi, Burdett and Yarlagadda (2017, 2019), Ahyudanari and Vandebona (2005), Correia and Wirasinghe (2007), Stolletz (2011), Fayez et al. (2008) and Borille and Correia (2013). However, as discussed earlier in Chapter 3, there is a lack of research focused on HTs and the assessment of processing in this environment, as this environment differs from other airport environments in terms of the components of processes, especially the arrival domain.

Through the results of Chapter 6 regarding issues of processing time, it was found that the variation in processing time between pilgrims and processes is affected by the number of pilgrims arriving and the efficiency of some operations. In addition, it was found that the airport administrations and agencies strive to reduce processing time, but these efforts are not significant, especially at peak times. Another issue is the lack of regularity with which some countries' missions offer pilgrims guidance before arrival in the HT. Moreover, manual registration has a negative impact on the processing time, as some agencies do not use new technology to improve procedures or the registration experience at these processes. Furthermore, an important aspect was found that has an impact on the speed of pilgrims' flow and their experience through the processes: interference between processes in a sequence. Thus, this issue causes delays, congestion and pressure in the next processes, which negatively affect the whole system.

Furthermore, another important issue related to processing was found to be the lack of improvement and development of the mechanism of processing in HTs by introducing and using modern technologies and digital devices to help facilitate the flow of pilgrims and the processing experience. Another phenomenon affecting the processing is the repetition of the registration process, which requires a larger number of employees and longer processing time. Therefore, this issue leads to long waiting times, high operating costs and negative experiences with HT processing for pilgrims.

Another substantial aspect related to operation factors is the fluctuation of demand, which has a significant effect on airport operation. As mentioned in

Chapter 3, much attention has been paid to airport capacity and demand management in the literature, such as Xu et al. (2016), Jacquillat and Odoni (2018), Neufville and Odoni (2003), Kumar and Sherry (2009) and Ryerson and Woodburn (2014). It is well known that demand management is one of the most challenging tasks and a major influential factor in air transport and airports. Therefore, countries and airport operators have given considerable attention to this aspect and to finding ways of balancing airport demand and capacity. Airports with HTs suffer the most from problems of demand fluctuation.

The findings on providers' perspectives revealed that HTs suffer from problems of poor scheduling and flight delays because many airlines and missions do not adhere to schedules and given slots. Thus, peaks in demand arise that affect the operational traffic and LoS in these terminals. The most important results of this phenomenon are congestion, long waiting times and poor LoS in these terminals. The results of the analysis of the interviews suggest that this factor has the most negative influence on the flow of pilgrims in HTs. In addition, another problem, the need to separate the luggage of mixed flights, causes delays in sending luggage from flights to BC belts in HTs. As mentioned earlier, these mixed flights contain both pilgrims and regular passengers. These flights cause major problems for the ground services in terms of distinguishing the luggage of pilgrims and non-pilgrims and confusion in the process of sending pilgrims to the designated terminals. This in turn leads to long waiting times, lost luggage and luggage/pilgrims being sent to the wrong terminals.

The theoretical basis for the causal loop diagram was discussed in the previous sections, and another diagram for infrastructure factors has been developed, as shown in Figure 8-4. This diagram illustrates positive and negative interactions and relations between operational factors, including accessibility, BC issues, processing issues and fluctuation of demand, and variables of LoS (time factors, space factors and level of pilgrim satisfaction in HTs). The time factors include time to join the processes, waiting time, processing time and total time. Furthermore, the space factors include queue length and level of crowding. As discussed above, there is a lack of data to verify this diagram.

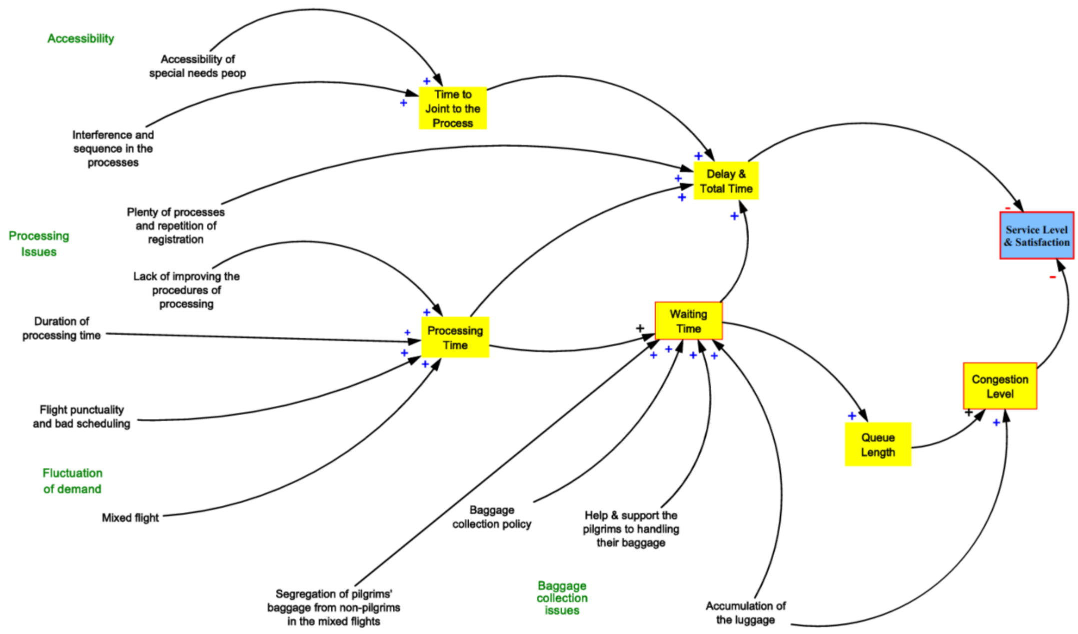


Figure 8-4 Causal loop diagram of interactions between operational factors and LoS variables.

8.2.2.4 Discussion of findings on technical factors

The fourth group of factors identified based on the providers' perspective analysis are technical factors. This section looks to the findings on these factors presented and demonstrated in Section 6.64. Technical factors are considered one of the main components of any sector, whether service or industrial. One of these sectors is transportation, where digital technologies and technical factors are considered some of the most important issues, particularly in the air transport and airports field.

Therefore, the topic of modern technology and technical factors in the field of airports has received great attention in the previous literature. For example, Kalakou, Psaraki-Kalouptsidi and Moura (2015) studied this by using a simulation model of the impact of the use of modern technology on the capabilities of the airport in terms of processing functions, including identity management and biometrics, near-field communications, smartphone applications and Big Data analytics. Moreover, Jaffer and Timbrell (2014) discussed ways in which digital technologies are applied to enhance the quality of service for passengers inside airports. On the other hand, Sohn, Kim and Lee developed and discussed a framework related to a smart airport service to ensure quicker service and greater convenience for passengers, saving time and increasing airport profits (2012, 2013). In addition, the main aims of applying and using technology in airports are to increase the capacity of the airport, enhance performance and improve passengers' perspectives and experience (Bouyakoub et al., 2017).

Based on the results, three factors were concluded through five codes based on 39 references in the interviews: biometric identification system, new technology and IT infrastructure.

The first of these factors is the biometric identification technique, which is one of the important components of HTs' identification system. Discussions with the service providers in the HTs revealed that there are problems and delays in the PC process caused by the deteriorating fingerprints of some pilgrims, especially the elderly, artisans and those with chronic diseases. This issue makes it difficult for the biometric identification systems at HTs to read these fingerprints. Thus, there is a delay in the process of completing pilgrims' registration and security checks. Accordingly, the process of registering pilgrims who have problems with their biometric fingerprints is longer, which causes delays for other pilgrims, increases waiting times and queues and leads to congestion and the deterioration of LoS. Furthermore, according to providers, the percentage of pilgrims who have problems with their fingerprints ranges between 25 and 30%, while about 2.5% of them have lost their fingerprints due to craftwork or chronic diseases. Consequently, this factor was found to have a high impact on PC in these terminals, especially during peak periods. Hence, the method and biotechnology used in HTs based on fingerprints are impractical, and the system in these halls needs to be developed.

Another important factor related to the technical aspect of HTs is the availability of modern technology. Based on the findings on this factor, it was concluded that HTs suffer from a low level of integration between processes and units because of the multiplicity of agencies and lack of unified and integrated systems. The presence of robust integrated systems facilitates the transfer of data and information between processes. Thus, it prevents the repetition of registration between processes, decreases processing time, reduces the number of workers needed, drives down costs and prevents wasted time. Furthermore, it makes the flow of passengers smoother and faster with minimum waiting times and congestion levels. Hence, all these aspects improve LoS and pilgrims' experience during the procedures within HTs. Another issue related to the availability of modern technology is the lack of modern tools and technology used in these terminals such as tracking technology. This increases the number of employees required and leads to many problems, as productivity depends on employee activity and monitoring. Thus, it increases processing time, extends waiting time and decreases LoS. Additionally, another aspect related to this factor that leads to many problems inside HTs is the lack of tracking system inside these terminals. Consequently, pilgrims often get lost inside these terminals, especially pilgrims who lack experience with airports and are unable to speak common languages and read the signs. The presence of a tracking system that facilitates the locating of lost pilgrims inside HTs reduces the cases of long waiting times for groups of pilgrims awaiting a lost group member.

As discussed above, IT is one of the most important factors affecting procedures in airport passenger terminals. Consequently, the level of the IT infrastructure affects processing and waiting times, as the speed of completing procedures at registration points depends on the speed of information transfer and communication between the information centre and registration points. One of the most important effects of this issue is the long duration of the procedures in some critical processes that require sending and receiving information between them and the central information office. This is one of the reasons HTs suffer from long processing and waiting times.

A different causal loop diagram was developed based on the findings on technical factors, as shown in Figure 8-5, and its theoretical basis was discussed in the previous sections. This diagram shows positive and negative connections between technical factors, including biometric systems, availability of modern technology and level of IT infrastructure, and variables of LoS (time factors, space factors and level of pilgrim satisfaction in HTs). The time factors include time to join the processes, processing time and waiting time. Additionally, the space factors include queue length and level of crowding. As mentioned earlier, this diagram has not been verified due to the lack of data.

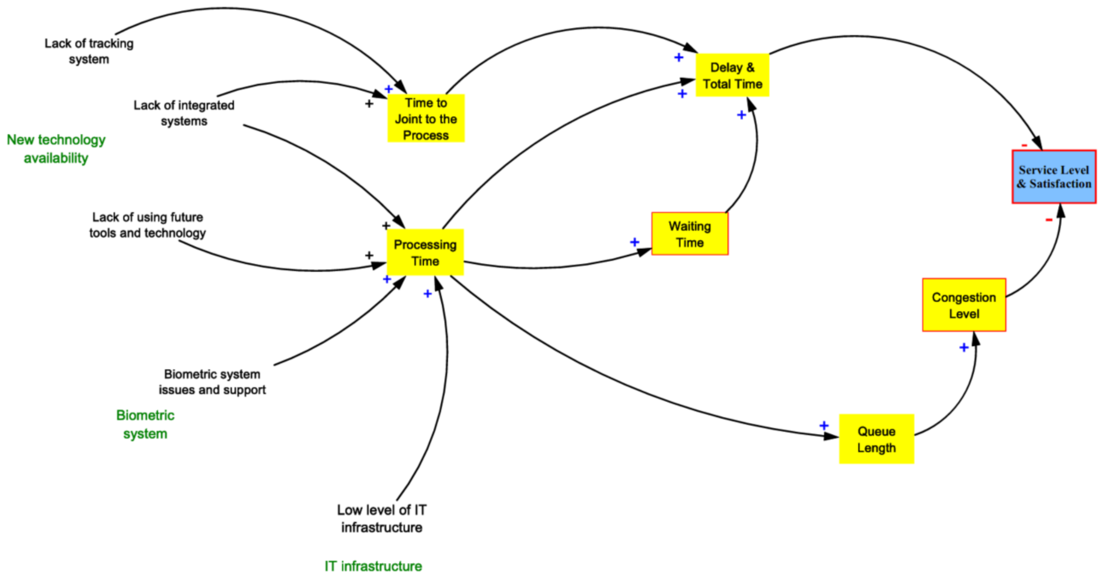


Figure 8-5 Causal loop diagram of interactions between technical factors and LoS variables.

8.2.2.5 Discussion of findings on organisational factors

This section discusses the findings related to organisational factors. These factors were found through the analysis of providers' perspectives in Section 6.6.5. Organisational factors are those that relate to the organisational matters of any system, and they can be external or internal factors. In addition, these factors have an influence on the organisational side of any organisation or system, whether positive or negative. Through the results of the providers' perspective analysis, three main factors that have direct relationships with the organisational aspect of HTs were found: cooperation issues, human resource issues and issues of communication with other agencies inside and outside HTs. These three factors were concluded through three codes based on 28 references in the interviews.

The first of these factors is cooperation within internal and external bodies of HTs. Through the results, it was concluded that there is complete coordination between the agencies operating inside the HTs. A number of participants reported that there is a common operating room for direct coordination and discussion of problems and urgent solutions among the top management of all the airport operating bodies and relevant government agencies. Hence, this is a strong indication of the coordination and cooperation between the authorities working in these terminals, which leads to the creation of a homogeneous work environment and helps to ensure a smooth workflow. In contrast, difficulties in cooperating with some external agencies, such as the missions of some African and Arab countries, were reported. Therefore, a protocol and a work procedure need to be created that can help improve this aspect.

Issues concerning the allocation and scheduling of human resources are another important organisational factor. Difficulties in these areas were found in the HTs. This causes the previously discussed phenomenon in which the human factors of employees, such as fatigue, in turn affect the workflow in these terminals. Some of the participants mentioned that some labourers work non-stop for 12 hours, which causes fatigue, low levels of performance, many mistakes and low LoS. It was concluded that the main reason for the allocation and scheduling problems is the fluctuation of demand resulting from flight delays and the poor scheduling of flights. This suggests that there is interference between factors, whether human, organisational, technical, operational or infrastructure.

Furthermore, another organisational factor is communication with inside/outside agencies. It was concluded that what applies to the coordination factor also applies to this factor, where there are issues in communicating with external agencies. Thus, the communication with external bodies needs to be significantly improved to facilitate the workflow and create a homogeneous environment.

As in the previous sections, a causal loop diagram based on the findings on organisational factors was developed, as shown in Figure 8-6. This diagram shows the positive and negative connections between organisational aspects, including cooperation issues, human resource issues and communication issues, and variables of LoS (time factors, space factors and level of pilgrim satisfaction in HTs). As mentioned earlier, the time factors include time to join the processes, processing time and waiting time. Additionally, the space factors include queue length and level of crowding.

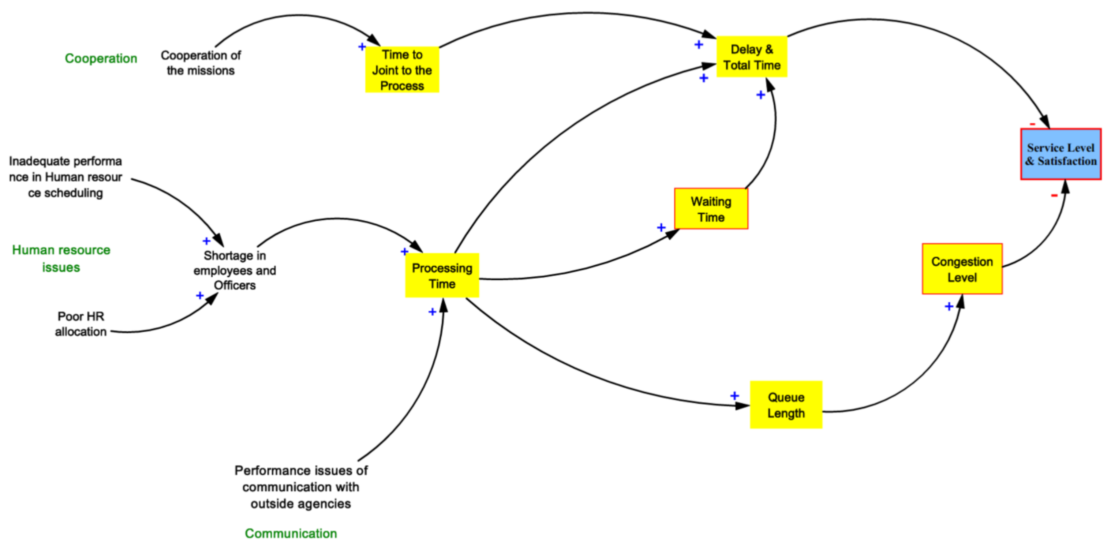


Figure 8-6 Causal loop diagram of interactions between organisational factors and LoS variables.

8.2.2.6 Arrival processing evaluation based on providers' perspectives

This section discusses the results of the providers' evaluation of the HTs for the processes and factors affecting pilgrims' flow. As explained in Chapter 6, there were 10 participants from the HT at Jeddah Airport and 6 participants from the HT at Medina Airport. Each of them was asked a final question to evaluate the processes and influence of impeding factors in the HT where they worked. Just as a problematic review matrix was developed for all processes based on users' perspectives, another one was created based on providers' perspectives in terms of processes but not including the aspects, as shown in Table 8-3.

A match was found in the evaluations of the processes of PC and HI based on the points of view of providers between HTs, where PC was the most problematic and HI was the least problematic process at both airports. Conversely, there was a difference in the other processes based on the problematic review matrix at both airports. The results of the problematic review matrix show that there is a match between the perspectives of providers and users in PC and HI, where PC was the most problematic and HI was the least problematic process in both airports. Thus, there is consensus in that HI is the highest process in terms of LoS and performance and the lowest in terms of operational problems. On the other hand, the matrix shows that in the HT at Jeddah Airport, UA and PC are the most problematic, while in the HT at Medina Airport, BS and PC are the most problematic. Hence, PC and UA in the HT at Jeddah Airport need improvement and development to raise LoS and facilitate the flow of pilgrims through them. Conversely, in the HT at Medina Airport, PC and BS need enhancement and development to increase their LoS.

Table 8-3 Problematic review matrix for arrival processing in HTs based on providers' perspectives.

Jeddah Airport	
Least problematic	Health Inspection (HI)
	Customs Inspection (CI)
Somewhat problematic	Baggage Claim (BC)
	Bus Connection (BS)
Most problematic	Unified Agents (UA)
	Passport Control (PC)
Medina Airport	
Least problematic	Health Inspection (HI)
	Unified Agents (UA)
Somewhat problematic	Baggage Claim (BC)
	Customs Inspection (CI)
Most problematic	Bus Connection (BS)
	Passport Control (PC)

8.2.3 Stage 3: Evaluation of current situation of terminal arrival processes

This section demonstrates and discusses three scenarios by simulating the HT at Jeddah Airport. The purpose of this simulation is to evaluate the current situation of the HT, pilgrims' demand pattern, distribution of pilgrims based on the configuration of lounges and queue length of HT lounges. Thus, this section provides three subsections that address the analysis results representing the impact of three factors by using the aforementioned what-if scenario.

8.2.3.1 Demand pattern and historical data

During the pilgrimage period, the HTs are open for 37 days at Jeddah Airport and for 36 days at Medina Airport on a 24-hour basis. At Jeddah, arrivals traffic exceeded capacity in an average of 191.4 out of 888 hours over the entire Hajj event periods between 2013 and 2017 (22%). In 2017, over-demand occurred during 30% of operating hours compared to 20% in 2013. Medina has a slightly lower peak pilgrim capacity of 1,200 arrivals per hour compared to Jeddah's 1,500. On average, excess demand was reported there in 17% of all operating hours in the 2013–2017 period, lower than at Jeddah. This may be because the Medina terminal was built more recently. However, the situation of excess demand at Medina deteriorated from 11% in 2013 to 26% in 2017.

Therefore, the nature, scale, intensity and peaking of demand are the most significant factors in understanding HT operation and management. Large volumes of arriving passengers have an impact on LoS and on the arrival processing performance of the HTs at both airports. This is reflected in impeded passenger flow, increased waiting times and queue lengths, reductions in available space for terminal operations and low levels of passenger satisfaction. A number of researchers have addressed the space index and its effect on LoS and passenger satisfaction. For example, Brunetta, Righi and Andreatta (1999) studied how to determine an optimal design and extend capacity to face uncertain demand by combining space with the deterministic queue model in an integrated time and space performance indicator.

In addition, based on observation and investigation, the longest total time required for pilgrims to complete all processes was during the period when the number of pilgrims exceeded the operating capacity at both airports. During this period, pilgrims needed seven to nine hours at Jeddah Airport and six to seven hours at Medina Airport to complete all processes. Thus, this explains why LoS decreased and waiting time and congestion levels increased during this period. These results are in line with those cited in the literature (Boonstra, Turkenburg and Wit, 2016; Borille and Correia, 2013; Zidarova and Zografos, 2011), which show an inverse relationship between service level and demand at airports.

Apart from the fact that there is a substantial peaking in demand, especially since many pilgrims prefer to arrive at the end of the Hajj arrival period in Jeddah and then proceeding to spend their second and third weeks in Medina), the challenge of managing airport capacity is accentuated by chronic failures in the slot allocation system. Many airlines often do not comply with their scheduled arrival and departure time slots and instead seek changes to time slots at relatively short notice. This practice, which has been present for many years, exists even though GACA imposes fines on those airlines that choose to operate at times that are significantly different from those planned for in the slot allocation system. Thus, the divergence between capacity and demand is primarily due to failures in the management of slot allocation processes at both airports. This has the effect of altering demand patterns without required adjustments to the resourcing of processing services in the HTs with consequent adverse effects on passenger satisfaction.

This study presented and reviewed many studies that investigated the impact of demand patterns on LoS and quality of service, such as Kandampully (2000), Kim, Wu and Koo (2017), Ronzani and Correia (2011, 2015), Yang and Fu (2015) and Horonjeff et al. (2010). Thus, this study investigated the demand pattern at the HT at Jeddah Airport. It was found that the demand pattern of pilgrims was heavily distributed (approximately 40%) within the last two weeks of the arrival period, while the rest of the pilgrims (representing approximately 60%) were distributed in the first four weeks of the arrival period. It was noticed that during

60% of the arrival period, the demand had a stable pattern for all lounges, while during 40% of the arrival period (peak time), there was a sharp increase of the demand pattern that influenced the process characteristics, such as the time and space factors. Thus, these findings confirmed the author's hypothesis mentioned in Chapter 5. Consequently, the four lounges of the HT at peak time were investigated in depth to explore and demonstrate the impact of peak time on the average waiting time and the queue length at the HT lounges.

8.2.3.2 Queue length

Queue length plays a significant role in service performance. Therefore, the queue length of the HT was investigated according to the three scenarios applied in this study. Generally, it was noticed that the queue length increased from Week 4 for all processes. The reason for this increase is associated with the demand pattern and pilgrims' crowding in HTs. Thus, the following discusses and illustrates the queue length at peak time for the HT at Jeddah Airport. Scenario 1 indicated that the queue length was generally increased at peak time, but there were obviously sharp increases in Lounges A and E, which represented the average number of pilgrims in the queue as between 5,000 and 6,000 for the PC process. Conversely, the queue length sharply increased, which represented the average number of pilgrims in the queue as 300 to 1,700, in Lounges B and D for CI. Thus, the second scenario was applied, which indicated a pattern of queue length of the processes similar to that of Scenario 1, but it was found that the second scenario generally increased the average number of pilgrims in the queue as with Scenario 1. It was noticed that the average number of pilgrims in the queue in PC increased to between 10,000 to 12,000 pilgrims in Scenario 2 for Lounges A and E. In contrast, the average number of pilgrims in the queue in Lounges B and D was between 300 and 3,500. Therefore, this study's findings confirm that the airport experience factor plays a significant role in terms of average queue length. Furthermore, this result was confirmed by some studies in the previous literature that considered passengers lacking experience, such as Utsunomiya, Tomiyama and Okuda (2016, 2017), Janssen et al. (2020), Ma et al. (2011) and Yang and Lu (2015).

According to Scenario 3, it was noticed that the average number of pilgrims in the queue in PC increased to between 14,000 and 15,000 in Scenario 2 for Lounges A and E. Conversely, the average number of pilgrims in the queue in Lounges B and D was between 1,000 and 3,500. Thus, there is clearly a sharp impact of the third factor applied in Scenario 3 on the average number of pilgrims in the queue in PC, while there is a slight impact on the average number of pilgrims in the queue at peak time. This study investigated why Lounges A and E have long average queue lengths in PC while Lounges B and D show the highest average queue length in CI. The configurations of all lounges were reviewed and it was shown that the lounges did not have similar configurations. Specifically, PC at Lounges A and E has 24 counters each, while PC at Lounges B and D has 48 counters each. Obviously, it was observed that the airport operators and management generally fairly distributed the demand according to the terminal to stratify the lounges according to the PC counters in each lounge, but the airport operators and management were not careful to distribute the pilgrims to all the process configurations to ensure a smooth flow and avoid congestion.

8.2.3.3 Average waiting time

A review of the results of the three scenarios reveals that there are differences between them at the process and domain levels as well as at the general level in terms of average waiting time. It is observed that there are increased waiting times for all processes in Scenario 2 compared with Scenario 1. Actually, it was found that PC had the highest average waiting time of approximately 32minutes in Scenario 1. In addition, PC still had the highest average waiting time in Scenario 2. It was noticed that the average waiting time for PC increased from 32.26 to 54.62 minutes. In fact, Scenario 1 assumed that all the pilgrims had experience with airport procedures, while Scenario 2 assumed that 25% had no experience with airport procedures based on the analysis of the survey with pilgrims. Therefore, it was found that pilgrims’ lack of experience sharply increased the average waiting time.

In addition, this study applied and analysed Scenario 3, which assumed that 25% of pilgrims had no experience with airport procedures, 10% had poor fingerprints and 2.5% had lost their fingerprints based on the analysis of the results of the survey with pilgrims at Jeddah Airport. It was found that all the processes had increased average waiting times except CI, whereas PC still had the highest average waiting time. In fact, Scenario 3 revealed an average waiting time of approximately 107.29 minutes. Clearly, the average waiting time increased sharply from 54.62 to 107.29 minutes. Therefore, the average waiting time increased by approximately 96%. It can be concluded that the three factors according to the three scenarios applied clearly affect the average waiting time. That clearly shows the significance of the three factors, in that they can play a dominant role to control (i.e. reduce or increase) the average waiting time. Thus, this study finds that the most sensitive process is PC according to the three scenarios that represented and simulated the three factors.

8.2.3.4 LoS of IATA matrix

There are differences in LoS between the three scenarios, which appeared in the density maps. Moreover, there is variation in terms of the size of differences: some are large, while some are very slight. The factors in these subsections show that the assumptions that were made in the scenarios affected the time factor and optimum space for each pilgrim at the various processes. Thus, the total waiting time in the second scenario is 75% higher than that in the first scenario, while the total waiting time in the third scenario is 28% higher than that in the second scenario. On the other hand, there is a slight difference between all scenarios in terms of processing time. In addition, there is high variation between all scenarios in terms of waiting time and queue length. Moreover, there are variations between scenarios in the density map, where the red and yellow indicators appear more in the third scenario than in the first and second scenarios. Thus, this finding indicates that there is an issue with the space factor in the HT, especially with the PC process.

8.2.3.5 Fourth stage: deep analysis of all findings

The aim of this subsection is to demonstrate and discuss the important integrated findings on the factors influencing passenger flow. Therefore, this subsection illustrates users' perspectives, providers' perspectives and the simulation results that focus on the main problems in the matrix that can influence the HT processes. The users' perspective findings came from the problematic matrix created for both airports. These show that the most problematic HT process is PC, as the evaluation score is 2.83. This supports the study finding that the most problematic process was PC based on the perspectives of providers' at both airports. Furthermore, the case study in which the simulation model was applied to Jeddah Airport also shows that PC has the highest waiting time and queue length. The density map based on the IATA LoS matrix shows PC located in the red zone for both airports, which validates this finding. Moreover, the finding shows that UA was the second worst process from the perspectives of both users and providers at Jeddah Airport. In addition, the simulation results for Jeddah Airport show that UA has the second highest waiting time. The findings indicate BC as the third most problematic process from users' perspective, while the providers' perspective results show that BC was ranked as the fourth most problematic process. It appears that the providers considered the average waiting time and queue length for each process separately, while the users evaluated and judged LoS for each process based on many factors, such as average waiting time, queue length, process environment, operator behavior and process complexity (e.g. guidelines, instructions, directions, procedures). Thus, the simulation results indicated that the density map based on the IATA LoS matrix shows BC located in the yellow zone. The users ranked the BS process at Jeddah Airport as the fourth most problematic process, while the providers ranked it as the third most problematic process. The inconsistency between users' and providers' rankings of BS is likely because the providers considered BS out of the plaza service, while the users considered it one part of the HT process. The users' and providers' perspectives indicated CI as the fifth most problematic process, while the simulation results showed CI as the optimal process regarding the waiting time and space for each passenger. The last process evaluated by the integrated framework, HI, is the best among all processes at the HT based on the users' and providers' perspectives. In addition, the simulation results indicated that HI has longer waiting times than CI, and the density map located HI in the yellow zone, which means that this process needs development. The inconsistency between the simulation results and the users' and providers' perspectives for HI and CI rankings can be explained by the terminal configurations, where HI has two counters in each lounge while CI has four counters in each lounge. This inconsistency could be become from the simulation assumption for lounges configurations for each process which the simulation generalised the results depends on the number of passengers in the service facility based on the parallel servers followed the triangular distributions.

Evaluations of the processes at Medina Airport from users' and providers' perspectives must also be considered, while the simulation can be done in future work. The results clearly show that the users' and providers' perspectives emphasise the PC process as the most problematic process. In addition, the results show BS as the second most problematic process for Medina Airport. The users' perspectives indicated UA as the third most problematic process, while the providers' perspectives indicated UA as the fifth most problematic process, which means providers have better views of UA. This inconsistency between users' and providers' perspectives regarding UA could be explained by the idea that providers believe that Medina Airport operates a new terminal that can provide a good LoS for UA. In addition, the providers evaluate the processes as individual processes, unlike the users, who take into account all the sub-processes and accumulative waiting time in the terminal. Remarkably, BC was ranked as the fourth most problematic process at both airports. CI was ranked as the fifth most problematic process based on users' perspectives, while the providers ranked this process as the third most problematic process.

Finally, the results indicated that HI was ranked as the sixth most problematic process, which means that this process has the best LoS based on the perspectives of users and providers at Medina Airport.

This study conducted the ranking of processes, which cannot be identical for all agents. Therefore, this study suggests using simulation to create the density map, as it can help decision-makers rethink the processes and determine which ones need to be developed. In addition, it is believed that users play a core role in the evaluation of HT processes.

In this study, the experts did not provide any reports to evaluate and rank the processes at both airports based on a scientific approach. They provided their perspectives and opinions based on their subjective beliefs. However, using the integrated framework, the qualitative and quantitative data can be combined with the subjective beliefs of users and providers. Furthermore, this study combines the simulation approach to verify the problematic review matrix for airport processes.

8.3 Validation of framework by expert judgement

This study uses the jury of expert opinion and judgment method to validate the integrated framework. Thus, the author of this study met with experts with distinct competencies who brought their viewpoints together to discuss and evaluate the integrated framework. The author met with six experts from different divisions related to the airport industry listed in Table D-1 (Appendix D). The experts had extensive experience in the airport field with an average of 16 years of working experience in the field. A questionnaire containing the seven questions listed in Appendix D was distributed to the experts. All the questions in the questionnaire aimed to evaluate the integrated framework proposed in Figure 8-7. Of a total of 8 responses, 6 agree to participate in this study and 2 declined. The experts that decided to participate and contribute in this study were asked to complete the research questionnaire and were told that each question could take approximately 30 to 45 seconds to answer. The survey responses were based on a Likert scale and ranged from 1 (strongly disagree) to 10 (strongly agree). Furthermore, experts were told that all information and responses would be anonymised. They were also informed that the study would not identify them and that the researchers would not be able to access their email or IP address from the survey. Experts were told that all data would be analysed and reported in aggregate and that no individual responses would be reported. The first question addressed whether the integrated framework could be implemented with other airports. The average score of all experts regarding the generalisability of the framework was 9.2. The second question was designed to evaluate the ability of the framework to measure LoS for airports. Remarkably, the experts indicated that the integrated framework could measure LoS, and the average score was 9.0. The third question was designed to measure whether the integrated framework would be comprehensible to the providers of top management. The experts’ responses indicated that the average score for the third question was 8.0. The fourth question intended to measure the capability to eliminate unnecessary activities and processes from airports. The experts evaluated this question with an average score of 8.7. The fifth question was designed to measure the ability of the framework to reduce the overall processing time. The experts’ responses indicated an average score of 8.7. The sixth question intended to measure the capability to reduce the congestion level. This question received an average score of 7.8 based on the experts’ responses. Finally, the seventh question intended to measure the capability to enhance passenger satisfaction. According to experts’ viewpoints regarding the last question, their responses indicated an average score of 8.3. The overall average score of experts’ responses for all questionnaire questions to evaluate the integrated framework was 8.5. This indicated that the integrated framework is reliable, generalisable and applicable to airports and can be used to evaluate and improve the flow of passengers arriving at airport passenger terminals.

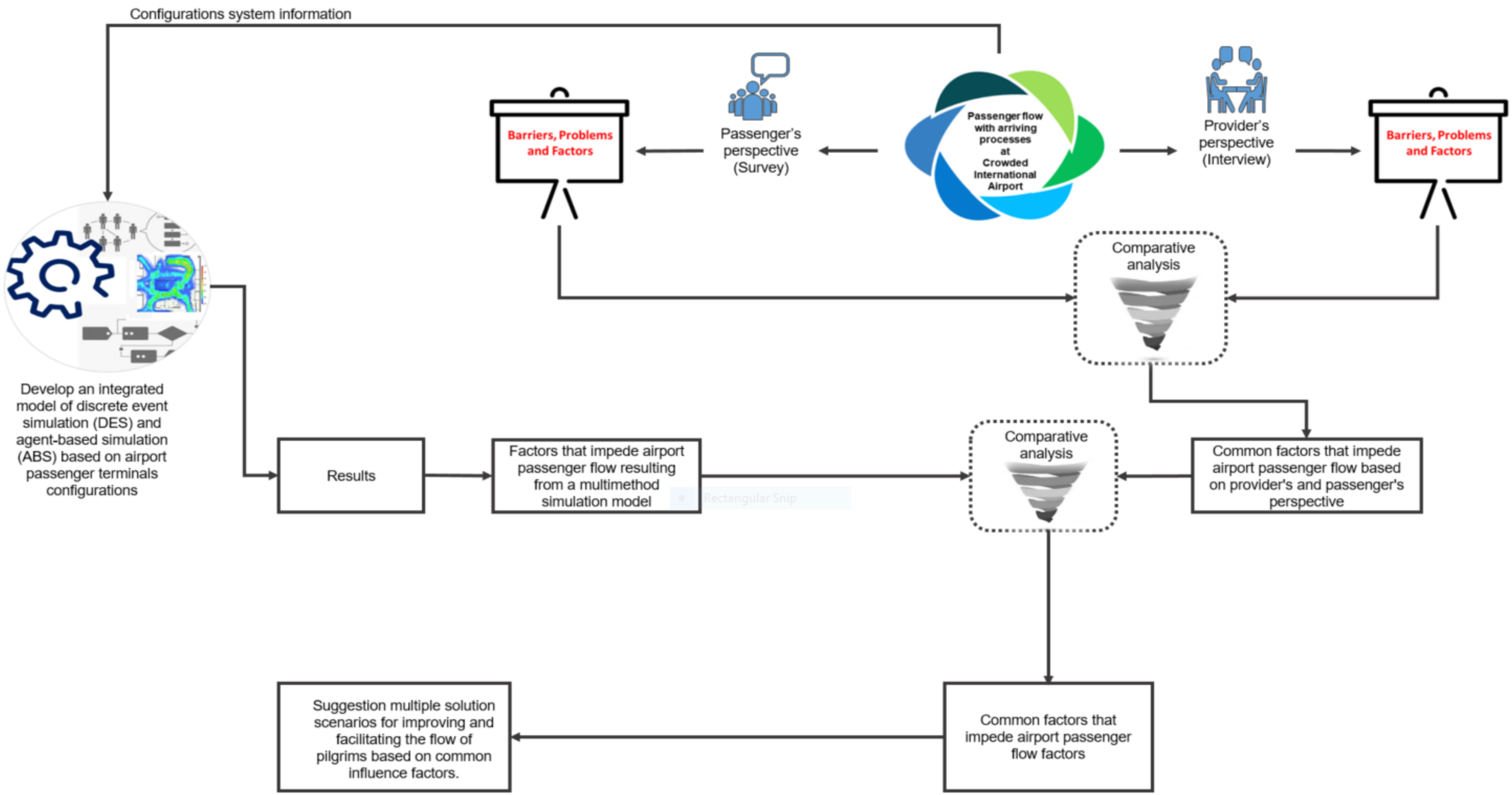


Figure 8-7 Integrated framework for improving arrival processing of pilgrims at HTs

8.4 Summary

The findings revealed the factors having the greatest effect in the problematic review matrix, which can influence passenger satisfaction and the flow of processes in airports. The problematic review matrix is likely under the influence of the density map IATA LoS matrix, which takes into account the waiting time and space for each passenger. Clearly, the findings came from the users' perspectives, providers' perspectives and simulation of the HT. Thus, the factors having the greatest effect and ranked most problematic in the review matrix can be summarised as follows: demand pattern of arriving pilgrims, PC procedures and technology, passenger experience, repeated procedures, terminal configuration and accessibility for people with special needs.

9 CHAPTER NINE: RESEARCH CONCLUSIONS

9.1 Research conclusions

This chapter highlights the comprehensive conclusion of the research aim to understand and improve the arrival passenger processing at HTs. Possible parameters, factors, weaknesses and problems that could affect the capacity utilisation and passenger movement through the arrival terminal were identified and analysed. This included a comprehensive literature review, which determined and exposed research gaps in the field. The research gaps indicated a lack of inbound airport processing and a lack of HT research and studies. Most previous studies used a single perspective to evaluate airport passenger terminals and DES or ABM to simulate airport terminals. This study listed research objectives to satisfy the research gaps. The research objectives aimed to identify the attributes of passenger flow through inbound processes based on the pilgrim and provider perspectives, develop an integrated simulation model to evaluate the current HT, and develop and validate the study framework. This study used a mixed-method approach to stratify research objectives. Thus, this study used a quantitative method to analyse the pilgrim perspective and the qualitative method to conduct and analyse the provider perspective. The simulation model integrated the DES and ABM to simulate the HT. The study worked to construct an integrated framework from three aspects of study methodology research to identify and evaluate the flow of pilgrims through the arrival HT.

The remainder of this chapter is organised as follows: Section 2 provides and illustrates the key findings for each research objective. Section 3 presents this study's theoretical and managerial research contributions and Section 4 highlights the study limitations. This chapter concludes with Section 5, which shares suggestions on possible future extensions of this work.

9.2 Research key findings

This section reviews the objectives set in Chapter 1 to fulfil the purpose of this study and summarizes the main findings according to each of the five objectives.

9.2.1 Objective 1 findings

Objective 1: To understand and conclude the performance of arriving passenger processing and evaluate the current Hajj terminal systems research gaps.

Based on the first objective, this study conducted a systematic literature review to show that several academic and institutional research studies have been carried out in recent years to understand the airport industry's performance and future trends. The distinct key findings emphasise and understand the performance of arriving passenger processing and evaluate the current Hajj terminal systems and processes as follows:

1.1. This study found numerous studies that analysed crowded airports and congestion at arrival terminals, which can impact the performance of arriving passenger processing. However, they failed to identify, analyse and evaluate passenger flow performance within components of crowded airports from providers' and passengers' perspectives.

1.2. Remarkably, previous studies have generally focused on reviewing passenger flow at arrival terminals; these studies rarely focused on identifying or assessing airport congestion and crowding.

1.3. Most previous studies assessed and evaluated aggregate airport processes, focusing on evaluating the overall LoS in the terminal, whereas this study specifically identified the impact of individual processes and sequences when processing the inbound domain.

1.4. Past studies have rarely worked to identify and analyse performance at arrival terminals from both providers' and passengers' perspectives.

1.5. Crowding and congestion at terminals do not just occur due to inefficient systems and operations but people characteristics and perspectives are also affected in the evaluation of performance at arrival terminals.

1.6. The lack of emphasis on performance at arrival terminals can be related to the providers' perspective, which can monitor and evaluate the processes at arrival terminals.

1.7. This study focuses on the lack of attention on the technological systems used at airports, which should be emphasised.

1.8. Limited research has considered the potential interactions between the flow of outbound and inbound passengers.

1.9. Airport terminals must develop a simulation model to evaluate the impact of sequential processes at airport terminals.

1.10. Although numerous studies have investigated customer satisfaction from many perspectives, there is a lack of studies that identify the impact of passenger perspective-related causes of inefficiency at airport passenger terminals.

9.2.2 Objective 2 findings

Objective 2: To identify the characteristics of the flow of pilgrims through arrival terminal processes from a user perspective.

Based on the analysis of quantitative data intended to identify and characterise passenger flow through airport arrival processes from the passenger perspective, the results of this phase show the following:

2.1. A problematic review matrix for all processes and aspects was determined by performing a descriptive analysis, comparing the means and ranking the variables.

2.2. The inexperience of passengers with the HT has a distinct role and impact on the performance of HT.

2.3. Total male processing time was longer than the female processing time for the inspection process and overall total time at Jeddah airport.

2.4. Remarkably, passenger fingerprinting can significantly delay and impact processing times while the percentage of those who have lost a fingerprint was no more than 2–3% of all passengers.

2.5. The airports' lack of accessibility for disabled pilgrims can impact overall passenger stratification, especially for disabled pilgrims. Mainly, the impact can be seen on the BS.

2.6. Many human factors of terminal operators can impact the performance of terminal processes such as staff knowledge, helpfulness, staff courtesy, staff fairness, and seriousness.

2.7. The user perspective, which was used to evaluate terminal processes through their flow, except for BS, was highly correlated with the overall experience of all processes. Thus, overall passenger experience can dominate all passenger experiences through the flow processes, which means that passenger experiences in each process were unfairly evaluated in terms of the overall experience. Therefore, this study prefers to use and evaluate each process separately and should emphasise that candidate passengers should just evaluate their current process regardless of the overall experience.

9.2.3 Objective 3 findings

Objective 3: To identify the characteristics of the flow of pilgrims through the arrival terminal processes from the provider perspective.

16 open-ended interviews were analysed to define the characteristics of the flow of pilgrims through arrival terminal processes from the perspective of providers; the results indicated the following:

3.1. The factors impeding passenger flow were determined and then a causal loop diagram for the interactions between these factors and LoS variables based on the viewpoints of providers at HTs in the Jeddah and Medina Airports was developed.

3.2. A problematic review matrix for all processes based on the provider perspective was designed

3.3. The study findings from interviewing providers found that the problems of HT can be grouped into five sets of factors: human, instructional, operational, technical, and organizational.

3.4. It was found that the operational factors have the greatest impact on HT LoS.

3.5. Providers stress that the diversity of passenger languages is one of the obstacles they face in the HT.

3.6. The study findings investigated the provider's other claims, which indicated that there are issues in the organizational culture to develop and thus provide solutions for HT processes. The provider perspective emphasises that human factors can play a significant role in evaluating the processes at HT.

9.2.4 Objective 4 findings

Objective 4: To develop an integrated simulation model to evaluate the current HTs by applying what-if scenarios with a simulation model to suggest solutions that can facilitate the flow of pilgrims arriving at HTs.

4.1. By analysing the historical data for the Hajj terminals at both airports, the researcher deduced the variations in demand for both airports during the Hajj season. Thus, there was a negative impact on passenger flow performance at both airports. Moreover, the airport performance literature demonstrated a strong relationship between airport performance and demand.

4.2. The sharp peak demand pattern can highly impact the reduction in performance of the LoS processes while widely spreading the passenger arrival distributions can control and improve the LoS processes at airport terminals.

4.3. Previous studies specifically focused on determining and optimising spaces based on an aggregate model by using the integrated time and space available per facility occupant and waiting for the process to start, while this study had a sub-optimal design for sequential processes of airport terminals.

4.4. The simulation results for Jeddah airport show the total time that the pilgrims needed to complete all processes was approximately 9.8 hours. The simulation results confirmed the survey results, which showed that pilgrims needed between seven and nine hours at Jeddah Airport to complete all processes.

4.5. The simulation showed that the peak demand pattern generally increased the queue length. Therefore, this study found a sharp increase in some processes at the airport terminal. For example, there were sharp increases in the queues at terminals A and E, which shows the average number of passengers as 5,000–6,000 for the PC process while the queue length sharply increased when the average number of passengers was 300–1,700 in terms of the average number of pilgrims in the queue in lounges B and D for the CI.

4.6. Passenger inexperience with the airport terminal generally increased the average number of pilgrims in the queue. Therefore, passenger inexperience negatively impacts the performance of airport terminals.

4.7. It was concluded that poor-quality and lost fingerprints increased the average waiting time of all processes except CI at Jeddah Airport.

4.8. The total waiting time in the second scenario was 75% higher than in the first scenario, while the total waiting time in the third scenario was 28% higher than in the second scenario.

4.9. Remarkably, the configuration of lounges when designing the airport terminal played a substantial role in the passenger processing flow.

9.2.5 Objective 5 findings

Objective 5: To develop and validate the integrated framework.

This research seeks to identify and integrate multiple dimensions to develop a robust framework that can emphasise the problematic processes of HT.

5.1. The study findings enhance the roles of the user perspective, provider perspective, and simulation results, which can provide and confirm a problematic matrix to group process factors and obstacles from different viewpoints.

5.2. The user perspective, provider perspective, and simulation results conclude that suboptimal processes can be highlighted and ranked at the HT from worst to excellent.

5.3. The PC has the most problematic process regarding the user perspective, provider perspective, and simulation results.

5.4. The problematic review provides and explains which factors can influence the individual processes by scoring them. In contrast, the density map IATA LoS matrix just considers the waiting time and space for each passenger to classify the processes.

5.5. The study findings emphasise the sub-optimal airport terminal processes to provide a better view to diagnose performance problems at the terminal processes.

5.6. The study findings validate the integrated framework by using Jury of Experts opinions and judgement, which indicated that the integrated framework could be generalised, the ability to measure the LoS for airport terminals, the framework was easy to understand from the top management and decision-makers, the capability to eliminate unnecessary activities and processes from airport terminals, the ability reduce overall processing times, the capability to reduce congestion levels, and the capability to enhance and increase passenger stratification.

9.3 Research contributions

9.3.1 Theoretical contributions

This study contributes to both academia and management practice. The academic contribution is the identification of what factors affect the performance of arrival terminal processes at HTs. This is the first study to highlight the literature related to the performance of passenger flow within components and processes at crowded airports using this approach to access all relevant high-quality research, reduce bias and produce reliable information. The literature clearly shows the research gaps in terms of the lack of studies that have evaluated airport inbound passenger flow. Considering the previous research on passenger flow through crowded international airports and the research gaps, this research aims to contribute to the development of passenger flow at the arrival terminals of crowded international airports, particularly during peak times. This is achieved by developing an innovative integrated framework to study, evaluate and provide innovative solutions to the problem of the flow of pilgrims arriving at the Hajj terminals in KAIA in Jeddah and Prince Mohammed bin Abdulaziz International Airport in Medina. The study contributed by integrating multiple viewpoints for the user perspective, provider perspective, and simulation model. The study integrated framework can provide a robust diagnosis for airport terminals by ranking and scoring problematic processes. This is the first study to highlight and develop an approach to evaluate the flow of pilgrims through the arrival Hajj terminal processes to identify what weaknesses and problems affect operational capacity and cause congestion and bottlenecks according to the providers' perspective. This study considers passenger attributes, behaviours, perspectives, and expectations as well as the attributes and behaviours of airport administrators and other agencies. Moreover, all circumstances and external influences (e.g. political, cultural and legal) play a role in this system. Therefore, this research makes the following contributions:

- Contributed to developing an approach to evaluate arrival terminal systems at crowded airports to identify what weaknesses and problems affect the operational capacity and cause congestion and bottlenecks by considering systems configuration, infrastructure and users' and providers' perspectives.
- Contributed to building and developing an integrated simulation model that can help evaluate and provide innovative solutions for this problem.
- Contributed to developing innovative solutions based on new identification technology that facilitates and accelerates passenger flow through arrival terminals at crowded airports.
- Examined how the sub-optimal approach used in this study could be more efficient and practicable to diagnose the operational process at HT.
- Contributed and conducted the causal loop that proposed the interaction between impediment factors (human, infrastructural, operational, technical, and organizational) and LoS variables with regard to the provider perspective at HTs in the Jeddah and Medina Airports.
- Validated the study integrated framework by using Jury of Experts judgement

9.3.2 Practical contributions

In practical terms, the integrated framework developed can be used for other crowded airports to develop higher performance and suggests solutions to facilitate passenger flow through processes. In practical terms, it identified and studied what factors impede the flow of passengers through arrival Hajj terminal processes to provide and enhance the decision-makers' capacity to generate alternate solutions with regard to user and provider perspectives and the simulation model. The integrated framework exposed using qualitative and quantitative approaches can combine the information and subjective beliefs from users and providers. Practically, the study provides a framework that can evaluate and optimise the performance of passenger flow within crowded airports and provide decision-makers clear classifications of problematic processes. Therefore, the problematic review matrix offered recommendations for Hajj terminal researchers and management companies to define the critical problems in arrival systems, obtain solutions and develop actions.

This research study has resulted in the following contributions to knowledge:

- Parameters, factors, weaknesses and problems affecting the capacity utilisation and passenger movement through arrival terminal processes that cause congestion and bottlenecks have been identified.
- An approach to evaluate the flow of pilgrims through arrival Hajj terminal processes has been developed to identify what weaknesses and problems affect the operational capacity according to the provider perspective.
- An integrated simulation model based on ABS and DES has been developed to evaluate the flow of passengers through arrival processes and assess multiple scenarios to improve and facilitate passenger flow.
- An integrated framework has been developed to evaluate crowded airports' arrival terminal systems. The aim is to identify what weaknesses and problems affect operational capacity considering the system configuration/infrastructure and users' and providers' perspectives and develop optimal solutions to facilitate passenger flow through the arrival terminal processes.
- This study suggests using simulation to find a density map that can help decision-makers rethink their processes and see which need to be developed.
- This study recommended that decision-makers combine the results of the simulation model to verify the problematic review matrix for airport processes.
- The study contributed and suggested that decision-makers conduct problematic processes and generate alternate solutions based on the

suboptimal approach, which is used to diagnose operational processes at airport passenger terminals.

9.4 Study limitations

This section highlights some of the limitations to consider in our research while we use the study findings. The limitations could be explored as gaps in future work. This study used cross-sectional analysis for the survey in Chapter 5, which recommends having further replications to validate and enhance the study findings. In addition, the survey design did not track passenger timings during any processes and the survey was only conducted and gathered in five languages. The author reported that he faced some challenges gathering the survey data at the border for each process. This implies that providers do not offer enough reporting to evaluate their processes based on the scientific approach to rank the processes at each airport. They provide their perspective and opinions based on subjective individual beliefs. The study findings from the simulation results lack consideration of providers' and operators' decisions during operational processes, which could impact their performance in real situations. In addition, this study neglected the change in airport policies and regulations that can impact processes' procedures and performance. Furthermore, this study does not consider how the rapid growth of technology can boost and improve airport terminal performance. Moreover, this study neither simulated the median airport due to lack of data availability nor considered the cost factor when evaluating user and provider perspectives regarding the problematic review matrix. Finally, the scoring and ranking of influence factors did not consider the expert viewpoint.

9.5 Future research

This study recommends to incorporate all decision-makers and operators levels of HTs to manage this phenomenon in a practical way and develop more sustainable solutions by setting a policy in which are rewarded for adhering to the slot assigned to each pilgrim mission. This study suggests collecting and surveying all management level perspectives to recognize the provider perspective from many management levels. In addition, the author recommends tracking, surveying, and timing passengers through all HT processes and developing a mathematical model to optimize and rank simulation scenarios in terms of time and cost factors. The author recommends applying the proposed causal loop impediment factors in the provider perspective. This study recommends applying the integrated framework to other crowded international airports. Potential future work could use the simulation technique to define the uncertainty in a process. In terms of airport services, uncertainty can exist in passenger arrival times, service demands, time taken to perform services, and the quality of services provided. Further research is needed, particularly in terms of the perspectives and insights of airport employees, both at the operational and managerial levels, who are directly involved in the delivery of services to arriving pilgrims.

REFERENCES

Acharya, A.S., Prakash, A., Saxena, P. and Nigam, A. (2013) 'Sampling: why and how of it?', *Indian Journal of Medical Specialities*, 4(2) Available at: 10.7713/ijms.2013.0032 (Accessed: 1 January 2020).

ACI (2018) *ACI World_2017 Preliminary rankings* ACI,

ACI (2013) *Airport-Service-Quality/About-ASQ*., *Airports Council International*

ACI (2011) *Introduction to ASQ Survey: measuring and benchmarking passenger satisfaction*.

Adacher, L., Flamini, M., Guaita, M. and Romano, E. (2017) 'A model to optimize the airport terminal departure operations', *Transportation Research Procedia*, 27 Elsevier, pp. 53–60.

Ahyudanari, E. and Vandebona, U. (2005) 'Simplified model for estimation of airport check-in facilities', *Transportation*, 6, pp. 724–735. Available at: 10.11175/easts.6.724 (Accessed: 31 March 2019).

Aksoy, S., Atilgan, E. and Akinci, S. (2003) 'Airline services marketing by domestic and foreign firms: Differences from the customers' viewpoint', *Journal of Air Transport Management*, 9(6), pp. 343–351. Available at: 10.1016/S0969-6997(03)00034-6 (Accessed: 4 June 2020).

Al-Dhaheri, A. and Kang, P.S. (2015) 'Using Lean Philosophy to Improve Passenger Departure Flow in Abu Dhabi Airport', *International Journal of Scientific & Engineering Research,* 6(7)

Albanese, C.T., Aaby, D.R. and Platchek, T.S. (2014) *Advanced Lean In Healthcare*. North Charleston , South Carolina: Self-Publish with Createspace.

Ali, F., Kim, W.G. and Ryu, K. (2016) 'The effect of physical environment on passenger delight and satisfaction: Moderating effect of national identity', *Tourism Management*, 57, pp. 213–224.

Aljamal, M., Yasin, M., Almwari, R. and Alharthi, N. (2015) 'Study the Waiting

Times of Pilgrims in the Stages of Arrival at Air Ports', *15th Hajj and Umrah Scientific Forum*., p. Arabic Language.

Allison, P.D. (2003) 'Missing Data Techniques for Structural Equation Modeling', *Journal of Abnormal Psychology*, 112(4), pp. 545–557. Available at: 10.1037/0021-843X.112.4.545 (Accessed: 31 December 2019).

Alodhaibi, S., Burdett, R.L. and Yarlagadda, P.K.D. V (2017) 'Framework for airport outbound passenger flow modelling', *Procedia Engineering*, 174, pp. 1100–1109.

Alodhaibi, S., Burdett, R.L. and Yarlagadda, P.K.D.V. (2019) 'Impact of passenger-arrival patterns in outbound processes of airports', *Procedia Manufacturing*. Elsevier, Vol.30, pp. 323–330. Available at: 10.1016/j.promfg.2019.02.046 (Accessed: 13 August 2019).

Alshenqeeti, H. (2014) 'Interviewing as a Data Collection Method: A Critical Review', *English Linguistics Research*, 3(1) Available at: 10.5430/elr.v3n1p39 (Accessed: 21 November 2019).

Altman, D.G. and Bland, j. M. (1995) 'Statistics notes: The Normal distribution', *BMJ*, 310(6975), p. 298.

Anderson, J.C. and Gerbing, D.W. (1988) 'Structural equation modeling in practice: A review and recommended two-step approach', *Psychological bulletin*, 103(3), p. 411.

Andriessen, H., Van Gulijk, C. and Ale, B. (n.d.) *Human factors in layers of defense in airport security*. Available at: https://pdfs.semanticscholar.org/8d04/2773ae8c0002a3069f893ba015b48cb6df1f.pdf (Accessed: 5 June 2020).

Ashford, N. (1988) 'Level of service design concept for airport passenger terminals-a european view', *Transportation Planning and Technology*, 12(1), pp. 5–21. Available at: 10.1080/03081068808717356 (Accessed: 26 August 2019).

Ashford, N.J., Mumayiz, S. and Wright, P.H. (2011) *Airport Engineering:*

Planning, Design, and Development of 21st Century Airports.4th editio. Hoboken, NJ, USA: John Wiley & Sons, Inc. Available at: 10.1002/9780470950074 (Accessed: 7 June 2020).

Awang, Z. (2012) *A handbook on structural equation modeling using AMOS*. Shah Alam: Universiti Teknologi MARA Publication.

Babaita, C., Ispas, A. and Pirjol, F. (2008) *The tourist perception of the hospitality industry: Romania versus European Union*. Available at: https://www.researchgate.net/publication/227462689 (Accessed: 6 June 2020).

Ball, M., Barnhart, C., Dresner, M., Hansen, M., Neels, K., Odoni, A., Peterson, E., Sherry, L., Trani, A.A. and Zou, B. (2010) 'Total delay impact study: a comprehensive assessment of the costs and impacts of flight delay in the United States', *The national center of excellence NEXTOR*, (December), p. 2015. Available at: https://rosap.ntl.bts.gov/view/dot/6234 (Accessed: 6 August 2019).

Barnhart, C., Fearing, D., Odoni, A. and and Vaze, V. (2012) 'Demand and capacity management in air transportation', *EURO Journal on Transportation and Logistics*, 1(1–2), pp. 135–155.

de Barros, A.G., Somasundaraswaran, A.K.K. and Wirasinghe, S.C.C. (2007) 'Evaluation of level of service for transfer passengers at airports', *Journal of Air Transport Management*, 13(5) Pergamon, pp. 293–298. Available at: 10.1016/j.jairtraman.2007.04.004 (Accessed: 31 March 2019).

Beck, A. (2011) 'Case study: Modelling passenger flows in Heathrow Terminal 5', *Journal of Simulation*, 5(2), pp. 69–76.

Bezerra, G.C.L. and Gomes, C.F. (2016a) 'Performance measurement in airport settings: a systematic literature review', *Benchmarking: An International Journal*, 23(4) Emerald Group Publishing Limited, pp. 1027–1050.

Bezerra, G.C.L. and Gomes, C.F. (2016b) 'Measuring airport service quality: A multidimensional approach', *Journal of Air Transport Management*, 53 Pergamon, pp. 85–93. Available at: 10.1016/j.jairtraman.2016.02.001 (Accessed: 31 March 2019).

Bezerra, G.C.L.G.G.C.L. and Gomes, C.C.F. (2015) 'The effects of service quality dimensions and passenger characteristics on passenger's overall satisfaction with an airport', *Journal of Air Transport Management*, 44–45, pp. 77–81.

Birch, C. (2018) '"Serve well": San Francisco International Airport's staff engagement approach to providing meaningful, empathy-based service', *Journal of Airport Management*, 12(3), pp. 283–290. Available at: https://www.ingentaconnect.com/content/hsp/cam/2018/00000012/00000003/art00007 (Accessed: 5 June 2020).

Bitner, M.J. (1992) 'Servicescapes: The Impact of Physical Surroundings on Customers and Employees', *Journal of Marketing*, 56(2) SAGE Publications, pp. 57–71.

Blaxter, L., Hughes, C. and Tight, M. (2010) *How to Research*.4th edn. Open University Press - McGraw-Hill Education.

Boff, K.R., Kaufman, L. and Thomas, J.P. eds. (1986) *Handbook of perception and human performance, Vol. 2. Cognitive processes and performance*. John Wiley & Sons.

Bogicevic, V., Bujisic, M., Bilgihan, A., Yang, W. and Cobanoglu, C. (2017) 'The impact of traveler-focused airport technology on traveler satisfaction', *Technological Forecasting and Social Change*, 123 North-Holland, pp. 351–361. Available at: 10.1016/j.techfore.2017.03.038 (Accessed: 21 November 2018).

Bogicevic, V., Yang, W., Bilgihan, A. and Bujisic, M. (2013) 'Airport service quality drivers of passenger satisfaction', *Tourism Review*, 68(4), pp. 3–18.

Bontikous, N., Dieke-meier, F. and Fricke, H. (2016) 'The potential of modern mobile technologies to improve airport operations A concept for controlling passengers flows', *7th ICRAT – International Conference on Air Transport*. Philadelphia. Available at: http://icrat.org/icrat/seminarContent/2016/papers/33/ICRAT_2016_paper_33.pdf (Accessed: 21 November 2018).

Boonstra, J., Turkenburg, J. and Wit, J.C. de (2016) Airport Capacity, *AviationFacts.eu*,

Borille, G.M.R. and Correia, A.R. (2013) 'A method for evaluating the level of service arrival components at airports', *Journal of Air Transport Management*, 27, pp. 5–10.

Borshchev, A. (2013) *The Big Book of Simulation Modeling: Multimethod Modeling with AnyLogic 6*. AnyLogic North America.

Bouyakoub, S., Belkhir, A., Guebli, W. and Bouyakoub, F.M. hame. (2017) 'Smart airport: An IoT-based Airport Management System', *ACM International Conference Proceeding Series*., Vol.Part F1305. Available at: 10.1145/3102304.3105572 (Accessed: 11 June 2020).

Bowen, G. (2009) 'Document Analysis as a Qualitative Research Method', *Qualitative Research Journal*, 9(2) Emerald Group Publishing Limited, pp. 27–40.

Boyce, C. and Neale, P. (2006) *Conducting In-Depth Interviews: A Guide for Designing and Conducting In-Depth Interviews for Evaluation Input*.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101. Available at: 10.1191/1478088706qp063oa (Accessed: 26 November 2019).

Brunetta, L., Righi, L. and Andreatta, G. (1999) 'An operations research model for the evaluation of an airport terminal: SLAM (simple landside aggregate model)', *Journal of Air Transport Management*, 5(3), pp. 161–175. Available at: 10.1016/S0969-6997(99)00010-1 (Accessed: 2 June 2020).

Bryman, A. (2016) *Social Research Methods*.5th edn. Oxford, United Kingdom: Oxford University Press.

Bryman, A. and Bell, E. (2011) *Business Research Method*.3rd ed. New York: Oxford University Press Inc.

Bubalo, B. (2011) *Airport Punctuality, Congestion and Delay: The Scope for Benchmarking*.

Burns, R.B. (1997) *Introduction to Research Methods*.2nd edn. Melbourne: Longman Cheshire.

Burton, D. (2000) ‘The Use of Case Studies in Social Science Research’, in *Research Training for Social Scientists*. , pp. 215–225. Available at: 10.4135/9780857028051.d24 (Accessed: 15 October 2019).

Caidi, N. (2019) ‘Pilgrimage to Hajj: An Information Journey’, *The International Journal of Information, Diversity, & Inclusion (IJIDI)*, 3(1), p. 2019.

Campbell, M.J., Machin, D. and Walters, S.J. (2007) *Medical Statistics: A Textbook for the Health Sciences*.4th edn. Hoboken, NJ: Wiley-Blackwell.

Carpenter, C. and Suto, M. (2008) *Qualitative Research for Occupational and Physical Therapists: A Practical Guide*.1st edn. Wiley-Blackwell.

Carvalho, J., Marques, M., Costeira, J.P. and Costeira, P. (2018) ‘Understanding people flow in transportation hubs’, *IEEE Transactions on Intelligent Transportation Systems*, 19(10), pp. 3282–3291.

Casado, S., Laguna, M. and Pacheco, J. (2005) ‘Heuristical labour scheduling to optimize airport passenger flows’, *Journal of the Operational Research Society*, 56(6), pp. 649–658.

Casas, P.F. i, Casanovas, J. and Ferran, X. (2014) ‘Passenger flow simulation in a hub airport: An application to the Barcelona International Airport’, *Simulation Modelling Practice and Theory*, 44 Elsevier, pp. 78–94. Available at: 10.1016/j.simpat.2014.03.008 (Accessed: 26 November 2018).

Castillo-Manzano, J.I. and López-Valpuesta, L. (2013) ‘Check-in services and passenger behaviour: Self service technologies in airport systems’, *Computers in Human Behavior*, 29(6) Pergamon, pp. 2431–2437. Available at: 10.1016/j.chb.2013.05.030 (Accessed: 21 November 2018).

Cavada, J.P., Cortés, C.E. and Rey, P.A. (2017) ‘A simulation approach to modelling baggage handling systems at an international airport’, *Simulation Modelling Practice and Theory*, 75, pp. 146–164.

Caves, R.E. and Pickard, C.D. (2001) ‘The satisfaction of human needs in airport passenger terminals’, *Proceedings of the Institution of Civil Engineers - Transport*, 147(1), pp. 9–15.

CDSI (2017) *Statistical Report for Hajj 1438H/2017*. Saudi Arabia: Central Department of Statistics & Information.

Chang, Y.C. and Chen, C.F. (2012a) ‘Service needs of elderly air passengers’, *Journal of Air Transport Management*, 18(1) Pergamon, pp. 26–29.

Chang, Y.C. and Chen, C.F. (2011) ‘Identifying mobility service needs for disabled air passengers’, *Tourism Management*, 32(5) Pergamon, pp. 1214–1217.

Chang, Y.C. and Chen, C.F. (2012b) ‘Meeting the needs of disabled air passengers: Factors that facilitate help from airlines and airports’, *Tourism Management*, 33(3) Pergamon, pp. 529–536.

Chao, C.-C., Lin, H.-C.L. and Chen, C.-Y. (2013) ‘Enhancing Airport Service Quality: A Case Study of Kaohsiung International Airport’, *Journal of the Eastern Asia Society for Transportation Studies*, 10, pp. 2235–2254. Available at: 10.11175/easts.10.2235 (Accessed: 15 September 2019).

Charmaz, K. (2006) *Constructing Grounded Theory: A practical guide through qualitative analysis*.1st edn. London, UK: SAGE Publications.

Chatzikonstantinou, I., Sariyildiz, S. and Bittermann, M.S. (2015) ‘Conceptual airport terminal design using evolutionary computation’, *Evolutionary Computation (CEC), 2015 IEEE Congress on*. IEEE, pp. 2245–2252. Available at: 10.1109/CEC.2015.7257162 (Accessed: 22 November 2018).

Chen, F.-Y. and Chang, Y.-H. (2005) ‘Examining airline service quality from a process perspective’, *Journal of Air Transport Management*, 11(2), pp. 79–87.

Chen, J.K.C., Batchuluun, A. and Batnasan, J. (2015) ‘Services innovation impact to customer satisfaction and customer value enhancement in airport’, *Technology in Society*

Chen, S.-C. and Kuo, S.-Y. (2008) 'The Evaluation of Airline Service Quality by the Refined', *Journal of Aeronautics, Astronautics and Aviation*, 40(3), pp. 173–182.

Chiang, P.N.P.-N. and Taaffe, K. (2014) 'Analysis of passenger flow in airport terminal', *Proceedings - 2014 10th International Conference on Intelligent Information Hiding and Multimedia Signal Processing, IIH-MSP 2014*. IEEE, pp. 102–105. Available at: 10.1109/IIH-MSP.2014.32 (Accessed: 22 November 2018).

Civil Foundation guides Madinah (2017) *Final Report for Hajj season 1438*.

Clothier, R.A. and Walker, R.A. (2015) 'Safety risk management of unmanned aircraft systems', in *Handbook of Unmanned Aerial Vehicles*. , pp. 2229–2275.

Cohen, D. and Crabtree, B. (2006) *Qualitative Research Guidelines Project*. New Jersey. Available at: http://www.qualres.org/HomeSemi-3629.html (Accessed: 6 November 2019).

Conover, W.J. and Iman, R.L. (1981) 'Rank transformations as a bridge between parametric and nonparametric statistics', *American Statistician*, 35(3), pp. 124–128.

Consumer Protection Group (2009) *The Through Airport Passenger Experience An assessment of the passenger experience and airport operations at Heathrow , Gatwick* ,. Available at: https://www.caa.co.uk/uploadedFiles/CAA/Content/Standard_Content/Data_and_analysis/Analysis_reports/Through airport passenger experience 2009.pdf (Accessed: 17 April 2019).

Correia, A.R. and Wirasinghe, S.C. (2007) 'Development of level of service standards for airport facilities: Application to São Paulo International Airport', *Journal of Air Transport Management*, 13(2) Pergamon, pp. 97–103. Available at: 10.1016/j.jairtraman.2006.10.002 (Accessed: 31 March 2019).

Correia, A.R. and Wirasinghe, S.C. (2008) 'Analysis of level of service at airport departure lounges: User perception approach', *Journal of Transportation*

Engineering, 134(2), pp. 105–109.

Correia, A.R. and Wirasinghe, S.C. (2010) ‘Level of service analysis for airport baggage claim with a case study of the Calgary International Airport’, *Journal of Advanced Transportation*., Vol.44, pp. 103–112.

Correia, A.R., Wirasinghe, S.C. and Barros, A.G. de (2008a) ‘Overall level of service measures for airport passenger terminals’, *Transportation Research Part A: Policy and Practice*, 42(2), pp. 330–346.

Correia, A.R., Wirasinghe, S.C. and Barros, A.G. de (2008b) ‘A global index for level of service evaluation at airport passenger terminals’, *Transportation Research Part E: Logistics and Transportation Review*, 44(4) Pergamon, pp. 607–620. Available at: 10.1016/j.tre.2007.05.009 (Accessed: 31 March 2019).

Creswell, J.W. (2008) *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*.3rd edn. New Jersey: Pearson Prentice Hall.

Creswell, J.W. and Clark, V.L.P. (2007) *Designing and Conducting Mixed Methods Research*.1st edn. SAGE Publications, Inc.

Creswell, J.W. and Zhang, W. (2009) ‘The application of mixed methods designs to trauma research’, *Journal of Traumatic Stress*., Vol.22, pp. 612–621.

Curcio, D., Longo, F., Mirabelli, G. and Pappoff, E. (2007) ‘Passengers’ Flow Analysis and Security Issues in Airport Terminals Using Modeling and Simulation’, *21st European Conference on Modelling and Simulation*., pp. 4–6.

Cutting, J. (2012) ‘English for airport ground staff’, *English for Specific Purposes*, 31(1) Pergamon, pp. 3–13.

Decrop, A. (1999) ‘Triangulation in qualitative tourism research’, *Tourism Management*, 20(1), pp. 157–161. Available at: 10.1016/S0261-5177(98)00102-2 (Accessed: 9 November 2019).

Denscombe, M. (2014) *The Good Research Guide: For Small-scale Social Research Projects*.5th edn. New York: McGraw-Hill.

Denzin, N.K. (1970) ‘Strategies of Multiple Triangulation’, in *The Research Act*. New York: McGraw-Hill, pp. 297–313.

Ding, X., Liu, Z. and Xu, H. (2019) ‘The passenger flow status identification based on image and WiFi detection for urban rail transit stations’, *Journal of Visual Communication and Image Representation*, 58, pp. 119–129.

Doc, I.C.A.O., 9303 (2006) *Machine Readable Travel Documents, part 1– Machine Readable Passports, 2006*., International Civil Aviation Organization.

Dorton, S.L.L. and Liu, D. (2016) ‘Effects of Baggage Volume and Alarm Rate on Airport Security Screening Checkpoint Efficiency using Queuing Networks and Discrete Event Simulation’, *Human Factors and Ergonomics in Manufacturing & Service Industries*, 26(1), pp. 95–109.

Driver, C. and Johnston, R. (2001) ‘Understanding Service Customers: The Value of Hard and Soft Attributes’, *Journal of Service Research*, 4(2), pp. 130–139. Available at: 10.1177/109467050142005 (Accessed: 28 August 2019).

Easterby-Smith, M., Thorpe, R. and Lowe, A. (2002) *Management research : an introduction*.2nd edn. London: SAGE Publications. Available at: https://books.google.co.uk/books/about/Management_Research.html?id=EczlVa2192gC&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false (Accessed: 9 November 2019).

Economical polices and Air Transport Sector (2019) *Hajj Instructions Governing the Carriage of Pilgrims by Air* General Authority of Civil Aviation (GACA), Saudi Arabia

Enciso, J., Vargas, J. and Martínez, P. (2016) ‘Modeling and Simulation of Passenger Traffic in a National Airport’, *Proceedings of the 14th LACCEI International Multi-Conference for Engineering, Education, and Technology: “Engineering Innovations for Global Sustainability”*.

Enoma, A. and Allen, S. (2007) ‘Developing key performance indicators for airport safety and security’, *Facilities*, 25(7/8), pp. 296–315.

Fan, T.P. and Odoni, A.R. (2002) 'A Practical Perspective on Airport Demand Management', *Air Traffic Control Quarterly*, 10(3) American Institute of Aeronautics and Astronautics, Inc., pp. 285–306. Available at: 10.2514/atcq.10.3.285 (Accessed: 1 April 2019).

Fayez, M.S.S.S., Kaylani, A., Cope, D., Rychlik, N. and Mollaghasemi, M. (2008) 'Managing airport operations using simulation', *Journal of Simulation*, 2(1), pp. 41–52.

Felkel, R. and Klann, D. (2012a) 'Practice papers: Comprehensive passenger flow management at Frankfurt Airport', *AIRPORT MANAGEMENT*, 6(2) Henry Stewart Publications, pp. 107–124.

Felkel, R. and Klann, D. (2012b) 'Comprehensive passenger flow management at Frankfurt Airport', *AIRPORT MANAGEMENT*, 6(2), pp. 107–124.

Fetisov, V.A. and Maiorov, N.N. (2017) 'Mathematical modelling and research of passenger flows in marine passenger port', *Naše more*, 64(1), pp. 1–6.

Fodness, D. and Murray, B. (2007) 'Passengers' expectations of airport service quality', *Journal of Services Marketing*, 21(7) Emerald Group Publishing Limited, pp. 492–506.

Fornell, C. and Larcker, D. (1981) 'Evaluating Structural Equation Models with Unobservable Variables and Measurement Error', *Journal of Marketing Research*, 18(1), pp. 39–50.

Forrester, J. (1961) *Industrial Dynamics*. Boston, MA, USA: MIT press.

Fruin, J. (1971) 'Designing for pedestrians: A level-of-service concept', *50th Annual Meeting of the Highway Research Board*. Washington District of Columbia, United States, pp. 1–15. Available at: https://trid.trb.org/view/116491 (Accessed: 4 May 2020).

GACA (2018) *kings of the kingdom throughout its history .. Unlimited interest and development in the civil aviation sector*., *General Authority of Civil Aviation* Available at: https://gaca.gov.sa/web/ar-sa/news/translation-of-ar_sa-gacanews-

220918-hf01_55975 (Accessed: 10 February 2020).

Ganglmair-Wooliscroft, A. and Wooliscroft, B. (2013) ‘A cross-cultural application of the Affective Response to Consumption scale: Investigating US-American and Austrian passengers on long-haul flights’, *Journal of Business Research*, 66(6), pp. 765–770. Available at: 10.1016/j.jbusres.2011.09.016 (Accessed: 4 June 2020).

Gelhausen, M. c., Berster, P. and Wilken, D. (2013) ‘Do airport capacity constraints have a serious impact on the future development of air traffic?’, *Journal of Air Transport Management*, 28, pp. 3–13.

General Authority for Statistics (2018) *Statistical Report for Hajj 1439H/2018*. Saudi Arabia: General Authority for Statistics.

General Authority for Statistics (2015) *Statistical Report for Hajj 1436 H/2015*. General Authority for Statistics at Saudi Arabia.

General Authority for Statistics (2017) *Statistical Report for Hajj 1438 H/2017*. General Authority for Statistics at Saudi Arabia.

General Authority for Statistics of Saudi Arabia (2020) *Limited to actual Haj*. Available at: https://www.stats.gov.sa/en/28 (Accessed: 5 February 2020).

General authority of civil Aviation (2017) *Hajj terminals statistical report*. Saudi Arabia.

Ghamdi, Z. (2020) *Hajj terminal*., *Saudi Projects* Available at: https://saudiprojects.net/?project=صالة-الحجاج (Accessed: 8 February 2020).

Ginieis, M., Sánchez-Rebull, M.V. and Campa-Planas, F. (2012) ‘The academic journal literature on air transport: Analysis using systematic literature review methodology’, *Journal of Air Transport Management*, 19(1) Pergamon, pp. 31–35.

Gitto, S. and Mancuso, P. (2017) ‘Improving airport services using sentiment analysis of the websites’, *Tourism Management Perspectives*, 22 Elsevier, pp. 132–136. Available at: 10.1016/j.tmp.2017.03.008 (Accessed: 1 April 2019).

Gkritza, K., Niemeier, D. and Mannering, F. (2006) ‘Airport security screening and changing passenger satisfaction: An exploratory assessment’, *Journal of Air Transport Management*, 12(5), pp. 213–219. Available at: 10.1016/j.jairtraman.2006.03.001 (Accessed: 18 February 2020).

Gonçalves, M.W.E. and Caetano, M. (2017) ‘Airport level of service: A model according to departing passengers’ perceptions at a small-sized airport’, *Journal of Airline and Airport Management*, 7(1), p. 65.

Government, S. (2016) *Saudi Vision 2030*.

Graham, A. (2005) ‘Airport benchmarking: a review of the current situation’, *Benchmarking: an international journal*, 12(2), pp. 99–111.

Gray, D.E. (2004) *Doing Research in the Real World*.1st edn. London: SAGE Publications Ltd. Available at: https://books.google.co.uk/books/about/Doing_Research_in_the_Real_World.html?id=N_WGAwAAQBAJ&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false (Accessed: 9 November 2019).

Greghi, M.F., Rossi, T.N., de Souza, J.B.G. and Menegon, N.L. (2013) ‘Brazilian passengers’ perceptions of air travel: Evidences from a survey’, *Journal of Air Transport Management*, 31 Pergamon, pp. 27–31. Available at: 10.1016/j.jairtraman.2012.11.008 (Accessed: 31 March 2019).

Gronfulaa, M. and Abbod, M. (2013) ‘Implementation and Development of a Global Index for Level of Service Evaluation at Airport Passenger Terminals: Hajj Terminal Saudi Arabia’, *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 2(2307–4531) Global Society of Scientific Research and Researchers (GSSRR), pp. 448–465.

Guba, E. and Lincoln, Y. (1985) *Naturalistic Inquiry*. Newbury Park, California: SAGE Publications. Available at: https://us.sagepub.com/en-us/nam/naturalistic-inquiry/book842 (Accessed: 16 November 2019).

Gubrium, E. and Koro-Ljungberg, M. (2005) ‘Contending with border making in the social constructionist interview’, *Qualitative Inquiry*, 11(5), pp. 689–715.

Guizzi, G., Murino, T. and Romano, E. (2009) ‘A discrete event simulation to model passenger flow in the airport terminal’, *In Proceedings of the 11th WSEAS International Conference on Mathematical Methods and Computational Techniques in Electrical Engineering (MMACTEE’09)*., pp. 427–434.

Hafizogullari, S., Bender, G. and Tunasar, C. (2003) ‘Simulation’s role in baggage screening at the airports: A case study’, *Winter Simulation Conference Proceedings*., Vol.2, pp. 1833–1837.

Hair, J., Black, W., Babin, B. and Anderson, R. (2013) *Multivariate data analysis: Pearson new international edition*. Pearson Education Limited.

Haksever, C. and Render, B. (2013) *Service Management: An Integrated Approach to Supply Chain Management and Operations*. 1ST edn. FT Press.

Halpern, N. (2011) ‘Measuring seasonal demand for Spanish airports: Implications for counter-seasonal strategies’, *Research in Transportation Business and Management*, 1(1) Elsevier, pp. 47–54.

Hamzawi, S.G. (1992) ‘Lack of airport capacity: Exploration of alternative solutions’, *Transportation Research Part A*, 26(1) Pergamon, pp. 47–58.

Haraldsson, H.V. (2004) *Introduction to System Thinking and Causal Loop Diagrams.* Available at: www.planteco.lu.se (Accessed: 6 June 2020).

Harma, M. (1993) ‘Individual differences in tolerance to shiftwork: A review’, *Ergonomics*. Publ by Taylor & Francis, Vol.36, pp. 101–109.

Harrison, A. (2015) *Principles of experience design for airport terminals*. Queensland University of Technology.

Hartvigsen, D. (2004) *SimQuick Process Simulation with Excel*. 3rd edn. Pearson Education, Inc.

Hoback, P. (2018) ‘Transforming pittsburgh international airport: Building an employee culture of innovation to fuel a dramatic turnaround in a post-hub era’, *Journal of Airport Management*, 12(4), pp. 370–378. Available at: https://www.ingentaconnect.com/content/hsp/cam/2018/00000012/00000004/art

00006 (Accessed: 5 June 2020).

Hockey, G.R.J. (1986) ‘Changes in operator efficiency as a function of environmental stress, fatigue, and circadian rhythms’, in *Handbook of human perception and performance*. , pp. 1–49. Available at: https://psycnet.apa.org/record/1986-98619-022 (Accessed: 5 June 2020).

Hopkin, V.D. (2017) *Human factors in air traffic control*. CRC Press.

Horonjeff, R., McKelvey, F.X., Sproule, W.J. and Young, S.B. (2010) *Planning and Design of Airports*.Fifth edit. McGraw-Hill.

Hsu, C.I., Chao, C.C. and Shih, K.Y. (2012) ‘Dynamic allocation of check-in facilities and dynamic assignment of passengers at air terminals’, *Computers and Industrial Engineering*, 63(2) Pergamon, pp. 410–417. Available at: 10.1016/j.cie.2012.04.003 (Accessed: 31 March 2019).

Huang, P.T.B., Yu, T.Y., Chou, Y. ju and Lin, Y.C. (2016) ‘Simulation method for dispatching national border security manpower to mitigate manpower shortage’, *Journal of Air Transport Management*, 57, pp. 43–51.

Humphreys, I. and Francis, G. (2002) ‘Performance measurement: a review of airports’, *International Journal of Transport Management*, 1(2), pp. 79–85.

Humphreys, I., Francis, G. and Fry, J. (2002) ‘Performance Measurement in Airports: A Critical International Comparison’, *Public Works Management & Policy*, 6(4), pp. 264–275.

Institute for Hajj and Umrah Research (2018) *Initiatives and research projects for the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research to improve services and develop facilities and raise the efficiency of their operation and increase assimilation*. Makkah.

International Air Transport Association (2014) *IATA Airport Development Reference Manual*.10TH edn. Montreal, Quebec: International Air Transport Association (IATA).

Ivankova, N. V, Creswell, J.W. and Stick, S.L. (2006) ‘Using Mixed-Methods

Sequential Explanatory Design: From Theory to Practice', *Field Methods*, 18(1), pp. 3–20.

Jacquillat, A. (2015) *Integrated allocation and utilization of airport capacity to mitigate air traffic congestion*. Massachusetts Institute of Technology.

Jacquillat, A. and Odoni, A.R.A.R. (2018) 'A roadmap toward airport demand and capacity management', *Transportation Research Part A: Policy and Practice*, 114 Elsevier Ltd, pp. 168–185.

Jaffer, S. and Timbrell, G. (2014) 'Digital strategy in airports', *25th Australasian Conference on Information Systems*. Auckland, New Zealand: ACIS.

Jain, L.C. and Aidman, Eugene V.Abeynayake, C. (2011) 'Innovations in Defence Support Systems -2', in Jain, L. C., Aidman, E. V. and Abeynayake, C. (eds.) *Innovations in Defence Support Systems - 2*. Studies in Computational Intelligence. Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 158–166.

Janssen, S., Sharpanskykh, A. and Curran, R. (2019) 'Agent-based modelling and analysis of security and efficiency in airport terminals', *Transportation Research Part C: Emerging Technologies*, 100, pp. 142–160.

Janssen, S., Van Der Sommen, R., Dilweg, A. and Sharpanskykh, A. (2020) 'Data-Driven Analysis of Airport Security Checkpoint Operations', *mdpi.com*, 7(6) Available at: 10.3390/aerospace7060069 (Accessed: 5 June 2020).

Johnson, R.B. and Onwuegbuzie, A.J. (2004) 'Mixed Methods Research: A Research Paradigm Whose Time Has Come', *Educational Researcher*, 33(7), pp. 14–26.

Kalakou, S. and Moura, F. (2015) 'Modelling passengers' activity choice in airport terminal before the security checkpoint: The case of portela airport in Lisbon', *Transportation Research Procedia*. Elsevier, Vol.10, pp. 881–890. Available at: 10.1016/j.trpro.2015.09.041 (Accessed: 26 November 2018).

Kalakou, S., Psaraki-Kalouptsidi, V. and Moura, F. (2015) 'Future airport terminals: New technologies promise capacity gains', *Journal of Air Transport*

Management, 42, pp. 203–212.

Kalemba, N. and Campa Planas, F. (2016) ‘An Overview of the Quality Concept in the Air Transportation Business: A Systematic Literature Review’, *International Journal for Quality Research*, 11(1), pp. 51–70.

Kandampully, J. (2000) ‘The impact of demand fluctuation on the quality of service: A tourism industry example’, *Managing Service Quality: An International Journal*, 10(1), pp. 10–19. Available at: 10.1108/09604520010307012 (Accessed: 30 May 2020).

Karlsson, J., Ludders, J.R., Wilde, D., Mochrie, D. and Seymour, C. (2008) *Airport Economic Impact Methods and Models*.

Katz, A. (2013) ‘As the Hajj Unfolds in Saudi Arabia, A Deep Look Inside the Battle Against MERS’, *TIME Magazine*, , pp. 1–7.

Kazda, A. and Caves, R.E. (2015) *Airport Design and Operation,*.3rd editio. Bingley , UK: Emerald Group Publishing Limited.

Keillor, B.D., Lewison, D., Hult, G.T.M. and Hauser, W. (2007) ‘The service encounter in a multi-national context’, *Journal of Services Marketing*, 21(6), pp. 451–461. Available at: 10.1108/08876040710818930 (Accessed: 4 June 2020).

Khail, M. (2017) The origin and development of the civil aviation sector in the Kingdom, *Albenaa Magazine*, Available at: https://albenaamag.com/2017/08/02/نشأة-وتطور-قطاع-الطيران-المدني-في-المم/ (Accessed: 10 February 2020).

Khan, E. (2011) ‘An RFID-Based System for Pilgrim Management in King Abdul Aziz International Airport’, *Information Management, Innovation Management and Industrial Engineering (ICIII), 2011 International Conference on*. IEEE, Vol.1, pp. 124–129.

Khan, E.A. and Shambour, M.K.Y. (2018) ‘An analytical study of mobile applications for Hajj and Umrah services’, *Applied Computing and Informatics*, 14(1), pp. 37–47. Available at: 10.1016/j.aci.2017.05.004 (Accessed: 1 February

2020).

Kim, G., Kim, J. and Chae, J. (2017) ‘Balancing the baggage handling performance of a check-in area shared by multiple airlines’, *Journal of Air Transport Management*, 58, pp. 31–49.

Kim, H.-Y. (2013) ‘Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis’, *Restorative Dentistry & Endodontics*, 38(1), p. 52. Available at: 10.5395/rde.2013.38.1.52 (Accessed: 26 July 2019).

Kim, T.H.T.H., Wu, C.-L.C.L. and Koo, T.-R.T.R. (2017) ‘Implications of the ageing society and internationalisation for airport services: A perspective on passenger demand for personal space at airport terminals’, *Journal of Air Transport Management*, 60, pp. 84–92.

Kirk, P.J., Popovic, V., Kraal, B. and Livingstone, A. (2012) ‘Towards a taxonomy of airport passenger activities’, *Proceedings of DRS2012 Bangkok. Chulalongkorn University, Bangkok, Thailand*

Kirschenbaum, A.A., Mariani, M., Van Gulijk, C., Lubasz, S., Rapaport, C. and Andriessen, H. (2012) ‘Airport security: An ethnographic study’, *Journal of Air Transport Management*, 18(1) Pergamon, pp. 68–73.

Kitchenham, B. (2004) *Procedures for Performing Systematic Literature Reviews*. Keele, UK: Keele University, 33(2004), pp.1-26.

Kiyildi, R.K.K. and Karasahin, M. (2008) ‘The capacity analysis of the check-in unit of Antalya Airport using the fuzzy logic method’, *Transportation Research Part A: Policy and Practice*, 42(4) Pergamon, pp. 610–619. Available at: 10.1016/j.tra.2008.01.004 (Accessed: 31 March 2019).

Kleinschmidt, T., Guo, X., Ma, W. and Yarlagadda, P.K.D.V.P.K.D.V.P.K.D. V (2011) ‘Including airport duty-free shopping in arriving passenger simulation and the opportunities this presents’, *Proceedings - Winter Simulation Conference*. IEEE, pp. 210–221.

Kline, R.B. (2015) *Principles and practice of structural equation modeling*. New York: Guilford publications.

Kneale, D.K., Baxter, G.S. and Wild, G. (2014) ‘The use of e-passports for inbound airport border security screening: the passenger perspective’, *Aviation*, 18(4), pp. 193–202.

Kokkinou, A. and Cranage, D.A. (2013) ‘Using self-service technology to reduce customer waiting times’, *International Journal of Hospitality Management*, 33(1) Pergamon, pp. 435–445. Available at: 10.1016/j.ijhm.2012.11.003 (Accessed: 26 November 2018).

Kothari, C.R. (2013) *Research methodology : methods & techniques*. 3rd edn. New Age International (P) Ltd.

Kovács, G., Harmati, I.I., Kiss, B.B.B., Vámos, G., Maráczy, P., Kovacs, G., Harmati, I.I., Kiss, B.B.B., Vamos, G., Maraczy, Gabor Kovacs Balint Kiss Peter Maraczy, Istvan Harmati, G.V., Kovács, G., Harmati, I.I., Kiss, B.B.B., Vámos, G. and Maráczy, P. (2012) ‘Methods for airport terminal passenger flow simulation’, *International Journal of Mathematics and Computers in Simulation*, 6(6), pp. 529–541.

Kramer, L., Bothner, A. and Spiro, M. (2013) *How Airports Measure Customer Service Performance*. Transportation Research Board. Available at: http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_048.pdf (Accessed: 1 June 2020).

Kumar, R. (2010) *Research Methodology: A Step-by-Step Guide for Beginners*.3rd edn. London, UK: SAGE Publications Ltd.

Kumar, V. and Sherry, L. (2009) ‘Airport troughput capacity limits for demand management planning’, *Integrated Communications, Navigation and Surveillance Conference, 2009. ICNS’09.* IEEE, pp. 1–10.

Lecompte, M.D. and Goetz, J.P. (1982) ‘Problems of Reliability and Validity in Ethnographic Research’, *Review of Educational Research*, 52(1), pp. 31–60.

Lee, A.J. and Jacobson, S.H. (2011) ‘The impact of aviation checkpoint queues on optimizing security screening effectiveness’, *Reliability Engineering and System Safety*, 96(8) Elsevier, pp. 900–911. Available at: 10.1016/j.ress.2011.03.011 (Accessed: 31 March 2019).

Lee, A.M. (1966) *Applied Queueing Theory*. LONDON: MacMillan & Co.

Lee, A.M. and Longton, P.A. (1959) ‘Queueing Processes Associated with Airline Passenger Check-in’, *Journal of the Operations Research Society*, 10(1) Operational Research Society, pp. 56–71.

Leedy, P.D.. and Ormrod, J. (2014) *Practical research: Planning and design*.11th edn. Essex: Pearson Education Limited. Available at: https://pdfs.semanticscholar.org/455a/f13418c73989d99f659d137c9302f0636bee.pdf (Accessed: 17 October 2019).

Lemer, A.C. (1992) ‘Measuring performance of airport passenger terminals’, *Transportation Research Part A: Policy and Practice*, 26(1), pp. 37–45.

Li, Y., Gao, X., Xu, Z. and Zhou, X. (2018) ‘Network-based queuing model for simulating passenger throughput at an airport security checkpoint’, *Journal of Air Transport Management*, 66, pp. 13–24.

Liu, X.X., Li, L., Liu, X.X. and Zhang, T. (2019) ‘Analysis of passenger flow and its influences on HVAC systems: An agent based simulation in a Chinese hub airport terminal’, *Building and Environment*, 154 Pergamon, pp. 55–67. Available at: 10.1016/j.buildenv.2019.03.011 (Accessed: 29 March 2019).

Liu, X.X., Li, L., Liu, X.X., Zhang, T., Rong, X., Yang, L. and Xiong, D. (2018) ‘Field investigation on characteristics of passenger flow in a Chinese hub airport terminal’, *Building and Environment*, 133, pp. 51–61.

Lubbe, B., Douglas, A. and Zambellis, J. (2011) ‘An application of the airport service quality model in South Africa’, *Journal of Air Transport Management*, 17(4), pp. 224–227. Available at: 10.1016/j.jairtraman.2010.08.001 (Accessed: 15 September 2019).

Ma, W. (2013) *Agent-based model of passenger flows in airport terminals*. Queensland University of Technology. Available at: http://eprints.qut.edu.au/63457/1/Wenbo_Ma_Thesis.pdf (Accessed: 27 May 2020).

Ma, W., Fookes, C., Kleinschmidt, T. and Yarlagadda, P. (2012) ‘Modelling passenger flow at airport terminals : individual agent decision model for stochastic passenger behaviour’, *Simultech 2012*, , pp. 109–113.

Ma, W., Kleinschmidt, T., Fookes, C. and Yarlagadda, P.K.D.V. (2011) ‘Check-in processing: Simulation of passengers with advanced traits’, *In Proceedings of the Winter Simulation Conference*. IEEE, pp. 1778–1789.

MacLeod, V. and McLindin, B. (2011) ‘Methodology for the evaluation of an international airport automated border control processing system’, *Studies in Computational Intelligence*, 338 Springer, Berlin, Heidelberg, pp. 115–145. Available at: 10.1007/978-3-642-17764-4_4 (Accessed: 4 December 2018).

Magri Jr, A.A. and Alves, C.J.P. (2005) ‘Passenger terminals at Brazilian airports: an evaluation of quality’, *Journal of the Brazilian air Transportation Research Society*, 13(1), pp. 9–17.

Majeske, K.D. and Lauer, T.W. (2012) ‘Optimizing airline passenger prescreening systems with Bayesian decision models’, *Computers and Operations Research*, 39(8) Pergamon, pp. 1827–1836. Available at: 10.1016/j.cor.2011.04.008 (Accessed: 31 March 2019).

Manataki, I.E. and Zografos, K.G. (2009) ‘A generic system dynamics based tool for airport terminal performance analysis’, *Transportation Research Part C: Emerging Technologies*, 17(4), pp. 428–443.

Matas, M. (2010) ‘Door-to-Gate Air Passenger Flow Model’, *4th International Conference for Research in Air Transportation*. Budapest.

Matthew, L. (2011) *Islamic Beliefs, Practices, and Cultures*. Tarrytown, New York: Marshall Cavendish Corporation. Available at: https://books.google.co.uk/books?id=H_m14NlQQMYC&pg=PA86&redir_esc=y

#v=onepage&q&f=false (Accessed: 1 February 2020).

Mayer, C., Felkel, R. and Peterson, K. (2014) 'Best Practice on Automated Passenger Flow Measurement Solutions', *Airport Management*, 9(2), pp. 1–28.

McCullough, B.F. and Roberts, F.L. (1979) 'DECISION TOOL FOR ANALYSIS OF CAPACITY OF AIRPORT TERMINAL BUILDINGS.', *Transportation Research Record*, (732), pp. 41–54. Available at: http://onlinepubs.trb.org/Onlinepubs/trr/1979/732/732-008.pdf (Accessed: 7 June 2020).

McHugh, M.L. (2012) 'Interrater reliability: The kappa statistic', *Biochemia Medica*, 22(3), pp. 276–282.

Mcmurdo, G. (1981) 'The IAP Library At King Abdulaziz International Airport', *Aslib Proceedings*., Vol.33, pp. 363–367.

Ministry of Hajj & Umrah (2020) *United Agents Office*., *www.haj.gov.sa* Available at: https://www.haj.gov.sa/ar/InternalPages/Details/41 (Accessed: 11 February 2020).

Ministry of Hajj and Umrah (2019) *The system of service providers for pilgrims abroad and its executive regulations*.

Mishra, P., Pandey, C.M., Singh, U., Gupta, A., Sahu, C. and Keshri, A. (2019) 'Descriptive statistics and normality tests for statistical data', *Annals of Cardiac Anaesthesia*, 22(1) Wolters Kluwer Medknow Publications, pp. 67–72.

Molla Gebre, B. (2016) 'Psycholinguistic Ambiance of Short Stories in Enhancing Students' Reading Comprehension and Vocabulary Power', *International Journal of Foreign Language Teaching and Research*, 4(13) Islamic Azad University, Najafabad Branch, Najafabad, Iran All rights reserved, pp. 97–108.

Moon, H., Yoon, H.J. and Han, H. (2016) 'Role of Airport Physical Environments in the Satisfaction Generation Process: Mediating the Impact of Traveller Emotion', *Asia Pacific Journal of Tourism Research*, 21(2) Routledge, pp. 193–211.

Morgan, D.L. (2014) 'Pragmatism as a Paradigm for Social Research', *Qualitative Inquiry*, 20(8) SAGE Publications Inc., pp. 1045–1053.

Moser, C.A. and Kalton, G. (1989) *Survey Methods in Social Investigation*.2nd edn. Aldershot: Gower.

Mota, M.M., Mujica Mota, M. and Mota, M.M. (2015) 'Check-in allocation improvements through the use of a simulation-optimization approach', *Transportation Research Part A: Policy and Practice*, 77, pp. 320–335.

Neufville, R. de and Odoni, A.R. (2003) *Airport Systems. Planning, Design and Management*.2nd editio.Cenveo Publisher Services (ed.) USA: McGraw-Hill Education.

Neuman, W.L. (2013) *Social Research Methods: Qualitative and Quantitative Approaches*.7th edn. Essex: Pearson Education Limited.

Nikoue, H., Marzuoli, A., Clarke, J.-P., Feron, E. and Peters, J. (2015) 'Passenger Flow Predictions at Sydney International Airport: A Data-Driven Queuing Approach', *arxiv.org* Available at: https://arxiv.org/abs/1508.04839 (Accessed: 27 November 2018).

Nõmmik, A. and Antov, D. (2017) 'Modelling Regional Airport Terminal Capacity', *Procedia Engineering*., Vol.178, pp. 427–434. Available at: 10.1016/j.proeng.2017.01.083 (Accessed: 6 June 2020).

Novrisal, D., Wahyuni, N. and Hamani, N. (2013) 'Simulation of Departure Terminal in Soekarno-Hatta International Airport', *Industrial Engineering and Engineering Management (IEEM), 2013 IEEE International Conference on*. IEEE, pp. 600–604.

Nunnally, J.C. (1978) *Psychometric theory*.2nd edn. New York: McGraw-Hill.

O'Reilly, M. and Parker, N. (2013) '"Unsatisfactory Saturation": A critical exploration of the notion of saturated sample sizes in qualitative research', *Qualitative Research*, 13(2), pp. 190–197. Available at: 10.1177/1468794112446106 (Accessed: 14 February 2020).

Oostveen, A.M. and Lehtonen, P. (2017) The requirement of accessibility: European automated border control systems for persons with disabilities, *Technology in Society*, 521 February, pp. 60–69. Available at: 10.1016/j.techsoc.2017.07.009 (Accessed: 25 November 2018).

Ormston, R., Ritchie, J., Lewis, J. and Morrell, G. (2014) ‘Generalising from Qualitative Research’, in *Qualitative research practice: a guide for social science students and researchers*. 2nd edn. Los Angeles: SAGE Publications Ltd, p. 347.

Oyewole, P. (2001) ‘Consumer’s socio-demographic characteristics and satisfaction with services in the airline industry’, *Services Marketing Quarterly*, 23(2), pp. 61–80. Available at: 10.1300/J396v23n02_04 (Accessed: 4 June 2020).

Pandey, M.M. and Shukla, D. (2019) ‘Evaluating the human performance factors of air traffic control in Thailand using Fuzzy Multi Criteria Decision Making method’, *Journal of Air Transport Management*, 81 Available at: 10.1016/j.jairtraman.2019.101708 (Accessed: 29 March 2020).

Pantouvakis, A. (2013) ‘The moderating role of nationality on the satisfaction loyalty link: Evidence from the tourism industry’, *Total Quality Management and Business Excellence*, 24(9–10), pp. 1174–1187.

Pantouvakis, A. and Renzi, M.F. (2016) ‘Exploring different nationality perceptions of airport service quality’, *Journal of Air Transport Management*, 52 Elsevier Ltd, pp. 90–98. Available at: 10.1016/j.jairtraman.2015.12.005 (Accessed: 4 June 2020).

Park, Y. (2003) ‘An analysis for the competitive strength of Asian major airports’, *Journal of Air Transport Management*, 9(6), pp. 353–360.

Park, Y. and Ahn, S.B. (2003) ‘Optimal assignment for check-in counters based on passenger arrival behaviour at an airport’, *Transportation Planning and Technology*, 26(5), pp. 397–416. Available at: 10.1080/03081060310001635887 (Accessed: 31 March 2019).

Paulus, P.B. and Nagar, D. (1989) ‘Environmental influences on groups’, *Psychology of group influence*, , pp. 111–142.

Pellissier, R. (2007) *Business Research Made Easy*.1st edn. Cape Town, South Africa: Juta & Co.

Pitchforth, J., Wu, P., Fookes, C. and Mengersen, K. (2015) 'Processing passengers efficiently: An analysis of airport processing times for international passengers', *Journal of Air Transport Management*, 49, pp. 35–45.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003) 'Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies', *Journal of Applied Psychology*, 88(5), pp. 879–903. Available at: 10.1037/0021-9010.88.5.879 (Accessed: 31 December 2019).

Poli, R. (2013) 'A note on the difference between complicated and complex social systems', *Cadmus*, 2(1), p. 142. Available at: https://www.cadmusjournal.org/files/pdfreprints/vol2issue1/reprint-cj-v2-i1-complex-vs-complicated-systems-rpoli.pdf (Accessed: 19 April 2020).

Popper, K. (2002) *The Logic of Scientific Discovery*. New York: Routledge, Taylor & Francis.

PPMDC (2019) *PPMDC - The Port Specialist*. Available at: http://ppmdc.com.sa/index.php (Accessed: 15 August 2019).

Price, M. (2014) *ACRP 116: Guidebook for Successfully Assessing and Managing Risks for Airport Capital and Maintenance Projects*. WASHINGTON, D.C.

Rauch, R. and Kljajić, M. (2006) 'Discrete Event Passenger Flow Simulation Model for an Airport Terminal Capacity Analysis', *Organizacija*, 39(10), pp. 652–660.

Rendeiro Martín-Cejas, R. (2006) 'Tourism service quality begins at the airport', *Tourism Management*, 27(5), pp. 874–877.

Rio, J.S. del, Moctezuma, D., Conde, C., Diego, I.M. de, Cabello, E., Sanchez del Rio, J., Moctezuma, D., Conde, C., Martin de Diego, I. and Cabello, E. (2016) ‘Automated border control e-gates and facial recognition systems’, *Computers and Security*, 62 Elsevier Advanced Technology, pp. 49–72. Available at: 10.1016/j.cose.2016.07.001 (Accessed: 3 December 2018).

Robson, C. (2002) *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*.2nd edn. Oxford, United Kingdom: Blackwell Publishers Ltd.

Robson, C. and McCartan, K. (2016) *REAL WORLD RESEARCH: A Resource for Users of Social Research Methods in Applied Settings*.4th edn. Chichester: John Wiley & Sons Ltd.

Rocha, P.M. da, Barros, A.P. de, Silva, G.B. da and Costa, H.G. (2016) ‘Analysis of the operational performance of brazilian airport terminals: A multicriteria approach with De Borda-AHP integration’, *Journal of Air Transport Management*, 51, pp. 19–26.

Rodrigue, J.-P. (2020) *The Geography of Transport Systems*.5th editio. New York: Routledge.

Rodrigue, J.P. (2016) *The geography of transport systems*. USA, New York: Taylor and Francis.

Ronzani, G.M. and Correia, A.R. (2015) ‘Impact of demand and airport characteristics on baggage claim’, *Proceedings of the Institution of Civil Engineers: Transport*, 168(2), pp. 150–160.

Rosnay, J. (1979) *The Macroscope: A new world scientific system*. New York: Harper & Row Publishers.

Ryerson, M.S. and Woodburn, A. (2014) ‘Build Airport Capacity or Manage Flight Demand? How Regional Planners Can Lead American Aviation Into a New Frontier of Demand Management’, *Journal of the American Planning Association*, 80(2), pp. 138–152. Available at: 10.1080/01944363.2014.961949 (Accessed: 24 November 2018).

Sabq.org (2017) ‘Medina airport’ is a second airport rank at the Middle East level and 55 globally, *Sabq online newspaper*, Available at: https://sabq.org/drgvP9 (Accessed: 10 February 2020).

Sasser, W.E. (1976) ‘Match supply and demand in service industries’, *Harvard Business Review*, 54(6), pp. 133–140.

Saudi Press Agency (2007) *The number of pilgrims coming from abroad during the past 77 years*, Available at: https://www.spa.gov.sa/510728 (Accessed: 5 February 2020).

Saunders, M., Lewis, P. and Thornhill, A. (2015) *Research methods for business students*.7th ed. London, UK: Pearson Education Limited: Prentice Hall.

Saunders, M., Lewis, P. and Thornhill, A. (2009) *Research Methods for Business Students*.5th ed. London, UK: Pearson Education Limited: Prentice Hall.

Schreier, M. (2012) *Qualitative Content Analysis in Practice*.1st edn. London: SAGE Publications.

Skorupski, J. and Uchroński, P. (2018) ‘Evaluation of the effectiveness of an airport passenger and baggage security screening system’, *Journal of Air Transport Management*, 66 Pergamon, pp. 53–64. Available at: 10.1016/j.jairtraman.2017.10.006 (Accessed: 26 November 2018).

Skytrax (2015) *World Airport Survey*.

Smith, H.W. (1991) *Strategies of Social Research*.3rd edn. Orlando, FL: Holt, Rinehart and Winston.

Smith, P.K. (2000) ‘Philosophy of science and its relevance for the social science’, in In: Burton (ed.) *Research Training for Social Scientists*. London: SAGE Publications Ltd, pp. 5–20.

Sohn, S.C., Kim, K.W. and Lee, C. (2012) ‘IT framework and user requirement analysis for smart airports’, *Lecture Notes in Electrical Engineering*., Vol.203 LNEE, pp. 547–555.

Sohn, S.C.C., Kim, K.W.W. and Lee, C. (2013) ‘User requirement analysis and

IT framework design for smart airports', *Wireless personal communications*, 73(4), pp. 1601–1611.

Soiferman, K. (2010) 'Compare and contrast inductive and deductive research approaches', *Inductive and deductive research approaches*, (March), p. 22. Available at: 10.1177/0266666903192004 (Accessed: 10 October 2019).

Spens, K.M. and Kovács, G. (2006) 'A content analysis of research approaches in logistics research', *International Journal of Physical Distribution and Logistics Management*, 36(5), pp. 374–390.

Starkie, D. (2008) *The Airport Industry in a Competitive Environment: A UK Perspective*., OECD/ITE Discussion Paper No. 2008-15.

Steber, C. (2017) *In-Depth Interviews: Data Collection Advantages and Disadvantages*., *Communication for Research*

Sterman, J.D. (2000) *Business Dynamics Systems Thinking and Modeling for a Complex World*.Isenberg, S. (ed.) Irwin/McGraw-Hill.

Stevens, N., Baker, D. and Freestone, R. (2010) 'Airports in their urban settings: towards a conceptual model of interfaces in the Australian context', *Journal of Transport Geography*, 18(2), pp. 276–284.

Stokols, D. (1972) 'On the distinction between density and crowding: some implications for future research', *Psychological review*, 79(3), p. 275.

Stokols, D., Novaco, R.W., Stokols, J. and Campbell, J. (1978) 'Traffic congestion, Type A behavior, and stress', *Journal of Applied Psychology*, 63(4), p. 467.

Stolletz, R. (2011) 'Analysis of passenger queues at airport terminals', *Research in Transportation Business & Management*, 1(1), pp. 144–149.

Tabachnick, B. and Fidell, L. (2019) *Using Multivariate Statistics*. 7th edn. Boston, MA, USA: Perason Allyn & Bacon.

Takakuwa, S. and Oyama, T. (2003) 'Modeling people flow: simulation analysis of international departure passenger flows in an airport terminal', *Proceedings of* *the 35th conference on Winter simulation: driving innovation*. IEEE, pp. 175–181.

Tam, M.-L. and Lam, W.H.K. (2004) 'Determination of service levels for passenger orientation in Hong Kong International Airport', *Journal of Air Transport Management*, 10(3), pp. 181–189.

Tam, M.L., Lam, W.H.K. and Lo, H.P. (2010) 'Incorporating passenger perceived service quality in airport ground access mode choice model', *Transportmetrica*, 6(1) Taylor & Francis Group, pp. 3–17.

Tan, Y.H., Teo, C.W., Ong, E., Tan, L.B. and Soo, M.J. (2004) 'Development and deployment of infrared fever screening systems', *Thermosense XXVI*. International Society for Optics and Photonics, Vol.5405, pp. 68–78. Available at: 10.1117/12.542993 (Accessed: 29 April 2020).

Tashakkori, A. and Creswell, J.W. (2007) Editorial: Exploring the Nature of Research Questions in Mixed Methods Research, *Journal of Mixed Methods Research*, 1(3), pp. 207–211.

Teperi, A.-M. and Leppänen, A. (2011) 'Managers' conceptions regarding human factors in air traffic management and in airport operations', *Safety Science*, 49(3), pp. 438–449. Available at: 10.1016/j.ssci.2010.10.009 (Accessed: 29 March 2020).

Thomet, M.A.M.A. and Mostoufi, F. (2008) 'Simulation-aided airport terminal design', *Transportation and Development Innovative Best Practices 2008*, 319(December) Reston, VA: American Society of Civil Engineers, pp. 118–123.

Trakoonsanti, L. (2016) 'A Process Simulation Model of Airline Passenger Check – In', *Universal Journal of Management*, 4(5), pp. 265–276.

Trochim, W. and Donnelly, J. (2006) *The Research Methods Knowledge Base*.3rd edn. United States: Atomic Dog Publishing Inc.

Trochim, W.M., Donnelly, J.P. and Arora, K. (2006) *Research Methods: The Essential Knowledge Base*.3rd ed. Boston, MA, USA: Cengage Learning.

Tsai, W.-H., Hsu, W. and Chou, W.-C. (2011) 'A gap analysis model for improving airport service quality', *Total Quality Management & Business Excellence*, 22(10), pp. 1025–1040.

Ucler, C. and Martin-Domingo, L. (2015) 'Traveler's Idle Time and The Value Chain at Airports', *Journal of Aeronautics and Space Technologies*, 8(2), pp. 25–33.

Unar, J.A., Seng, W.C. and Abbasi, A. (2014) 'A review of biometric technology along with trends and prospects', *Pattern Recognition*, 47(8) Pergamon, pp. 2673–2688. Available at: 10.1016/j.patcog.2014.01.016 (Accessed: 31 March 2019).

Verbraeck, A. and Valentin, E. (2002) 'Simulation building blocks for airport terminal modeling', *Proceedings of the 2002 Winter Simulation Conference*., p. Vol.-2, 1199-1209.

Verma, A., Tahlyan, D. and Bhusari, S. (2018) 'Agent based simulation model for improving passenger service time at Bangalore airport', *Case Studies on Transport Policy*, Elsevier

Walker, J.L. (2012) 'The use of saturation in qualitative research.', *Canadian journal of cardiovascular nursing = Journal canadien en soins infirmiers cardio-vasculaires*, 22(2), pp. 37–46.

Wang, H., Wang, B., Xu, J. and Hu, Z. (2018) 'Analysis and Optimization of Passenger Flowlines at Zhongchuan High-Speed Railway Station', *Modelling and Simulation in Engineering*, 2018, pp. 1–8. Available at: 10.1155/2018/9184136 (Accessed: 29 March 2019).

Wang, L., Yan, X. and Wang, Y. (2015) 'Modeling and Optimization of Collaborative Passenger Control in Urban Rail Stations under Mass Passenger Flow', *Mathematical Problems in Engineering*, 2015 Hindawi, pp. 1–8. Available at: 10.1155/2015/786120 (Accessed: 31 March 2019).

Webster, D.M., Richter, L. and Kruglanski, A.W. (1996) 'On leaping to conclusions when feeling tired: Mental fatigue effects on impressional primacy', *Journal of Experimental Social Psychology*, 32(2), pp. 181–195. Available at:

10.1006/jesp.1996.0009 (Accessed: 5 June 2020).

Webster, J. and Watson, R.T. (2002) ‘Analyzing the Past to Prepare for the Future : Writing a Literature Review ANALYZING THE PAST TO PREPARE FOR THE FUTURE : WRITING A’, *MIS Quarterly*, , pp. xiii–xxiii.

Widarsyah, R. (2013) *The Impact of Airport Service Quality Dimension on Overall Airport Experience and Impression*. University of Nevada, Las Vegas,.

Wijnen, R.A.A., Walker, W.E. and Kwakkel, J.H. (2008) ‘Decision support for airport strategic planning’, *Transportation Planning and Technology*, 31(1), pp. 11–34.

Willis, A., Gjersoe, N., Havard, C., Kerridge, J. and Kukla, R. (2004) ‘Human movement behaviour in urban spaces: Implications for the design and modelling of effective pedestrian environments’, *Environment and Planning B: Planning and Design*, 31(6) Pion Limited, pp. 805–828. Available at: 10.1068/b3060 (Accessed: 4 May 2020).

Wiredja, D., Popovic, V. and Blackler, A. (2015) ‘Questionnaire design for airport passenger experience survey’, *Proceedings of the 6th IASDR (The International Association of Societies of Design Research Congress)*. Brisbane, Australia: IASDR (The International Association of Societies of Design Research), pp. 2236–2254.

Wolfe, H.P. (2003) *Accommodating Aging Population Needs in Airport Terminals*. Maricopa Association of Governments.

Woodside, A.G., Hsu, S.Y. and Marshall, R. (2011) ‘General theory of cultures’ consequences on international tourism behavior’, *Journal of Business Research*, 64(8), pp. 785–799. Available at: 10.1016/j.jbusres.2010.10.008 (Accessed: 4 June 2020).

World Tourism Organization (UNWTO) (2020) *Yearbook of Tourism Statistics, Data 2014 – 2018*.2020 Editi. Madrid: World Tourism Organization (UNWTO).

Wu, P.P.-Y., Pitchforth, J. and Mengersen, K. (2014) ‘A Hybrid Queue-based

Bayesian Network framework for passenger facilitation modelling', *Transportation Research Part C: Emerging Technologies*, 46, pp. 247–260.

Wu, P.P.Y. and Mengersen, K. (2013) 'A review of models and model usage scenarios for an airport complex system', *Transportation Research Part A: Policy and Practice*, 47 Elsevier Ltd, pp. 124–140.

Xiao, Y., Liu, Y., Liu, J.J., Xiao, J. and Hu, Y. (2016) 'Oscillations extracting for the management of passenger flows in the airport of Hong Kong', *Transportmetrica A: Transport Science*, 12(1), pp. 65–79.

Xiaojiang, L. and Jixian, W. (2001) 'Airport Area Economic Development Model [J]', *Urban Planning Overseas*, 2, p. 12.

Xie, Y., Shortle, J. and Donohue, G. (2004) 'Airport terminal-approach safety and capacity analysis using an agent-based model', *Simulation Conference, 2004. Proceedings of the 2004 Winter*. IEEE, Vol.2, pp. 1349–1357.

Xu, X. yue, Liu, J., Li, H. ying and Jiang, M. (2016) 'Capacity-oriented passenger flow control under uncertain demand: Algorithm development and real-world case study', *Transportation Research Part E: Logistics and Transportation Review*

Xu, X., Zhou, Z., Dou, Y., Tan, Y. and Liao, T. (2018) 'Sustainable Queuing-Network Design for Airport Security Based on the Monte Carlo Method', *Sustainability*, 10(2), p. 1.

Yang, C.-H. and Lu, A.Y.L. (2015) 'Which Factors Affect Passengers' Intention to Use the Automated Immigration Clearance System (e-Gate)?', *Journal of Tourism and Recreation*, 2(1) Science and Education Centre of North America, pp. 1–22. Available at: 10.12735/jotr.v2i1p01 (Accessed: 7 December 2018).

Yang, H. and Fu, X. (2015) 'A comparison of price-cap and light-handed airport regulation with demand uncertainty', *Transportation Research Part B: Methodological*, 73, pp. 122–132. Available at: 10.1016/j.trb.2015.02.002 (Accessed: 12 June 2020).

Yang, Y., Li, J. and Zhao, Q. (2014) 'Study on passenger flow simulation in urban subway station based on anylogic', *Journal of Software*, 9(1), pp. 140–146. Available at: 10.4304/jsw.9.1.140-146 (Accessed: 2 April 2019).

Yeh, C.-H.H. and Kuo, Y.-L.L. (2003) 'Evaluating passenger services of Asia-Pacific international airports', *Transportation Research Part E: Logistics and Transportation Review*, 39(1), pp. 35–48.

Yen, J.-R., Teng, C.-H. and Chen, P.S. (2001) 'Measuring the level of services at airport passenger terminals: Comparison of perceived and observed time', *Transportation Research Record*, 1744(1744), pp. 17–23. Available at: 10.3141/1744-03 (Accessed: 15 September 2019).

Yoon, S.W. and Jeong, S.J. (2015) 'An alternative methodology for planning baggage carousel capacity expansion: A case study of Incheon International Airport', *Journal of Air Transport Management*, 42 Pergamon, pp. 63–74. Available at: 10.1016/j.jairtraman.2014.09.001 (Accessed: 21 November 2018).

Young, S.B. (1999) 'Evaluation of pedestrian walking speeds in airport terminals', *Transportation Research Record*, (1674) National Research Council, pp. 20–26.

Young, S.B. and Wells, A.T. (2011) *Airport planning and management*.6th editio. USA: McGraw-Hilll.

Yu, T.-Y. and Huang, P.-T. (2014) 'Border innovation management, improved passenger services and satisfaction acceptance.', *International Journal of Process Management & Benchmarking*, 4(1), pp. 89–108.

Zeithaml, V.A., Berry, L.L. and Parasuraman, A. (1988) 'Communication and Control Processes in the Delivery of Service Quality', *Journal of Marketing*, 52(2) SAGE Publications, pp. 35–48.

Zhong, G., Wan, X., Zhang, J., Yin, T. and Ran, B. (2017) 'Characterizing Passenger Flow for a Transportation Hub Based on Mobile Phone Data', *IEEE Transactions on Intelligent Transportation Systems*, 18(6), pp. 1507–1518. Available at: 10.1109/TITS.2016.2607760 (Accessed: 20 February 2020).

Zidarova, E. and Zografos, K. (2011) 'Measuring Quality of Service in Airport

Passenger Terminals', *Transportation Research Record: Journal of the Transportation Research Board*, 2214(2214) Transportation Research Board of the National Academies, pp. 69–76.

Zografos, K.G. and Madas, M.A. (2006) 'Development and demonstration of an integrated decision support system for airport performance analysis', *Transportation Research Part C: Emerging Technologies*, 14(1), pp. 1–17.

APPENDICES

Appendix A Ethical Approval

Abudiyah, Alhussin

From:	donotreply@infonetica.net
Sent:	11 July 2017 19:29
To:	Abudiyah, Alhussin
Cc:	Moxon, Rich
Subject:	CURES Submission: Approved
Follow Up Flag:	Follow up
Flag Status:	Flagged

Dear Alhussin

Reference: CURES/3299/2017
Title: Developing a framework for improving the performance of passenger arrival processing at Hajj terminals

Thank you for your application to the Cranfield University Research Ethics System (CURES).

Your proposed research activity has been confirmed as Level 1 risk in terms of research ethics. You may now proceed with the research activities you have sought approval for.

Please remember that CURES occasionally conducts audits of projects. We may therefore contact you during or following execution of your fieldwork. Guidance on good practice is available on the research ethics intranet pages.

If you have any queries, please contact cures-support@cranfield.ac.uk

We wish you every success with your project.

Regards

CURES Team

May we remind you of the importance of addressing health and safety issues in your research. Templates and further guidance are available here.

Appendix B Passenger Survey

Cranfield University, Centre for Air Transport Management

Dear Participant,

You have been randomly selected to take part in a survey which is part of PhD research study to identify factors, challenges and barriers that impede the flow of passengers within arrival domain at Hajj terminals to help to develop an innovative, practical solutions for improvement that and levels of service.

In this study, you will be asked to complete face to face survey. Your participation in this study is voluntary and you are free to withdraw your participation from this study at any time. The survey will take between 20 to 25 minutes of your time to complete the questionnaire.

This survey has been approved by Cranfield University. There are no risks associated with participating in this study. All the information and result that extracts from this survey will be used by Cranfield University for research purposes. The survey collects no identifying information of any respondent. All of the response in the survey will be recorded anonymously. While you will not experience any direct benefits from participation, information collected in this study may benefit the performance of the flow of pilgrims through arrival terminals processes in the future by better understanding the characteristics and experiences of all agents and actors in this environment.

If you have any questions regarding the survey or this research project in general, please contact Mr Alhussin K Abudiyah at (abudiyah@cranfield.ac.uk).

By completing and submitting this survey, you are indicating your consent to participate in the study. Your participation is appreciated. Please give your consent below;

☐ Yes, I consent

☐ No, I consent

Arrival Hajj terminal:

- ☐ HT at Jeddah Airport
- ☐ HT at Medina Airport

Arrival Date:

Day Month Year

Arrival Time:

- ☐ 00:00 - 02:59
- ☐ 03:00 - 05:59
- ☐ 06:00 - 08:59
- ☐ 09:00 - 11:59
- ☐ 12:00 - 14:59
- ☐ 15:00 - 17:59
- ☐ 18:00 - 20:59
- ☐ 21:00 - 23:59

What is your nationality?

What is your country of residence?

Do you have a disability or impairment?

What is your type of disability?

- ☐ A vision impairment
- ☐ A hearing impairment
- ☐ A mobility impairment
- ☐ A learning disability
- ☐ A mental health disorder
- ☐ Other

How many international trips have you made by air transport in the past 5 years?

- ☐ 1 - 2
- ☐ 3 - 5
- ☐ 6 - 10
- ☐ 11- 20
- ☐ 21 or more

Have you have any experience with HTs?

- ☐ Yes, …….. times
- ☐ No

Have you arrived at the Hajj terminal as a group or alone?

- ☐ As an alone
- ☐ As a group

What is your gender?

- ☐ Male
- ☐ Female

What is your age?

- ☐ Under 18 years old
- ☐ 18-29 years old
- ☐ 30-49 years old
- ☐ 50-64 years old
- ☐ 65 years or older

How do you evaluate the HI experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Waiting time in queue/line	☐	☐	☐	☐	☐	☐
Processing time	☐	☐	☐	☐	☐	☐
Efficiency of inspection time (Note: Efficiency of inspection time: ratio the actual time to finish inspection to the total time which the employee exhausted to complete it, e.g., actual time 2 minutes to finish the inspection but the office spent more than 5 minutes because of laziness, fatigue, poor knowledge of the system or poorly utilized and productivity).	☐	☐	☐	☐	☐	☐
Courtesy/ helpfulness and professionalism of the staff	☐	☐	☐	☐	☐	☐
Knowledge and expertise of the staff	☐	☐	☐	☐	☐	☐

How do you evaluate the PC experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Waiting time in queue/line	☐	☐	☐	☐	☐	☐
Processing time	☐	☐	☐	☐	☐	☐
Efficiency of inspection time	☐	☐	☐	☐	☐	☐
Courtesy/ helpfulness and professionalism of the staff	☐	☐	☐	☐	☐	☐
Knowledge and expertise of the staff	☐	☐	☐	☐	☐	☐

How many pieces of baggage taken with you on this flight?

- ☐ 1
- ☐ 2
- ☐ 3 -5
- ☐ More than 5

How do you evaluate the BC experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Waiting time for your luggage	□	□	□	□	□	□
Comfortable space around carousels	□	□	□	□	□	□
Courtesy/ helpfulness and professionalism of the staff	□	□	□	□	□	□
Availability of baggage carts/trolley	□	□	□	□	□	□

How do you evaluate the CI experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Waiting time in queue/line	□	□	□	□	□	□
Processing time	□	□	□	□	□	□
Efficiency of inspection time	□	□	□	□	□	□
Courtesy/ helpfulness and professionalism of the staff	□	□	□	□	□	□
Knowledge and expertise of the staff	□	□	□	□	□	□

How do you evaluate the UA experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Waiting time in queue/line	□	□	□	□	□	□
Processing time	□	□	□	□	□	□
Efficiency of inspection time	□	□	□	□	□	□
Courtesy/ helpfulness and professionalism of the staff	□	□	□	□	□	□
Knowledge and expertise of the staff	□	□	□	□	□	□

How do you evaluate the BS experience based on:

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Terrible (1)	Did not notice/use
Processing time	□	□	□	□	□	□
Efficiency of inspection time	□	□	□	□	□	□
Courtesy/ helpfulness and professionalism of the staff	□	□	□	□	□	□
Knowledge and expertise of the staff	□	□	□	□	□	□
Justice (first in, first out rule)	□	□	□	□	□	□
Support tools for special need people	□	□	□	□	□	□

How long did you spend on the arrivals Hajj terminals for previous processes?

NOTE: Including (disembarkation, health, immigration, baggage claim and customs)

- ☐ Half hour or less
- ☐ One hour or less
- ☐ Two hours or less
- ☐ Four hours or less
- ☐ Five hours or less
- ☐ More than five hours

How long did you spend to finish all processes from disembarkation step until arriving at the bus?

- ☐ 2 hour or less
- ☐ 3 hours or less
- ☐ 4 hours or less
- ☐ 5 hours or less
- ☐ 6 hours or less
- ☐ 7 hours or less
- ☐ 8 hours or less
- ☐ 9 hours or more

Have you waited at any points or steps for other reasons not mentioned in previous questions? (e.g. waiting for your group, waiting for service, waiting for permission from airport staff)

- ☐ Yes , Location: & Period :
- ☐ No

How do you rate your experience with Hajj terminals in general?

	Very Satisfied (5)	Satisfied (4)	Neutral (3)	Dissatisfied (2)	Very dissatisfied (1)	Did not notice/use
Arrival HTs organization (arrangement) and layout	☐	☐	☐	☐	☐	☐
Arrival Hajj terminals accessibility	☐	☐	☐	☐	☐	☐
Wait and process time for all inspection points at arrival HTs	☐	☐	☐	☐	☐	☐
Knowledge and expertise of the staff	☐	☐	☐	☐	☐	☐
Service staff at arrival Hajj terminals	☐	☐	☐	☐	☐	☐
Arrival Hajj terminals in general	☐	☐	☐	☐	☐	☐

What extent do you agree or disagree with the following statements:

	Strongly Agree (5)	Agree (4)	Neither (3)	Disagree (2)	Strongly Disagree (1)	Did not notice/use
Arrival HTs service is better than my expectation	☐	☐	☐	☐	☐	☐

What is a maximum acceptable waiting time for you in the queue/line for any service?

- ☐ 15 minutes
- ☐ 30 minutes
- ☐ 45 minutes
- ☐ 1 hour
- ☐ 1.5 hours
- ☐ 2 hours or more

Do you have any other comments, questions or concerns regarding the arrival Hajj terminals?

Appendix C Quantitative result

C.1 Pilgrims' evaluates measurement items descriptive for HT

Table C-1 Pilgrims' evaluates measurement items descriptive for HT at Jeddah Airport

Variables	N valid responses	Percentage of the cases "Did not notice/use", %	Mean	SE	Median	Kurtosis	Skewness
Passenger evaluate for HI based on waiting time	252	16.56	3.04	0.07	3	-0.84	-0.20
Passenger evaluate for HI Inspection staff based on Efficiency of inspection time	253	16.23	3.10	.062	3	-.240	-.084
Passenger evaluate for HI staff based on Courtesy/ helpfulness	253	16.23	3.77	0.06	4	0.61	-0.81
Passenger evaluate for HI staff based on Knowledge /expertise	253	16.23	3.55	0.06	4	-0.40	-0.35
Passenger evaluate for PC Inspection based on waiting time	302	0.00	2.10	0.07	2	-0.22	0.75
Passenger evaluate for PC Inspection based on processing time	302	0.00	3.36	0.06	4	0.13	-0.84
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	302	0.00	2.65	0.06	3	-0.27	-0.02
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	302	0.00	2.86	0.06	3	-0.23	0.04
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	302	0.00	3.18	0.06	3	-0.75	-0.25
Passenger evaluate for BC based on waiting time to collect the baggage	302	0.00	2.25	0.07	2	-0.47	0.73
Passenger evaluate for BC based on comfortable space around carousels	302	0.00	2.98	0.08	3	-1.32	0.03
Passenger evaluate for BC based on the helpfulness of support staff	270	10.60	3.04	0.08	3	-0.46	-0.34
Passenger evaluate for BC based on the availability of baggage carts/trolley	302	0.00	3.57	0.06	4	0.09	-0.67
Passenger evaluate for Customs inspection based on waiting time	302	0.00	2.46	0.06	3	-0.52	0.26
Passenger evaluate for Customs inspection based on processing time	302	0.00	3.14	0.06	3	-0.64	-0.14

Passenger evaluate for Customs inspection staff based on efficiency of inspection time	302	0.00	2.87	0.07	3	-0.67	0.17
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	302	0.00	3.44	0.06	4	-0.16	-0.73
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	302	0.00	3.29	0.06	3	-0.66	-0.36
Passenger evaluate for UA registration based on waiting time	302	0.00	2.90	0.08	3	-1.22	0.16
Passenger evaluate for UA registration based on processing time	302	0.00	3.14	0.07	3	-1.12	-0.08
Passenger evaluate for UA registration staff based on Efficiency of registration time	302	0.00	2.80	0.08	3	-1.10	0.23
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	302	0.00	3.01	0.06	3	-0.28	-0.28
Passenger evaluate for UA registration staff based on Knowledge /expertise	302	0.00	2.77	0.07	3	-0.91	0.29
Passenger evaluate for ASB based on duration time of this process	302	0.00	2.78	0.07	3	-0.94	0.16
Passenger evaluate for ABS staff based on Efficiency of duration time	302	0.00	2.75	0.07	3	-0.79	0.28
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	302	0.00	3.12	0.07	3	-0.80	-0.16
Passenger evaluate for ABS staff based on Knowledge /expertise	302	0.00	2.77	0.07	3	-0.85	0.23
Passenger evaluate for ABS staff based on Justice (first in, first out rule)	302	0.00	3.71	0.05	4	1.35	-1.11
Passenger evaluate for ABS staff based on Support tools for special need people	233	22.85	2.76	0.08	3	-0.91	0.24
Overall passenger evaluate for waiting time in all steps	302	0.00	1.61	0.04	1	1.74	1.18
Overall passenger evaluate for processing time in all steps	302	0.00	2.34	0.06	2	-0.62	0.43
Overall passenger evaluate for Hajj Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)	301	0.33	2.65	0.04	3	-0.49	0.16
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	167	44.70	2.40	0.06	2	0.13	0.69
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	194	35.76	1.75	0.05	2	-0.31	0.45
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	302	0.00	2.33	0.04	2	-0.03	0.33
Overall passenger evaluate for HT facilities based on information visibility/signs	302	0.00	2.76	0.04	3	-0.54	0.16

Overall passenger evaluate for HT facilities based on help and contacts Information service	298	1.32	2.81	0.04	3	-0.71	0.31
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	302	0.00	3.20	0.04	3	-0.46	-0.12
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	302	0.00	3.36	0.04	3	-0.23	-0.51
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	302	0.00	2.91	0.04	3	-0.92	0.08
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	302	0.00	2.67	0.04	3	-0.68	0.25
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	302	0.00	2.32	0.05	2	0.29	0.81
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	148	50.99	1.75	0.04	2	-0.49	-0.94

Table C-2 Pilgrims' evaluates measurement items descriptive for HT at Medina Airport

Variables	N valid responses	Percentage of the cases "Did not notice/use", %	Mean	SE	Median	Kurtosis	Skewness
Passenger evaluate for HI based on waiting time	157	17.80	3.69	0.09	4	-0.18	-0.68
Passenger evaluate for HI Inspection staff based on Efficiency of inspection time	157	17.80	3.34	0.09	4	-0.45	-0.19
Passenger evaluate for HI staff based on Courtesy/ helpfulness	155	18.85	4.10	0.06	4	-0.02	-0.59
Passenger evaluate for HI staff based on Knowledge /expertise	155	18.85	4.00	0.06	4	-0.43	-0.39
Passenger evaluate for PC Inspection based on waiting time	191	0.00	2.31	0.08	2	0.08	0.78
Passenger evaluate for PC Inspection based on processing time	191	0.00	3.51	0.06	3	-0.50	0.63
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	191	0.00	2.85	0.08	2	-0.85	0.28
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	191	0.00	2.59	0.08	2	-0.64	0.37
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	191	0.00	2.60	0.08	2	-0.68	0.43

Passenger evaluate for BC based on waiting time to collect the baggage	191	0.00	2.74	0.08	3	-0.97	0.00
Passenger evaluate for BC based on comfortable space around carousels	191	0.00	2.82	0.08	3	-0.79	0.07
Passenger evaluate for BC based on the helpfulness of support staff	191	0.00	3.65	0.09	4	-0.75	-0.59
Passenger evaluate for BC based on the availability of baggage carts/trolley	191	0.00	3.36	0.09	4	-0.75	-0.59
Passenger evaluate for Customs inspection based on waiting time	191	0.00	2.71	0.08	2	-0.80	0.37
Passenger evaluate for Customs inspection based on processing time	191	0.00	4.08	0.05	4	0.27	-0.59
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	191	0.00	3.64	0.07	4	-0.75	-0.28
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	191	0.00	3.97	0.06	4	0.86	-0.77
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	191	0.00	3.55	0.08	4	-0.66	-0.42
Passenger evaluate for UA registration based on waiting time	191	0.00	2.71	0.08	3	-0.57	0.19
Passenger evaluate for UA registration based on processing time	191	0.00	2.84	0.09	3	-0.95	0.23
Passenger evaluate for UA registration staff based on Efficiency of registration time	191	0.00	2.77	0.08	3	-0.84	0.24
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	191	0.00	3.48	0.06	4	-0.06	-0.43
Passenger evaluate for UA registration staff based on Knowledge /expertise	191	0.00	3.19	0.07	3	-0.55	-0.25
Passenger evaluate for ASB based on duration time of this process	191	0.00	2.73	0.09	3	-0.89	0.16
Passenger evaluate for ABS staff based on Efficiency of duration time	191	0.00	2.35	0.06	2	-0.05	0.45
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	190	0.52	3.45	0.05	4	0.34	-0.57
Passenger evaluate for ABS staff based on Knowledge /expertise	190	0.52	3.08	0.07	3	-0.39	-0.28
Passenger evaluate for ABS staff based on Justice (first in, first out rule)	190	0.52	3.74	0.05	4	1.19	-0.75
Passenger evaluate for ABS staff based on Support tools for special need people	132	30.89	2.10	0.08	2	0.62	0.89
Overall passenger evaluate for waiting time in all steps	191	0.00	2.31	0.08	2	-0.65	0.51
Overall passenger evaluate for processing time in all steps	191	0.00	3.16	0.09	3	-1.00	0.02

Overall passenger evaluate for Hajj Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)	190	0.52	3.79	0.04	4	2.49	-0.69
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	95	50.26	3.51	0.07	4	-0.21	-0.15
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	123	35.60	2.01	0.07	2	-0.21	0.52
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	190	0.52	3.57	0.05	4	-0.32	0.04
Overall passenger evaluate for HT facilities based on information visibility/signs	189	1.05	3.51	0.06	4	-0.25	-0.41
Overall passenger evaluate for HT facilities based on help and contacts Information service	187	2.09	3.35	0.06	3	-0.12	0.01
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	190	0.52	3.82	0.05	4	0.96	-0.71
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	189	1.05	3.84	0.04	4	0.16	-0.13
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	190	0.52	3.48	0.06	4	0.93	-0.92
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	189	1.05	3.93	0.04	4	0.40	-0.06
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	190	0.52	3.74	0.05	4	0.98	-0.54
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	69	63.87	1.87	0.08	2	3.11	1.09

C.2 Pilgrims’ evaluates for processes within the passenger flow and overall evaluate for HT facilities

Table C-3 Pilgrims’ evaluates for processes and overall evaluate for HT facilities at both airports

	Health inspection	Passport control	Baggage claim	Customs Inspection	Unified Agents registration	Allocated and Sent to the Bus	Overall evaluate for HT facilities
Jeddah airport							
N	253	302	270	302	302	302	297
Mean	3.367	2.831	2.962	3.042	2.925	2.999	2.579
Std. Error of Mean	0.055	0.047	0.053	0.048	0.062	0.052	0.034
Minimum	1.00	1.00	1.25	1.00	1.00	1.00	1.20
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	4.67
Kurtosis	-0.404	-0.021	-1.012	-0.459	-1.208	-0.617	-0.215
Skewness	-0.394	-0.164	0.272	-0.495	0.052	0.078	0.441
Medina airport							
N	155	191	191	191	191	190	184
Mean	3.774	2.773	3.143	3.590	2.997	2.961	3.287
Std. Error of Mean	0.060	0.062	0.071	0.054	0.057	0.044	0.041
Minimum	1.50	1.40	1.00	1.40	1.20	1.17	1.67
Maximum	5.00	5.00	5.00	5.00	5.00	4.80	4.67
Kurtosis	0.575	-0.667	-0.564	-0.035	-0.053	0.268	-0.145
Skewness	-0.684	0.366	-0.466	-0.179	-0.042	0.046	-0.045

C.3 Processes time characteristics by pilgrims' gender

Table C-4 Processes time characteristics by pilgrims' gender

Processes characteristics	Male	Female	Difference in means	t-staistics	p-value
Jeddah airport					
Walk time from the gate until the 1st inspection point	6.34	6.10	0.25	0.78	0.44
Maximum acceptable waiting time	27.67	25.84	1.83	1.19	0.24
Health Inspection (HI) waiting time	12.11	10.25	1.86	1.50	0.13
Health Inspection (HI) processing time	2.52	2.40	0.12	0.64	0.52
Passport Control (PC) inspection waiting time	50.41	46.93	3.48	1.24	0.22
Passport Control (PC) inspection processing time	5.65	6.11	-0.46	-0.53	0.60
Waiting time to collect the baggage	24.73	23.02	1.70	0.98	0.33
Customs inspection waiting time	28.70	24.10	4.60	2.06	0.41
Customs inspection processing time	4.68	4.05	0.63	3.07	0.00
Unified Agents (UA) registration waiting time	46.46	43.92	2.55	1.22	0.23
Unified Agents (UA) registration registration processing time	32.01	29.82	2.19	1.17	0.25
Process of allocated and sent to the bus (ASB) time	64.11	60.42	3.69	1.54	0.13
If you spent additional time, determine the duration	54.61	44.55	10.05	2.62	0.01
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	332.32	301.66	30.66	2.24	0.03
Medina airport					
Walk time from the gate until the 1st inspection point	6.69	6.31	0.38	1.16	0.25
Maximum acceptable waiting time	27.35	26.78	0.57	0.44	0.66
Health Inspection (HI) waiting time	9.02	8.27	0.75	0.85	0.39
Health Inspection (HI) processing time	3.36	3.12	0.24	0.79	0.43
Passport Control (PC) inspection waiting time	54.77	51.05	3.72	1.40	0.16
Passport Control (PC) inspection processing time	3.47	3.29	0.18	0.86	0.39
Waiting time to collect the baggage	14.36	14.07	0.29	0.37	0.71
Customs inspection waiting time	26.89	25.51	1.39	1.27	0.20
Customs inspection processing time	3.45	3.41	0.04	0.16	0.87
Unified Agents (UA) registration waiting time	41.86	39.03	2.83	1.42	0.16

Unified Agents (UA) registration registration processing time	20.41	19.15	1.26	1.23	0.22
Process of allocated and sent to the bus (ASB) time	34.77	33.15	1.62	0.74	0.46
If you spent additional time, determine the duration	15.72	15.34	0.38	0.15	0.88
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	234.77	221.69	13.08	1.10	0.27

Table C-5 ANOVA results for the test of relationships between age groups and processes characteristics for Jeddah sample

		Sum of Squares	df	Mean Square	F	Sig.
Walk time from the gate until the 1st inspection point	Between Groups	4.462	4	1.115	.183	.947
	Within Groups	1809.727	297	6.093		
	Total	1814.189	301			
Maximum acceptable waiting time	Between Groups	435.197	4	108.799	.763	.550
	Within Groups	42369.190	297	142.657		
	Total	42804.387	301			
Health Inspection (HI) waiting time	Between Groups	374.234	4	93.558	1.010	.403
	Within Groups	27514.084	297	92.640		
	Total	27888.318	301			
Health Inspection (HI) processing time	Between Groups	16.330	4	4.082	2.010	.093
	Within Groups	603.088	297	2.031		
	Total	619.417	301			
Passport Control (PC) inspection waiting time	Between Groups	2377.390	4	594.348	1.260	.286

	Within Groups	140089.364	297	471.681		
	Total	142466.755	301			
Passport Control (PC) inspection processing time	Between Groups	60.204	4	15.051	.325	.861
	Within Groups	13748.485	297	46.291		
	Total	13808.689	301			
Waiting time to collect the baggage	Between Groups	1374.258	4	343.564	1.900	.110
	Within Groups	53699.597	297	180.807		
	Total	55073.854	301			
Customs inspection waiting time	Between Groups	2438.173	4	609.543	1.991	.096
	Within Groups	90938.002	297	306.189		
	Total	93376.175	301			
Customs inspection processing time	Between Groups	6.799	4	1.700	.385	.819
	Within Groups	1310.698	297	4.413		
	Total	1317.497	301			
Unified Agents (UA) registration waiting time	Between Groups	1149.218	4	287.304	1.090	.362
	Within Groups	78275.617	297	263.554		
	Total	79424.834	301			
Unified Agents (UA) registration registration processing time	Between Groups	1031.947	4	257.987	1.210	.307
	Within Groups	63343.139	297	213.277		
	Total	64375.086	301			
	Between Groups	872.191	4	218.048	.570	.685

Process of allocated and sent to the bus (ASB) time	Within Groups	113708.025	297	382.855		
	Total	114580.215	301			
If you spent additional time, determine the duration	Between Groups	2105.374	4	526.344	.580	.677
	Within Groups	269348.311	297	906.897		
	Total	271453.685	301			
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Between Groups	44315.418	4	11078.855	.965	.427
	Within Groups	3408933.191	297	11477.890		
	Total	3453248.609	301			

Table C-6 Multiple Comparisons among age –groups for Jeddah sample

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Walk time from the gate until the 1st inspection point	Under 18 years old	18-29 years old	-1.357	1.866	.950	-6.48	3.76
		30-49 years old	-1.207	1.765	.960	-6.05	3.64
		50-64 years old	-1.278	1.759	.950	-6.10	3.55
		65 years or older	-1.379	1.772	.937	-6.24	3.48
	18-29 years old	Under 18 years old	1.357	1.866	.950	-3.76	6.48
		30-49 years old	.150	.711	1.000	-1.80	2.10
		50-64 years old	.079	.694	1.000	-1.82	1.98
		65 years or older	-.022	.726	1.000	-2.02	1.97
		Under 18 years old	1.207	1.765	.960	-3.64	6.05

	30-49 years old	18-29 years old	-.150	.711	1.000	-2.10	1.80
		50-64 years old	-.071	.340	1.000	-1.01	.86
		65 years or older	-.172	.403	.993	-1.28	.93
	50-64 years old	Under 18 years old	1.278	1.759	.950	-3.55	6.10
		18-29 years old	-.079	.694	1.000	-1.98	1.82
		30-49 years old	.071	.340	1.000	-.86	1.01
		65 years or older	-.101	.372	.999	-1.12	.92
	65 years or older	Under 18 years old	1.379	1.772	.937	-3.48	6.24
		18-29 years old	.022	.726	1.000	-1.97	2.02
		30-49 years old	.172	.403	.993	-.93	1.28
		50-64 years old	.101	.372	.999	-.92	1.12
Maximum acceptable waiting time	Under 18 years old	18-29 years old	.000	9.029	1.000	-24.78	24.78
		30-49 years old	-4.224	8.542	.988	-27.67	19.22
		50-64 years old	-5.132	8.509	.975	-28.49	18.22
		65 years or older	-5.455	8.573	.969	-28.98	18.07
	18-29 years old	Under 18 years old	.000	9.029	1.000	-24.78	24.78
		30-49 years old	-4.224	3.439	.735	-13.66	5.22
		50-64 years old	-5.132	3.356	.544	-14.34	4.08
		65 years or older	-5.455	3.514	.529	-15.10	4.19
	30-49 years old	Under 18 years old	4.224	8.542	.988	-19.22	27.67
		18-29 years old	4.224	3.439	.735	-5.22	13.66
		50-64 years old	-.907	1.647	.982	-5.43	3.61
		65 years or older	-1.230	1.950	.970	-6.58	4.12
		Under 18 years old	5.132	8.509	.975	-18.22	28.49
		18-29 years old	5.132	3.356	.544	-4.08	14.34

	50-64 years old	30-49 years old	.907	1.647	.982	-3.61	5.43
		65 years or older	-.323	1.798	1.000	-5.26	4.61
	65 years or older	Under 18 years old	5.455	8.573	.969	-18.07	28.98
		18-29 years old	5.455	3.514	.529	-4.19	15.10
		30-49 years old	1.230	1.950	.970	-4.12	6.58
		50-64 years old	.323	1.798	1.000	-4.61	5.26
Health Inspection (HI) waiting time	Under 18 years old	18-29 years old	-4.500	7.276	.972	-24.47	15.47
		30-49 years old	-4.282	6.884	.971	-23.17	14.61
		50-64 years old	-3.124	6.857	.991	-21.94	15.70
		65 years or older	-5.879	6.908	.914	-24.84	13.08
	18-29 years old	Under 18 years old	4.500	7.276	.972	-15.47	24.47
		30-49 years old	.218	2.772	1.000	-7.39	7.83
		50-64 years old	1.376	2.704	.986	-6.05	8.80
		65 years or older	-1.379	2.832	.989	-9.15	6.39
	30-49 years old	Under 18 years old	4.282	6.884	.971	-14.61	23.17
		18-29 years old	-.218	2.772	1.000	-7.83	7.39
		50-64 years old	1.158	1.327	.907	-2.49	4.80
		65 years or older	-1.597	1.571	.848	-5.91	2.71
	50-64 years old	Under 18 years old	3.124	6.857	.991	-15.70	21.94
		18-29 years old	-1.376	2.704	.986	-8.80	6.05
		30-49 years old	-1.158	1.327	.907	-4.80	2.49
		65 years or older	-2.755	1.449	.319	-6.73	1.22
	65 years or older	Under 18 years old	5.879	6.908	.914	-13.08	24.84
		18-29 years old	1.379	2.832	.989	-6.39	9.15
		30-49 years old	1.597	1.571	.848	-2.71	5.91

		50-64 years old	2.755	1.449	.319	-1.22	6.73
Health Inspection (HI) processing time	Under 18 years old	18-29 years old	-1.071	1.077	.858	-4.03	1.89
		30-49 years old	-.856	1.019	.918	-3.65	1.94
		50-64 years old	-.868	1.015	.913	-3.65	1.92
		65 years or older	-1.394	1.023	.652	-4.20	1.41
	18-29 years old	Under 18 years old	1.071	1.077	.858	-1.89	4.03
		30-49 years old	.215	.410	.985	-.91	1.34
		50-64 years old	.203	.400	.987	-.90	1.30
		65 years or older	-.323	.419	.939	-1.47	.83
	30-49 years old	Under 18 years old	.856	1.019	.918	-1.94	3.65
		18-29 years old	-.215	.410	.985	-1.34	.91
		50-64 years old	-.012	.196	1.000	-.55	.53
		65 years or older	-.538	.233	.144	-1.18	.10
	50-64 years old	Under 18 years old	.868	1.015	.913	-1.92	3.65
		18-29 years old	-.203	.400	.987	-1.30	.90
		30-49 years old	.012	.196	1.000	-.53	.55
		65 years or older	-.526	.215	.105	-1.11	.06
	65 years or older	Under 18 years old	1.394	1.023	.652	-1.41	4.20
		18-29 years old	.323	.419	.939	-.83	1.47
		30-49 years old	.538	.233	.144	-.10	1.18
		50-64 years old	.526	.215	.105	-.06	1.11
Passport Control (PC) inspection waiting time	Under 18 years old	18-29 years old	6.786	16.417	.994	-38.27	51.85
		30-49 years old	-.540	15.533	1.000	-43.17	42.09
		50-64 years old	2.669	15.472	1.000	-39.80	45.13
		65 years or older	-3.591	15.588	.999	-46.37	39.19

	18-29 years old	Under 18 years old	-6.786	16.417	.994	-51.85	38.27
		30-49 years old	-7.326	6.254	.768	-24.49	9.84
		50-64 years old	-4.117	6.102	.962	-20.86	12.63
		65 years or older	-10.377	6.390	.483	-27.92	7.16
	30-49 years old	Under 18 years old	.540	15.533	1.000	-42.09	43.17
		18-29 years old	7.326	6.254	.768	-9.84	24.49
		50-64 years old	3.209	2.995	.821	-5.01	11.43
		65 years or older	-3.051	3.545	.911	-12.78	6.68
	50-64 years old	Under 18 years old	-2.669	15.472	1.000	-45.13	39.80
		18-29 years old	4.117	6.102	.962	-12.63	20.86
		30-49 years old	-3.209	2.995	.821	-11.43	5.01
		65 years or older	-6.260	3.270	.312	-15.24	2.71
	65 years or older	Under 18 years old	3.591	15.588	.999	-39.19	46.37
		18-29 years old	10.377	6.390	.483	-7.16	27.92
		30-49 years old	3.051	3.545	.911	-6.68	12.78
		50-64 years old	6.260	3.270	.312	-2.71	15.24
Passport Control (PC) inspection processing time	Under 18 years old	18-29 years old	-1.071	5.143	1.000	-15.19	13.04
		30-49 years old	-2.230	4.866	.991	-15.59	11.13
		50-64 years old	-1.391	4.847	.999	-14.69	11.91
		65 years or older	-2.152	4.883	.992	-15.55	11.25
	18-29 years old	Under 18 years old	1.071	5.143	1.000	-13.04	15.19
		30-49 years old	-1.158	1.959	.976	-6.54	4.22
		50-64 years old	-.320	1.912	1.000	-5.57	4.93
		65 years or older	-1.080	2.002	.983	-6.57	4.41
		Under 18 years old	2.230	4.866	.991	-11.13	15.59

	30-49 years old	18-29 years old	1.158	1.959	.976	-4.22	6.54
		50-64 years old	.839	.938	.899	-1.74	3.41
		65 years or older	.078	1.111	1.000	-2.97	3.13
	50-64 years old	Under 18 years old	1.391	4.847	.999	-11.91	14.69
		18-29 years old	.320	1.912	1.000	-4.93	5.57
		30-49 years old	-.839	.938	.899	-3.41	1.74
		65 years or older	-.761	1.024	.946	-3.57	2.05
	65 years or older	Under 18 years old	2.152	4.883	.992	-11.25	15.55
		18-29 years old	1.080	2.002	.983	-4.41	6.57
		30-49 years old	-.078	1.111	1.000	-3.13	2.97
		50-64 years old	.761	1.024	.946	-2.05	3.57
Waiting time to collect the baggage	Under 18 years old	18-29 years old	10.643	10.165	.833	-17.25	38.54
		30-49 years old	7.333	9.617	.941	-19.06	33.73
		50-64 years old	5.940	9.579	.972	-20.35	32.23
		65 years or older	2.379	9.651	.999	-24.11	28.87
	18-29 years old	Under 18 years old	-10.643	10.165	.833	-38.54	17.25
		30-49 years old	-3.310	3.872	.913	-13.94	7.32
		50-64 years old	-4.703	3.778	.725	-15.07	5.67
		65 years or older	-8.264	3.957	.228	-19.12	2.60
	30-49 years old	Under 18 years old	-7.333	9.617	.941	-33.73	19.06
		18-29 years old	3.310	3.872	.913	-7.32	13.94
		50-64 years old	-1.393	1.854	.944	-6.48	3.70
		65 years or older	-4.955	2.195	.162	-10.98	1.07
		Under 18 years old	-5.940	9.579	.972	-32.23	20.35
		18-29 years old	4.703	3.778	.725	-5.67	15.07

	50-64 years old	30-49 years old	1.393	1.854	.944	-3.70	6.48
		65 years or older	-3.561	2.025	.400	-9.12	2.00
	65 years or older	Under 18 years old	-2.379	9.651	.999	-28.87	24.11
		18-29 years old	8.264	3.957	.228	-2.60	19.12
		30-49 years old	4.955	2.195	.162	-1.07	10.98
		50-64 years old	3.561	2.025	.400	-2.00	9.12
Customs inspection waiting time	Under 18 years old	18-29 years old	25.071	13.227	.322	-11.23	61.38
		30-49 years old	20.960	12.515	.451	-13.39	55.31
		50-64 years old	21.222	12.466	.434	-12.99	55.44
		65 years or older	16.106	12.559	.702	-18.36	50.58
	18-29 years old	Under 18 years old	-25.071	13.227	.322	-61.38	11.23
		30-49 years old	-4.112	5.039	.926	-17.94	9.72
		50-64 years old	-3.850	4.917	.935	-17.34	9.64
		65 years or older	-8.965	5.149	.410	-23.10	5.17
	30-49 years old	Under 18 years old	-20.960	12.515	.451	-55.31	13.39
		18-29 years old	4.112	5.039	.926	-9.72	17.94
		50-64 years old	.262	2.413	1.000	-6.36	6.88
		65 years or older	-4.854	2.856	.436	-12.69	2.99
	50-64 years old	Under 18 years old	-21.222	12.466	.434	-55.44	12.99
		18-29 years old	3.850	4.917	.935	-9.64	17.34
		30-49 years old	-.262	2.413	1.000	-6.88	6.36
		65 years or older	-5.116	2.635	.298	-12.35	2.12
	65 years or older	Under 18 years old	-16.106	12.559	.702	-50.58	18.36
		18-29 years old	8.965	5.149	.410	-5.17	23.10
		30-49 years old	4.854	2.856	.436	-2.99	12.69

		50-64 years old	5.116	2.635	.298	-2.12	12.35
Customs inspection processing time	Under 18 years old	18-29 years old	-.857	1.588	.983	-5.22	3.50
		30-49 years old	-.925	1.502	.973	-5.05	3.20
		50-64 years old	-.966	1.497	.967	-5.07	3.14
		65 years or older	-1.242	1.508	.923	-5.38	2.90
	18-29 years old	Under 18 years old	.857	1.588	.983	-3.50	5.22
		30-49 years old	-.068	.605	1.000	-1.73	1.59
		50-64 years old	-.109	.590	1.000	-1.73	1.51
		65 years or older	-.385	.618	.971	-2.08	1.31
	30-49 years old	Under 18 years old	.925	1.502	.973	-3.20	5.05
		18-29 years old	.068	.605	1.000	-1.59	1.73
		50-64 years old	-.041	.290	1.000	-.84	.75
		65 years or older	-.317	.343	.887	-1.26	.62
	50-64 years old	Under 18 years old	.966	1.497	.967	-3.14	5.07
		18-29 years old	.109	.590	1.000	-1.51	1.73
		30-49 years old	.041	.290	1.000	-.75	.84
		65 years or older	-.276	.316	.906	-1.14	.59
	65 years or older	Under 18 years old	1.242	1.508	.923	-2.90	5.38
		18-29 years old	.385	.618	.971	-1.31	2.08
		30-49 years old	.317	.343	.887	-.62	1.26
		50-64 years old	.276	.316	.906	-.59	1.14
Unified Agents (UA) registration waiting time	Under 18 years old	18-29 years old	19.643	12.272	.498	-14.04	53.32
		30-49 years old	16.868	11.611	.594	-15.00	48.73
		50-64 years old	17.726	11.565	.542	-14.02	49.47
		65 years or older	14.470	11.652	.727	-17.51	46.45

	18-29 years old	Under 18 years old	-19.643	12.272	.498	-53.32	14.04
		30-49 years old	-2.775	4.675	.976	-15.61	10.06
		50-64 years old	-1.917	4.561	.993	-14.44	10.60
		65 years or older	-5.173	4.777	.815	-18.28	7.94
	30-49 years old	Under 18 years old	-16.868	11.611	.594	-48.73	15.00
		18-29 years old	2.775	4.675	.976	-10.06	15.61
		50-64 years old	.858	2.239	.995	-5.29	7.00
		65 years or older	-2.398	2.650	.895	-9.67	4.88
	50-64 years old	Under 18 years old	-17.726	11.565	.542	-49.47	14.02
		18-29 years old	1.917	4.561	.993	-10.60	14.44
		30-49 years old	-.858	2.239	.995	-7.00	5.29
		65 years or older	-3.256	2.444	.671	-9.96	3.45
	65 years or older	Under 18 years old	-14.470	11.652	.727	-46.45	17.51
		18-29 years old	5.173	4.777	.815	-7.94	18.28
		30-49 years old	2.398	2.650	.895	-4.88	9.67
		50-64 years old	3.256	2.444	.671	-3.45	9.96
Unified Agents (UA) registration registration processing time	Under 18 years old	18-29 years old	18.571	11.040	.447	-11.73	48.87
		30-49 years old	16.810	10.445	.492	-11.86	45.48
		50-64 years old	16.711	10.404	.495	-11.84	45.27
		65 years or older	13.848	10.482	.678	-14.92	42.62
	18-29 years old	Under 18 years old	-18.571	11.040	.447	-48.87	11.73
		30-49 years old	-1.761	4.205	.994	-13.30	9.78
		50-64 years old	-1.861	4.103	.991	-13.12	9.40
		65 years or older	-4.723	4.297	.807	-16.52	7.07
		Under 18 years old	-16.810	10.445	.492	-45.48	11.86

	30-49 years old	18-29 years old	1.761	4.205	.994	-9.78	13.30
		50-64 years old	-.100	2.014	1.000	-5.63	5.43
		65 years or older	-2.962	2.384	.726	-9.50	3.58
	50-64 years old	Under 18 years old	-16.711	10.404	.495	-45.27	11.84
		18-29 years old	1.861	4.103	.991	-9.40	13.12
		30-49 years old	.100	2.014	1.000	-5.43	5.63
		65 years or older	-2.862	2.199	.690	-8.90	3.17
	65 years or older	Under 18 years old	-13.848	10.482	.678	-42.62	14.92
		18-29 years old	4.723	4.297	.807	-7.07	16.52
		30-49 years old	2.962	2.384	.726	-3.58	9.50
		50-64 years old	2.862	2.199	.690	-3.17	8.90
Process of allocated and sent to the bus (ASB) time	Under 18 years old	18-29 years old	-3.929	14.791	.999	-44.52	36.67
		30-49 years old	-7.126	13.994	.986	-45.53	31.28
		50-64 years old	-8.045	13.939	.978	-46.30	30.21
		65 years or older	-10.606	14.044	.943	-49.15	27.94
	18-29 years old	Under 18 years old	3.929	14.791	.999	-36.67	44.52
		30-49 years old	-3.198	5.634	.980	-18.66	12.27
		50-64 years old	-4.117	5.498	.945	-19.21	10.97
		65 years or older	-6.677	5.757	.774	-22.48	9.12
	30-49 years old	Under 18 years old	7.126	13.994	.986	-31.28	45.53
		18-29 years old	3.198	5.634	.980	-12.27	18.66
		50-64 years old	-.919	2.698	.997	-8.32	6.49
		65 years or older	-3.480	3.194	.812	-12.25	5.29
		Under 18 years old	8.045	13.939	.978	-30.21	46.30
		18-29 years old	4.117	5.498	.945	-10.97	19.21

	50-64 years old	30-49 years old	.919	2.698	.997	-6.49	8.32
		65 years or older	-2.561	2.946	.908	-10.65	5.52
	65 years or older	Under 18 years old	10.606	14.044	.943	-27.94	49.15
		18-29 years old	6.677	5.757	.774	-9.12	22.48
		30-49 years old	3.480	3.194	.812	-5.29	12.25
		50-64 years old	2.561	2.946	.908	-5.52	10.65
If you spent additional time, determine the duration	Under 18 years old	18-29 years old	-3.000	22.765	1.000	-65.48	59.48
		30-49 years old	-8.282	21.538	.995	-67.39	50.83
		50-64 years old	-11.981	21.454	.981	-70.86	46.90
		65 years or older	-7.061	21.615	.998	-66.38	52.26
	18-29 years old	Under 18 years old	3.000	22.765	1.000	-59.48	65.48
		30-49 years old	-5.282	8.672	.974	-29.08	18.52
		50-64 years old	-8.981	8.462	.826	-32.20	14.24
		65 years or older	-4.061	8.861	.991	-28.38	20.26
	30-49 years old	Under 18 years old	8.282	21.538	.995	-50.83	67.39
		18-29 years old	5.282	8.672	.974	-18.52	29.08
		50-64 years old	-3.700	4.152	.900	-15.10	7.70
		65 years or older	1.221	4.916	.999	-12.27	14.71
	50-64 years old	Under 18 years old	11.981	21.454	.981	-46.90	70.86
		18-29 years old	8.981	8.462	.826	-14.24	32.20
		30-49 years old	3.700	4.152	.900	-7.70	15.10
		65 years or older	4.921	4.534	.814	-7.52	17.37
	65 years or older	Under 18 years old	7.061	21.615	.998	-52.26	66.38
		18-29 years old	4.061	8.861	.991	-20.26	28.38
		30-49 years old	-1.221	4.916	.999	-14.71	12.27

		50-64 years old	-4.921	4.534	.814	-17.37	7.52
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Under 18 years old	18-29 years old	64.929	80.986	.930	-157.35	287.20
		30-49 years old	36.523	76.622	.989	-173.77	246.82
		50-64 years old	36.613	76.323	.989	-172.86	246.09
		65 years or older	13.500	76.895	1.000	-197.55	224.55
	18-29 years old	Under 18 years old	-64.929	80.986	.930	-287.20	157.35
		30-49 years old	-28.406	30.851	.889	-113.08	56.27
		50-64 years old	-28.316	30.102	.881	-110.93	54.30
		65 years or older	-51.429	31.524	.478	-137.95	35.09
	30-49 years old	Under 18 years old	-36.523	76.622	.989	-246.82	173.77
		18-29 years old	28.406	30.851	.889	-56.27	113.08
		50-64 years old	.090	14.773	1.000	-40.46	40.63
		65 years or older	-23.023	17.488	.681	-71.02	24.98
	50-64 years old	Under 18 years old	-36.613	76.323	.989	-246.09	172.86
		18-29 years old	28.316	30.102	.881	-54.30	110.93
		30-49 years old	-.090	14.773	1.000	-40.63	40.46
		65 years or older	-23.113	16.131	.607	-67.39	21.16
	65 years or older	Under 18 years old	-13.500	76.895	1.000	-224.55	197.55
		18-29 years old	51.429	31.524	.478	-35.09	137.95
		30-49 years old	23.023	17.488	.681	-24.98	71.02
		50-64 years old	23.113	16.131	.607	-21.16	67.39

Table C-7 ANOVA results for the test of relationships between age groups and processes characteristics for Medina sample

		Sum of Squares	df	Mean Square	F	Sig.
Walk time from the gate until the 1st inspection point	Between Groups	5.457	3	1.819	.405	.749
	Within Groups	839.339	187	4.488		
	Total	844.796	190			
Maximum acceptable waiting time	Between Groups	757.624	3	252.541	3.963	.009
	Within Groups	11915.675	187	63.720		
	Total	12673.298	190			
Health Inspection (HI) waiting time	Between Groups	221.657	3	73.886	2.387	.070
	Within Groups	5787.966	187	30.952		
	Total	6009.623	190			
Health Inspection (HI) processing time	Between Groups	12.481	3	4.160	1.147	.331
	Within Groups	678.252	187	3.627		
	Total	690.733	190			
Passport Control (PC) inspection waiting time	Between Groups	44.928	3	14.976	.051	.985
	Within Groups	54809.931	187	293.101		
	Total	54854.859	190			
Passport Control (PC) inspection processing time	Between Groups	1.854	3	.618	.338	.798
	Within Groups	342.470	187	1.831		

	Total	344.325	190			
Waiting time to collect the baggage	Between Groups	20.434	3	6.811	.277	.842
	Within Groups	4598.948	187	24.593		
	Total	4619.382	190			
Customs inspection waiting time	Between Groups	87.892	3	29.297	.602	.615
	Within Groups	9101.637	187	48.672		
	Total	9189.529	190			
Customs inspection processing time	Between Groups	3.924	3	1.308	.500	.683
	Within Groups	489.008	187	2.615		
	Total	492.932	190			
Unified Agents (UA) registration waiting time	Between Groups	195.602	3	65.201	.396	.756
	Within Groups	30814.377	187	164.783		
	Total	31009.979	190			
Unified Agents (UA) registration registration processing time	Between Groups	26.416	3	8.805	.204	.894
	Within Groups	8071.500	187	43.163		
	Total	8097.916	190			
Process of allocated and sent to the bus (ASB) time	Between Groups	213.359	3	71.120	.363	.780
	Within Groups	36676.484	187	196.131		
	Total	36889.843	190			
If you spent additional time, determine the duration	Between Groups	411.563	3	137.188	.520	.669
	Within Groups	49344.196	187	263.873		

	Total	49755.759	190			
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Between Groups	4352.737	3	1450.912	.248	.863
	Within Groups	1096202.645	187	5862.046		
	Total	1100555.382	190			

Table C-8 Multiple Comparisons among age –groups for Medina sample

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Walk time from the gate until the 1st inspection point	18-29 years old	30-49 years old	-.006	.761	1.000	-1.98	1.97
		50-64 years old	-.381	.743	.956	-2.31	1.55
		65 years or older	-.310	.778	.979	-2.33	1.71
	30-49 years old	18-29 years old	.006	.761	1.000	-1.97	1.98
		50-64 years old	-.375	.365	.734	-1.32	.57
		65 years or older	-.304	.432	.896	-1.42	.82
	50-64 years old	18-29 years old	.381	.743	.956	-1.55	2.31
		30-49 years old	.375	.365	.734	-.57	1.32
		65 years or older	.071	.400	.998	-.97	1.11
	65 years or older	18-29 years old	.310	.778	.979	-1.71	2.33
		30-49 years old	.304	.432	.896	-.82	1.42
		50-64 years old	-.071	.400	.998	-1.11	.97
		30-49 years old	5.317	2.867	.251	-2.11	12.75

Maximum acceptable waiting time	18-29 years old	50-64 years old	8.413*	2.800	.016	1.15	15.67
		65 years or older	6.627	2.932	.111	-.97	14.23
	30-49 years old	18-29 years old	-5.317	2.867	.251	-12.75	2.11
		50-64 years old	3.095	1.377	.114	-.47	6.67
		65 years or older	1.310	1.629	.853	-2.91	5.53
	50-64 years old	18-29 years old	-8.413*	2.800	.016	-15.67	-1.15
		30-49 years old	-3.095	1.377	.114	-6.67	.47
		65 years or older	-1.786	1.509	.638	-5.70	2.12
	65 years or older	18-29 years old	-6.627	2.932	.111	-14.23	.97
		30-49 years old	-1.310	1.629	.853	-5.53	2.91
		50-64 years old	1.786	1.509	.638	-2.12	5.70
Health Inspection (HI) waiting time	18-29 years old	30-49 years old	1.026	1.998	.956	-4.15	6.21
		50-64 years old	-1.468	1.951	.876	-6.53	3.59
		65 years or older	-1.016	2.044	.960	-6.31	4.28
	30-49 years old	18-29 years old	-1.026	1.998	.956	-6.21	4.15
		50-64 years old	-2.494*	.960	.049	-4.98	-.01
		65 years or older	-2.042	1.136	.278	-4.99	.90
	50-64 years old	18-29 years old	1.468	1.951	.876	-3.59	6.53
		30-49 years old	2.494*	.960	.049	.01	4.98
		65 years or older	.452	1.051	.973	-2.27	3.18
	65 years or older	18-29 years old	1.016	2.044	.960	-4.28	6.31
		30-49 years old	2.042	1.136	.278	-.90	4.99
		50-64 years old	-.452	1.051	.973	-3.18	2.27
Health Inspection (HI)	18-29 years old	30-49 years old	-.058	.684	1.000	-1.83	1.72
		50-64 years old	-.516	.668	.867	-2.25	1.22

processing time		65 years or older	-.683	.700	.763	-2.50	1.13
	30-49 years old	18-29 years old	.058	.684	1.000	-1.72	1.83
		50-64 years old	-.458	.329	.504	-1.31	.39
		65 years or older	-.625	.389	.377	-1.63	.38
	50-64 years old	18-29 years old	.516	.668	.867	-1.22	2.25
		30-49 years old	.458	.329	.504	-.39	1.31
		65 years or older	-.167	.360	.967	-1.10	.77
	65 years or older	18-29 years old	.683	.700	.763	-1.13	2.50
		30-49 years old	.625	.389	.377	-.38	1.63
		50-64 years old	.167	.360	.967	-.77	1.10
Passport Control (PC) inspection waiting time	18-29 years old	30-49 years old	-.240	6.148	1.000	-16.18	15.70
		50-64 years old	-1.306	6.005	.996	-16.87	14.26
		65 years or older	-.913	6.289	.999	-17.21	15.39
	30-49 years old	18-29 years old	.240	6.148	1.000	-15.70	16.18
		50-64 years old	-1.065	2.954	.984	-8.72	6.59
		65 years or older	-.673	3.495	.997	-9.73	8.39
	50-64 years old	18-29 years old	1.306	6.005	.996	-14.26	16.87
		30-49 years old	1.065	2.954	.984	-6.59	8.72
		65 years or older	.393	3.235	.999	-7.99	8.78
	65 years or older	18-29 years old	.913	6.289	.999	-15.39	17.21
		30-49 years old	.673	3.495	.997	-8.39	9.73
		50-64 years old	-.393	3.235	.999	-8.78	7.99
Passport Control (PC) inspection	18-29 years old	30-49 years old	.363	.486	.878	-.90	1.62
		50-64 years old	.179	.475	.982	-1.05	1.41
		65 years or older	.310	.497	.925	-.98	1.60

processing time	30-49 years old	18-29 years old	-.363	.486	.878	-1.62	.90
		50-64 years old	-.185	.233	.859	-.79	.42
		65 years or older	-.054	.276	.997	-.77	.66
	50-64 years old	18-29 years old	-.179	.475	.982	-1.41	1.05
		30-49 years old	.185	.233	.859	-.42	.79
		65 years or older	.131	.256	.956	-.53	.79
	65 years or older	18-29 years old	-.310	.497	.925	-1.60	.98
		30-49 years old	.054	.276	.997	-.66	.77
		50-64 years old	-.131	.256	.956	-.79	.53
Waiting time to collect the baggage	18-29 years old	30-49 years old	-.040	1.781	1.000	-4.66	4.58
		50-64 years old	-.742	1.739	.974	-5.25	3.77
		65 years or older	-.183	1.822	1.000	-4.90	4.54
	30-49 years old	18-29 years old	.040	1.781	1.000	-4.58	4.66
		50-64 years old	-.702	.856	.844	-2.92	1.52
		65 years or older	-.143	1.012	.999	-2.77	2.48
	50-64 years old	18-29 years old	.742	1.739	.974	-3.77	5.25
		30-49 years old	.702	.856	.844	-1.52	2.92
		65 years or older	.560	.937	.933	-1.87	2.99
	65 years or older	18-29 years old	.183	1.822	1.000	-4.54	4.90
		30-49 years old	.143	1.012	.999	-2.48	2.77
		50-64 years old	-.560	.937	.933	-2.99	1.87
Customs inspection waiting time	18-29 years old	30-49 years old	-.625	2.505	.995	-7.12	5.87
		50-64 years old	-1.964	2.447	.853	-8.31	4.38
		65 years or older	-1.905	2.563	.879	-8.55	4.74
		18-29 years old	.625	2.505	.995	-5.87	7.12

	30-49 years old	50-64 years old	-1.339	1.204	.682	-4.46	1.78
		65 years or older	-1.280	1.424	.806	-4.97	2.41
	50-64 years old	18-29 years old	1.964	2.447	.853	-4.38	8.31
		30-49 years old	1.339	1.204	.682	-1.78	4.46
		65 years or older	.060	1.318	1.000	-3.36	3.48
	65 years or older	18-29 years old	1.905	2.563	.879	-4.74	8.55
		30-49 years old	1.280	1.424	.806	-2.41	4.97
		50-64 years old	-.060	1.318	1.000	-3.48	3.36
Customs inspection processing time	18-29 years old	30-49 years old	-.210	.581	.984	-1.72	1.30
		50-64 years old	-.317	.567	.944	-1.79	1.15
		65 years or older	-.556	.594	.786	-2.10	.98
	30-49 years old	18-29 years old	.210	.581	.984	-1.30	1.72
		50-64 years old	-.107	.279	.981	-.83	.62
		65 years or older	-.345	.330	.723	-1.20	.51
	50-64 years old	18-29 years old	.317	.567	.944	-1.15	1.79
		30-49 years old	.107	.279	.981	-.62	.83
		65 years or older	-.238	.306	.864	-1.03	.55
	65 years or older	18-29 years old	.556	.594	.786	-.98	2.10
		30-49 years old	.345	.330	.723	-.51	1.20
		50-64 years old	.238	.306	.864	-.55	1.03
Unified Agents (UA) registration waiting time	18-29 years old	30-49 years old	-.341	4.610	1.000	-12.29	11.61
		50-64 years old	-2.591	4.502	.939	-14.26	9.08
		65 years or older	-1.389	4.715	.991	-13.61	10.83
	30-49 years old	18-29 years old	.341	4.610	1.000	-11.61	12.29
		50-64 years old	-2.250	2.215	.740	-7.99	3.49

		65 years or older	-1.048	2.620	.978	-7.84	5.74
	50-64 years old	18-29 years old	2.591	4.502	.939	-9.08	14.26
		30-49 years old	2.250	2.215	.740	-3.49	7.99
		65 years or older	1.202	2.426	.960	-5.09	7.49
	65 years or older	18-29 years old	1.389	4.715	.991	-10.83	13.61
		30-49 years old	1.048	2.620	.978	-5.74	7.84
		50-64 years old	-1.202	2.426	.960	-7.49	5.09
Unified Agents (UA) registration registration processing time	18-29 years old	30-49 years old	-.274	2.359	.999	-6.39	5.84
		50-64 years old	-1.071	2.304	.967	-7.04	4.90
		65 years or older	-.619	2.413	.994	-6.87	5.64
	30-49 years old	18-29 years old	.274	2.359	.999	-5.84	6.39
		50-64 years old	-.798	1.133	.896	-3.74	2.14
		65 years or older	-.345	1.341	.994	-3.82	3.13
	50-64 years old	18-29 years old	1.071	2.304	.967	-4.90	7.04
		30-49 years old	.798	1.133	.896	-2.14	3.74
		65 years or older	.452	1.242	.983	-2.77	3.67
	65 years or older	18-29 years old	.619	2.413	.994	-5.64	6.87
		30-49 years old	.345	1.341	.994	-3.13	3.82
		50-64 years old	-.452	1.242	.983	-3.67	2.77
Process of allocated and sent to the bus (ASB) time	18-29 years old	30-49 years old	-1.865	5.029	.983	-14.90	11.17
		50-64 years old	-2.294	4.912	.966	-15.03	10.44
		65 years or older	.278	5.144	1.000	-13.06	13.61
	30-49 years old	18-29 years old	1.865	5.029	.983	-11.17	14.90
		50-64 years old	-.429	2.416	.998	-6.69	5.83
		65 years or older	2.143	2.859	.877	-5.27	9.55

	50-64 years old	18-29 years old	2.294	4.912	.966	-10.44	15.03
		30-49 years old	.429	2.416	.998	-5.83	6.69
		65 years or older	2.571	2.647	.766	-4.29	9.43
	65 years or older	18-29 years old	-.278	5.144	1.000	-13.61	13.06
		30-49 years old	-2.143	2.859	.877	-9.55	5.27
		50-64 years old	-2.571	2.647	.766	-9.43	4.29
If you spent additional time, determine the duration	18-29 years old	30-49 years old	-7.054	5.834	.622	-22.18	8.07
		50-64 years old	-5.476	5.697	.772	-20.25	9.29
		65 years or older	-5.119	5.967	.826	-20.59	10.35
	30-49 years old	18-29 years old	7.054	5.834	.622	-8.07	22.18
		50-64 years old	1.577	2.802	.943	-5.69	8.84
		65 years or older	1.935	3.316	.937	-6.66	10.53
	50-64 years old	18-29 years old	5.476	5.697	.772	-9.29	20.25
		30-49 years old	-1.577	2.802	.943	-8.84	5.69
		65 years or older	.357	3.070	.999	-7.60	8.32
	65 years or older	18-29 years old	5.119	5.967	.826	-10.35	20.59
		30-49 years old	-1.935	3.316	.937	-10.53	6.66
		50-64 years old	-.357	3.070	.999	-8.32	7.60
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	18-29 years old	30-49 years old	-9.323	27.496	.987	-80.60	61.95
		50-64 years old	-17.948	26.854	.909	-87.56	51.66
		65 years or older	-12.103	28.123	.973	-85.01	60.80
	30-49 years old	18-29 years old	9.323	27.496	.987	-61.95	80.60
		50-64 years old	-8.625	13.209	.914	-42.87	25.62
		65 years or older	-2.780	15.629	.998	-43.29	37.73
		18-29 years old	17.948	26.854	.909	-51.66	87.56

	50-64 years old	30-49 years old	8.625	13.209	.914	-25.62	42.87
		65 years or older	5.845	14.469	.978	-31.66	43.35
	65 years or older	18-29 years old	12.103	28.123	.973	-60.80	85.01
		30-49 years old	2.780	15.629	.998	-37.73	43.29
		50-64 years old	-5.845	14.469	.978	-43.35	31.66

*. The mean difference is significant at the 0.05 level.

Table C-9 Processes time characteristics among experience with HT

Processes characteristics	Experienced	Non-experienced	Difference in means	t-staistics	p-value
Jeddah					
Walk time from the gate until the 1st inspection point	6.88	6.22	0.66	0.97	0.340
Maximum acceptable waiting time	25.80	27.29	-1.49	-0.60	0.550
Health Inspection (HI) waiting time	10.48	11.70	-1.22	-0.61	0.543
Health Inspection (HI) processing time	2.12	2.52	-0.40	-1.32	0.186
Passport Control (PC) inspection waiting time	45.28	49.83	-4.55	-0.85	0.402
Passport Control (PC) inspection processing time	3.80	5.95	-2.15	-3.94	0.000
Waiting time to collect the baggage	22.92	24.38	-1.46	-0.52	0.606
Customs inspection waiting time	25.52	27.61	-2.09	-0.57	0.571
Customs inspection processing time	4.60	4.49	0.11	0.24	0.810
Unified Agents (UA) registration waiting time	42.80	46.03	-3.23	-0.95	0.342

Unified Agents (UA) registration registration processing time	30.60	31.48	-0.88	-0.29	0.77 3
Process of allocated and sent to the bus (ASB) time	60.40	63.34	-2.94	-0.72	0.47 2
If you spent additional time, determine the duration	57.36	51.35	6.01	0.96	0.33 8
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	312.7 6	324.9 0	-12.14	-0.54	0.58 8
Medina					
Walk time from the gate until the 1st inspection point	5.64	6.63	-0.99	-1.52	0.13 0
Maximum acceptable waiting time	30.45	26.97	3.48	1.38	0.17 0
Health Inspection (HI) waiting time	6.18	8.95	-2.77	-1.59	0.11 3
Health Inspection (HI) processing time	2.45	3.33	-0.88	-1.49	0.13 8
Passport Control (PC) inspection waiting time	45.45	54.12	-8.67	-1.65	0.10 1
Passport Control (PC) inspection processing time	3.09	3.43	-0.34	-0.82	0.41 4
Waiting time to collect the baggage	11.64	14.43	-2.79	-1.83	0.06 8
Customs inspection waiting time	23.64	26.64	-3.00	-1.39	0.16 5
Customs inspection processing time	2.73	3.48	-0.75	-1.51	0.13 4
Unified Agents (UA) registration waiting time	35.91	41.30	-5.39	-1.36	0.17 5
Unified Agents (UA) registration registration processing time	17.09	20.20	-3.11	-1.54	0.12 6
Process of allocated and sent to the bus (ASB) time	26.36	34.76	-8.39	-1.95	0.05 2
If you spent additional time, determine the duration	11.82	15.83	-4.02	-0.80	0.42 6
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	192.0 0	233.1 0	-41.10	-1.75	0.08 2

Table C-10 Processes time characteristics among disability status

Processes characteristics	Yes	No	Difference in means	t-staistics	p-value
Jeddah					
Walk time from the gate until the 1st inspection point	7.61	6.11	1.49	3.06	0.004
Maximum acceptable waiting time	26.36	27.27	-0.90	-0.41	0.682
Health Inspection (HI) waiting time	11.88	11.57	0.31	0.17	0.862
Health Inspection (HI) processing time	2.76	2.45	0.31	1.16	0.245
Passport Control (PC) inspection waiting time	54.55	48.83	5.72	1.43	0.154
Passport Control (PC) inspection processing time	7.58	5.55	2.02	1.28	0.210
Waiting time to collect the baggage	26.15	24.03	2.13	0.85	0.395
Customs inspection waiting time	28.45	27.31	1.15	0.35	0.725
Customs inspection processing time	4.55	4.50	0.05	0.12	0.903
Unified Agents (UA) registration waiting time	49.24	45.33	3.91	1.31	0.193
Unified Agents (UA) registration processing time	33.79	31.12	2.67	0.99	0.323
Process of allocated and sent to the bus (ASB) time	66.82	62.64	4.18	1.16	0.246
If you spent additional time, determine the duration	43.73	52.84	-9.11	-1.65	0.100
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	337.09	322.28	14.82	0.75	0.454
Medina					
Walk time from the gate until the 1st inspection point	7.84	6.43	1.41	2.82	0.005
Maximum acceptable waiting time	27.37	27.15	0.22	0.11	0.913
Health Inspection (HI) waiting time	11.21	8.52	2.69	1.99	0.048
Health Inspection (HI) processing time	3.42	3.27	0.15	0.33	0.740
Passport Control (PC) inspection waiting time	64.47	52.42	12.05	2.99	0.003
Passport Control (PC) inspection processing time	3.58	3.40	0.18	0.56	0.574

Waiting time to collect the baggage	15.58	14.12	1.46	1.22	0.223
Customs inspection waiting time	30.53	26.02	4.51	3.29	0.003
Customs inspection processing time	4.05	3.37	0.69	2.00	0.057
Unified Agents (UA) registration waiting time	48.05	40.21	7.84	2.58	0.011
Unified Agents (UA) registration processing time	23.63	19.62	4.01	2.58	0.011
Process of allocated and sent to the bus (ASB) time	41.32	33.49	7.82	2.35	0.020
If you spent additional time, determine the duration	18.95	15.23	3.71	0.95	0.344
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	272.63	226.10	46.53	2.57	0.011

Table C-11 Processes time characteristics among arrival status

Processes characteristics	As alone	As group	Difference in means	t-staistics	p-value
Jeddah					
Walk time from the gate until the 1st inspection point	5.99	6.39	-0.40	-1.26	0.208
Maximum acceptable waiting time	29.11	26.42	2.69	1.76	0.080
Health Inspection (HI) waiting time	12.39	11.30	1.09	0.89	0.377
Health Inspection (HI) processing time	2.56	2.45	0.11	0.57	0.568
Passport Control (PC) inspection waiting time	50.18	49.17	1.01	0.39	0.699
Passport Control (PC) inspection processing time	5.43	5.91	-0.48	-0.55	0.582
Waiting time to collect the baggage	26.54	23.38	3.15	1.95	0.052
Customs inspection waiting time	29.46	26.65	2.81	1.24	0.214
Customs inspection processing time	4.77	4.40	0.37	1.26	0.211
Unified Agents (UA) registration waiting time	47.14	45.23	1.91	0.98	0.329
Unified Agents (UA) registration processing time	32.15	31.12	1.03	0.55	0.584
Process of allocated and sent to the bus (ASB) time	63.51	62.94	0.58	0.23	0.819
If you spent additional time, determine the duration	52.49	51.60	0.89	0.23	0.818
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	332.62	320.53	12.09	0.96	0.338

Medina					
Walk time from the gate until the 1st inspection point	6.60	6.56	0.04	0.11	0.912
Maximum acceptable waiting time	28.25	26.72	1.53	1.09	0.279
Health Inspection (HI) waiting time	8.49	8.92	-0.43	-0.48	0.633
Health Inspection (HI) processing time	3.54	3.17	0.37	1.24	0.218
Passport Control (PC) inspection waiting time	53.89	53.51	0.39	0.14	0.886
Passport Control (PC) inspection processing time	3.37	3.43	-0.06	-0.30	0.763
Waiting time to collect the baggage	14.47	14.18	0.29	0.38	0.707
Customs inspection waiting time	26.49	26.46	0.04	0.03	0.974
Customs inspection processing time	3.46	3.43	0.03	0.12	0.904
Unified Agents (UA) registration waiting time	41.28	40.87	0.42	0.20	0.838
Unified Agents (UA) registration processing time	20.19	19.95	0.25	0.24	0.813
Process of allocated and sent to the bus (ASB) time	34.12	34.34	-0.21	-0.10	0.923
If you spent additional time, determine the duration	15.00	15.86	-0.86	-0.33	0.738
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	230.91	230.66	0.26	0.02	0.983

Table C-12 Processes time characteristics among Arabic language proficiency

Processes characteristics	Yes	No	Difference in means	t-staistics	p-value
Jeddah					
Walk time from the gate until the 1st inspection point	5.92	6.36	-0.45	-1.40	0.163
Maximum acceptable waiting time	25.42	27.59	-2.17	-1.25	0.211
Health Inspection (HI) waiting time	10.24	11.93	-1.70	-1.09	0.277
Health Inspection (HI) processing time	1.98	2.60	-0.62	-2.73	0.008
Passport Control (PC) inspection waiting time	52.03	48.82	3.21	1.02	0.310
Passport Control (PC) inspection processing time	5.32	5.88	-0.56	-0.57	0.568
Waiting time to collect the baggage	27.36	23.51	3.85	2.09	0.039
Customs inspection waiting time	29.24	27.00	2.24	0.88	0.381
Customs inspection processing time	4.25	4.56	-0.31	-1.33	0.185
Unified Agents (UA) registration waiting time	47.20	45.41	1.79	0.76	0.448

Unified Agents (UA) registration processing time	32.46	31.16	1.30	0.61	0.541
Process of allocated and sent to the bus (ASB) time	66.27	62.33	3.95	1.40	0.164
If you spent additional time, determine the duration	61.22	49.57	11.65	2.70	0.007
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	343.49	319.14	24.36	1.57	0.117
Medina					
Walk time from the gate until the 1st inspection point	6.59	6.56	0.03	0.09	0.931
Maximum acceptable waiting time	26.72	27.38	-0.66	-0.52	0.602
Health Inspection (HI) waiting time	9.48	8.47	1.01	1.15	0.250
Health Inspection (HI) processing time	3.44	3.21	0.23	0.79	0.429
Passport Control (PC) inspection waiting time	53.48	53.69	-0.22	-0.08	0.935
Passport Control (PC) inspection processing time	3.33	3.45	-0.13	-0.60	0.548
Waiting time to collect the baggage	14.36	14.22	0.14	0.18	0.858
Customs inspection waiting time	26.64	26.38	0.25	0.24	0.814
Customs inspection processing time	3.54	3.38	0.16	0.62	0.533
Unified Agents (UA) registration waiting time	41.57	40.72	0.86	0.43	0.666
Unified Agents (UA) registration processing time	20.15	19.96	0.19	0.18	0.855
Process of allocated and sent to the bus (ASB) time	34.36	34.23	0.13	0.06	0.952
If you spent additional time, determine the duration	12.95	16.85	-3.90	-1.56	0.121
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	229.89	231.13	-1.25	-0.11	0.916

Table C-13 Time characteristics of the processes and demand status for Jeddah airport sample

		Sum of Squares	df	Mean Square	F	Sig.
Walk time from the gate until the 1st inspection point	Between Groups	36.294	4	9.073	1.516	.198
	Within Groups	1777.895	297	5.986		
	Total	1814.189	301			

Maximum acceptable waiting time	Between Groups	246.314	4	61.578	.430	.787
	Within Groups	42558.074	297	143.293		
	Total	42804.387	301			
Health Inspection (HI) waiting time	Between Groups	2814.928	4	703.732	8.336	.000
	Within Groups	25073.390	297	84.422		
	Total	27888.318	301			
Health Inspection (HI) processing time	Between Groups	8.630	4	2.158	1.049	.382
	Within Groups	610.787	297	2.057		
	Total	619.417	301			
Passport Control (PC) inspection waiting time	Between Groups	85913.475	4	21478.369	112.798	.000
	Within Groups	56553.280	297	190.415		
	Total	142466.755	301			
Passport Control (PC) inspection processing time	Between Groups	788.556	4	197.139	4.497	.002
	Within Groups	13020.133	297	43.839		
	Total	13808.689	301			
Waiting time to collect the baggage	Between Groups	10590.128	4	2647.532	17.677	.000
	Within Groups	44483.726	297	149.777		
	Total	55073.854	301			
Customs inspection waiting time	Between Groups	57299.839	4	14324.960	117.931	.000
	Within Groups	36076.337	297	121.469		
	Total	93376.175	301			

Customs inspection processing time	Between Groups	57.956	4	14.489	3.417	.009
	Within Groups	1259.540	297	4.241		
	Total	1317.497	301			
Unified Agents (UA) registration waiting time	Between Groups	67210.806	4	16802.702	408.580	.000
	Within Groups	12214.028	297	41.125		
	Total	79424.834	301			
Unified Agents (UA) registration registration processing time	Between Groups	51632.644	4	12908.161	300.863	.000
	Within Groups	12742.442	297	42.904		
	Total	64375.086	301			
Process of allocated and sent to the bus (ASB) time	Between Groups	52092.069	4	13023.017	61.897	.000
	Within Groups	62488.146	297	210.398		
	Total	114580.215	301			
If you spent additional time, determine the duration	Between Groups	46653.059	4	11663.265	15.409	.000
	Within Groups	224800.627	297	756.904		
	Total	271453.685	301			
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Between Groups	2414666.718	4	603666.679	172.629	.000
	Within Groups	1038581.892	297	3496.909		
	Total	3453248.609	301			

Table C-14 Comparison across demand groups for Jeddah airport

Dependent Variable	(I) Demand status	(J) Demand status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Walk time from the gate until the 1st inspection point	Extreme High	High	.493	.428	.778	-.68	1.67
		Considerable	.201	.450	.992	-1.04	1.44
		Moderate	-.502	.474	.826	-1.80	.80
		Low	-.039	.542	1.000	-1.53	1.45
	High	Extreme High	-.493	.428	.778	-1.67	.68
		Considerable	-.292	.389	.944	-1.36	.78
		Moderate	-.996	.416	.119	-2.14	.14
		Low	-.533	.492	.815	-1.88	.82
	Considerable	Extreme High	-.201	.450	.992	-1.44	1.04
		High	.292	.389	.944	-.78	1.36
		Moderate	-.704	.439	.496	-1.91	.50
		Low	-.240	.511	.990	-1.64	1.16
	Moderate	Extreme High	.502	.474	.826	-.80	1.80
		High	.996	.416	.119	-.14	2.14
		Considerable	.704	.439	.496	-.50	1.91
		Low	.463	.532	.907	-1.00	1.92
	Low	Extreme High	.039	.542	1.000	-1.45	1.53
		High	.533	.492	.815	-.82	1.88
		Considerable	.240	.511	.990	-1.16	1.64

		Moderate	-.463	.532	.907	-1.92	1.00
Maximum acceptable waiting time	Extreme High	High	-.669	2.094	.998	-6.42	5.08
		Considerable	1.424	2.204	.967	-4.62	7.47
		Moderate	-.504	2.317	.999	-6.86	5.86
		Low	1.324	2.650	.987	-5.95	8.60
	High	Extreme High	.669	2.094	.998	-5.08	6.42
		Considerable	2.093	1.903	.806	-3.13	7.32
		Moderate	.165	2.033	1.000	-5.42	5.74
		Low	1.993	2.406	.922	-4.61	8.60
	Considerable	Extreme High	-1.424	2.204	.967	-7.47	4.62
		High	-2.093	1.903	.806	-7.32	3.13
		Moderate	-1.929	2.146	.897	-7.82	3.96
		Low	-.101	2.502	1.000	-6.97	6.77
	Moderate	Extreme High	.504	2.317	.999	-5.86	6.86
		High	-.165	2.033	1.000	-5.74	5.42
		Considerable	1.929	2.146	.897	-3.96	7.82
		Low	1.828	2.603	.956	-5.32	8.97
	Low	Extreme High	-1.324	2.650	.987	-8.60	5.95
		High	-1.993	2.406	.922	-8.60	4.61
		Considerable	.101	2.502	1.000	-6.77	6.97
		Moderate	-1.828	2.603	.956	-8.97	5.32
Health Inspection (HI) waiting time	Extreme High	High	.312	1.607	1.000	-4.10	4.72
		Considerable	4.199	1.692	.097	-.44	8.84
		Moderate	7.909*	1.778	.000	3.03	12.79
		Low	5.755*	2.034	.040	.17	11.34

	High	Extreme High	-.312	1.607	1.000	-4.72	4.10
		Considerable	3.887	1.461	.062	-.12	7.90
		Moderate	7.598*	1.561	.000	3.31	11.88
		Low	5.443*	1.847	.028	.37	10.51
	Considerable	Extreme High	-4.199	1.692	.097	-8.84	.44
		High	-3.887	1.461	.062	-7.90	.12
		Moderate	3.711	1.647	.164	-.81	8.23
		Low	1.556	1.921	.927	-3.72	6.83
	Moderate	Extreme High	-7.909*	1.778	.000	-12.79	-3.03
		High	-7.598*	1.561	.000	-11.88	-3.31
		Considerable	-3.711	1.647	.164	-8.23	.81
		Low	-2.154	1.998	.818	-7.64	3.33
	Low	Extreme High	-5.755*	2.034	.040	-11.34	-.17
		High	-5.443*	1.847	.028	-10.51	-.37
		Considerable	-1.556	1.921	.927	-6.83	3.72
		Moderate	2.154	1.998	.818	-3.33	7.64
Health Inspection (HI) processing time	Extreme High	High	-.137	.251	.982	-.83	.55
		Considerable	-.286	.264	.815	-1.01	.44
		Moderate	-.008	.278	1.000	-.77	.75
		Low	-.539	.318	.437	-1.41	.33
	High	Extreme High	.137	.251	.982	-.55	.83
		Considerable	-.149	.228	.966	-.78	.48
		Moderate	.129	.244	.984	-.54	.80
		Low	-.402	.288	.631	-1.19	.39
	Considerable	Extreme High	.286	.264	.815	-.44	1.01

		High	.149	.228	.966	-.48	.78
		Moderate	.279	.257	.815	-.43	.98
		Low	-.253	.300	.917	-1.08	.57
	Moderate	Extreme High	.008	.278	1.000	-.75	.77
		High	-.129	.244	.984	-.80	.54
		Considerable	-.279	.257	.815	-.98	.43
		Low	-.532	.312	.433	-1.39	.32
	Low	Extreme High	.539	.318	.437	-.33	1.41
		High	.402	.288	.631	-.39	1.19
		Considerable	.253	.300	.917	-.57	1.08
		Moderate	.532	.312	.433	-.32	1.39
Passport Control (PC) inspection waiting time	Extreme High	High	7.727*	2.414	.013	1.10	14.35
		Considerable	31.282*	2.540	.000	24.31	38.25
		Moderate	36.889*	2.671	.000	29.56	44.22
		Low	48.706*	3.055	.000	40.32	57.09
	High	Extreme High	-7.727*	2.414	.013	-14.35	-1.10
		Considerable	23.555*	2.194	.000	17.53	29.58
		Moderate	29.162*	2.344	.000	22.73	35.59
		Low	40.979*	2.774	.000	33.37	48.59
	Considerable	Extreme High	-31.282*	2.540	.000	-38.25	-24.31
		High	-23.555*	2.194	.000	-29.58	-17.53
		Moderate	5.607	2.474	.159	-1.18	12.40
		Low	17.424*	2.885	.000	9.51	25.34
	Moderate	Extreme High	-36.889*	2.671	.000	-44.22	-29.56
		High	-29.162*	2.344	.000	-35.59	-22.73

		Considerable	-5.607	2.474	.159	-12.40	1.18
		Low	11.817*	3.000	.001	3.58	20.05
	Low	Extreme High	-48.706*	3.055	.000	-57.09	-40.32
		High	-40.979*	2.774	.000	-48.59	-33.37
		Considerable	-17.424*	2.885	.000	-25.34	-9.51
		Moderate	-11.817*	3.000	.001	-20.05	-3.58
Passport Control (PC) inspection processing time	Extreme High	High	2.299	1.158	.276	-.88	5.48
		Considerable	3.949*	1.219	.012	.60	7.29
		Moderate	4.938*	1.282	.001	1.42	8.46
		Low	3.618	1.466	.101	-.41	7.64
	High	Extreme High	-2.299	1.158	.276	-5.48	.88
		Considerable	1.649	1.053	.520	-1.24	4.54
		Moderate	2.639	1.125	.133	-.45	5.73
		Low	1.318	1.331	.859	-2.33	4.97
	Considerable	Extreme High	-3.949*	1.219	.012	-7.29	-.60
		High	-1.649	1.053	.520	-4.54	1.24
		Moderate	.989	1.187	.920	-2.27	4.25
		Low	-.331	1.384	.999	-4.13	3.47
	Moderate	Extreme High	-4.938*	1.282	.001	-8.46	-1.42
		High	-2.639	1.125	.133	-5.73	.45
		Considerable	-.989	1.187	.920	-4.25	2.27
		Low	-1.320	1.440	.890	-5.27	2.63
	Low	Extreme High	-3.618	1.466	.101	-7.64	.41
		High	-1.318	1.331	.859	-4.97	2.33
		Considerable	.331	1.384	.999	-3.47	4.13

		Moderate	1.320	1.440	.890	-2.63	5.27
Waiting time to collect the baggage	Extreme High	High	1.754	2.141	.924	-4.12	7.63
		Considerable	7.570*	2.253	.008	1.39	13.75
		Moderate	13.691*	2.369	.000	7.19	20.19
		Low	16.529*	2.710	.000	9.09	23.97
	High	Extreme High	-1.754	2.141	.924	-7.63	4.12
		Considerable	5.815*	1.946	.025	.48	11.16
		Moderate	11.937*	2.079	.000	6.23	17.64
		Low	14.775*	2.460	.000	8.02	21.53
	Considerable	Extreme High	-7.570*	2.253	.008	-13.75	-1.39
		High	-5.815*	1.946	.025	-11.16	-.48
		Moderate	6.121*	2.194	.044	.10	12.14
		Low	8.960*	2.558	.005	1.94	15.98
	Moderate	Extreme High	-13.691*	2.369	.000	-20.19	-7.19
		High	-11.937*	2.079	.000	-17.64	-6.23
		Considerable	-6.121*	2.194	.044	-12.14	-.10
		Low	2.838	2.661	.823	-4.46	10.14
	Low	Extreme High	-16.529*	2.710	.000	-23.97	-9.09
		High	-14.775*	2.460	.000	-21.53	-8.02
		Considerable	-8.960*	2.558	.005	-15.98	-1.94
		Moderate	-2.838	2.661	.823	-10.14	4.46
Customs inspection waiting time	Extreme High	High	.523	1.928	.999	-4.77	5.81
		Considerable	22.725*	2.029	.000	17.16	28.29
		Moderate	29.843*	2.133	.000	23.99	35.70
		Low	32.392*	2.440	.000	25.69	39.09

	High	Extreme High	-.523	1.928	.999	-5.81	4.77
		Considerable	22.202*	1.752	.000	17.39	27.01
		Moderate	29.320*	1.872	.000	24.18	34.46
		Low	31.869*	2.215	.000	25.79	37.95
	Considerable	Extreme High	-22.725*	2.029	.000	-28.29	-17.16
		High	-22.202*	1.752	.000	-27.01	-17.39
		Moderate	7.118*	1.976	.003	1.69	12.54
		Low	9.667*	2.304	.000	3.34	15.99
	Moderate	Extreme High	-29.843*	2.133	.000	-35.70	-23.99
		High	-29.320*	1.872	.000	-34.46	-24.18
		Considerable	-7.118*	1.976	.003	-12.54	-1.69
		Low	2.549	2.396	.825	-4.03	9.13
	Low	Extreme High	-32.392*	2.440	.000	-39.09	-25.69
		High	-31.869*	2.215	.000	-37.95	-25.79
		Considerable	-9.667*	2.304	.000	-15.99	-3.34
		Moderate	-2.549	2.396	.825	-9.13	4.03
Customs inspection processing time	Extreme High	High	.718	.360	.272	-.27	1.71
		Considerable	1.148*	.379	.022	.11	2.19
		Moderate	.994	.399	.095	-.10	2.09
		Low	1.451*	.456	.014	.20	2.70
	High	Extreme High	-.718	.360	.272	-1.71	.27
		Considerable	.430	.327	.684	-.47	1.33
		Moderate	.276	.350	.934	-.68	1.24
		Low	.733	.414	.393	-.40	1.87
	Considerable	Extreme High	-1.148*	.379	.022	-2.19	-.11

		High	-.430	.327	.684	-1.33	.47
		Moderate	-.154	.369	.994	-1.17	.86
		Low	.303	.430	.955	-.88	1.48
	Moderate	Extreme High	-.994	.399	.095	-2.09	.10
		High	-.276	.350	.934	-1.24	.68
		Considerable	.154	.369	.994	-.86	1.17
		Low	.457	.448	.846	-.77	1.69
	Low	Extreme High	-1.451*	.456	.014	-2.70	-.20
		High	-.733	.414	.393	-1.87	.40
		Considerable	-.303	.430	.955	-1.48	.88
		Moderate	-.457	.448	.846	-1.69	.77
Unified Agents (UA) registration waiting time	Extreme High	High	12.638*	1.122	.000	9.56	15.72
		Considerable	31.913*	1.181	.000	28.67	35.15
		Moderate	35.949*	1.241	.000	32.54	39.36
		Low	44.363*	1.420	.000	40.47	48.26
	High	Extreme High	-12.638*	1.122	.000	-15.72	-9.56
		Considerable	19.275*	1.020	.000	16.48	22.07
		Moderate	23.310*	1.089	.000	20.32	26.30
		Low	31.724*	1.289	.000	28.19	35.26
	Considerable	Extreme High	-31.913*	1.181	.000	-35.15	-28.67
		High	-19.275*	1.020	.000	-22.07	-16.48
		Moderate	4.036*	1.150	.005	.88	7.19
		Low	12.450*	1.341	.000	8.77	16.13
	Moderate	Extreme High	-35.949*	1.241	.000	-39.36	-32.54
		High	-23.310*	1.089	.000	-26.30	-20.32

		Considerable	-4.036*	1.150	.005	-7.19	-.88
		Low	8.414*	1.394	.000	4.59	12.24
	Low	Extreme High	-44.363*	1.420	.000	-48.26	-40.47
		High	-31.724*	1.289	.000	-35.26	-28.19
		Considerable	-12.450*	1.341	.000	-16.13	-8.77
		Moderate	-8.414*	1.394	.000	-12.24	-4.59
Unified Agents (UA) registration registration processing time	Extreme High	High	12.452*	1.146	.000	9.31	15.60
		Considerable	31.067*	1.206	.000	27.76	34.38
		Moderate	30.567*	1.268	.000	27.09	34.05
		Low	38.382*	1.450	.000	34.40	42.36
	High	Extreme High	-12.452*	1.146	.000	-15.60	-9.31
		Considerable	18.615*	1.041	.000	15.76	21.47
		Moderate	18.115*	1.112	.000	15.06	21.17
		Low	25.931*	1.317	.000	22.32	29.54
	Considerable	Extreme High	-31.067*	1.206	.000	-34.38	-27.76
		High	-18.615*	1.041	.000	-21.47	-15.76
		Moderate	-.500	1.174	.993	-3.72	2.72
		Low	7.315*	1.369	.000	3.56	11.07
	Moderate	Extreme High	-30.567*	1.268	.000	-34.05	-27.09
		High	-18.115*	1.112	.000	-21.17	-15.06
		Considerable	.500	1.174	.993	-2.72	3.72
		Low	7.815*	1.424	.000	3.91	11.72
	Low	Extreme High	-38.382*	1.450	.000	-42.36	-34.40
		High	-25.931*	1.317	.000	-29.54	-22.32
		Considerable	-7.315*	1.369	.000	-11.07	-3.56

		Moderate	-7.815*	1.424	.000	-11.72	-3.91
Process of allocated and sent to the bus (ASB) time	Extreme High	High	-2.311	2.537	.893	-9.27	4.65
		Considerable	13.546*	2.670	.000	6.22	20.88
		Moderate	26.350*	2.808	.000	18.64	34.06
		Low	32.794*	3.211	.000	23.98	41.61
	High	Extreme High	2.311	2.537	.893	-4.65	9.27
		Considerable	15.857*	2.306	.000	9.53	22.19
		Moderate	28.661*	2.464	.000	21.90	35.42
		Low	35.105*	2.916	.000	27.10	43.11
	Considerable	Extreme High	-13.546*	2.670	.000	-20.88	-6.22
		High	-15.857*	2.306	.000	-22.19	-9.53
		Moderate	12.804*	2.601	.000	5.67	19.94
		Low	19.248*	3.032	.000	10.93	27.57
	Moderate	Extreme High	-26.350*	2.808	.000	-34.06	-18.64
		High	-28.661*	2.464	.000	-35.42	-21.90
		Considerable	-12.804*	2.601	.000	-19.94	-5.67
		Low	6.444	3.154	.248	-2.21	15.10
	Low	Extreme High	-32.794*	3.211	.000	-41.61	-23.98
		High	-35.105*	2.916	.000	-43.11	-27.10
		Considerable	-19.248*	3.032	.000	-27.57	-10.93
		Moderate	-6.444	3.154	.248	-15.10	2.21
If you spent additional time, determine the duration	Extreme High	High	-4.960	4.812	.841	-18.17	8.25
		Considerable	12.798	5.065	.087	-1.10	26.70
		Moderate	-1.452	5.325	.999	-16.07	13.16
		Low	34.588*	6.091	.000	17.87	51.31

	High	Extreme High	4.960	4.812	.841	-8.25	18.17
		Considerable	17.758*	4.374	.001	5.75	29.76
		Moderate	3.508	4.673	.944	-9.32	16.33
		Low	39.548*	5.530	.000	24.37	54.73
	Considerable	Extreme High	-12.798	5.065	.087	-26.70	1.10
		High	-17.758*	4.374	.001	-29.76	-5.75
		Moderate	-14.250*	4.932	.034	-27.79	-.71
		Low	21.790*	5.751	.002	6.01	37.57
	Moderate	Extreme High	1.452	5.325	.999	-13.16	16.07
		High	-3.508	4.673	.944	-16.33	9.32
		Considerable	14.250*	4.932	.034	.71	27.79
		Low	36.040*	5.981	.000	19.62	52.46
	Low	Extreme High	-34.588*	6.091	.000	-51.31	-17.87
		High	-39.548*	5.530	.000	-54.73	-24.37
		Considerable	-21.790*	5.751	.002	-37.57	-6.01
		Moderate	-36.040*	5.981	.000	-52.46	-19.62
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Extreme High	High	31.509*	10.344	.021	3.12	59.90
		Considerable	160.111*	10.887	.000	130.23	189.99
		Moderate	185.168*	11.446	.000	153.75	216.58
		Low	258.000*	13.093	.000	222.07	293.93
	High	Extreme High	-31.509*	10.344	.021	-59.90	-3.12
		Considerable	128.602*	9.401	.000	102.80	154.40
		Moderate	153.659*	10.044	.000	126.09	181.22
		Low	226.491*	11.886	.000	193.87	259.11
	Considerable	Extreme High	-160.111*	10.887	.000	-189.99	-130.23

		High	-128.602*	9.401	.000	-154.40	-102.80
		Moderate	25.057	10.602	.128	-4.04	54.16
		Low	97.889*	12.361	.000	63.96	131.82
	Moderate	Extreme High	-185.168*	11.446	.000	-216.58	-153.75
		High	-153.659*	10.044	.000	-181.22	-126.09
		Considerable	-25.057	10.602	.128	-54.16	4.04
		Low	72.832*	12.857	.000	37.55	108.12
	Low	Extreme High	-258.000*	13.093	.000	-293.93	-222.07
		High	-226.491*	11.886	.000	-259.11	-193.87
		Considerable	-97.889*	12.361	.000	-131.82	-63.96
		Moderate	-72.832*	12.857	.000	-108.12	-37.55

*. The mean difference is significant at the 0.05 level.

Table C-15 Time characteristics of the processes and demand status for Medina airport sample

		Sum of Squares	df	Mean Square	F	Sig.
Walk time from the gate until the 1st inspection point	Between Groups	699.228	4	174.807	223.361	.000
	Within Groups	145.567	186	.783		
	Total	844.796	190			
Maximum acceptable waiting time	Between Groups	154.105	4	38.526	.572	.683
	Within Groups	12519.194	186	67.307		
	Total	12673.298	190			
Health Inspection (HI) waiting time	Between Groups	2812.252	4	703.063	40.899	.000

	Within Groups	3197.371	186	17.190		
	Total	6009.623	190			
Health Inspection (HI) processing time	Between Groups	52.474	4	13.118	3.823	.005
	Within Groups	638.259	186	3.432		
	Total	690.733	190			
Passport Control (PC) inspection waiting time	Between Groups	40269.045	4	10067.261	128.379	.000
	Within Groups	14585.814	186	78.418		
	Total	54854.859	190			
Passport Control (PC) inspection processing time	Between Groups	78.420	4	19.605	13.714	.000
	Within Groups	265.904	186	1.430		
	Total	344.325	190			
Waiting time to collect the baggage	Between Groups	1960.845	4	490.211	34.297	.000
	Within Groups	2658.538	186	14.293		
	Total	4619.382	190			
Customs inspection waiting time	Between Groups	7003.967	4	1750.992	149.016	.000
	Within Groups	2185.562	186	11.750		
	Total	9189.529	190			
Customs inspection processing time	Between Groups	318.934	4	79.734	85.234	.000
	Within Groups	173.997	186	.935		
	Total	492.932	190			
Unified Agents (UA) registration waiting time	Between Groups	24954.437	4	6238.609	191.623	.000

	Within Groups	6055.542	186	32.557		
	Total	31009.979	190			
Unified Agents (UA) registration registration processing time	Between Groups	6543.922	4	1635.980	195.813	.000
	Within Groups	1553.995	186	8.355		
	Total	8097.916	190			
Process of allocated and sent to the bus (ASB) time	Between Groups	28264.653	4	7066.163	152.380	.000
	Within Groups	8625.190	186	46.372		
	Total	36889.843	190			
If you spent additional time, determine the duration	Between Groups	11637.353	4	2909.338	14.196	.000
	Within Groups	38118.406	186	204.938		
	Total	49755.759	190			
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Between Groups	877365.618	4	219341.405	182.793	.000
	Within Groups	223189.764	186	1199.945		
	Total	1100555.382	190			

Table C-16 Multiply comparison across groups with different demand status in Medina airport

Dependent Variable	(I) Demand status	(J) Demand status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Walk time from the gate until the 1st inspection point	Extreme High	High	1.870*	.263	.000	1.14	2.59
		Considerable	2.917*	.255	.000	2.21	3.62
		Moderate	4.850*	.268	.000	4.11	5.59
		Low	6.667*	.280	.000	5.90	7.44
	High	Extreme High	-1.870*	.263	.000	-2.59	-1.14
		Considerable	1.047*	.173	.000	.57	1.52
		Moderate	2.980*	.191	.000	2.45	3.51
		Low	4.797*	.208	.000	4.23	5.37
	Considerable	Extreme High	-2.917*	.255	.000	-3.62	-2.21
		High	-1.047*	.173	.000	-1.52	-.57
		Moderate	1.933*	.181	.000	1.44	2.43
		Low	3.750*	.198	.000	3.21	4.29
	Moderate	Extreme High	-4.850*	.268	.000	-5.59	-4.11
		High	-2.980*	.191	.000	-3.51	-2.45
		Considerable	-1.933*	.181	.000	-2.43	-1.44
		Low	1.817*	.214	.000	1.23	2.41
	Low	Extreme High	-6.667*	.280	.000	-7.44	-5.90
		High	-4.797*	.208	.000	-5.37	-4.23

		Considerable	-3.750*	.198	.000	-4.29	-3.21
		Moderate	-1.817*	.214	.000	-2.41	-1.23
Maximum acceptable waiting time	Extreme High	High	-1.254	2.439	.986	-7.97	5.47
		Considerable	1.167	2.368	.988	-5.36	7.69
		Moderate	.208	2.484	1.000	-6.63	7.05
		Low	.333	2.594	1.000	-6.81	7.48
	High	Extreme High	1.254	2.439	.986	-5.47	7.97
		Considerable	2.420	1.608	.560	-2.01	6.85
		Moderate	1.462	1.774	.923	-3.42	6.35
		Low	1.587	1.925	.923	-3.72	6.89
	Considerable	Extreme High	-1.167	2.368	.988	-7.69	5.36
		High	-2.420	1.608	.560	-6.85	2.01
		Moderate	-.958	1.675	.979	-5.57	3.65
		Low	-.833	1.834	.991	-5.89	4.22
	Moderate	Extreme High	-.208	2.484	1.000	-7.05	6.63
		High	-1.462	1.774	.923	-6.35	3.42
		Considerable	.958	1.675	.979	-3.65	5.57
		Low	.125	1.981	1.000	-5.33	5.58
	Low	Extreme High	-.333	2.594	1.000	-7.48	6.81
		High	-1.587	1.925	.923	-6.89	3.72
		Considerable	.833	1.834	.991	-4.22	5.89
		Moderate	-.125	1.981	1.000	-5.58	5.33
Health Inspection (HI) waiting time	Extreme High	High	4.577*	1.233	.002	1.18	7.97
		Considerable	7.117*	1.197	.000	3.82	10.41
		Moderate	10.758*	1.255	.000	7.30	14.22

		Low	13.700*	1.311	.000	10.09	17.31
	High	Extreme High	-4.577*	1.233	.002	-7.97	-1.18
		Considerable	2.540*	.813	.017	.30	4.78
		Moderate	6.182*	.896	.000	3.71	8.65
		Low	9.123*	.973	.000	6.44	11.80
	Considerable	Extreme High	-7.117*	1.197	.000	-10.41	-3.82
		High	-2.540*	.813	.017	-4.78	-.30
		Moderate	3.642*	.846	.000	1.31	5.97
		Low	6.583*	.927	.000	4.03	9.14
	Moderate	Extreme High	-10.758*	1.255	.000	-14.22	-7.30
		High	-6.182*	.896	.000	-8.65	-3.71
		Considerable	-3.642*	.846	.000	-5.97	-1.31
		Low	2.942*	1.001	.030	.18	5.70
	Low	Extreme High	-13.700*	1.311	.000	-17.31	-10.09
		High	-9.123*	.973	.000	-11.80	-6.44
		Considerable	-6.583*	.927	.000	-9.14	-4.03
		Moderate	-2.942*	1.001	.030	-5.70	-.18
Health Inspection (HI) processing time	Extreme High	High	-.403	.551	.949	-1.92	1.11
		Considerable	.233	.535	.992	-1.24	1.71
		Moderate	.042	.561	1.000	-1.50	1.59
		Low	1.267	.586	.199	-.35	2.88
	High	Extreme High	.403	.551	.949	-1.11	1.92
		Considerable	.636	.363	.405	-.36	1.64
		Moderate	.445	.400	.801	-.66	1.55
		Low	1.670*	.435	.002	.47	2.87

	Considerable	Extreme High	-.233	.535	.992	-1.71	1.24
		High	-.636	.363	.405	-1.64	.36
		Moderate	-.192	.378	.987	-1.23	.85
		Low	1.033	.414	.096	-.11	2.17
	Moderate	Extreme High	-.042	.561	1.000	-1.59	1.50
		High	-.445	.400	.801	-1.55	.66
		Considerable	.192	.378	.987	-.85	1.23
		Low	1.225	.447	.052	-.01	2.46
	Low	Extreme High	-1.267	.586	.199	-2.88	.35
		High	-1.670*	.435	.002	-2.87	-.47
		Considerable	-1.033	.414	.096	-2.17	.11
		Moderate	-1.225	.447	.052	-2.46	.01
Passport Control (PC) inspection waiting time	Extreme High	High	11.196*	2.633	.000	3.94	18.45
		Considerable	26.167*	2.556	.000	19.12	33.21
		Moderate	37.875*	2.681	.000	30.49	45.26
		Low	47.933*	2.800	.000	40.22	55.65
	High	Extreme High	-11.196*	2.633	.000	-18.45	-3.94
		Considerable	14.971*	1.735	.000	10.19	19.75
		Moderate	26.679*	1.914	.000	21.41	31.95
		Low	36.738*	2.078	.000	31.01	42.46
	Considerable	Extreme High	-26.167*	2.556	.000	-33.21	-19.12
		High	-14.971*	1.735	.000	-19.75	-10.19
		Moderate	11.708*	1.808	.000	6.73	16.69
		Low	21.767*	1.980	.000	16.31	27.22
	Moderate	Extreme High	-37.875*	2.681	.000	-45.26	-30.49

		High	-26.679*	1.914	.000	-31.95	-21.41
		Considerable	-11.708*	1.808	.000	-16.69	-6.73
		Low	10.058*	2.139	.000	4.17	15.95
	Low	Extreme High	-47.933*	2.800	.000	-55.65	-40.22
		High	-36.738*	2.078	.000	-42.46	-31.01
		Considerable	-21.767*	1.980	.000	-27.22	-16.31
		Moderate	-10.058*	2.139	.000	-15.95	-4.17
Passport Control (PC) inspection processing time	Extreme High	High	.401	.356	.791	-.58	1.38
		Considerable	1.067*	.345	.019	.12	2.02
		Moderate	1.317*	.362	.003	.32	2.31
		Low	2.200*	.378	.000	1.16	3.24
	High	Extreme High	-.401	.356	.791	-1.38	.58
		Considerable	.665*	.234	.040	.02	1.31
		Moderate	.915*	.258	.005	.20	1.63
		Low	1.799*	.281	.000	1.03	2.57
	Considerable	Extreme High	-1.067*	.345	.019	-2.02	-.12
		High	-.665*	.234	.040	-1.31	-.02
		Moderate	.250	.244	.844	-.42	.92
		Low	1.133*	.267	.000	.40	1.87
	Moderate	Extreme High	-1.317*	.362	.003	-2.31	-.32
		High	-.915*	.258	.005	-1.63	-.20
		Considerable	-.250	.244	.844	-.92	.42
		Low	.883*	.289	.021	.09	1.68
	Low	Extreme High	-2.200*	.378	.000	-3.24	-1.16
		High	-1.799*	.281	.000	-2.57	-1.03

		Considerable	-1.133*	.267	.000	-1.87	-.40
		Moderate	-.883*	.289	.021	-1.68	-.09
Waiting time to collect the baggage	Extreme High	High	3.332*	1.124	.028	.24	6.43
		Considerable	5.133*	1.091	.000	2.13	8.14
		Moderate	9.067*	1.145	.000	5.91	12.22
		Low	10.733*	1.196	.000	7.44	14.03
	High	Extreme High	-3.332*	1.124	.028	-6.43	-.24
		Considerable	1.801	.741	.112	-.24	3.84
		Moderate	5.735*	.817	.000	3.48	7.99
		Low	7.401*	.887	.000	4.96	9.85
	Considerable	Extreme High	-5.133*	1.091	.000	-8.14	-2.13
		High	-1.801	.741	.112	-3.84	.24
		Moderate	3.933*	.772	.000	1.81	6.06
		Low	5.600*	.845	.000	3.27	7.93
	Moderate	Extreme High	-9.067*	1.145	.000	-12.22	-5.91
		High	-5.735*	.817	.000	-7.99	-3.48
		Considerable	-3.933*	.772	.000	-6.06	-1.81
		Low	1.667	.913	.362	-.85	4.18
	Low	Extreme High	-10.733*	1.196	.000	-14.03	-7.44
		High	-7.401*	.887	.000	-9.85	-4.96
		Considerable	-5.600*	.845	.000	-7.93	-3.27
		Moderate	-1.667	.913	.362	-4.18	.85
Customs inspection waiting time	Extreme High	High	2.812*	1.019	.049	.00	5.62
		Considerable	4.917*	.990	.000	2.19	7.64
		Moderate	13.333*	1.038	.000	10.47	16.19

		Low	18.167*	1.084	.000	15.18	21.15
	High	Extreme High	-2.812*	1.019	.049	-5.62	.00
		Considerable	2.105*	.672	.017	.25	3.96
		Moderate	10.522*	.741	.000	8.48	12.56
		Low	15.355*	.804	.000	13.14	17.57
	Considerable	Extreme High	-4.917*	.990	.000	-7.64	-2.19
		High	-2.105*	.672	.017	-3.96	-.25
		Moderate	8.417*	.700	.000	6.49	10.34
		Low	13.250*	.766	.000	11.14	15.36
	Moderate	Extreme High	-13.333*	1.038	.000	-16.19	-10.47
		High	-10.522*	.741	.000	-12.56	-8.48
		Considerable	-8.417*	.700	.000	-10.34	-6.49
		Low	4.833*	.828	.000	2.55	7.11
	Low	Extreme High	-18.167*	1.084	.000	-21.15	-15.18
		High	-15.355*	.804	.000	-17.57	-13.14
		Considerable	-13.250*	.766	.000	-15.36	-11.14
		Moderate	-4.833*	.828	.000	-7.11	-2.55
Customs inspection processing time	Extreme High	High	-.096	.288	.997	-.89	.70
		Considerable	.517	.279	.348	-.25	1.29
		Moderate	2.425*	.293	.000	1.62	3.23
		Low	3.300*	.306	.000	2.46	4.14
	High	Extreme High	.096	.288	.997	-.70	.89
		Considerable	.612*	.190	.013	.09	1.13
		Moderate	2.521*	.209	.000	1.94	3.10
		Low	3.396*	.227	.000	2.77	4.02

	Considerable	Extreme High	-.517	.279	.348	-1.29	.25
		High	-.612*	.190	.013	-1.13	-.09
		Moderate	1.908*	.197	.000	1.36	2.45
		Low	2.783*	.216	.000	2.19	3.38
	Moderate	Extreme High	-2.425*	.293	.000	-3.23	-1.62
		High	-2.521*	.209	.000	-3.10	-1.94
		Considerable	-1.908*	.197	.000	-2.45	-1.36
		Low	.875*	.234	.002	.23	1.52
	Low	Extreme High	-3.300*	.306	.000	-4.14	-2.46
		High	-3.396*	.227	.000	-4.02	-2.77
		Considerable	-2.783*	.216	.000	-3.38	-2.19
		Moderate	-.875*	.234	.002	-1.52	-.23
Unified Agents (UA) registration waiting time	Extreme High	High	12.326*	1.697	.000	7.65	17.00
		Considerable	20.033*	1.647	.000	15.50	24.57
		Moderate	30.500*	1.728	.000	25.74	35.26
		Low	40.500*	1.804	.000	35.53	45.47
	High	Extreme High	-12.326*	1.697	.000	-17.00	-7.65
		Considerable	7.707*	1.118	.000	4.63	10.79
		Moderate	18.174*	1.234	.000	14.78	21.57
		Low	28.174*	1.339	.000	24.49	31.86
	Considerable	Extreme High	-20.033*	1.647	.000	-24.57	-15.50
		High	-7.707*	1.118	.000	-10.79	-4.63
		Moderate	10.467*	1.165	.000	7.26	13.68
		Low	20.467*	1.276	.000	16.95	23.98
	Moderate	Extreme High	-30.500*	1.728	.000	-35.26	-25.74

		High	-18.174*	1.234	.000	-21.57	-14.78
		Considerable	-10.467*	1.165	.000	-13.68	-7.26
		Low	10.000*	1.378	.000	6.20	13.80
	Low	Extreme High	-40.500*	1.804	.000	-45.47	-35.53
		High	-28.174*	1.339	.000	-31.86	-24.49
		Considerable	-20.467*	1.276	.000	-23.98	-16.95
		Moderate	-10.000*	1.378	.000	-13.80	-6.20
Unified Agents (UA) registration registration processing time	Extreme High	High	5.761*	.859	.000	3.39	8.13
		Considerable	10.117*	.834	.000	7.82	12.42
		Moderate	15.275*	.875	.000	12.86	17.69
		Low	20.467*	.914	.000	17.95	22.98
	High	Extreme High	-5.761*	.859	.000	-8.13	-3.39
		Considerable	4.356*	.566	.000	2.80	5.92
		Moderate	9.514*	.625	.000	7.79	11.24
		Low	14.706*	.678	.000	12.84	16.57
	Considerable	Extreme High	-10.117*	.834	.000	-12.42	-7.82
		High	-4.356*	.566	.000	-5.92	-2.80
		Moderate	5.158*	.590	.000	3.53	6.78
		Low	10.350*	.646	.000	8.57	12.13
	Moderate	Extreme High	-15.275*	.875	.000	-17.69	-12.86
		High	-9.514*	.625	.000	-11.24	-7.79
		Considerable	-5.158*	.590	.000	-6.78	-3.53
		Low	5.192*	.698	.000	3.27	7.11
	Low	Extreme High	-20.467*	.914	.000	-22.98	-17.95
		High	-14.706*	.678	.000	-16.57	-12.84

		Considerable	-10.350*	.646	.000	-12.13	-8.57
		Moderate	-5.192*	.698	.000	-7.11	-3.27
Process of allocated and sent to the bus (ASB) time	Extreme High	High	17.558*	2.025	.000	11.98	23.14
		Considerable	29.400*	1.966	.000	23.98	34.82
		Moderate	41.417*	2.062	.000	35.74	47.10
		Low	39.833*	2.153	.000	33.90	45.77
	High	Extreme High	-17.558*	2.025	.000	-23.14	-11.98
		Considerable	11.842*	1.335	.000	8.17	15.52
		Moderate	23.859*	1.472	.000	19.80	27.91
		Low	22.275*	1.598	.000	17.87	26.68
	Considerable	Extreme High	-29.400*	1.966	.000	-34.82	-23.98
		High	-11.842*	1.335	.000	-15.52	-8.17
		Moderate	12.017*	1.390	.000	8.19	15.85
		Low	10.433*	1.523	.000	6.24	14.63
	Moderate	Extreme High	-41.417*	2.062	.000	-47.10	-35.74
		High	-23.859*	1.472	.000	-27.91	-19.80
		Considerable	-12.017*	1.390	.000	-15.85	-8.19
		Low	-1.583	1.645	.871	-6.11	2.95
	Low	Extreme High	-39.833*	2.153	.000	-45.77	-33.90
		High	-22.275*	1.598	.000	-26.68	-17.87
		Considerable	-10.433*	1.523	.000	-14.63	-6.24
		Moderate	1.583	1.645	.871	-2.95	6.11
If you spent additional time, determine the duration	Extreme High	High	13.029*	4.256	.021	1.30	24.75
		Considerable	19.500*	4.133	.000	8.12	30.88
		Moderate	22.083*	4.334	.000	10.14	34.02

		Low	30.833*	4.527	.000	18.36	43.30
	High	Extreme High	-13.029*	4.256	.021	-24.75	-1.30
		Considerable	6.471	2.805	.147	-1.26	14.20
		Moderate	9.054*	3.095	.031	.53	17.58
		Low	17.804*	3.360	.000	8.55	27.06
	Considerable	Extreme High	-19.500*	4.133	.000	-30.88	-8.12
		High	-6.471	2.805	.147	-14.20	1.26
		Moderate	2.583	2.922	.903	-5.47	10.63
		Low	11.333*	3.201	.005	2.52	20.15
	Moderate	Extreme High	-22.083*	4.334	.000	-34.02	-10.14
		High	-9.054*	3.095	.031	-17.58	-.53
		Considerable	-2.583	2.922	.903	-10.63	5.47
		Low	8.750	3.458	.088	-.77	18.27
	Low	Extreme High	-30.833*	4.527	.000	-43.30	-18.36
		High	-17.804*	3.360	.000	-27.06	-8.55
		Considerable	-11.333*	3.201	.005	-20.15	-2.52
		Moderate	-8.750	3.458	.088	-18.27	.77
Total time to finish all processes in the Hajj terminal from disembarkation to leave the bus the terminal (inside & outside)	Extreme High	High	72.362*	10.300	.000	43.99	100.73
		Considerable	127.117*	10.000	.000	99.57	154.66
		Moderate	188.942*	10.488	.000	160.05	217.83
		Low	235.600*	10.954	.000	205.42	265.78
	High	Extreme High	-72.362*	10.300	.000	-100.73	-43.99
		Considerable	54.754*	6.789	.000	36.05	73.46
		Moderate	116.579*	7.489	.000	95.95	137.21
		Low	163.238*	8.129	.000	140.84	185.63

	Considerable	Extreme High	-127.117*	10.000	.000	-154.66	-99.57
		High	-54.754*	6.789	.000	-73.46	-36.05
		Moderate	61.825*	7.071	.000	42.35	81.30
		Low	108.483*	7.746	.000	87.15	129.82
	Moderate	Extreme High	-188.942*	10.488	.000	-217.83	-160.05
		High	-116.579*	7.489	.000	-137.21	-95.95
		Considerable	-61.825*	7.071	.000	-81.30	-42.35
		Low	46.658*	8.366	.000	23.61	69.71
	Low	Extreme High	-235.600*	10.954	.000	-265.78	-205.42
		High	-163.238*	8.129	.000	-185.63	-140.84
		Considerable	-108.483*	7.746	.000	-129.82	-87.15
		Moderate	-46.658*	8.366	.000	-69.71	-23.61

*. The mean difference is significant at the 0.05 level.

Table C-17 Average evaluates of processes and system overall among gender

Processes characteristics	Male	Female	Difference in means	t-staistics	p-value
Jeddah					
HI					
Passenger evaluate for HI based on waiting time	2.99	3.17	-0.17	-1.01	0.311
Passenger evaluate for HI staff based on Efficiency of inspection time	3.05	3.26	-0.21	-1.40	0.164
Passenger evaluate for HI staff based on Courtesy/ helpfulness	3.72	3.94	-0.22	-1.65	0.101
Passenger evaluate for HI staff based on Knowledge /expertise	3.49	3.73	-0.24	-1.66	0.098
PC					
Passenger evaluate for PC Inspection based on waiting time	2.14	2.43	-0.29	-1.77	0.080
Passenger evaluate for PC Inspection based on processing time	3.64	3.75	-0.11	-0.74	0.457

Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.99	3.18	-0.19	-1.39	0.167
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.83	2.94	-0.11	-0.84	0.401
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.18	3.18	0.00	0.01	0.989
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.16	2.49	-0.34	-1.92	0.057
Passenger evaluate for BC based on comfortable space around carousels	2.96	3.05	-0.09	-0.53	0.599
Passenger evaluate for BC based on the helpfulness of support staff	3.03	3.08	-0.05	-0.34	0.735
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.56	3.61	-0.06	-0.43	0.665
CI					
Passenger evaluate for Customs inspection based on waiting time	2.39	2.64	-0.25	-1.77	0.077
Passenger evaluate for Customs inspection based on processing time	3.11	3.22	-0.11	-0.75	0.451
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	2.82	3.02	-0.21	-1.57	0.119
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.40	3.55	-0.15	-1.05	0.294
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.31	3.24	0.07	0.49	0.627
UA registration					
Passenger evaluate for UA registration based on waiting time	2.83	3.08	-0.25	-1.44	0.151
Passenger evaluate for UA registration based on processing time	3.08	3.31	-0.24	-1.41	0.161
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.76	2.92	-0.16	-0.93	0.356
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	2.95	3.18	-0.24	-1.87	0.062
Passenger evaluate for UA registration staff based on Knowledge /expertise	2.73	2.89	-0.17	-1.06	0.290
ASB					
Passenger evaluate for ASB based on duration time of this process	2.70	3.00	-0.30	-1.91	0.057
Passenger evaluate for ABS staff based on Efficiency of duration time	2.68	2.90	-0.22	-1.38	0.170
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.08	3.24	-0.16	-1.06	0.289

Passenger evaluate for ABS staff based on Knowledge /expertise	2.74	2.84	-0.10	-0.63	0.528
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.68	3.80	-0.11	-1.02	0.311
Passenger evaluate for ABS based on support tools for special need people	2.76	2.75	0.01	0.07	0.943
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	1.60	1.63	-0.03	-0.30	0.761
Overall passenger evaluate for processing time in all steps	2.32	2.42	-0.11	-0.81	0.418
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	2.58	2.83	-0.25	-2.63	0.009
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	2.37	2.49	-0.12	-0.92	0.359
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	1.70	1.88	-0.19	-1.74	0.084
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	2.28	2.45	-0.16	-1.73	0.084
Overall passenger evaluate for HT facilities based on information visibility/signs	2.74	2.83	-0.10	-0.98	0.328
Overall passenger evaluate for HT facilities based on help and contacts Information service	2.77	2.89	-0.12	-1.26	0.209
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.16	3.28	-0.11	-1.19	0.233
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.36	3.37	-0.01	-0.15	0.882
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	2.91	2.89	0.02	0.22	0.829
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	2.62	2.80	-0.17	-1.76	0.080
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	2.25	2.53	-0.28	-2.48	0.014
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.74	1.78	-0.04	-0.44	0.659
Medina					
HI					
Passenger evaluate for HI based on waiting time	3.62	3.86	-0.24	-1.25	0.213
Passenger evaluate for HI staff based on Efficiency of inspection time	3.28	3.56	-0.28	-1.52	0.130
Passenger evaluate for HI staff based on Courtesy/ helpfulness	4.08	4.12	-0.04	-0.28	0.781

Passenger evaluate for HI staff based on Knowledge /expertise	4.03	3.94	0.09	0.65	0.518
PC					
Passenger evaluate for PC Inspection based on waiting time	2.28	2.41	-0.13	-0.73	0.464
Passenger evaluate for PC Inspection based on processing time	3.48	3.58	-0.09	-0.72	0.471
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.55	2.61	-0.06	-0.36	0.717
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.58	2.61	-0.03	-0.19	0.848
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	2.55	2.71	-0.16	-0.88	0.382
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.78	2.66	0.12	0.65	0.517
Passenger evaluate for BC based on comfortable space around carousels	2.82	2.83	-0.01	-0.07	0.945
Passenger evaluate for BC based on the helpfulness of support staff	3.66	3.63	0.03	0.17	0.865
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.30	3.47	-0.17	-0.89	0.376
CI					
Passenger evaluate for Customs inspection based on waiting time	2.63	2.88	-0.25	-1.39	0.167
Passenger evaluate for Customs inspection based on processing time	4.02	4.20	-0.18	-1.55	0.122
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	3.61	3.71	-0.11	-0.67	0.505
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.95	4.02	-0.06	-0.48	0.635
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.52	3.61	-0.09	-0.50	0.616
UA registration					
Passenger evaluate for UA registration based on waiting time	2.61	2.92	-0.30	-1.69	0.093
Passenger evaluate for UA registration based on processing time	2.76	3.02	-0.26	-1.32	0.190
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.73	2.86	-0.14	-0.77	0.441
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.44	3.56	-0.12	-0.87	0.383
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.13	3.34	-0.21	-1.32	0.189

ASB					
Passenger evaluate for ASB based on duration time of this process	2.68	2.85	-0.17	-0.86	0.390
Passenger evaluate for ABS staff based on Efficiency of duration time	2.27	2.51	-0.24	-1.71	0.089
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.45	3.44	0.01	0.08	0.935
Passenger evaluate for ABS staff based on Knowledge /expertise	3.05	3.14	-0.08	-0.57	0.570
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.69	3.83	-0.14	-1.34	0.182
Passenger evaluate for ABS based on support tools for special need people	2.08	2.14	-0.06	-0.33	0.744
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	2.24	2.47	-0.23	-1.28	0.202
Overall passenger evaluate for processing time in all steps	3.27	2.92	0.35	1.90	0.059
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	3.82	3.73	0.10	0.98	0.331
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	3.41	3.71	-0.30	-2.23	0.028
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	2.02	1.97	0.05	0.32	0.753
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	3.56	3.59	-0.04	-0.31	0.759
Overall passenger evaluate for HT facilities based on information visibility/signs	3.50	3.54	-0.04	-0.30	0.761
Overall passenger evaluate for HT facilities based on help and contacts Information service	3.31	3.44	-0.13	-0.96	0.336
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.81	3.83	-0.02	-0.18	0.858
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.83	3.85	-0.02	-0.18	0.856
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.47	3.51	-0.04	-0.26	0.796
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	3.94	3.90	0.04	0.46	0.646
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	3.75	3.73	0.02	0.18	0.861
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.98	1.65	0.33	1.97	0.053

Table C-18 Average evaluates of processes and system overall among age groups in HT at Jeddah airport

		Sum of Squares	df	Mean Square	F	Sig.
Passenger evaluate for HI based on waiting time	Between Groups	1.228	4	.307	.216	.929
	Within Groups	352.376	248	1.421		
	Total	353.605	252			
Passenger evaluate for HI staff based on Efficiency of inspection time	Between Groups	2.189	4	.547	.554	.697
	Within Groups	245.139	248	.988		
	Total	247.328	252			
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Between Groups	3.707	4	.927	1.033	.391
	Within Groups	222.451	248	.897		
	Total	226.158	252			
Passenger evaluate for HI staff based on Knowledge /expertise	Between Groups	3.414	4	.853	.823	.512
	Within Groups	257.219	248	1.037		
	Total	260.632	252			
Passenger evaluate for PC Inspection based on waiting time	Between Groups	5.477	4	1.369	1.010	.403
	Within Groups	402.659	297	1.356		
	Total	408.136	301			
Passenger evaluate for PC Inspection based on processing time	Between Groups	5.033	4	1.258	1.000	.408
	Within Groups	373.854	297	1.259		

	Total	378.887	301			
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Between Groups	4.840	4	1.210	1.258	.286
	Within Groups	285.600	297	.962		
	Total	290.440	301			
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Between Groups	6.687	4	1.672	1.680	.154
	Within Groups	295.472	297	.995		
	Total	302.159	301			
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	Between Groups	10.592	4	2.648	2.207	.068
	Within Groups	356.391	297	1.200		
	Total	366.983	301			
Passenger evaluate for BC based on waiting time to collect the baggage	Between Groups	13.790	4	3.448	2.139	.076
	Within Groups	478.584	297	1.611		
	Total	492.374	301			
Passenger evaluate for BC based on comfortable space around carousels	Between Groups	10.714	4	2.679	1.565	.183
	Within Groups	508.203	297	1.711		
	Total	518.917	301			
Passenger evaluate for BC based on the helpfulness of support staff	Between Groups	8.866	4	2.217	1.891	.112
	Within Groups	310.600	265	1.172		
	Total	319.467	269			
Passenger evaluate for BC based on the	Between Groups	1.275	4	.319	.301	.877
	Within Groups	314.623	297	1.059		

availability of baggage carts/trolley	Total	315.897	301			
Passenger evaluate for Customs inspection based on waiting time	Between Groups	5.299	4	1.325	1.138	.339
	Within Groups	345.724	297	1.164		
	Total	351.023	301			
Passenger evaluate for Customs inspection based on processing time	Between Groups	1.765	4	.441	.360	.837
	Within Groups	364.394	297	1.227		
	Total	366.159	301			
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Between Groups	.492	4	.123	.094	.984
	Within Groups	388.726	297	1.309		
	Total	389.219	301			
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Between Groups	3.252	4	.813	.640	.634
	Within Groups	377.291	297	1.270		
	Total	380.543	301			
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Between Groups	5.593	4	1.398	1.145	.336
	Within Groups	362.764	297	1.221		
	Total	368.358	301			
Passenger evaluate for UA registration based on waiting time	Between Groups	9.940	4	2.485	1.334	.257
	Within Groups	553.080	297	1.862		
	Total	563.020	301			
Passenger evaluate for UA registration based on processing time	Between Groups	7.215	4	1.804	1.064	.375
	Within Groups	503.662	297	1.696		

	Total	510.877	301			
Passenger evaluate for UA registration staff based on Efficiency of registration time	Between Groups	8.554	4	2.138	1.227	.299
	Within Groups	517.526	297	1.743		
	Total	526.079	301			
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Between Groups	10.231	4	2.558	2.725	.030
	Within Groups	278.739	297	.939		
	Total	288.970	301			
Passenger evaluate for UA registration staff based on Knowledge /expertise	Between Groups	12.707	4	3.177	2.202	.069
	Within Groups	428.528	297	1.443		
	Total	441.235	301			
Passenger evaluate for ASB based on duration time of this process	Between Groups	4.842	4	1.210	.758	.553
	Within Groups	474.168	297	1.597		
	Total	479.010	301			
Passenger evaluate for ABS staff based on Efficiency of duration time	Between Groups	9.290	4	2.323	1.533	.193
	Within Groups	450.077	297	1.515		
	Total	459.368	301			
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Between Groups	11.136	4	2.784	1.981	.097
	Within Groups	417.331	297	1.405		
	Total	428.467	301			
Passenger evaluate for ABS staff based on Knowledge /expertise	Between Groups	11.313	4	2.828	1.936	.104
	Within Groups	433.922	297	1.461		

	Total	445.235	301			
Passenger evaluate for ABS based on Justice (first in, first out rule)	Between Groups	.406	4	.102	.114	.977
	Within Groups	263.531	297	.887		
	Total	263.937	301			
Passenger evaluate for ABS based on support tools for special need people	Between Groups	5.670	4	1.418	.881	.476
	Within Groups	366.871	228	1.609		
	Total	372.541	232			
Overall passenger evaluate for waiting time in all steps	Between Groups	2.032	4	.508	.979	.419
	Within Groups	154.078	297	.519		
	Total	156.109	301			
Overall passenger evaluate for processing time in all steps	Between Groups	5.557	4	1.389	1.346	.253
	Within Groups	306.629	297	1.032		
	Total	312.185	301			
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	Between Groups	4.678	4	1.169	2.168	.073
	Within Groups	159.695	296	.540		
	Total	164.372	300			
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Between Groups	1.288	4	.322	.615	.653
	Within Groups	84.832	162	.524		
	Total	86.120	166			
Overall passenger evaluate for HT facilities based on special needs	Between Groups	2.577	4	.644	1.449	.220
	Within Groups	84.047	189	.445		

and disabilities support service	Total	86.624	193			
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Between Groups	2.512	4	.628	1.180	.320
	Within Groups	158.034	297	.532		
	Total	160.546	301			
Overall passenger evaluate for HT facilities based on information visibility/signs	Between Groups	4.581	4	1.145	1.998	.095
	Within Groups	170.253	297	.573		
	Total	174.834	301			
Overall passenger evaluate for HT facilities based on help and contacts Information service	Between Groups	1.910	4	.477	.928	.448
	Within Groups	150.801	293	.515		
	Total	152.711	297			
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Between Groups	1.475	4	.369	.684	.603
	Within Groups	159.999	297	.539		
	Total	161.474	301			
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	Between Groups	.848	4	.212	.473	.756
	Within Groups	133.086	297	.448		
	Total	133.934	301			
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Between Groups	1.124	4	.281	.463	.763
	Within Groups	180.280	297	.607		
	Total	181.404	301			
Overall passenger evaluate for HT facilities based on cleanliness of	Between Groups	3.408	4	.852	1.442	.220
	Within Groups	175.480	297	.591		

arrival domain at Hajj terminals	Total	178.887	301			
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Between Groups	4.925	4	1.231	1.731	.143
	Within Groups	211.274	297	.711		
	Total	216.199	301			
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Between Groups	1.253	4	.313	1.572	.185
	Within Groups	28.497	143	.199		
	Total	29.750	147			

Table C-19 Average evaluates of processes and system overall among age groups in HT at Medina Airport

		Sum of Squares	df	Mean Square	F	Sig.
Passenger evaluate for HI based on waiting time	Between Groups	4.988	3	1.663	1.296	.278
	Within Groups	196.337	153	1.283		
	Total	201.325	156			
Passenger evaluate for HI Inspection staff based on Efficiency of inspection time	Between Groups	2.343	3	.781	.670	.571
	Within Groups	178.230	153	1.165		
	Total	180.573	156			
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Between Groups	1.247	3	.416	.680	.566
	Within Groups	92.302	151	.611		
	Total	93.548	154			

Passenger evaluate for HI staff based on Knowledge /expertise	Between Groups	3.989	3	1.330	2.136	.098
	Within Groups	94.011	151	.623		
	Total	98.000	154			
Passenger evaluate for PC Inspection based on waiting time	Between Groups	1.947	3	.649	.533	.660
	Within Groups	227.571	187	1.217		
	Total	229.518	190			
Passenger evaluate for PC Inspection based on processing time	Between Groups	.390	3	.130	.197	.898
	Within Groups	123.327	187	.660		
	Total	123.717	190			
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Between Groups	6.650	3	2.217	1.740	.160
	Within Groups	238.282	187	1.274		
	Total	244.932	190			
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Between Groups	3.668	3	1.223	.934	.425
	Within Groups	244.657	187	1.308		
	Total	248.325	190			
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	Between Groups	6.799	3	2.266	1.716	.165
	Within Groups	246.960	187	1.321		
	Total	253.759	190			
Passenger evaluate for BC based on waiting time to collect the baggage	Between Groups	2.052	3	.684	.495	.686
	Within Groups	258.377	187	1.382		
	Total	260.429	190			

Passenger evaluate for BC based on comfortable space around carousels	Between Groups	1.886	3	.629	.486	.693
	Within Groups	242.062	187	1.294		
	Total	243.948	190			
Passenger evaluate for BC based on the helpfulness of support staff	Between Groups	.283	3	.094	.065	.979
	Within Groups	273.214	187	1.461		
	Total	273.497	190			
Passenger evaluate for BC based on the availability of baggage carts/trolley	Between Groups	4.088	3	1.363	.892	.446
	Within Groups	285.702	187	1.528		
	Total	289.791	190			
Passenger evaluate for Customs inspection based on waiting time	Between Groups	7.871	3	2.624	1.965	.121
	Within Groups	249.710	187	1.335		
	Total	257.581	190			
Passenger evaluate for Customs inspection based on processing time	Between Groups	3.665	3	1.222	2.236	.085
	Within Groups	102.157	187	.546		
	Total	105.822	190			
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Between Groups	8.536	3	2.845	2.868	.038
	Within Groups	185.538	187	.992		
	Total	194.073	190			
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Between Groups	4.500	3	1.500	2.185	.091
	Within Groups	128.369	187	.686		
	Total	132.869	190			

Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Between Groups	8.283	3	2.761	2.295	.079
	Within Groups	224.994	187	1.203		
	Total	233.277	190			
Passenger evaluate for UA registration based on waiting time	Between Groups	2.811	3	.937	.710	.547
	Within Groups	246.770	187	1.320		
	Total	249.581	190			
Passenger evaluate for UA registration based on processing time	Between Groups	1.419	3	.473	.294	.829
	Within Groups	300.550	187	1.607		
	Total	301.969	190			
Passenger evaluate for UA registration staff based on Efficiency of registration time	Between Groups	5.904	3	1.968	1.546	.204
	Within Groups	237.960	187	1.273		
	Total	243.864	190			
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Between Groups	1.269	3	.423	.548	.650
	Within Groups	144.375	187	.772		
	Total	145.644	190			
Passenger evaluate for UA registration staff based on Knowledge /expertise	Between Groups	4.315	3	1.438	1.390	.247
	Within Groups	193.518	187	1.035		
	Total	197.832	190			
Passenger evaluate for ASB based on duration time of this process	Between Groups	2.148	3	.716	.473	.702
	Within Groups	283.234	187	1.515		
	Total	285.382	190			

Passenger evaluate for ABS staff based on Efficiency of duration time	Between Groups	3.864	3	1.288	1.657	.178
	Within Groups	145.329	187	.777		
	Total	149.194	190			
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Between Groups	5.311	3	1.770	3.239	.023
	Within Groups	101.663	186	.547		
	Total	106.974	189			
Passenger evaluate for ABS staff based on Knowledge /expertise	Between Groups	5.830	3	1.943	2.347	.074
	Within Groups	153.986	186	.828		
	Total	159.816	189			
Passenger evaluate for ABS staff based on Justice (first in, first out rule)	Between Groups	1.151	3	.384	.761	.517
	Within Groups	93.691	186	.504		
	Total	94.842	189			
Passenger evaluate for ABS staff based on Support tools for special need people	Between Groups	2.858	3	.953	1.100	.352
	Within Groups	110.861	128	.866		
	Total	113.720	131			
Overall passenger evaluate for waiting time in all steps	Between Groups	2.049	3	.683	.505	.680
	Within Groups	253.103	187	1.353		
	Total	255.152	190			
Overall passenger evaluate for processing time in all steps	Between Groups	5.649	3	1.883	1.346	.261
	Within Groups	261.639	187	1.399		
	Total	267.288	190			

Overall passenger evaluate for Hajj Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)	Between Groups	1.166	3	.389	1.208	.308
	Within Groups	59.829	186	.322		
	Total	60.995	189			
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Between Groups	2.475	3	.825	2.128	.102
	Within Groups	35.273	91	.388		
	Total	37.747	94			
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	Between Groups	1.832	3	.611	.896	.446
	Within Groups	81.159	119	.682		
	Total	82.992	122			
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Between Groups	6.474	3	2.158	4.090	.008
	Within Groups	98.137	186	.528		
	Total	104.611	189			
Overall passenger evaluate for HT facilities based on information visibility/signs	Between Groups	12.613	3	4.204	5.778	.001
	Within Groups	134.604	185	.728		
	Total	147.217	188			
Overall passenger evaluate for HT facilities based on help and contacts Information service	Between Groups	4.478	3	1.493	2.130	.098
	Within Groups	128.228	183	.701		
	Total	132.706	186			
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Between Groups	7.660	3	2.553	4.707	.003
	Within Groups	100.893	186	.542		
	Total	108.553	189			

Overall passenger evaluate for HT facilities based on walking distance inside the terminal	Between Groups	7.121	3	2.374	7.732	.000
	Within Groups	56.794	185	.307		
	Total	63.915	188			
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Between Groups	1.625	3	.542	.721	.541
	Within Groups	139.827	186	.752		
	Total	141.453	189			
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	Between Groups	2.474	3	.825	2.907	.036
	Within Groups	52.489	185	.284		
	Total	54.963	188			
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Between Groups	5.345	3	1.782	3.809	.011
	Within Groups	87.018	186	.468		
	Total	92.363	189			
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Between Groups	.083	2	.042	.092	.912
	Within Groups	29.743	66	.451		
	Total	29.826	68			

Table C-20 Multiple Comparisons

Dependent Variable	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Passenger evaluate for HI based on waiting time	18-29 years old	30-49 years old	-.331	.463	.891	-1.53	.87
		50-64 years old	.058	.448	.999	-1.11	1.22
		65 years or older	-.266	.467	.941	-1.48	.95
	30-49 years old	18-29 years old	.331	.463	.891	-.87	1.53
		50-64 years old	.389	.222	.300	-.19	.96
		65 years or older	.065	.257	.994	-.60	.73
	50-64 years old	18-29 years old	-.058	.448	.999	-1.22	1.11
		30-49 years old	-.389	.222	.300	-.96	.19
		65 years or older	-.324	.229	.493	-.92	.27
	65 years or older	18-29 years old	.266	.467	.941	-.95	1.48
		30-49 years old	-.065	.257	.994	-.73	.60
		50-64 years old	.324	.229	.493	-.27	.92
Passenger evaluate for HI	18-29 years old	30-49 years old	-.132	.441	.991	-1.28	1.01

Inspection staff based on Efficiency of inspection time		50-64 years old	.165	.427	.980	-.95	1.27
		65 years or older	.077	.445	.998	-1.08	1.23
	30-49 years old	18-29 years old	.132	.441	.991	-1.01	1.28
		50-64 years old	.297	.211	.497	-.25	.85
		65 years or older	.210	.245	.827	-.43	.85
	50-64 years old	18-29 years old	-.165	.427	.980	-1.27	.95
		30-49 years old	-.297	.211	.497	-.85	.25
		65 years or older	-.087	.218	.978	-.65	.48
	65 years or older	18-29 years old	-.077	.445	.998	-1.23	1.08
		30-49 years old	-.210	.245	.827	-.85	.43
		50-64 years old	.087	.218	.978	-.48	.65
Passenger evaluate for HI staff based on Courtesy/ helpfulness	18-29 years old	30-49 years old	.045	.320	.999	-.79	.88
		50-64 years old	-.029	.310	1.000	-.83	.78
		65 years or older	.197	.322	.928	-.64	1.03
	30-49 years old	18-29 years old	-.045	.320	.999	-.88	.79

		50-64 years old	-.074	.154	.963	-.47	.33
		65 years or older	.152	.177	.828	-.31	.61
	50-64 years old	18-29 years old	.029	.310	1.000	-.78	.83
		30-49 years old	.074	.154	.963	-.33	.47
		65 years or older	.225	.159	.490	-.19	.64
	65 years or older	18-29 years old	-.197	.322	.928	-1.03	.64
		30-49 years old	-.152	.177	.828	-.61	.31
		50-64 years old	-.225	.159	.490	-.64	.19
Passenger evaluate for HI staff based on Knowledge /expertise	18-29 years old	30-49 years old	.429	.323	.547	-.41	1.27
		50-64 years old	.343	.313	.692	-.47	1.16
		65 years or older	.672	.325	.169	-.17	1.52
	30-49 years old	18-29 years old	-.429	.323	.547	-1.27	.41
		50-64 years old	-.086	.155	.946	-.49	.32
		65 years or older	.243	.179	.527	-.22	.71
	50-64 years old	18-29 years old	-.343	.313	.692	-1.16	.47

		30-49 years old	.086	.155	.946	-.32	.49
		65 years or older	.329	.160	.174	-.09	.75
	65 years or older	18-29 years old	-.672	.325	.169	-1.52	.17
		30-49 years old	-.243	.179	.527	-.71	.22
		50-64 years old	-.329	.160	.174	-.75	.09
Passenger evaluate for PC Inspection based on waiting time	18-29 years old	30-49 years old	.274	.396	.900	-.75	1.30
		50-64 years old	.429	.387	.685	-.57	1.43
		65 years or older	.357	.405	.815	-.69	1.41
	30-49 years old	18-29 years old	-.274	.396	.900	-1.30	.75
		50-64 years old	.155	.190	.848	-.34	.65
		65 years or older	.083	.225	.983	-.50	.67
	50-64 years old	18-29 years old	-.429	.387	.685	-1.43	.57
		30-49 years old	-.155	.190	.848	-.65	.34
		65 years or older	-.071	.208	.986	-.61	.47
	65 years or older	18-29 years old	-.357	.405	.815	-1.41	.69

		30-49 years old	-.083	.225	.983	-.67	.50
		50-64 years old	.071	.208	.986	-.47	.61
Passenger evaluate for PC Inspection based on processing time	18-29 years old	30-49 years old	-.220	.292	.874	-.98	.54
		50-64 years old	-.179	.285	.923	-.92	.56
		65 years or older	-.167	.298	.944	-.94	.61
	30-49 years old	18-29 years old	.220	.292	.874	-.54	.98
		50-64 years old	.042	.140	.991	-.32	.40
		65 years or older	.054	.166	.988	-.38	.48
	50-64 years old	18-29 years old	.179	.285	.923	-.56	.92
		30-49 years old	-.042	.140	.991	-.40	.32
		65 years or older	.012	.153	1.000	-.39	.41
	65 years or older	18-29 years old	.167	.298	.944	-.61	.94
		30-49 years old	-.054	.166	.988	-.48	.38
		50-64 years old	-.012	.153	1.000	-.41	.39
Passenger evaluate for PC	18-29 years old	30-49 years old	-.270	.405	.910	-1.32	.78

Inspection staff based on Efficiency of inspection time		50-64 years old	.075	.396	.998	-.95	1.10
		65 years or older	-.341	.415	.843	-1.42	.73
	30-49 years old	18-29 years old	.270	.405	.910	-.78	1.32
		50-64 years old	.345	.195	.290	-.16	.85
		65 years or older	-.071	.230	.990	-.67	.53
	50-64 years old	18-29 years old	-.075	.396	.998	-1.10	.95
		30-49 years old	-.345	.195	.290	-.85	.16
		65 years or older	-.417	.213	.210	-.97	.14
	65 years or older	18-29 years old	.341	.415	.843	-.73	1.42
		30-49 years old	.071	.230	.990	-.53	.67
		50-64 years old	.417	.213	.210	-.14	.97
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	18-29 years old	30-49 years old	-.323	.411	.860	-1.39	.74
		50-64 years old	-.008	.401	1.000	-1.05	1.03
		65 years or older	-.198	.420	.965	-1.29	.89
	30-49 years old	18-29 years old	.323	.411	.860	-.74	1.39

		50-64 years old	.315	.197	.382	-.20	.83
		65 years or older	.125	.233	.950	-.48	.73
	50-64 years old	18-29 years old	.008	.401	1.000	-1.03	1.05
		30-49 years old	-.315	.197	.382	-.83	.20
		65 years or older	-.190	.216	.815	-.75	.37
	65 years or older	18-29 years old	.198	.420	.965	-.89	1.29
		30-49 years old	-.125	.233	.950	-.73	.48
		50-64 years old	.190	.216	.815	-.37	.75
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	18-29 years old	30-49 years old	-.341	.413	.842	-1.41	.73
		50-64 years old	.040	.403	1.000	-1.01	1.08
		65 years or older	-.341	.422	.850	-1.44	.75
	30-49 years old	18-29 years old	.341	.413	.842	-.73	1.41
		50-64 years old	.381	.198	.223	-.13	.89
		65 years or older	.000	.235	1.000	-.61	.61
	50-64 years old	18-29 years old	-.040	.403	1.000	-1.08	1.01

		30-49 years old	-.381	.198	.223	-.89	.13
		65 years or older	-.381	.217	.299	-.94	.18
	65 years or older	18-29 years old	.341	.422	.850	-.75	1.44
		30-49 years old	.000	.235	1.000	-.61	.61
		50-64 years old	.381	.217	.299	-.18	.94
Passenger evaluate for BC based on waiting time to collect the baggage	18-29 years old	30-49 years old	.032	.422	1.000	-1.06	1.13
		50-64 years old	.258	.412	.924	-.81	1.33
		65 years or older	.103	.432	.995	-1.02	1.22
	30-49 years old	18-29 years old	-.032	.422	1.000	-1.13	1.06
		50-64 years old	.226	.203	.680	-.30	.75
		65 years or older	.071	.240	.991	-.55	.69
	50-64 years old	18-29 years old	-.258	.412	.924	-1.33	.81
		30-49 years old	-.226	.203	.680	-.75	.30
		65 years or older	-.155	.222	.898	-.73	.42
	65 years or older	18-29 years old	-.103	.432	.995	-1.22	1.02

		30-49 years old	-.071	.240	.991	-.69	.55
		50-64 years old	.155	.222	.898	-.42	.73
Passenger evaluate for BC based on comfortable space around carousels	18-29 years old	30-49 years old	.014	.409	1.000	-1.05	1.07
		50-64 years old	.175	.399	.972	-.86	1.21
		65 years or older	-.063	.418	.999	-1.15	1.02
	30-49 years old	18-29 years old	-.014	.409	1.000	-1.07	1.05
		50-64 years old	.161	.196	.846	-.35	.67
		65 years or older	-.077	.232	.987	-.68	.52
	50-64 years old	18-29 years old	-.175	.399	.972	-1.21	.86
		30-49 years old	-.161	.196	.846	-.67	.35
		65 years or older	-.238	.215	.685	-.80	.32
	65 years or older	18-29 years old	.063	.418	.999	-1.02	1.15
		30-49 years old	.077	.232	.987	-.52	.68
		50-64 years old	.238	.215	.685	-.32	.80
Passenger evaluate for BC	18-29 years old	30-49 years old	.060	.434	.999	-1.07	1.18

based on the helpfulness of support staff		50-64 years old	-.024	.424	1.000	-1.12	1.08
		65 years or older	.048	.444	1.000	-1.10	1.20
	30-49 years old	18-29 years old	-.060	.434	.999	-1.18	1.07
		50-64 years old	-.083	.209	.978	-.62	.46
		65 years or older	-.012	.247	1.000	-.65	.63
	50-64 years old	18-29 years old	.024	.424	1.000	-1.08	1.12
		30-49 years old	.083	.209	.978	-.46	.62
		65 years or older	.071	.228	.989	-.52	.66
	65 years or older	18-29 years old	-.048	.444	1.000	-1.20	1.10
		30-49 years old	.012	.247	1.000	-.63	.65
		50-64 years old	-.071	.228	.989	-.66	.52
Passenger evaluate for BC based on the availability of baggage carts/trolley	18-29 years old	30-49 years old	.131	.444	.991	-1.02	1.28
		50-64 years old	.393	.434	.802	-.73	1.52
		65 years or older	.452	.454	.752	-.72	1.63
	30-49 years old	18-29 years old	-.131	.444	.991	-1.28	1.02

		50-64 years old	.262	.213	.610	-.29	.81
		65 years or older	.321	.252	.581	-.33	.98
	50-64 years old	18-29 years old	-.393	.434	.802	-1.52	.73
		30-49 years old	-.262	.213	.610	-.81	.29
		65 years or older	.060	.234	.994	-.55	.67
	65 years or older	18-29 years old	-.452	.454	.752	-1.63	.72
		30-49 years old	-.321	.252	.581	-.98	.33
		50-64 years old	-.060	.234	.994	-.67	.55
Passenger evaluate for Customs inspection based on waiting time	18-29 years old	30-49 years old	.147	.415	.985	-.93	1.22
		50-64 years old	.528	.405	.563	-.52	1.58
		65 years or older	.587	.424	.511	-.51	1.69
	30-49 years old	18-29 years old	-.147	.415	.985	-1.22	.93
		50-64 years old	.381	.199	.227	-.14	.90
		65 years or older	.440	.236	.246	-.17	1.05
	50-64 years old	18-29 years old	-.528	.405	.563	-1.58	.52

		30-49 years old	-.381	.199	.227	-.90	.14
		65 years or older	.060	.218	.993	-.51	.63
	65 years or older	18-29 years old	-.587	.424	.511	-1.69	.51
		30-49 years old	-.440	.236	.246	-1.05	.17
		50-64 years old	-.060	.218	.993	-.63	.51
Passenger evaluate for Customs inspection based on processing time	18-29 years old	30-49 years old	.284	.265	.709	-.40	.97
		50-64 years old	.349	.259	.534	-.32	1.02
		65 years or older	.587	.271	.137	-.12	1.29
	30-49 years old	18-29 years old	-.284	.265	.709	-.97	.40
		50-64 years old	.065	.128	.956	-.27	.40
		65 years or older	.304	.151	.187	-.09	.69
	50-64 years old	18-29 years old	-.349	.259	.534	-1.02	.32
		30-49 years old	-.065	.128	.956	-.40	.27
		65 years or older	.238	.140	.324	-.12	.60
	65 years or older	18-29 years old	-.587	.271	.137	-1.29	.12

		30-49 years old	-.304	.151	.187	-.69	.09
		50-64 years old	-.238	.140	.324	-.60	.12
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	18-29 years old	30-49 years old	-.097	.358	.993	-1.02	.83
		50-64 years old	.135	.349	.980	-.77	1.04
		65 years or older	.492	.366	.536	-.46	1.44
	30-49 years old	18-29 years old	.097	.358	.993	-.83	1.02
		50-64 years old	.232	.172	.532	-.21	.68
		65 years or older	.589*	.203	.022	.06	1.12
	50-64 years old	18-29 years old	-.135	.349	.980	-1.04	.77
		30-49 years old	-.232	.172	.532	-.68	.21
		65 years or older	.357	.188	.233	-.13	.85
	65 years or older	18-29 years old	-.492	.366	.536	-1.44	.46
		30-49 years old	-.589*	.203	.022	-1.12	-.06
		50-64 years old	-.357	.188	.233	-.85	.13
Passenger evaluate for	18-29 years old	30-49 years old	.226	.298	.872	-.55	1.00

Customs inspection staff based on Courtesy/ helpfulness		50-64 years old	.369	.291	.583	-.38	1.12
		65 years or older	.595	.304	.209	-.19	1.38
	30-49 years old	18-29 years old	-.226	.298	.872	-1.00	.55
		50-64 years old	.143	.143	.750	-.23	.51
		65 years or older	.369	.169	.132	-.07	.81
	50-64 years old	18-29 years old	-.369	.291	.583	-1.12	.38
		30-49 years old	-.143	.143	.750	-.51	.23
		65 years or older	.226	.157	.473	-.18	.63
	65 years or older	18-29 years old	-.595	.304	.209	-1.38	.19
		30-49 years old	-.369	.169	.132	-.81	.07
		50-64 years old	-.226	.157	.473	-.63	.18
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	18-29 years old	30-49 years old	.708	.394	.277	-.31	1.73
		50-64 years old	.798	.385	.166	-.20	1.79
		65 years or older	1.024	.403	.057	-.02	2.07
	30-49 years old	18-29 years old	-.708	.394	.277	-1.73	.31

		50-64 years old	.089	.189	.965	-.40	.58
		65 years or older	.315	.224	.495	-.26	.90
	50-64 years old	18-29 years old	-.798	.385	.166	-1.79	.20
		30-49 years old	-.089	.189	.965	-.58	.40
		65 years or older	.226	.207	.695	-.31	.76
	65 years or older	18-29 years old	-1.024	.403	.057	-2.07	.02
		30-49 years old	-.315	.224	.495	-.90	.26
		50-64 years old	-.226	.207	.695	-.76	.31
Passenger evaluate for UA registration based on waiting time	18-29 years old	30-49 years old	-.337	.413	.846	-1.41	.73
		50-64 years old	-.087	.403	.996	-1.13	.96
		65 years or older	-.063	.422	.999	-1.16	1.03
	30-49 years old	18-29 years old	.337	.413	.846	-.73	1.41
		50-64 years old	.250	.198	.589	-.26	.76
		65 years or older	.274	.234	.648	-.33	.88
	50-64 years old	18-29 years old	.087	.403	.996	-.96	1.13

		30-49 years old	-.250	.198	.589	-.76	.26
		65 years or older	.024	.217	1.000	-.54	.59
	65 years or older	18-29 years old	.063	.422	.999	-1.03	1.16
		30-49 years old	-.274	.234	.648	-.88	.33
		50-64 years old	-.024	.217	1.000	-.59	.54
Passenger evaluate for UA registration based on processing time	18-29 years old	30-49 years old	-.169	.455	.983	-1.35	1.01
		50-64 years old	.028	.445	1.000	-1.12	1.18
		65 years or older	-.103	.466	.996	-1.31	1.10
	30-49 years old	18-29 years old	.169	.455	.983	-1.01	1.35
		50-64 years old	.196	.219	.806	-.37	.76
		65 years or older	.065	.259	.994	-.61	.74
	50-64 years old	18-29 years old	-.028	.445	1.000	-1.18	1.12
		30-49 years old	-.196	.219	.806	-.76	.37
		65 years or older	-.131	.240	.947	-.75	.49
	65 years or older	18-29 years old	.103	.466	.996	-1.10	1.31

		30-49 years old	-.065	.259	.994	-.74	.61
		50-64 years old	.131	.240	.947	-.49	.75
Passenger evaluate for UA registration staff based on Efficiency of registration time	18-29 years old	30-49 years old	.623	.405	.417	-.43	1.67
		50-64 years old	.683	.396	.314	-.34	1.71
		65 years or older	.873	.414	.155	-.20	1.95
	30-49 years old	18-29 years old	-.623	.405	.417	-1.67	.43
		50-64 years old	.060	.195	.990	-.44	.56
		65 years or older	.250	.230	.699	-.35	.85
	50-64 years old	18-29 years old	-.683	.396	.314	-1.71	.34
		30-49 years old	-.060	.195	.990	-.56	.44
		65 years or older	.190	.213	.808	-.36	.74
	65 years or older	18-29 years old	-.873	.414	.155	-1.95	.20
		30-49 years old	-.250	.230	.699	-.85	.35
		50-64 years old	-.190	.213	.808	-.74	.36
Passenger evaluate for UA	18-29 years old	30-49 years old	.113	.316	.984	-.70	.93

registration staff based on Courtesy/ helpfulness		50-64 years old	.274	.308	.811	-.53	1.07
		65 years or older	.167	.323	.955	-.67	1.00
	30-49 years old	18-29 years old	-.113	.316	.984	-.93	.70
		50-64 years old	.161	.152	.714	-.23	.55
		65 years or older	.054	.179	.991	-.41	.52
	50-64 years old	18-29 years old	-.274	.308	.811	-1.07	.53
		30-49 years old	-.161	.152	.714	-.55	.23
		65 years or older	-.107	.166	.917	-.54	.32
	65 years or older	18-29 years old	-.167	.323	.955	-1.00	.67
		30-49 years old	-.054	.179	.991	-.52	.41
		50-64 years old	.107	.166	.917	-.32	.54
Passenger evaluate for UA registration staff based on Knowledge /expertise	18-29 years old	30-49 years old	.399	.365	.695	-.55	1.35
		50-64 years old	.464	.357	.563	-.46	1.39
		65 years or older	.690	.374	.254	-.28	1.66
	30-49 years old	18-29 years old	-.399	.365	.695	-1.35	.55

		50-64 years old	.065	.175	.982	-.39	.52
		65 years or older	.292	.208	.498	-.25	.83
	50-64 years old	18-29 years old	-.464	.357	.563	-1.39	.46
		30-49 years old	-.065	.175	.982	-.52	.39
		65 years or older	.226	.192	.642	-.27	.72
	65 years or older	18-29 years old	-.690	.374	.254	-1.66	.28
		30-49 years old	-.292	.208	.498	-.83	.25
		50-64 years old	-.226	.192	.642	-.72	.27
Passenger evaluate for ASB based on duration time of this process	18-29 years old	30-49 years old	-.198	.442	.970	-1.34	.95
		50-64 years old	-.306	.432	.894	-1.42	.81
		65 years or older	-.437	.452	.769	-1.61	.74
	30-49 years old	18-29 years old	.198	.442	.970	-.95	1.34
		50-64 years old	-.107	.212	.958	-.66	.44
		65 years or older	-.238	.251	.779	-.89	.41
	50-64 years old	18-29 years old	.306	.432	.894	-.81	1.42

		30-49 years old	.107	.212	.958	-.44	.66
		65 years or older	-.131	.233	.943	-.73	.47
	65 years or older	18-29 years old	.437	.452	.769	-.74	1.61
		30-49 years old	.238	.251	.779	-.41	.89
		50-64 years old	.131	.233	.943	-.47	.73
Passenger evaluate for ABS staff based on Efficiency of duration time	18-29 years old	30-49 years old	.456	.317	.475	-.36	1.28
		50-64 years old	.361	.309	.648	-.44	1.16
		65 years or older	.635	.324	.207	-.20	1.47
	30-49 years old	18-29 years old	-.456	.317	.475	-1.28	.36
		50-64 years old	-.095	.152	.924	-.49	.30
		65 years or older	.179	.180	.754	-.29	.65
	50-64 years old	18-29 years old	-.361	.309	.648	-1.16	.44
		30-49 years old	.095	.152	.924	-.30	.49
		65 years or older	.274	.167	.357	-.16	.71
	65 years or older	18-29 years old	-.635	.324	.207	-1.47	.20

		30-49 years old	-.179	.180	.754	-.65	.29
		50-64 years old	-.274	.167	.357	-.71	.16
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	18-29 years old	30-49 years old	.381	.266	.479	-.31	1.07
		50-64 years old	.052	.259	.997	-.62	.72
		65 years or older	.381	.272	.499	-.32	1.08
	30-49 years old	18-29 years old	-.381	.266	.479	-1.07	.31
		50-64 years old	-.329	.128	.053	-.66	.00
		65 years or older	.000	.151	1.000	-.39	.39
	50-64 years old	18-29 years old	-.052	.259	.997	-.72	.62
		30-49 years old	.329	.128	.053	.00	.66
		65 years or older	.329	.140	.091	-.03	.69
	65 years or older	18-29 years old	-.381	.272	.499	-1.08	.32
		30-49 years old	.000	.151	1.000	-.39	.39
		50-64 years old	-.329	.140	.091	-.69	.03
Passenger evaluate for ABS	18-29 years old	30-49 years old	.560	.327	.320	-.29	1.41

staff based on Knowledge /expertise		50-64 years old	.546	.319	.321	-.28	1.37
		65 years or older	.833	.334	.064	-.03	1.70
	30-49 years old	18-29 years old	-.560	.327	.320	-1.41	.29
		50-64 years old	-.013	.157	1.000	-.42	.39
		65 years or older	.274	.186	.455	-.21	.76
	50-64 years old	18-29 years old	-.546	.319	.321	-1.37	.28
		30-49 years old	.013	.157	1.000	-.39	.42
		65 years or older	.287	.172	.344	-.16	.73
	65 years or older	18-29 years old	-.833	.334	.064	-1.70	.03
		30-49 years old	-.274	.186	.455	-.76	.21
		50-64 years old	-.287	.172	.344	-.73	.16
Passenger evaluate for ABS staff based on Justice (first in, first out rule)	18-29 years old	30-49 years old	.228	.255	.807	-.43	.89
		50-64 years old	.082	.249	.988	-.56	.73
		65 years or older	.222	.261	.829	-.45	.90
	30-49 years old	18-29 years old	-.228	.255	.807	-.89	.43

		50-64 years old	-.147	.123	.632	-.46	.17
		65 years or older	-.006	.145	1.000	-.38	.37
	50-64 years old	18-29 years old	-.082	.249	.988	-.73	.56
		30-49 years old	.147	.123	.632	-.17	.46
		65 years or older	.141	.134	.723	-.21	.49
	65 years or older	18-29 years old	-.222	.261	.829	-.90	.45
		30-49 years old	.006	.145	1.000	-.37	.38
		50-64 years old	-.141	.134	.723	-.49	.21
Passenger evaluate for ABS staff based on Support tools for special need people	18-29 years old	30-49 years old	.450	.387	.651	-.56	1.46
		50-64 years old	.433	.372	.650	-.54	1.40
		65 years or older	.660	.386	.324	-.35	1.67
	30-49 years old	18-29 years old	-.450	.387	.651	-1.46	.56
		50-64 years old	-.017	.203	1.000	-.54	.51
		65 years or older	.209	.227	.794	-.38	.80
	50-64 years old	18-29 years old	-.433	.372	.650	-1.40	.54

		30-49 years old	.017	.203	1.000	-.51	.54
		65 years or older	.226	.201	.675	-.30	.75
	65 years or older	18-29 years old	-.660	.386	.324	-1.67	.35
		30-49 years old	-.209	.227	.794	-.80	.38
		50-64 years old	-.226	.201	.675	-.75	.30
Overall passenger evaluate for waiting time in all steps	18-29 years old	30-49 years old	-.242	.418	.938	-1.33	.84
		50-64 years old	-.063	.408	.999	-1.12	.99
		65 years or older	.032	.427	1.000	-1.08	1.14
	30-49 years old	18-29 years old	.242	.418	.938	-.84	1.33
		50-64 years old	.179	.201	.810	-.34	.70
		65 years or older	.274	.237	.657	-.34	.89
	50-64 years old	18-29 years old	.063	.408	.999	-.99	1.12
		30-49 years old	-.179	.201	.810	-.70	.34
		65 years or older	.095	.220	.973	-.47	.67
	65 years or older	18-29 years old	-.032	.427	1.000	-1.14	1.08

		30-49 years old	-.274	.237	.657	-.89	.34
		50-64 years old	-.095	.220	.973	-.67	.47
Overall passenger evaluate for processing time in all steps	18-29 years old	30-49 years old	.710	.425	.341	-.39	1.81
		50-64 years old	.829	.415	.192	-.25	1.90
		65 years or older	.722	.434	.347	-.40	1.85
	30-49 years old	18-29 years old	-.710	.425	.341	-1.81	.39
		50-64 years old	.119	.204	.937	-.41	.65
		65 years or older	.012	.241	1.000	-.61	.64
	50-64 years old	18-29 years old	-.829	.415	.192	-1.90	.25
		30-49 years old	-.119	.204	.937	-.65	.41
		65 years or older	-.107	.224	.964	-.69	.47
	65 years or older	18-29 years old	-.722	.434	.347	-1.85	.40
		30-49 years old	-.012	.241	1.000	-.64	.61
		50-64 years old	.107	.224	.964	-.47	.69
Overall passenger evaluate for Hajj	18-29 years old	30-49 years old	-.190	.204	.786	-.72	.34

Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)		50-64 years old	-.165	.199	.841	-.68	.35
		65 years or older	.000	.208	1.000	-.54	.54
	30-49 years old	18-29 years old	.190	.204	.786	-.34	.72
		50-64 years old	.026	.098	.994	-.23	.28
		65 years or older	.190	.116	.356	-.11	.49
	50-64 years old	18-29 years old	.165	.199	.841	-.35	.68
		30-49 years old	-.026	.098	.994	-.28	.23
		65 years or older	.165	.107	.420	-.11	.44
	65 years or older	18-29 years old	.000	.208	1.000	-.54	.54
		30-49 years old	-.190	.116	.356	-.49	.11
		50-64 years old	-.165	.107	.420	-.44	.11
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	18-29 years old	30-49 years old	-.667	.456	.465	-1.86	.53
		50-64 years old	-.545	.450	.621	-1.72	.63
		65 years or older	-.273	.460	.934	-1.48	.93
	30-49 years old	18-29 years old	.667	.456	.465	-.53	1.86

		50-64 years old	.121	.152	.856	-.28	.52
		65 years or older	.394	.179	.130	-.07	.86
	50-64 years old	18-29 years old	.545	.450	.621	-.63	1.72
		30-49 years old	-.121	.152	.856	-.52	.28
		65 years or older	.273	.163	.341	-.15	.70
	65 years or older	18-29 years old	.273	.460	.934	-.93	1.48
		30-49 years old	-.394	.179	.130	-.86	.07
		50-64 years old	-.273	.163	.341	-.70	.15
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	18-29 years old	30-49 years old	.147	.440	.987	-1.00	1.29
		50-64 years old	.198	.427	.967	-.91	1.31
		65 years or older	.438	.438	.750	-.70	1.58
	30-49 years old	18-29 years old	-.147	.440	.987	-1.29	1.00
		50-64 years old	.052	.188	.993	-.44	.54
		65 years or older	.291	.212	.518	-.26	.84
	50-64 years old	18-29 years old	-.198	.427	.967	-1.31	.91

		30-49 years old	-.052	.188	.993	-.54	.44
		65 years or older	.239	.182	.555	-.23	.71
	65 years or older	18-29 years old	-.438	.438	.750	-1.58	.70
		30-49 years old	-.291	.212	.518	-.84	.26
		50-64 years old	-.239	.182	.555	-.71	.23
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	18-29 years old	30-49 years old	.018	.275	1.000	-.69	.73
		50-64 years old	.143	.269	.951	-.55	.84
		65 years or older	.512	.280	.264	-.21	1.24
	30-49 years old	18-29 years old	-.018	.275	1.000	-.73	.69
		50-64 years old	.125	.125	.751	-.20	.45
		65 years or older	.494*	.148	.006	.11	.88
	50-64 years old	18-29 years old	-.143	.269	.951	-.84	.55
		30-49 years old	-.125	.125	.751	-.45	.20
		65 years or older	.369*	.137	.039	.01	.72
	65 years or older	18-29 years old	-.512	.280	.264	-1.24	.21

		30-49 years old	-.494*	.148	.006	-.88	-.11
		50-64 years old	-.369*	.137	.039	-.72	-.01
Overall passenger evaluate for HT facilities based on information visibility/signs	18-29 years old	30-49 years old	.020	.323	1.000	-.82	.86
		50-64 years old	.458	.316	.469	-.36	1.28
		65 years or older	.685	.329	.163	-.17	1.54
	30-49 years old	18-29 years old	-.020	.323	1.000	-.86	.82
		50-64 years old	.438*	.148	.018	.05	.82
		65 years or older	.664*	.175	.001	.21	1.12
	50-64 years old	18-29 years old	-.458	.316	.469	-1.28	.36
		30-49 years old	-.438*	.148	.018	-.82	-.05
		65 years or older	.226	.161	.499	-.19	.64
	65 years or older	18-29 years old	-.685	.329	.163	-1.54	.17
		30-49 years old	-.664*	.175	.001	-1.12	-.21
		50-64 years old	-.226	.161	.499	-.64	.19
Overall passenger evaluate for HT	18-29 years old	30-49 years old	-.152	.317	.963	-.97	.67

facilities based on help and contacts Information service		50-64 years old	.009	.310	1.000	-.79	.81
		65 years or older	.280	.323	.822	-.56	1.12
	30-49 years old	18-29 years old	.152	.317	.963	-.67	.97
		50-64 years old	.161	.146	.686	-.22	.54
		65 years or older	.432	.172	.060	-.01	.88
	50-64 years old	18-29 years old	-.009	.310	1.000	-.81	.79
		30-49 years old	-.161	.146	.686	-.54	.22
		65 years or older	.271	.159	.325	-.14	.68
	65 years or older	18-29 years old	-.280	.323	.822	-1.12	.56
		30-49 years old	-.432	.172	.060	-.88	.01
		50-64 years old	-.271	.159	.325	-.68	.14
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	18-29 years old	30-49 years old	.071	.278	.994	-.65	.79
		50-64 years old	.351	.273	.571	-.36	1.06
		65 years or older	.601	.284	.152	-.14	1.34
	30-49 years old	18-29 years old	-.071	.278	.994	-.79	.65

		50-64 years old	.280	.127	.127	-.05	.61
		65 years or older	.530*	.150	.003	.14	.92
	50-64 years old	18-29 years old	-.351	.273	.571	-1.06	.36
		30-49 years old	-.280	.127	.127	-.61	.05
		65 years or older	.250	.139	.278	-.11	.61
	65 years or older	18-29 years old	-.601	.284	.152	-1.34	.14
		30-49 years old	-.530*	.150	.003	-.92	-.14
		50-64 years old	-.250	.139	.278	-.61	.11
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	18-29 years old	30-49 years old	-.089	.209	.974	-.63	.45
		50-64 years old	.214	.205	.723	-.32	.75
		65 years or older	.439	.214	.174	-.12	.99
	30-49 years old	18-29 years old	.089	.209	.974	-.45	.63
		50-64 years old	.304*	.096	.009	.06	.55
		65 years or older	.528*	.114	.000	.23	.82
	50-64 years old	18-29 years old	-.214	.205	.723	-.75	.32

		30-49 years old	-.304*	.096	.009	-.55	-.06
		65 years or older	.225	.106	.148	-.05	.50
	65 years or older	18-29 years old	-.439	.214	.174	-.99	.12
		30-49 years old	-.528*	.114	.000	-.82	-.23
		50-64 years old	-.225	.106	.148	-.50	.05
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	18-29 years old	30-49 years old	-.232	.328	.894	-1.08	.62
		50-64 years old	-.101	.321	.989	-.93	.73
		65 years or older	.018	.334	1.000	-.85	.88
	30-49 years old	18-29 years old	.232	.328	.894	-.62	1.08
		50-64 years old	.131	.150	.818	-.26	.52
		65 years or older	.250	.177	.493	-.21	.71
	50-64 years old	18-29 years old	.101	.321	.989	-.73	.93
		30-49 years old	-.131	.150	.818	-.52	.26
		65 years or older	.119	.164	.886	-.31	.54
	65 years or older	18-29 years old	-.018	.334	1.000	-.88	.85

		30-49 years old	-.250	.177	.493	-.71	.21
		50-64 years old	-.119	.164	.886	-.54	.31
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	18-29 years old	30-49 years old	.089	.201	.971	-.43	.61
		50-64 years old	.197	.197	.749	-.31	.71
		65 years or older	.387	.205	.239	-.15	.92
	30-49 years old	18-29 years old	-.089	.201	.971	-.61	.43
		50-64 years old	.108	.092	.645	-.13	.35
		65 years or older	.298*	.109	.034	.02	.58
	50-64 years old	18-29 years old	-.197	.197	.749	-.71	.31
		30-49 years old	-.108	.092	.645	-.35	.13
		65 years or older	.190	.101	.240	-.07	.45
	65 years or older	18-29 years old	-.387	.205	.239	-.92	.15
		30-49 years old	-.298*	.109	.034	-.58	-.02
		50-64 years old	-.190	.101	.240	-.45	.07
Overall passenger evaluate for HT	18-29 years old	30-49 years old	.196	.259	.872	-.47	.87

facilities based on ambiance of arrival domain at Hajj terminals		50-64 years old	.435	.253	.318	-.22	1.09
		65 years or older	.601	.264	.107	-.08	1.29
	30-49 years old	18-29 years old	-.196	.259	.872	-.87	.47
		50-64 years old	.238	.118	.185	-.07	.54
		65 years or older	.405*	.140	.022	.04	.77
	50-64 years old	18-29 years old	-.435	.253	.318	-1.09	.22
		30-49 years old	-.238	.118	.185	-.54	.07
		65 years or older	.167	.129	.571	-.17	.50
	65 years or older	18-29 years old	-.601	.264	.107	-1.29	.08
		30-49 years old	-.405*	.140	.022	-.77	-.04
		50-64 years old	-.167	.129	.571	-.50	.17

*. The mean difference is significant at the 0.05 level.

Table C-21 Average evaluates of processes and system overall among pilgrims' experience with international airports

Processes characteristics	Yes	No	Difference in means	t-staistics	p-value
Jeddah					
HI					
Passenger evaluate for HI based on waiting time	3.06	3.03	0.04	0.26	0.799
Passenger evaluate for HI staff based on Efficiency of inspection time	3.05	3.13	-0.08	-0.60	0.550
Passenger evaluate for HI staff based on Courtesy/ helpfulness	3.71	3.81	-0.10	-0.83	0.406
Passenger evaluate for HI staff based on Knowledge /expertise	3.51	3.58	-0.07	-0.52	0.601
PC					
Passenger evaluate for PC Inspection based on waiting time	2.18	2.25	-0.06	-0.47	0.641
Passenger evaluate for PC Inspection based on processing time	3.72	3.64	0.08	0.60	0.549
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	3.06	3.03	0.03	0.22	0.827
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.80	2.90	-0.10	-0.86	0.392
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.19	3.18	0.02	0.12	0.903
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.35	2.18	0.17	1.12	0.263
Passenger evaluate for BC based on comfortable space around carousels	3.07	2.93	0.14	0.89	0.372
Passenger evaluate for BC based on the helpfulness of support staff	3.16	2.98	0.18	1.31	0.190
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.47	3.64	-0.18	-1.47	0.144
CI					
Passenger evaluate for Customs inspection based on waiting time	2.45	2.47	-0.02	-0.13	0.894
Passenger evaluate for Customs inspection based on processing time	3.16	3.13	0.03	0.25	0.806

Passenger evaluate for Customs inspection staff based on efficiency of inspection time	2.90	2.86	0.04	0.32	0.749
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.58	3.35	0.23	1.76	0.080
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.50	3.15	0.35	2.69	0.008
UA registration					
Passenger evaluate for UA registration based on waiting time	2.93	2.88	0.05	0.34	0.737
Passenger evaluate for UA registration based on processing time	3.19	3.11	0.08	0.53	0.594
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.88	2.75	0.14	0.87	0.382
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.19	2.89	0.30	2.64	0.009
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.03	2.60	0.42	2.99	0.003
ASB					
Passenger evaluate for ASB based on duration time of this process	2.82	2.76	0.05	0.36	0.722
Passenger evaluate for ABS staff based on Efficiency of duration time	2.88	2.66	0.22	1.49	0.138
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.35	2.97	0.38	2.72	0.007
Passenger evaluate for ABS staff based on Knowledge /expertise	2.88	2.70	0.17	1.20	0.231
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.73	3.70	0.02	0.20	0.844
Passenger evaluate for ABS based on support tools for special need people	2.90	2.67	0.24	1.39	0.166
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	1.63	1.59	0.05	0.54	0.593
Overall passenger evaluate for processing time in all steps	2.35	2.34	0.01	0.08	0.938
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	2.71	2.61	0.10	1.20	0.232
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	2.41	2.40	0.01	0.12	0.907

Overall passenger evaluate for HT facilities based on special needs and disabilities support service	1.81	1.71	0.10	1.04	0.297
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	2.37	2.30	0.06	0.75	0.454
Overall passenger evaluate for HT facilities based on information visibility/signs	2.83	2.72	0.11	1.17	0.241
Overall passenger evaluate for HT facilities based on help and contacts Information service	2.92	2.73	0.18	2.18	0.030
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.27	3.15	0.12	1.35	0.177
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.41	3.34	0.07	0.93	0.352
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	2.95	2.88	0.07	0.78	0.438
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	2.78	2.60	0.18	1.95	0.052
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	2.40	2.27	0.13	1.22	0.225
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.63	1.81	-0.19	-2.15	0.035
Medina					
HI					
Passenger evaluate for HI based on waiting time	3.44	3.73	-0.28	-0.99	0.323
Passenger evaluate for HI staff based on Efficiency of inspection time	3.22	3.39	-0.17	-0.62	0.539
Passenger evaluate for HI staff based on Courtesy/ helpfulness	4.18	4.09	0.09	0.45	0.656
Passenger evaluate for HI staff based on Knowledge /expertise	4.06	3.99	0.07	0.32	0.748
PC					
Passenger evaluate for PC Inspection based on waiting time	2.14	2.34	-0.21	-0.83	0.408
Passenger evaluate for PC Inspection based on processing time	3.73	3.49	0.24	1.33	0.186
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.50	2.57	-0.07	-0.29	0.775
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.68	2.57	0.11	0.42	0.678

Passenger evaluate for PC Inspection staff based on Knowledge /expertise	2.68	2.59	0.09	0.34	0.732
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.55	2.77	-0.22	-0.84	0.400
Passenger evaluate for BC based on comfortable space around carousels	2.45	2.87	-0.42	-1.62	0.106
Passenger evaluate for BC based on the helpfulness of support staff	3.77	3.63	0.14	0.51	0.609
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.00	3.40	-0.40	-1.44	0.151
CI					
Passenger evaluate for Customs inspection based on waiting time	2.86	2.69	0.18	0.67	0.503
Passenger evaluate for Customs inspection based on processing time	4.09	4.08	0.01	0.06	0.951
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	4.00	3.59	0.41	1.79	0.075
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	4.23	3.94	0.29	1.52	0.131
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.91	3.50	0.41	1.62	0.106
UA registration					
Passenger evaluate for UA registration based on waiting time	2.68	2.71	-0.03	-0.11	0.914
Passenger evaluate for UA registration based on processing time	2.50	2.88	-0.38	-1.34	0.182
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.73	2.78	-0.05	-0.19	0.853
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.50	3.47	0.03	0.13	0.894
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.41	3.17	0.24	1.05	0.294
ASB					
Passenger evaluate for ASB based on duration time of this process	2.50	2.76	-0.26	-0.95	0.345
Passenger evaluate for ABS staff based on Efficiency of duration time	2.41	2.34	0.07	0.36	0.722
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.64	3.42	0.21	1.25	0.211
Passenger evaluate for ABS staff based on Knowledge /expertise	3.36	3.04	0.32	1.55	0.123

Passenger evaluate for ABS based on Justice (first in, first out rule)	3.91	3.71	0.19	1.21	0.226
Passenger evaluate for ABS based on support tools for special need people	2.27	2.08	0.19	0.54	0.599
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	2.14	2.34	-0.20	-0.76	0.446
Overall passenger evaluate for processing time in all steps	2.86	3.20	-0.33	-1.24	0.218
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	3.86	3.79	0.08	0.60	0.547
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	3.50	3.51	-0.01	-0.02	0.983
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	2.14	1.99	0.15	0.65	0.518
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	3.77	3.54	0.23	1.82	0.078
Overall passenger evaluate for HT facilities based on information visibility/signs	3.77	3.48	0.29	1.81	0.079
Overall passenger evaluate for HT facilities based on help and contacts Information service	3.41	3.35	0.06	0.33	0.741
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	4.09	3.78	0.31	2.45	0.020
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.91	3.83	0.08	0.81	0.424
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.27	3.51	-0.24	-1.22	0.224
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	4.09	3.90	0.19	1.53	0.128
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	4.09	3.70	0.39	3.71	0.001
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	0.00	1.87	-1.87	1.97	0.053

Table C-22 Average evaluates of processes and system overall among pilgrims' experience with Hajj terminals

Processes characteristics	Yes	No	Difference in means	t-statistics	p-value
Jeddah					
HI					
Passenger evaluate for HI based on waiting time	3.00	3.04	-0.04	-0.14	0.887
Passenger evaluate for HI staff based on Efficiency of inspection time	3.06	3.11	-0.05	-0.19	0.850
Passenger evaluate for HI staff based on Courtesy/ helpfulness	3.35	3.81	-0.45	-1.39	0.183
Passenger evaluate for HI staff based on Knowledge /expertise	3.41	3.56	-0.15	-0.58	0.564
PC					
Passenger evaluate for PC Inspection based on waiting time	2.60	2.19	0.41	1.70	0.090
Passenger evaluate for PC Inspection based on processing time	3.88	3.65	0.23	1.35	0.186
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	3.36	3.01	0.35	1.69	0.092
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	3.08	2.84	0.24	1.14	0.254
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.24	3.18	0.06	0.37	0.713
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.28	2.25	0.03	0.13	0.897
Passenger evaluate for BC based on comfortable space around carousels	3.20	2.96	0.24	0.86	0.390
Passenger evaluate for BC based on the helpfulness of support staff	3.31	3.10	0.21	0.97	0.333
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.84	3.55	0.29	1.36	0.174
CI					
Passenger evaluate for Customs inspection based on waiting time	2.56	2.45	0.11	0.48	0.630
Passenger evaluate for Customs inspection based on processing time	3.00	3.15	-0.15	-0.53	0.598

Passenger evaluate for Customs inspection staff based on efficiency of inspection time	2.84	2.88	-0.04	-0.16	0.876
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.32	3.45	-0.13	-0.57	0.567
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.32	3.29	0.03	0.13	0.893
UA registration					
Passenger evaluate for UA registration based on waiting time	3.24	2.87	0.37	1.10	0.283
Passenger evaluate for UA registration based on processing time	3.28	3.13	0.15	0.55	0.582
Passenger evaluate for UA registration staff based on Efficiency of registration time	3.32	2.75	0.57	2.06	0.040
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.08	3.00	0.08	0.37	0.710
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.04	2.75	0.29	1.23	0.230
ASB					
Passenger evaluate for ASB based on duration time of this process	2.84	2.78	0.06	0.23	0.820
Passenger evaluate for ABS staff based on Efficiency of duration time	2.88	2.73	0.15	0.57	0.569
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.48	3.09	0.39	1.57	0.118
Passenger evaluate for ABS staff based on Knowledge /expertise	3.04	2.75	0.29	1.15	0.250
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.84	3.70	0.14	0.50	0.622
Passenger evaluate for ABS based on support tools for special need people	2.82	2.75	0.07	0.22	0.830
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	1.80	1.59	0.21	1.41	0.160
Overall passenger evaluate for processing time in all steps	2.64	2.32	0.32	1.52	0.130
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	2.80	2.64	0.16	1.05	0.295
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	2.56	2.38	0.18	0.72	0.481
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	2.00	1.72	0.28	1.58	0.116

Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	2.48	2.31	0.17	1.09	0.277
Overall passenger evaluate for HT facilities based on information visibility/signs	2.84	2.75	0.09	0.54	0.592
Overall passenger evaluate for HT facilities based on help and contacts Information service	2.96	2.79	0.17	1.13	0.261
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.16	3.20	-0.04	-0.25	0.801
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.16	3.38	-0.22	-1.21	0.236
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.00	2.90	0.10	0.62	0.534
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	2.92	2.65	0.27	1.71	0.089
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	2.72	2.29	0.43	2.46	0.015
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.85	1.74	0.11	0.95	0.358
Medina					
HI					
Passenger evaluate for HI based on waiting time	4.14	3.67	0.47	1.07	0.287
Passenger evaluate for HI staff based on Efficiency of inspection time	3.71	3.35	0.36	0.87	0.387
Passenger evaluate for HI staff based on Courtesy/ helpfulness	4.29	4.09	0.20	0.66	0.513
Passenger evaluate for HI staff based on Knowledge /expertise	4.14	3.99	0.15	0.48	0.629
PC					
Passenger evaluate for PC Inspection based on waiting time	2.73	2.29	0.43	1.27	0.206
Passenger evaluate for PC Inspection based on processing time	3.64	3.51	0.13	0.52	0.603
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	3.18	2.53	0.65	1.87	0.063
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	3.36	2.54	0.82	2.35	0.020
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.36	2.56	0.81	2.28	0.024
BC					

Passenger evaluate for BC based on waiting time to collect the baggage	3.36	2.71	0.66	1.82	0.070
Passenger evaluate for BC based on comfortable space around carousels	3.64	2.77	0.86	2.49	0.014
Passenger evaluate for BC based on the helpfulness of support staff	4.45	3.60	0.82	2.32	0.021
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.36	3.36	0.01	0.02	0.983
CI					
Passenger evaluate for Customs inspection based on waiting time	2.91	2.69	0.21	0.59	0.554
Passenger evaluate for Customs inspection based on processing time	4.27	4.07	0.21	0.89	0.375
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	4.27	3.60	0.67	2.16	0.032
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	4.45	3.94	0.51	1.98	0.049
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	4.27	3.51	0.77	2.25	0.025
UA registration					
Passenger evaluate for UA registration based on waiting time	3.00	2.69	0.31	0.87	0.384
Passenger evaluate for UA registration based on processing time	3.27	2.81	0.46	1.18	0.239
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.82	2.77	0.05	0.15	0.884
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.91	3.45	0.46	1.70	0.091
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.55	3.17	0.37	1.18	0.240
ASB					
Passenger evaluate for ASB based on duration time of this process	3.09	2.71	0.38	1.00	0.320
Passenger evaluate for ABS staff based on Efficiency of duration time	2.73	2.32	0.41	1.48	0.142
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.82	3.42	0.39	1.69	0.092
Passenger evaluate for ABS staff based on Knowledge /expertise	3.36	3.06	0.30	1.06	0.291
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.91	3.73	0.18	0.53	0.609
Passenger evaluate for ABS based on support tools for special need people	2.57	2.07	0.50	1.38	0.168

Overall evaluates					
Overall passenger evaluate for waiting time in all steps	2.73	2.29	0.44	1.22	0.224
Overall passenger evaluate for processing time in all steps	3.27	3.15	0.12	0.33	0.740
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	3.82	3.79	0.02	0.14	0.888
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	3.50	3.51	-0.01	-0.02	0.983
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	2.20	1.99	0.21	0.77	0.445
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	3.51	3.57	-0.07	-0.29	0.776
Overall passenger evaluate for HT facilities based on information visibility/signs	3.77	3.50	0.28	1.97	0.062
Overall passenger evaluate for HT facilities based on help and contacts Information service	3.30	3.36	-0.05	-0.20	0.844
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.89	3.81	0.08	0.76	0.457
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.89	3.83	0.06	0.62	0.548
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.86	3.46	0.40	3.67	0.002
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	3.90	3.93	-0.02	-0.15	0.883
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	3.89	3.73	0.15	1.44	0.168
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.75	1.88	-0.13	-0.37	0.713

Table C-23 Average evaluates of processes and system overall among pilgrims' arrival status

Processes characteristics	A alone	As group	Difference in means	t-statistics	p-value
Jeddah					
HI					
Passenger evaluate for HI based on waiting time	2.99	3.06	-0.07	-0.46	0.648
Passenger evaluate for HI staff based on Efficiency of inspection time	3.05	3.12	-0.07	-0.50	0.616
Passenger evaluate for HI staff based on Courtesy/ helpfulness	3.70	3.80	-0.10	-0.78	0.438
Passenger evaluate for HI staff based on Knowledge /expertise	3.45	3.59	-0.15	-1.04	0.299
PC					
Passenger evaluate for PC Inspection based on waiting time	2.15	2.25	-0.09	-0.67	0.501
Passenger evaluate for PC Inspection based on processing time	3.67	3.67	0.00	-0.02	0.982
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.93	3.09	-0.16	-1.26	0.209
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.82	2.88	-0.05	-0.42	0.671
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.18	3.18	0.00	-0.03	0.972
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.02	2.33	-0.31	-2.02	0.045
Passenger evaluate for BC based on comfortable space around carousels	2.90	3.01	-0.11	-0.65	0.519
Passenger evaluate for BC based on the helpfulness of support staff	3.01	3.06	-0.04	-0.31	0.757
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.52	3.59	-0.07	-0.52	0.606
CI					
Passenger evaluate for Customs inspection based on waiting time	2.30	2.52	-0.23	-1.63	0.104

Passenger evaluate for Customs inspection based on processing time	3.06	3.17	-0.11	-0.78	0.437
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	2.77	2.91	-0.14	-0.95	0.342
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.38	3.47	-0.09	-0.60	0.548
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.26	3.30	-0.04	-0.29	0.774
UA registration					
Passenger evaluate for UA registration based on waiting time	2.65	3.00	-0.34	-2.07	0.040
Passenger evaluate for UA registration based on processing time	3.02	3.19	-0.16	-0.98	0.327
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.65	2.86	-0.20	-1.20	0.232
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	2.98	3.02	-0.05	-0.37	0.711
Passenger evaluate for UA registration staff based on Knowledge /expertise	2.61	2.83	-0.23	-1.47	0.143
ASB					
Passenger evaluate for ASB based on duration time of this process	2.80	2.78	0.02	0.11	0.913
Passenger evaluate for ABS staff based on Efficiency of duration time	2.71	2.76	-0.04	-0.27	0.789
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.19	3.10	0.09	0.61	0.540
Passenger evaluate for ABS staff based on Knowledge /expertise	2.82	2.75	0.07	0.44	0.659
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.68	3.72	-0.05	-0.38	0.702
Passenger evaluate for ABS based on support tools for special need people	2.83	2.73	0.10	0.54	0.588
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	1.69	1.57	0.12	1.27	0.206
Overall passenger evaluate for processing time in all steps	2.39	2.33	0.07	0.51	0.608
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	2.58	2.68	-0.10	-1.05	0.293

Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	2.37	2.41	-0.04	-0.34	0.734
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	1.80	1.73	0.07	0.73	0.468
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	2.21	2.37	-0.16	-1.84	0.067
Overall passenger evaluate for HT facilities based on information visibility/signs	2.75	2.77	-0.02	-0.16	0.870
Overall passenger evaluate for HT facilities based on help and contacts Information service	2.74	2.83	-0.09	-1.01	0.311
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.20	3.19	0.01	0.10	0.918
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.40	3.35	0.06	0.65	0.513
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	2.98	2.88	0.10	0.96	0.339
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	2.60	2.70	-0.10	-1.03	0.304
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	2.18	2.38	-0.20	-1.98	0.049
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.85	1.70	0.15	2.19	0.031
Medina					
HI					
Passenger evaluate for HI based on waiting time	3.67	3.70	-0.03	-0.14	0.886
Passenger evaluate for HI staff based on Efficiency of inspection time	3.37	3.37	0.00	0.00	0.999
Passenger evaluate for HI staff based on Courtesy/ helpfulness	4.00	4.14	-0.14	-1.00	0.317
Passenger evaluate for HI staff based on Knowledge /expertise	3.91	4.04	-0.12	-0.88	0.380
PC					
Passenger evaluate for PC Inspection based on waiting time	2.37	2.30	0.07	0.40	0.689

Passenger evaluate for PC Inspection based on processing time	3.49	3.52	-0.03	-0.24	0.808
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.63	2.54	0.09	0.52	0.601
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.70	2.54	0.16	0.91	0.364
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	2.58	2.61	-0.03	-0.18	0.857
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.81	2.72	0.09	0.49	0.626
Passenger evaluate for BC based on comfortable space around carousels	2.84	2.81	0.03	0.16	0.873
Passenger evaluate for BC based on the helpfulness of support staff	3.53	3.70	-0.18	-0.92	0.357
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.23	3.41	-0.18	-0.93	0.352
CI					
Passenger evaluate for Customs inspection based on waiting time	2.72	2.70	0.02	0.10	0.923
Passenger evaluate for Customs inspection based on processing time	4.09	4.07	0.01	0.11	0.912
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	3.68	3.62	0.06	0.40	0.686
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.96	3.98	-0.01	-0.10	0.924
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.56	3.54	0.02	0.09	0.925
UA registration					
Passenger evaluate for UA registration based on waiting time	2.75	2.69	0.07	0.37	0.709
Passenger evaluate for UA registration based on processing time	2.74	2.88	-0.14	-0.72	0.472
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.67	2.81	-0.15	-0.82	0.414
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.42	3.50	-0.08	-0.57	0.570
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.11	3.23	-0.13	-0.78	0.436

ASB					
Passenger evaluate for ASB based on duration time of this process	2.63	2.78	-0.14	-0.74	0.457
Passenger evaluate for ABS staff based on Efficiency of duration time	2.30	2.37	-0.07	-0.48	0.632
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.34	3.49	-0.15	-1.28	0.201
Passenger evaluate for ABS staff based on Knowledge /expertise	3.04	3.10	-0.06	-0.42	0.676
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.55	3.81	-0.26	-2.10	0.039
Passenger evaluate for ABS based on support tools for special need people	2.15	2.08	0.08	0.44	0.660
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	2.28	2.33	-0.05	-0.26	0.796
Overall passenger evaluate for processing time in all steps	3.23	3.13	0.10	0.54	0.591
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	3.84	3.77	0.07	0.75	0.453
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	3.35	3.58	-0.22	-1.62	0.108
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	2.19	1.93	0.26	1.61	0.111
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	3.52	3.59	-0.07	-0.60	0.546
Overall passenger evaluate for HT facilities based on information visibility/signs	3.47	3.53	-0.06	-0.40	0.688
Overall passenger evaluate for HT facilities based on help and contacts Information service	3.22	3.41	-0.18	-1.35	0.178
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.80	3.82	-0.02	-0.14	0.886
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.93	3.80	0.13	1.49	0.139
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.50	3.48	0.02	0.16	0.871

Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	3.96	3.91	0.05	0.63	0.528
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	3.71	3.75	-0.04	-0.35	0.724
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	2.00	1.81	0.19	1.12	0.266

Table C-24 Average evaluates of processes and system overall among Arabic language proficiency

Processes characteristics	Arabic language	Non Arabic language	Difference in means	t-statistics	p-value
Jeddah					
HI					
Passenger evaluate for HI based on waiting time	2.72	3.10	-0.38	-1.85	0.065
Passenger evaluate for HI staff based on Efficiency of inspection time	2.79	3.16	-0.36	-2.13	0.035
Passenger evaluate for HI staff based on Courtesy/ helpfulness	3.56	3.81	-0.25	-1.29	0.204
Passenger evaluate for HI staff based on Knowledge /expertise	3.41	3.57	-0.16	-0.93	0.354
PC					
Passenger evaluate for PC Inspection based on waiting time	2.14	2.24	-0.11	-0.63	0.527
Passenger evaluate for PC Inspection based on processing time	3.78	3.64	0.14	0.85	0.399
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	3.19	3.01	0.18	1.25	0.212
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.92	2.85	0.07	0.46	0.643
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	3.32	3.15	0.17	1.09	0.279
BC					

Passenger evaluate for BC based on waiting time to collect the baggage	1.98	2.31	-0.33	-1.94	0.055
Passenger evaluate for BC based on comfortable space around carousels	2.58	3.08	-0.51	-2.68	0.008
Passenger evaluate for BC based on the helpfulness of support staff	2.62	3.15	-0.52	-3.20	0.002
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.61	3.56	0.05	0.31	0.756
CI					
Passenger evaluate for Customs inspection based on waiting time	2.32	2.49	-0.17	-1.10	0.274
Passenger evaluate for Customs inspection based on processing time	3.25	3.11	0.14	0.89	0.372
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	2.80	2.89	-0.10	-0.69	0.494
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	3.51	3.43	0.08	0.49	0.623
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.29	3.29	0.00	-0.03	0.977
UA registration					
Passenger evaluate for UA registration based on waiting time	2.81	2.92	-0.11	-0.54	0.586
Passenger evaluate for UA registration based on processing time	2.97	3.19	-0.22	-1.16	0.247
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.44	2.89	-0.45	-2.35	0.019
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	2.98	3.02	-0.03	-0.23	0.815
Passenger evaluate for UA registration staff based on Knowledge /expertise	2.54	2.83	-0.28	-1.63	0.105
ASB					
Passenger evaluate for ASB based on duration time of this process	2.56	2.84	-0.28	-1.53	0.126
Passenger evaluate for ABS staff based on Efficiency of duration time	2.34	2.84	-0.50	-2.85	0.005

Passenger evaluate for ABS staff based on Courtesy/ helpfulness	2.95	3.16	-0.22	-1.25	0.214
Passenger evaluate for ABS staff based on Knowledge /expertise	2.47	2.84	-0.37	-2.10	0.036
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.56	3.75	-0.19	-1.40	0.163
Passenger evaluate for ABS based on support tools for special need people	2.71	2.77	-0.07	-0.34	0.732
Overall evaluates					
Overall passenger evaluate for waiting time in all steps	1.56	1.62	-0.06	-0.55	0.580
Overall passenger evaluate for processing time in all steps	2.32	2.35	-0.03	-0.19	0.851
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	2.53	2.68	-0.16	-1.46	0.146
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	2.31	2.42	-0.11	-0.80	0.424
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	1.75	1.75	0.00	0.03	0.978
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	2.24	2.35	-0.11	-1.19	0.237
Overall passenger evaluate for HT facilities based on information visibility/signs	2.71	2.77	-0.06	-0.56	0.577
Overall passenger evaluate for HT facilities based on help and contacts Information service	2.69	2.83	-0.14	-1.32	0.187
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.03	3.23	-0.20	-2.08	0.040
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.12	3.42	-0.31	-3.60	0.000
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	2.76	2.94	-0.18	-1.60	0.111
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	2.47	2.72	-0.24	-2.51	0.014

Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	2.20	2.35	-0.15	-1.49	0.138
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	1.76	1.75	0.02	0.21	0.835
Medina					
HI					
Passenger evaluate for HI based on waiting time	3.52	3.78	-0.26	-1.36	0.175
Passenger evaluate for HI staff based on Efficiency of inspection time	3.33	3.39	-0.06	-0.35	0.729
Passenger evaluate for HI staff based on Courtesy/ helpfulness	4.18	4.06	0.12	0.89	0.374
Passenger evaluate for HI staff based on Knowledge /expertise	4.10	3.95	0.15	1.07	0.285
PC					
Passenger evaluate for PC Inspection based on waiting time	2.43	2.27	0.16	0.92	0.359
Passenger evaluate for PC Inspection based on processing time	3.51	3.52	-0.01	-0.06	0.954
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	2.69	2.51	0.18	1.03	0.306
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	2.64	2.56	0.08	0.44	0.662
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	2.69	2.56	0.13	0.71	0.480
BC					
Passenger evaluate for BC based on waiting time to collect the baggage	2.77	2.73	0.04	0.22	0.828
Passenger evaluate for BC based on comfortable space around carousels	2.74	2.86	-0.12	-0.70	0.483
Passenger evaluate for BC based on the helpfulness of support staff	3.69	3.63	0.06	0.31	0.757
Passenger evaluate for BC based on the availability of baggage carts/trolley	3.30	3.38	-0.09	-0.47	0.642
CI					

Passenger evaluate for Customs inspection based on waiting time	2.59	2.76	-0.17	-0.95	0.344
Passenger evaluate for Customs inspection based on processing time	4.28	3.98	0.29	2.50	0.014
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	3.92	3.51	0.41	2.66	0.009
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	4.21	3.86	0.35	2.76	0.006
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	3.80	3.43	0.37	2.19	0.030
UA registration					
Passenger evaluate for UA registration based on waiting time	2.64	2.74	-0.10	-0.56	0.579
Passenger evaluate for UA registration based on processing time	2.82	2.85	-0.03	-0.14	0.893
Passenger evaluate for UA registration staff based on Efficiency of registration time	2.46	2.92	-0.46	-2.64	0.009
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	3.56	3.44	0.12	0.87	0.383
Passenger evaluate for UA registration staff based on Knowledge /expertise	3.11	3.23	-0.12	-0.73	0.465
ASB					
Passenger evaluate for ASB based on duration time of this process	2.82	2.69	0.13	0.67	0.505
Passenger evaluate for ABS staff based on Efficiency of duration time	2.34	2.35	0.00	-0.01	0.989
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	3.65	3.35	0.30	2.83	0.005
Passenger evaluate for ABS staff based on Knowledge /expertise	3.10	3.07	0.03	0.21	0.831
Passenger evaluate for ABS based on Justice (first in, first out rule)	3.75	3.73	0.02	0.17	0.862
Passenger evaluate for ABS based on support tools for special need people	2.26	2.02	0.24	1.28	0.205
Overall evaluates					

Overall passenger evaluate for waiting time in all steps	2.28	2.33	-0.05	-0.29	0.773
Overall passenger evaluate for processing time in all steps	3.25	3.12	0.13	0.71	0.480
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	3.77	3.81	-0.04	-0.46	0.645
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	3.50	3.51	-0.01	-0.05	0.963
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	1.93	2.05	-0.12	-0.77	0.443
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	3.47	3.62	-0.15	-1.28	0.201
Overall passenger evaluate for HT facilities based on information visibility/signs	3.59	3.48	0.12	0.99	0.326
Overall passenger evaluate for HT facilities based on help and contacts Information service	3.31	3.38	-0.07	-0.59	0.559
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	3.83	3.81	0.03	0.26	0.795
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	3.85	3.83	0.02	0.20	0.842
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	3.75	3.36	0.39	3.43	0.001
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	3.88	3.95	-0.06	-0.74	0.462
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	3.78	3.72	0.06	0.63	0.529
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	2.00	1.82	0.18	0.97	0.335

Table C-25 ANOVA results for relationships between the passengers' evaluates and demand status in Jeddah airport

		Sum of Squares	df	Mean Square	F	Sig.
Passenger evaluate for HI based on waiting time	Between Groups	85.620	4	21.405	19.809	.000
	Within Groups	267.984	248	1.081		
	Total	353.605	252			
Passenger evaluate for HI staff based on Efficiency of inspection time	Between Groups	117.225	4	29.306	55.863	.000
	Within Groups	130.103	248	.525		
	Total	247.328	252			
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Between Groups	27.240	4	6.810	8.490	.000
	Within Groups	198.918	248	.802		
	Total	226.158	252			
Passenger evaluate for HI staff based on Knowledge /expertise	Between Groups	34.746	4	8.686	9.537	.000
	Within Groups	225.887	248	.911		
	Total	260.632	252			
Passenger evaluate for PC Inspection based on waiting time	Between Groups	211.690	4	52.923	80.012	.000
	Within Groups	196.446	297	.661		
	Total	408.136	301			
Passenger evaluate for PC Inspection based on processing time	Between Groups	16.999	4	4.250	3.488	.008
	Within Groups	361.889	297	1.218		

	Total	378.887	301			
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Between Groups	44.310	4	11.078	13.367	.000
	Within Groups	246.130	297	.829		
	Total	290.440	301			
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Between Groups	84.079	4	21.020	28.627	.000
	Within Groups	218.080	297	.734		
	Total	302.159	301			
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	Between Groups	26.811	4	6.703	5.852	.000
	Within Groups	340.173	297	1.145		
	Total	366.983	301			
Passenger evaluate for BC based on waiting time to collect the baggage	Between Groups	102.374	4	25.594	19.490	.000
	Within Groups	390.000	297	1.313		
	Total	492.374	301			
Passenger evaluate for BC based on comfortable space around carousels	Between Groups	154.533	4	38.633	31.489	.000
	Within Groups	364.385	297	1.227		
	Total	518.917	301			
Passenger evaluate for BC based on the helpfulness of support staff	Between Groups	97.341	4	24.335	29.032	.000
	Within Groups	222.126	265	.838		
	Total	319.467	269			
Passenger evaluate for BC based on the	Between Groups	112.220	4	28.055	40.909	.000
	Within Groups	203.677	297	.686		

availability of baggage carts/trolley	Total	315.897	301			
Passenger evaluate for Customs inspection based on waiting time	Between Groups	173.236	4	43.309	72.349	.000
	Within Groups	177.787	297	.599		
	Total	351.023	301			
Passenger evaluate for Customs inspection based on processing time	Between Groups	11.816	4	2.954	2.476	.044
	Within Groups	354.343	297	1.193		
	Total	366.159	301			
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Between Groups	27.443	4	6.861	5.632	.000
	Within Groups	361.775	297	1.218		
	Total	389.219	301			
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Between Groups	72.413	4	18.103	17.449	.000
	Within Groups	308.130	297	1.037		
	Total	380.543	301			
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Between Groups	83.970	4	20.993	21.924	.000
	Within Groups	284.387	297	.958		
	Total	368.358	301			
Passenger evaluate for UA registration based on waiting time	Between Groups	452.914	4	113.229	305.424	.000
	Within Groups	110.105	297	.371		
	Total	563.020	301			
Passenger evaluate for UA registration based on processing time	Between Groups	360.256	4	90.064	177.591	.000
	Within Groups	150.621	297	.507		

	Total	510.877	301			
Passenger evaluate for UA registration staff based on Efficiency of registration time	Between Groups	255.809	4	63.952	70.277	.000
	Within Groups	270.270	297	.910		
	Total	526.079	301			
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Between Groups	100.577	4	25.144	39.640	.000
	Within Groups	188.393	297	.634		
	Total	288.970	301			
Passenger evaluate for UA registration staff based on Knowledge /expertise	Between Groups	199.436	4	49.859	61.241	.000
	Within Groups	241.799	297	.814		
	Total	441.235	301			
Passenger evaluate for ASB based on duration time of this process	Between Groups	185.468	4	46.367	46.913	.000
	Within Groups	293.542	297	.988		
	Total	479.010	301			
Passenger evaluate for ABS staff based on Efficiency of duration time	Between Groups	129.816	4	32.454	29.249	.000
	Within Groups	329.551	297	1.110		
	Total	459.368	301			
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Between Groups	44.707	4	11.177	8.650	.000
	Within Groups	383.760	297	1.292		
	Total	428.467	301			
Passenger evaluate for ABS staff based on Knowledge /expertise	Between Groups	88.836	4	22.209	18.507	.000
	Within Groups	356.399	297	1.200		

	Total	445.235	301			
Passenger evaluate for ABS based on Justice (first in, first out rule)	Between Groups	10.193	4	2.548	2.983	.019
	Within Groups	253.744	297	.854		
	Total	263.937	301			
Passenger evaluate for ABS based on support tools for special need people	Between Groups	34.411	4	8.603	5.801	.000
	Within Groups	338.129	228	1.483		
	Total	372.541	232			
Overall passenger evaluate for waiting time in all steps	Between Groups	46.883	4	11.721	31.870	.000
	Within Groups	109.226	297	.368		
	Total	156.109	301			
Overall passenger evaluate for processing time in all steps	Between Groups	84.747	4	21.187	27.666	.000
	Within Groups	227.439	297	.766		
	Total	312.185	301			
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	Between Groups	47.129	4	11.782	29.746	.000
	Within Groups	117.243	296	.396		
	Total	164.372	300			
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Between Groups	25.990	4	6.498	17.505	.000
	Within Groups	60.130	162	.371		
	Total	86.120	166			
Overall passenger evaluate for HT facilities based on special needs	Between Groups	9.089	4	2.272	5.539	.000
	Within Groups	77.535	189	.410		

and disabilities support service	Total	86.624	193			
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Between Groups	29.842	4	7.460	16.952	.000
	Within Groups	130.705	297	.440		
	Total	160.546	301			
Overall passenger evaluate for HT facilities based on information visibility/signs	Between Groups	48.987	4	12.247	28.902	.000
	Within Groups	125.848	297	.424		
	Total	174.834	301			
Overall passenger evaluate for HT facilities based on help and contacts Information service	Between Groups	33.498	4	8.374	20.582	.000
	Within Groups	119.214	293	.407		
	Total	152.711	297			
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Between Groups	30.272	4	7.568	17.132	.000
	Within Groups	131.201	297	.442		
	Total	161.474	301			
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	Between Groups	11.980	4	2.995	7.294	.000
	Within Groups	121.954	297	.411		
	Total	133.934	301			
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Between Groups	33.149	4	8.287	16.602	.000
	Within Groups	148.255	297	.499		
	Total	181.404	301			
Overall passenger evaluate for HT facilities based on cleanliness of	Between Groups	67.918	4	16.979	45.444	.000
	Within Groups	110.969	297	.374		

arrival domain at Hajj terminals	Total	178.887	301			
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Between Groups	75.831	4	18.958	40.112	.000
	Within Groups	140.368	297	.473		
	Total	216.199	301			
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Between Groups	3.408	4	.852	4.625	.002
	Within Groups	26.342	143	.184		
	Total	29.750	147			

Table C-26 Multiple Comparisons

Dependent Variable	(I) Demand status	(J) Demand status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Passenger evaluate for HI based on waiting time	Extreme High	High	.015	.198	1.000	-.53	.56
		Considerable	-.689*	.206	.009	-1.26	-.12
		Moderate	-1.334*	.222	.000	-1.94	-.72
		Low	-1.401*	.255	.000	-2.10	-.70
	High	Extreme High	-.015	.198	1.000	-.56	.53
		Considerable	-.704*	.178	.001	-1.19	-.21
		Moderate	-1.349*	.196	.000	-1.89	-.81
		Low	-1.415*	.233	.000	-2.06	-.78
	Considerable	Extreme High	.689*	.206	.009	.12	1.26
		High	.704*	.178	.001	.21	1.19
		Moderate	-.645*	.204	.015	-1.20	-.09

		Low	-.711*	.240	.027	-1.37	-.05
	Moderate	Extreme High	1.334*	.222	.000	.72	1.94
		High	1.349*	.196	.000	.81	1.89
		Considerable	.645*	.204	.015	.09	1.20
		Low	-.067	.253	.999	-.76	.63
	Low	Extreme High	1.401*	.255	.000	.70	2.10
		High	1.415*	.233	.000	.78	2.06
		Considerable	.711*	.240	.027	.05	1.37
		Moderate	.067	.253	.999	-.63	.76
Passenger evaluate for HI staff based on Efficiency of inspection time	Extreme High	High	-.105	.138	.942	-.48	.28
		Considerable	-.830*	.144	.000	-1.23	-.44
		Moderate	-1.538*	.154	.000	-1.96	-1.11
		Low	-1.864*	.178	.000	-2.35	-1.38
	High	Extreme High	.105	.138	.942	-.28	.48
		Considerable	-.726*	.124	.000	-1.07	-.39
		Moderate	-1.433*	.136	.000	-1.81	-1.06
		Low	-1.759*	.162	.000	-2.21	-1.31
	Considerable	Extreme High	.830*	.144	.000	.44	1.23
		High	.726*	.124	.000	.39	1.07
		Moderate	-.708*	.142	.000	-1.10	-.32
		Low	-1.033*	.167	.000	-1.49	-.57
	Moderate	Extreme High	1.538*	.154	.000	1.11	1.96
		High	1.433*	.136	.000	1.06	1.81
		Considerable	.708*	.142	.000	.32	1.10
		Low	-.326	.176	.348	-.81	.16

	Low	Extreme High	1.864*	.178	.000	1.38	2.35
		High	1.759*	.162	.000	1.31	2.21
		Considerable	1.033*	.167	.000	.57	1.49
		Moderate	.326	.176	.348	-.16	.81
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Extreme High	High	.283	.171	.464	-.19	.75
		Considerable	-.349	.178	.287	-.84	.14
		Moderate	-.616*	.191	.012	-1.14	-.09
		Low	-.127	.220	.979	-.73	.48
	High	Extreme High	-.283	.171	.464	-.75	.19
		Considerable	-.632*	.153	.000	-1.05	-.21
		Moderate	-.898*	.168	.000	-1.36	-.44
		Low	-.409	.201	.250	-.96	.14
	Considerable	Extreme High	.349	.178	.287	-.14	.84
		High	.632*	.153	.000	.21	1.05
		Moderate	-.267	.175	.550	-.75	.22
		Low	.222	.207	.819	-.35	.79
	Moderate	Extreme High	.616*	.191	.012	.09	1.14
		High	.898*	.168	.000	.44	1.36
		Considerable	.267	.175	.550	-.22	.75
		Low	.489	.218	.168	-.11	1.09
	Low	Extreme High	.127	.220	.979	-.48	.73
		High	.409	.201	.250	-.14	.96
		Considerable	-.222	.207	.819	-.79	.35
		Moderate	-.489	.218	.168	-1.09	.11
	Extreme High	High	.217	.182	.755	-.28	.72

Passenger evaluate for HI staff based on Knowledge /expertise		Considerable	-.377	.189	.274	-.90	.14
		Moderate	-.829*	.204	.001	-1.39	-.27
		Low	-.244	.234	.836	-.89	.40
	High	Extreme High	-.217	.182	.755	-.72	.28
		Considerable	-.594*	.163	.003	-1.04	-.15
		Moderate	-1.046*	.180	.000	-1.54	-.55
		Low	-.461	.214	.200	-1.05	.13
	Considerable	Extreme High	.377	.189	.274	-.14	.90
		High	.594*	.163	.003	.15	1.04
		Moderate	-.452	.187	.114	-.97	.06
		Low	.133	.220	.974	-.47	.74
	Moderate	Extreme High	.829*	.204	.001	.27	1.39
		High	1.046*	.180	.000	.55	1.54
		Considerable	.452	.187	.114	-.06	.97
		Low	.585	.232	.090	-.05	1.22
	Low	Extreme High	.244	.234	.836	-.40	.89
		High	.461	.214	.200	-.13	1.05
		Considerable	-.133	.220	.974	-.74	.47
		Moderate	-.585	.232	.090	-1.22	.05
Passenger evaluate for PC Inspection based on waiting time	Extreme High	High	-.226	.142	.505	-.62	.16
		Considerable	-1.393*	.150	.000	-1.80	-.98
		Moderate	-1.800*	.157	.000	-2.23	-1.37
		Low	-2.324*	.180	.000	-2.82	-1.83
	High	Extreme High	.226	.142	.505	-.16	.62
		Considerable	-1.167*	.129	.000	-1.52	-.81

		Moderate	-1.574*	.138	.000	-1.95	-1.20
		Low	-2.097*	.163	.000	-2.55	-1.65
	Considerable	Extreme High	1.393*	.150	.000	.98	1.80
		High	1.167*	.129	.000	.81	1.52
		Moderate	-.407*	.146	.044	-.81	-.01
		Low	-.930*	.170	.000	-1.40	-.46
	Moderate	Extreme High	1.800*	.157	.000	1.37	2.23
		High	1.574*	.138	.000	1.20	1.95
		Considerable	.407*	.146	.044	.01	.81
		Low	-.523*	.177	.027	-1.01	-.04
	Low	Extreme High	2.324*	.180	.000	1.83	2.82
		High	2.097*	.163	.000	1.65	2.55
		Considerable	.930*	.170	.000	.46	1.40
		Moderate	.523*	.177	.027	.04	1.01
Passenger evaluate for PC Inspection based on processing time	Extreme High	High	-.255	.193	.677	-.79	.27
		Considerable	-.492	.203	.113	-1.05	.07
		Moderate	-.742*	.214	.005	-1.33	-.16
		Low	-.412	.244	.445	-1.08	.26
	High	Extreme High	.255	.193	.677	-.27	.79
		Considerable	-.236	.175	.662	-.72	.25
		Moderate	-.486	.187	.074	-1.00	.03
		Low	-.156	.222	.955	-.77	.45
	Considerable	Extreme High	.492	.203	.113	-.07	1.05
		High	.236	.175	.662	-.25	.72
		Moderate	-.250	.198	.714	-.79	.29

		Low	.080	.231	.997	-.55	.71
	Moderate	Extreme High	.742*	.214	.005	.16	1.33
		High	.486	.187	.074	-.03	1.00
		Considerable	.250	.198	.714	-.29	.79
		Low	.330	.240	.645	-.33	.99
	Low	Extreme High	.412	.244	.445	-.26	1.08
		High	.156	.222	.955	-.45	.77
		Considerable	-.080	.231	.997	-.71	.55
		Moderate	-.330	.240	.645	-.99	.33
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Extreme High	High	-.299	.159	.333	-.74	.14
		Considerable	-.772*	.168	.000	-1.23	-.31
		Moderate	-.994*	.176	.000	-1.48	-.51
		Low	-1.059*	.202	.000	-1.61	-.51
	High	Extreme High	.299	.159	.333	-.14	.74
		Considerable	-.474*	.145	.010	-.87	-.08
		Moderate	-.695*	.155	.000	-1.12	-.27
		Low	-.760*	.183	.000	-1.26	-.26
	Considerable	Extreme High	.772*	.168	.000	.31	1.23
		High	.474*	.145	.010	.08	.87
		Moderate	-.221	.163	.656	-.67	.23
		Low	-.287	.190	.559	-.81	.24
	Moderate	Extreme High	.994*	.176	.000	.51	1.48
		High	.695*	.155	.000	.27	1.12
		Considerable	.221	.163	.656	-.23	.67
		Low	-.065	.198	.997	-.61	.48

	Low	Extreme High	1.059*	.202	.000	.51	1.61
		High	.760*	.183	.000	.26	1.26
		Considerable	.287	.190	.559	-.24	.81
		Moderate	.065	.198	.997	-.48	.61
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Extreme High	High	-.455*	.150	.022	-.87	-.04
		Considerable	-1.175*	.158	.000	-1.61	-.74
		Moderate	-1.336*	.166	.000	-1.79	-.88
		Low	-1.461*	.190	.000	-1.98	-.94
	High	Extreme High	.455*	.150	.022	.04	.87
		Considerable	-.720*	.136	.000	-1.09	-.35
		Moderate	-.880*	.146	.000	-1.28	-.48
		Low	-1.005*	.172	.000	-1.48	-.53
	Considerable	Extreme High	1.175*	.158	.000	.74	1.61
		High	.720*	.136	.000	.35	1.09
		Moderate	-.161	.154	.834	-.58	.26
		Low	-.286	.179	.502	-.78	.21
	Moderate	Extreme High	1.336*	.166	.000	.88	1.79
		High	.880*	.146	.000	.48	1.28
		Considerable	.161	.154	.834	-.26	.58
		Low	-.125	.186	.963	-.64	.39
	Low	Extreme High	1.461*	.190	.000	.94	1.98
		High	1.005*	.172	.000	.53	1.48
		Considerable	.286	.179	.502	-.21	.78
		Moderate	.125	.186	.963	-.39	.64
	Extreme High	High	-.222	.187	.760	-.74	.29

Passenger evaluate for PC Inspection staff based on Knowledge /expertise		Considerable	-.741*	.197	.002	-1.28	-.20
		Moderate	-.773*	.207	.002	-1.34	-.20
		Low	-.490	.237	.236	-1.14	.16
	High	Extreme High	.222	.187	.760	-.29	.74
		Considerable	-.519*	.170	.021	-.99	-.05
		Moderate	-.551*	.182	.022	-1.05	-.05
		Low	-.268	.215	.724	-.86	.32
	Considerable	Extreme High	.741*	.197	.002	.20	1.28
		High	.519*	.170	.021	.05	.99
		Moderate	-.032	.192	1.000	-.56	.49
		Low	.250	.224	.796	-.36	.86
	Moderate	Extreme High	.773*	.207	.002	.20	1.34
		High	.551*	.182	.022	.05	1.05
		Considerable	.032	.192	1.000	-.49	.56
		Low	.283	.233	.743	-.36	.92
	Low	Extreme High	.490	.237	.236	-.16	1.14
		High	.268	.215	.724	-.32	.86
		Considerable	-.250	.224	.796	-.86	.36
		Moderate	-.283	.233	.743	-.92	.36
Passenger evaluate for BC based on waiting time to collect the baggage	Extreme High	High	-.251	.200	.721	-.80	.30
		Considerable	-.856*	.211	.001	-1.44	-.28
		Moderate	-1.417*	.222	.000	-2.03	-.81
		Low	-1.618*	.254	.000	-2.31	-.92
	High	Extreme High	.251	.200	.721	-.30	.80
		Considerable	-.605*	.182	.009	-1.11	-.11

		Moderate	-1.166*	.195	.000	-1.70	-.63
		Low	-1.367*	.230	.000	-2.00	-.73
	Considerable	Extreme High	.856*	.211	.001	.28	1.44
		High	.605*	.182	.009	.11	1.11
		Moderate	-.561	.205	.052	-1.12	.00
		Low	-.761*	.240	.014	-1.42	-.10
	Moderate	Extreme High	1.417*	.222	.000	.81	2.03
		High	1.166*	.195	.000	.63	1.70
		Considerable	.561	.205	.052	.00	1.12
		Low	-.201	.249	.929	-.88	.48
	Low	Extreme High	1.618*	.254	.000	.92	2.31
		High	1.367*	.230	.000	.73	2.00
		Considerable	.761*	.240	.014	.10	1.42
		Moderate	.201	.249	.929	-.48	.88
Passenger evaluate for BC based on comfortable space around carousels	Extreme High	High	-.119	.194	.973	-.65	.41
		Considerable	-.759*	.204	.002	-1.32	-.20
		Moderate	-1.602*	.214	.000	-2.19	-1.01
		Low	-1.951*	.245	.000	-2.62	-1.28
	High	Extreme High	.119	.194	.973	-.41	.65
		Considerable	-.641*	.176	.003	-1.12	-.16
		Moderate	-1.484*	.188	.000	-2.00	-.97
		Low	-1.832*	.223	.000	-2.44	-1.22
	Considerable	Extreme High	.759*	.204	.002	.20	1.32
		High	.641*	.176	.003	.16	1.12
		Moderate	-.843*	.199	.000	-1.39	-.30

		Low	-1.192*	.232	.000	-1.83	-.56
	Moderate	Extreme High	1.602*	.214	.000	1.01	2.19
		High	1.484*	.188	.000	.97	2.00
		Considerable	.843*	.199	.000	.30	1.39
		Low	-.349	.241	.597	-1.01	.31
	Low	Extreme High	1.951*	.245	.000	1.28	2.62
		High	1.832*	.223	.000	1.22	2.44
		Considerable	1.192*	.232	.000	.56	1.83
		Moderate	.349	.241	.597	-.31	1.01
Passenger evaluate for BC based on the helpfulness of support staff	Extreme High	High	.065	.169	.995	-.40	.53
		Considerable	-.617*	.176	.005	-1.10	-.13
		Moderate	-1.261*	.191	.000	-1.79	-.74
		Low	-1.510*	.211	.000	-2.09	-.93
	High	Extreme High	-.065	.169	.995	-.53	.40
		Considerable	-.682*	.152	.000	-1.10	-.26
		Moderate	-1.326*	.169	.000	-1.79	-.86
		Low	-1.574*	.191	.000	-2.10	-1.05
	Considerable	Extreme High	.617*	.176	.005	.13	1.10
		High	.682*	.152	.000	.26	1.10
		Moderate	-.644*	.176	.003	-1.13	-.16
		Low	-.893*	.198	.000	-1.44	-.35
	Moderate	Extreme High	1.261*	.191	.000	.74	1.79
		High	1.326*	.169	.000	.86	1.79
		Considerable	.644*	.176	.003	.16	1.13
		Low	-.249	.211	.763	-.83	.33

	Low	Extreme High	1.510*	.211	.000	.93	2.09
		High	1.574*	.191	.000	1.05	2.10
		Considerable	.893*	.198	.000	.35	1.44
		Moderate	.249	.211	.763	-.33	.83
Passenger evaluate for BC based on the availability of baggage carts/trolley	Extreme High	High	-.240	.145	.462	-.64	.16
		Considerable	-1.053*	.152	.000	-1.47	-.63
		Moderate	-1.571*	.160	.000	-2.01	-1.13
		Low	-1.431*	.183	.000	-1.93	-.93
	High	Extreme High	.240	.145	.462	-.16	.64
		Considerable	-.813*	.132	.000	-1.17	-.45
		Moderate	-1.331*	.141	.000	-1.72	-.95
		Low	-1.191*	.166	.000	-1.65	-.73
	Considerable	Extreme High	1.053*	.152	.000	.63	1.47
		High	.813*	.132	.000	.45	1.17
		Moderate	-.518*	.148	.005	-.93	-.11
		Low	-.378	.173	.188	-.85	.10
	Moderate	Extreme High	1.571*	.160	.000	1.13	2.01
		High	1.331*	.141	.000	.95	1.72
		Considerable	.518*	.148	.005	.11	.93
		Low	.140	.180	.937	-.35	.63
	Low	Extreme High	1.431*	.183	.000	.93	1.93
		High	1.191*	.166	.000	.73	1.65
		Considerable	.378	.173	.188	-.10	.85
		Moderate	-.140	.180	.937	-.63	.35
	Extreme High	High	-.017	.135	1.000	-.39	.35

Passenger evaluate for Customs inspection based on waiting time		Considerable	-1.185*	.142	.000	-1.58	-.79
		Moderate	-1.421*	.150	.000	-1.83	-1.01
		Low	-2.049*	.171	.000	-2.52	-1.58
	High	Extreme High	.017	.135	1.000	-.35	.39
		Considerable	-1.168*	.123	.000	-1.51	-.83
		Moderate	-1.404*	.131	.000	-1.76	-1.04
		Low	-2.032*	.156	.000	-2.46	-1.61
	Considerable	Extreme High	1.185*	.142	.000	.79	1.58
		High	1.168*	.123	.000	.83	1.51
		Moderate	-.236	.139	.436	-.62	.14
		Low	-.864*	.162	.000	-1.31	-.42
	Moderate	Extreme High	1.421*	.150	.000	1.01	1.83
		High	1.404*	.131	.000	1.04	1.76
		Considerable	.236	.139	.436	-.14	.62
		Low	-.628*	.168	.002	-1.09	-.17
	Low	Extreme High	2.049*	.171	.000	1.58	2.52
		High	2.032*	.156	.000	1.61	2.46
		Considerable	.864*	.162	.000	.42	1.31
		Moderate	.628*	.168	.002	.17	1.09
Passenger evaluate for Customs inspection based on processing time	Extreme High	High	-.054	.191	.999	-.58	.47
		Considerable	-.484	.201	.117	-1.04	.07
		Moderate	-.330	.211	.523	-.91	.25
		Low	-.422	.242	.409	-1.09	.24
	High	Extreme High	.054	.191	.999	-.47	.58
		Considerable	-.430	.174	.099	-.91	.05

		Moderate	-.276	.186	.571	-.79	.23
		Low	-.367	.220	.452	-.97	.24
	Considerable	Extreme High	.484	.201	.117	-.07	1.04
		High	.430	.174	.099	-.05	.91
		Moderate	.154	.196	.935	-.38	.69
		Low	.062	.228	.999	-.56	.69
	Moderate	Extreme High	.330	.211	.523	-.25	.91
		High	.276	.186	.571	-.23	.79
		Considerable	-.154	.196	.935	-.69	.38
		Low	-.091	.237	.995	-.74	.56
	Low	Extreme High	.422	.242	.409	-.24	1.09
		High	.367	.220	.452	-.24	.97
		Considerable	-.062	.228	.999	-.69	.56
		Moderate	.091	.237	.995	-.56	.74
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Extreme High	High	-.036	.193	1.000	-.57	.49
		Considerable	-.574*	.203	.040	-1.13	-.02
		Moderate	-.342	.214	.498	-.93	.24
		Low	-.873*	.244	.004	-1.54	-.20
	High	Extreme High	.036	.193	1.000	-.49	.57
		Considerable	-.538*	.175	.020	-1.02	-.06
		Moderate	-.306	.187	.477	-.82	.21
		Low	-.837*	.222	.002	-1.45	-.23
	Considerable	Extreme High	.574*	.203	.040	.02	1.13
		High	.538*	.175	.020	.06	1.02
		Moderate	.232	.198	.767	-.31	.78

		Low	-.298	.231	.696	-.93	.33
	Moderate	Extreme High	.342	.214	.498	-.24	.93
		High	.306	.187	.477	-.21	.82
		Considerable	-.232	.198	.767	-.78	.31
		Low	-.530	.240	.179	-1.19	.13
	Low	Extreme High	.873*	.244	.004	.20	1.54
		High	.837*	.222	.002	.23	1.45
		Considerable	.298	.231	.696	-.33	.93
		Moderate	.530	.240	.179	-.13	1.19
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Extreme High	High	-.157	.178	.904	-.65	.33
		Considerable	-.857*	.188	.000	-1.37	-.34
		Moderate	-1.228*	.197	.000	-1.77	-.69
		Low	-1.127*	.226	.000	-1.75	-.51
	High	Extreme High	.157	.178	.904	-.33	.65
		Considerable	-.700*	.162	.000	-1.14	-.26
		Moderate	-1.071*	.173	.000	-1.55	-.60
		Low	-.971*	.205	.000	-1.53	-.41
	Considerable	Extreme High	.857*	.188	.000	.34	1.37
		High	.700*	.162	.000	.26	1.14
		Moderate	-.371	.183	.252	-.87	.13
		Low	-.271	.213	.709	-.85	.31
	Moderate	Extreme High	1.228*	.197	.000	.69	1.77
		High	1.071*	.173	.000	.60	1.55
		Considerable	.371	.183	.252	-.13	.87
		Low	.101	.221	.991	-.51	.71

	Low	Extreme High	1.127*	.226	.000	.51	1.75
		High	.971*	.205	.000	.41	1.53
		Considerable	.271	.213	.709	-.31	.85
		Moderate	-.101	.221	.991	-.71	.51
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Extreme High	High	-.310	.171	.367	-.78	.16
		Considerable	-.946*	.180	.000	-1.44	-.45
		Moderate	-1.378*	.189	.000	-1.90	-.86
		Low	-1.373*	.217	.000	-1.97	-.78
	High	Extreme High	.310	.171	.367	-.16	.78
		Considerable	-.635*	.156	.001	-1.06	-.21
		Moderate	-1.067*	.166	.000	-1.52	-.61
		Low	-1.062*	.197	.000	-1.60	-.52
	Considerable	Extreme High	.946*	.180	.000	.45	1.44
		High	.635*	.156	.001	.21	1.06
		Moderate	-.432	.175	.102	-.91	.05
		Low	-.427	.205	.228	-.99	.13
	Moderate	Extreme High	1.378*	.189	.000	.86	1.90
		High	1.067*	.166	.000	.61	1.52
		Considerable	.432	.175	.102	-.05	.91
		Low	.005	.213	1.000	-.58	.59
	Low	Extreme High	1.373*	.217	.000	.78	1.97
		High	1.062*	.197	.000	.52	1.60
		Considerable	.427	.205	.228	-.13	.99
		Moderate	-.005	.213	1.000	-.59	.58
	Extreme High	High	-.749*	.107	.000	-1.04	-.46

Passenger evaluate for UA registration based on waiting time		Considerable	-2.404*	.112	.000	-2.71	-2.10
		Moderate	-2.786*	.118	.000	-3.11	-2.46
		Low	-3.598*	.135	.000	-3.97	-3.23
	High	Extreme High	.749*	.107	.000	.46	1.04
		Considerable	-1.655*	.097	.000	-1.92	-1.39
		Moderate	-2.037*	.103	.000	-2.32	-1.75
		Low	-2.849*	.122	.000	-3.18	-2.51
	Considerable	Extreme High	2.404*	.112	.000	2.10	2.71
		High	1.655*	.097	.000	1.39	1.92
		Moderate	-.382*	.109	.005	-.68	-.08
		Low	-1.194*	.127	.000	-1.54	-.84
	Moderate	Extreme High	2.786*	.118	.000	2.46	3.11
		High	2.037*	.103	.000	1.75	2.32
		Considerable	.382*	.109	.005	.08	.68
		Low	-.812*	.132	.000	-1.18	-.45
	Low	Extreme High	3.598*	.135	.000	3.23	3.97
		High	2.849*	.122	.000	2.51	3.18
		Considerable	1.194*	.127	.000	.84	1.54
		Moderate	.812*	.132	.000	.45	1.18
Passenger evaluate for UA registration based on processing time	Extreme High	High	-.781*	.125	.000	-1.12	-.44
		Considerable	-2.365*	.131	.000	-2.73	-2.01
		Moderate	-2.397*	.138	.000	-2.78	-2.02
		Low	-3.245*	.158	.000	-3.68	-2.81
	High	Extreme High	.781*	.125	.000	.44	1.12
		Considerable	-1.585*	.113	.000	-1.90	-1.27

		Moderate	-1.617*	.121	.000	-1.95	-1.28
		Low	-2.464*	.143	.000	-2.86	-2.07
	Considerable	Extreme High	2.365*	.131	.000	2.01	2.73
		High	1.585*	.113	.000	1.27	1.90
		Moderate	-.032	.128	.999	-.38	.32
		Low	-.880*	.149	.000	-1.29	-.47
	Moderate	Extreme High	2.397*	.138	.000	2.02	2.78
		High	1.617*	.121	.000	1.28	1.95
		Considerable	.032	.128	.999	-.32	.38
		Low	-.848*	.155	.000	-1.27	-.42
	Low	Extreme High	3.245*	.158	.000	2.81	3.68
		High	2.464*	.143	.000	2.07	2.86
		Considerable	.880*	.149	.000	.47	1.29
		Moderate	.848*	.155	.000	.42	1.27
Passenger evaluate for UA registration staff based on Efficiency of registration time	Extreme High	High	-.136	.167	.925	-.59	.32
		Considerable	-1.707*	.176	.000	-2.19	-1.22
		Moderate	-1.753*	.185	.000	-2.26	-1.25
		Low	-2.441*	.211	.000	-3.02	-1.86
	High	Extreme High	.136	.167	.925	-.32	.59
		Considerable	-1.570*	.152	.000	-1.99	-1.15
		Moderate	-1.617*	.162	.000	-2.06	-1.17
		Low	-2.305*	.192	.000	-2.83	-1.78
	Considerable	Extreme High	1.707*	.176	.000	1.22	2.19
		High	1.570*	.152	.000	1.15	1.99
		Moderate	-.046	.171	.999	-.52	.42

		Low	-.734*	.199	.003	-1.28	-.19
	Moderate	Extreme High	1.753*	.185	.000	1.25	2.26
		High	1.617*	.162	.000	1.17	2.06
		Considerable	.046	.171	.999	-.42	.52
		Low	-.688*	.207	.009	-1.26	-.12
	Low	Extreme High	2.441*	.211	.000	1.86	3.02
		High	2.305*	.192	.000	1.78	2.83
		Considerable	.734*	.199	.003	.19	1.28
		Moderate	.688*	.207	.009	.12	1.26
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Extreme High	High	-.500*	.139	.004	-.88	-.12
		Considerable	-1.106*	.147	.000	-1.51	-.70
		Moderate	-1.434*	.154	.000	-1.86	-1.01
		Low	-1.775*	.176	.000	-2.26	-1.29
	High	Extreme High	.500*	.139	.004	.12	.88
		Considerable	-.605*	.127	.000	-.95	-.26
		Moderate	-.934*	.135	.000	-1.31	-.56
		Low	-1.274*	.160	.000	-1.71	-.84
	Considerable	Extreme High	1.106*	.147	.000	.70	1.51
		High	.605*	.127	.000	.26	.95
		Moderate	-.329	.143	.147	-.72	.06
		Low	-.669*	.166	.001	-1.13	-.21
	Moderate	Extreme High	1.434*	.154	.000	1.01	1.86
		High	.934*	.135	.000	.56	1.31
		Considerable	.329	.143	.147	-.06	.72
		Low	-.340	.173	.286	-.82	.13

	Low	Extreme High	1.775*	.176	.000	1.29	2.26
		High	1.274*	.160	.000	.84	1.71
		Considerable	.669*	.166	.001	.21	1.13
		Moderate	.340	.173	.286	-.13	.82
Passenger evaluate for UA registration staff based on Knowledge /expertise	Extreme High	High	-.306	.158	.299	-.74	.13
		Considerable	-1.168*	.166	.000	-1.62	-.71
		Moderate	-1.803*	.175	.000	-2.28	-1.32
		Low	-2.402*	.200	.000	-2.95	-1.85
	High	Extreme High	.306	.158	.299	-.13	.74
		Considerable	-.862*	.143	.000	-1.26	-.47
		Moderate	-1.497*	.153	.000	-1.92	-1.08
		Low	-2.096*	.181	.000	-2.59	-1.60
	Considerable	Extreme High	1.168*	.166	.000	.71	1.62
		High	.862*	.143	.000	.47	1.26
		Moderate	-.636*	.162	.001	-1.08	-.19
		Low	-1.234*	.189	.000	-1.75	-.72
	Moderate	Extreme High	1.803*	.175	.000	1.32	2.28
		High	1.497*	.153	.000	1.08	1.92
		Considerable	.636*	.162	.001	.19	1.08
		Low	-.599*	.196	.021	-1.14	-.06
	Low	Extreme High	2.402*	.200	.000	1.85	2.95
		High	2.096*	.181	.000	1.60	2.59
		Considerable	1.234*	.189	.000	.72	1.75
		Moderate	.599*	.196	.021	.06	1.14
	Extreme High	High	.179	.174	.842	-.30	.66

Passenger evaluate for ASB based on duration time of this process		Considerable	-.872*	.183	.000	-1.37	-.37
		Moderate	-1.290*	.192	.000	-1.82	-.76
		Low	-2.137*	.220	.000	-2.74	-1.53
	High	Extreme High	-.179	.174	.842	-.66	.30
		Considerable	-1.051*	.158	.000	-1.48	-.62
		Moderate	-1.468*	.169	.000	-1.93	-1.00
		Low	-2.316*	.200	.000	-2.86	-1.77
	Considerable	Extreme High	.872*	.183	.000	.37	1.37
		High	1.051*	.158	.000	.62	1.48
		Moderate	-.418	.178	.134	-.91	.07
		Low	-1.266*	.208	.000	-1.84	-.70
	Moderate	Extreme High	1.290*	.192	.000	.76	1.82
		High	1.468*	.169	.000	1.00	1.93
		Considerable	.418	.178	.134	-.07	.91
		Low	-.848*	.216	.001	-1.44	-.25
	Low	Extreme High	2.137*	.220	.000	1.53	2.74
		High	2.316*	.200	.000	1.77	2.86
		Considerable	1.266*	.208	.000	.70	1.84
		Moderate	.848*	.216	.001	.25	1.44
Passenger evaluate for ABS staff based on Efficiency of duration time	Extreme High	High	.092	.184	.987	-.41	.60
		Considerable	-.508	.194	.070	-1.04	.02
		Moderate	-1.140*	.204	.000	-1.70	-.58
		Low	-1.853*	.233	.000	-2.49	-1.21
	High	Extreme High	-.092	.184	.987	-.60	.41
		Considerable	-.600*	.167	.004	-1.06	-.14

		Moderate	-1.232*	.179	.000	-1.72	-.74
		Low	-1.945*	.212	.000	-2.53	-1.36
	Considerable	Extreme High	.508	.194	.070	-.02	1.04
		High	.600*	.167	.004	.14	1.06
		Moderate	-.632*	.189	.008	-1.15	-.11
		Low	-1.345*	.220	.000	-1.95	-.74
	Moderate	Extreme High	1.140*	.204	.000	.58	1.70
		High	1.232*	.179	.000	.74	1.72
		Considerable	.632*	.189	.008	.11	1.15
		Low	-.713*	.229	.017	-1.34	-.08
	Low	Extreme High	1.853*	.233	.000	1.21	2.49
		High	1.945*	.212	.000	1.36	2.53
		Considerable	1.345*	.220	.000	.74	1.95
		Moderate	.713*	.229	.017	.08	1.34
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Extreme High	High	.009	.199	1.000	-.54	.55
		Considerable	-.541	.209	.076	-1.11	.03
		Moderate	-.755*	.220	.006	-1.36	-.15
		Low	-1.020*	.252	.001	-1.71	-.33
	High	Extreme High	-.009	.199	1.000	-.55	.54
		Considerable	-.549*	.181	.022	-1.05	-.05
		Moderate	-.764*	.193	.001	-1.29	-.23
		Low	-1.028*	.228	.000	-1.66	-.40
	Considerable	Extreme High	.541	.209	.076	-.03	1.11
		High	.549*	.181	.022	.05	1.05
		Moderate	-.214	.204	.831	-.77	.35

		Low	-.479	.238	.261	-1.13	.17
	Moderate	Extreme High	.755*	.220	.006	.15	1.36
		High	.764*	.193	.001	.23	1.29
		Considerable	.214	.204	.831	-.35	.77
		Low	-.265	.247	.821	-.94	.41
	Low	Extreme High	1.020*	.252	.001	.33	1.71
		High	1.028*	.228	.000	.40	1.66
		Considerable	.479	.238	.261	-.17	1.13
		Moderate	.265	.247	.821	-.41	.94
Passenger evaluate for ABS staff based on Knowledge /expertise	Extreme High	High	-.079	.192	.994	-.60	.45
		Considerable	-.747*	.202	.002	-1.30	-.19
		Moderate	-1.107*	.212	.000	-1.69	-.53
		Low	-1.539*	.243	.000	-2.20	-.87
	High	Extreme High	.079	.192	.994	-.45	.60
		Considerable	-.668*	.174	.001	-1.15	-.19
		Moderate	-1.029*	.186	.000	-1.54	-.52
		Low	-1.461*	.220	.000	-2.06	-.86
	Considerable	Extreme High	.747*	.202	.002	.19	1.30
		High	.668*	.174	.001	.19	1.15
		Moderate	-.361	.196	.354	-.90	.18
		Low	-.792*	.229	.006	-1.42	-.16
	Moderate	Extreme High	1.107*	.212	.000	.53	1.69
		High	1.029*	.186	.000	.52	1.54
		Considerable	.361	.196	.354	-.18	.90
		Low	-.432	.238	.368	-1.09	.22

	Low	Extreme High	1.539*	.243	.000	.87	2.20
		High	1.461*	.220	.000	.86	2.06
		Considerable	.792*	.229	.006	.16	1.42
		Moderate	.432	.238	.368	-.22	1.09
Passenger evaluate for ABS based on Justice (first in, first out rule)	Extreme High	High	.205	.162	.711	-.24	.65
		Considerable	-.176	.170	.839	-.64	.29
		Moderate	-.173	.179	.871	-.66	.32
		Low	-.304	.205	.573	-.87	.26
	High	Extreme High	-.205	.162	.711	-.65	.24
		Considerable	-.381	.147	.074	-.78	.02
		Moderate	-.378	.157	.116	-.81	.05
		Low	-.509	.186	.051	-1.02	.00
	Considerable	Extreme High	.176	.170	.839	-.29	.64
		High	.381	.147	.074	-.02	.78
		Moderate	.004	.166	1.000	-.45	.46
		Low	-.128	.193	.964	-.66	.40
	Moderate	Extreme High	.173	.179	.871	-.32	.66
		High	.378	.157	.116	-.05	.81
		Considerable	-.004	.166	1.000	-.46	.45
		Low	-.131	.201	.966	-.68	.42
	Low	Extreme High	.304	.205	.573	-.26	.87
		High	.509	.186	.051	.00	1.02
		Considerable	.128	.193	.964	-.40	.66
		Moderate	.131	.201	.966	-.42	.68
	Extreme High	High	-.274	.244	.793	-.94	.40

Passenger evaluate for ABS based on support tools for special need people		Considerable	-.211	.256	.922	-.92	.49
		Moderate	-.862*	.270	.014	-1.60	-.12
		Low	-1.249*	.326	.002	-2.15	-.35
	High	Extreme High	.274	.244	.793	-.40	.94
		Considerable	.063	.216	.998	-.53	.66
		Moderate	-.588	.232	.088	-1.23	.05
		Low	-.974*	.296	.010	-1.79	-.16
	Considerable	Extreme High	.211	.256	.922	-.49	.92
		High	-.063	.216	.998	-.66	.53
		Moderate	-.651	.245	.064	-1.33	.02
		Low	-1.037*	.306	.007	-1.88	-.19
	Moderate	Extreme High	.862*	.270	.014	.12	1.60
		High	.588	.232	.088	-.05	1.23
		Considerable	.651	.245	.064	-.02	1.33
		Low	-.386	.318	.743	-1.26	.49
	Low	Extreme High	1.249*	.326	.002	.35	2.15
		High	.974*	.296	.010	.16	1.79
		Considerable	1.037*	.306	.007	.19	1.88
		Moderate	.386	.318	.743	-.49	1.26
Overall passenger evaluate for waiting time in all steps	Extreme High	High	-.120	.106	.789	-.41	.17
		Considerable	-.509*	.112	.000	-.82	-.20
		Moderate	-.716*	.117	.000	-1.04	-.39
		Low	-1.265*	.134	.000	-1.63	-.90
	High	Extreme High	.120	.106	.789	-.17	.41
		Considerable	-.389*	.096	.001	-.65	-.12

		Moderate	-.596*	.103	.000	-.88	-.31
		Low	-1.144*	.122	.000	-1.48	-.81
	Considerable	Extreme High	.509*	.112	.000	.20	.82
		High	.389*	.096	.001	.12	.65
		Moderate	-.207	.109	.317	-.51	.09
		Low	-.755*	.127	.000	-1.10	-.41
	Moderate	Extreme High	.716*	.117	.000	.39	1.04
		High	.596*	.103	.000	.31	.88
		Considerable	.207	.109	.317	-.09	.51
		Low	-.548*	.132	.000	-.91	-.19
	Low	Extreme High	1.265*	.134	.000	.90	1.63
		High	1.144*	.122	.000	.81	1.48
		Considerable	.755*	.127	.000	.41	1.10
		Moderate	.548*	.132	.000	.19	.91
Overall passenger evaluate for processing time in all steps	Extreme High	High	.058	.153	.996	-.36	.48
		Considerable	-.618*	.161	.001	-1.06	-.18
		Moderate	-.903*	.169	.000	-1.37	-.44
		Low	-1.500*	.194	.000	-2.03	-.97
	High	Extreme High	-.058	.153	.996	-.48	.36
		Considerable	-.676*	.139	.000	-1.06	-.29
		Moderate	-.962*	.149	.000	-1.37	-.55
		Low	-1.558*	.176	.000	-2.04	-1.08
	Considerable	Extreme High	.618*	.161	.001	.18	1.06
		High	.676*	.139	.000	.29	1.06
		Moderate	-.286	.157	.363	-.72	.14

		Low	-.882*	.183	.000	-1.38	-.38
	Moderate	Extreme High	.903*	.169	.000	.44	1.37
		High	.962*	.149	.000	.55	1.37
		Considerable	.286	.157	.363	-.14	.72
		Low	-.597*	.190	.016	-1.12	-.07
	Low	Extreme High	1.500*	.194	.000	.97	2.03
		High	1.558*	.176	.000	1.08	2.04
		Considerable	.882*	.183	.000	.38	1.38
		Moderate	.597*	.190	.016	.07	1.12
Overall passenger evaluate for Hajj Terminal (HT)facilities based on cleanliness of restrooms/ washrooms (WC)	Extreme High	High	-.044	.110	.995	-.35	.26
		Considerable	-.411*	.116	.004	-.73	-.09
		Moderate	-.725*	.122	.000	-1.06	-.39
		Low	-1.210*	.141	.000	-1.60	-.82
	High	Extreme High	.044	.110	.995	-.26	.35
		Considerable	-.367*	.100	.003	-.64	-.09
		Moderate	-.681*	.107	.000	-.97	-.39
		Low	-1.166*	.128	.000	-1.52	-.82
	Considerable	Extreme High	.411*	.116	.004	.09	.73
		High	.367*	.100	.003	.09	.64
		Moderate	-.314*	.113	.045	-.62	.00
		Low	-.799*	.133	.000	-1.16	-.43
	Moderate	Extreme High	.725*	.122	.000	.39	1.06
		High	.681*	.107	.000	.39	.97
		Considerable	.314*	.113	.045	.00	.62
		Low	-.485*	.138	.005	-.86	-.11

	Low	Extreme High	1.210*	.141	.000	.82	1.60
		High	1.166*	.128	.000	.82	1.52
		Considerable	.799*	.133	.000	.43	1.16
		Moderate	.485*	.138	.005	.11	.86
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Extreme High	High	-.064	.125	.986	-.41	.28
		Considerable	-.261	.145	.374	-.66	.14
		Moderate	-.979*	.179	.000	-1.47	-.48
		Low	-1.361*	.218	.000	-1.96	-.76
	High	Extreme High	.064	.125	.986	-.28	.41
		Considerable	-.197	.126	.526	-.55	.15
		Moderate	-.915*	.165	.000	-1.37	-.46
		Low	-1.297*	.206	.000	-1.87	-.73
	Considerable	Extreme High	.261	.145	.374	-.14	.66
		High	.197	.126	.526	-.15	.55
		Moderate	-.718*	.180	.001	-1.21	-.22
		Low	-1.100*	.218	.000	-1.70	-.50
	Moderate	Extreme High	.979*	.179	.000	.48	1.47
		High	.915*	.165	.000	.46	1.37
		Considerable	.718*	.180	.001	.22	1.21
		Low	-.382	.243	.516	-1.05	.29
	Low	Extreme High	1.361*	.218	.000	.76	1.96
		High	1.297*	.206	.000	.73	1.87
		Considerable	1.100*	.218	.000	.50	1.70
		Moderate	.382	.243	.516	-.29	1.05
	Extreme High	High	-.098	.135	.950	-.47	.27

Overall passenger evaluate for HT facilities based on special needs and disabilities support service		Considerable	-.108	.146	.947	-.51	.29
		Moderate	-.413	.154	.061	-.84	.01
		Low	-.826*	.209	.001	-1.40	-.25
	High	Extreme High	.098	.135	.950	-.27	.47
		Considerable	-.010	.123	1.000	-.35	.33
		Moderate	-.315	.134	.132	-.68	.05
		Low	-.728*	.194	.002	-1.26	-.19
	Considerable	Extreme High	.108	.146	.947	-.29	.51
		High	.010	.123	1.000	-.33	.35
		Moderate	-.305	.144	.220	-.70	.09
		Low	-.718*	.202	.004	-1.27	-.16
	Moderate	Extreme High	.413	.154	.061	-.01	.84
		High	.315	.134	.132	-.05	.68
		Considerable	.305	.144	.220	-.09	.70
		Low	-.413	.208	.277	-.99	.16
	Low	Extreme High	.826*	.209	.001	.25	1.40
		High	.728*	.194	.002	.19	1.26
		Considerable	.718*	.202	.004	.16	1.27
		Moderate	.413	.208	.277	-.16	.99
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Extreme High	High	.015	.116	1.000	-.30	.33
		Considerable	-.313	.122	.081	-.65	.02
		Moderate	-.513*	.128	.001	-.87	-.16
		Low	-.941*	.147	.000	-1.34	-.54
	High	Extreme High	-.015	.116	1.000	-.33	.30
		Considerable	-.327*	.105	.018	-.62	-.04

		Moderate	-.527*	.113	.000	-.84	-.22
		Low	-.956*	.133	.000	-1.32	-.59
	Considerable	Extreme High	.313	.122	.081	-.02	.65
		High	.327*	.105	.018	.04	.62
		Moderate	-.200	.119	.447	-.53	.13
		Low	-.629*	.139	.000	-1.01	-.25
	Moderate	Extreme High	.513*	.128	.001	.16	.87
		High	.527*	.113	.000	.22	.84
		Considerable	.200	.119	.447	-.13	.53
		Low	-.429*	.144	.026	-.82	-.03
	Low	Extreme High	.941*	.147	.000	.54	1.34
		High	.956*	.133	.000	.59	1.32
		Considerable	.629*	.139	.000	.25	1.01
		Moderate	.429*	.144	.026	.03	.82
Overall passenger evaluate for HT facilities based on information visibility/signs	Extreme High	High	-.087	.114	.942	-.40	.23
		Considerable	-.447*	.120	.002	-.78	-.12
		Moderate	-.736*	.126	.000	-1.08	-.39
		Low	-1.265*	.144	.000	-1.66	-.87
	High	Extreme High	.087	.114	.942	-.23	.40
		Considerable	-.360*	.103	.005	-.64	-.08
		Moderate	-.650*	.111	.000	-.95	-.35
		Low	-1.178*	.131	.000	-1.54	-.82
	Considerable	Extreme High	.447*	.120	.002	.12	.78
		High	.360*	.103	.005	.08	.64
		Moderate	-.289	.117	.098	-.61	.03

		Low	-.818*	.136	.000	-1.19	-.44
	Moderate	Extreme High	.736*	.126	.000	.39	1.08
		High	.650*	.111	.000	.35	.95
		Considerable	.289	.117	.098	-.03	.61
		Low	-.528*	.142	.002	-.92	-.14
	Low	Extreme High	1.265*	.144	.000	.87	1.66
		High	1.178*	.131	.000	.82	1.54
		Considerable	.818*	.136	.000	.44	1.19
		Moderate	.528*	.142	.002	.14	.92
Overall passenger evaluate for HT facilities based on help and contacts Information service	Extreme High	High	-.120	.112	.817	-.43	.19
		Considerable	-.375*	.118	.014	-.70	-.05
		Moderate	-.603*	.123	.000	-.94	-.26
		Low	-1.130*	.145	.000	-1.53	-.73
	High	Extreme High	.120	.112	.817	-.19	.43
		Considerable	-.255	.102	.093	-.53	.02
		Moderate	-.482*	.108	.000	-.78	-.18
		Low	-1.009*	.133	.000	-1.37	-.65
	Considerable	Extreme High	.375*	.118	.014	.05	.70
		High	.255	.102	.093	-.02	.53
		Moderate	-.227	.115	.277	-.54	.09
		Low	-.755*	.138	.000	-1.13	-.38
	Moderate	Extreme High	.603*	.123	.000	.26	.94
		High	.482*	.108	.000	.18	.78
		Considerable	.227	.115	.277	-.09	.54
		Low	-.527*	.143	.002	-.92	-.14

	Low	Extreme High	1.130*	.145	.000	.73	1.53
		High	1.009*	.133	.000	.65	1.37
		Considerable	.755*	.138	.000	.38	1.13
		Moderate	.527*	.143	.002	.14	.92
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Extreme High	High	.038	.116	.998	-.28	.36
		Considerable	-.182	.122	.571	-.52	.15
		Moderate	-.557*	.129	.000	-.91	-.20
		Low	-.892*	.147	.000	-1.30	-.49
	High	Extreme High	-.038	.116	.998	-.36	.28
		Considerable	-.220	.106	.232	-.51	.07
		Moderate	-.595*	.113	.000	-.90	-.28
		Low	-.930*	.134	.000	-1.30	-.56
	Considerable	Extreme High	.182	.122	.571	-.15	.52
		High	.220	.106	.232	-.07	.51
		Moderate	-.375*	.119	.016	-.70	-.05
		Low	-.710*	.139	.000	-1.09	-.33
	Moderate	Extreme High	.557*	.129	.000	.20	.91
		High	.595*	.113	.000	.28	.90
		Considerable	.375*	.119	.016	.05	.70
		Low	-.335	.145	.142	-.73	.06
	Low	Extreme High	.892*	.147	.000	.49	1.30
		High	.930*	.134	.000	.56	1.30
		Considerable	.710*	.139	.000	.33	1.09
		Moderate	.335	.145	.142	-.06	.73
	Extreme High	High	-.032	.112	.998	-.34	.28

Overall passenger evaluate for HT facilities based on walking distance inside the terminal		Considerable	-.209	.118	.391	-.53	.11
		Moderate	-.306	.124	.102	-.65	.03
		Low	-.647*	.142	.000	-1.04	-.26
	High	Extreme High	.032	.112	.998	-.28	.34
		Considerable	-.177	.102	.413	-.46	.10
		Moderate	-.273	.109	.091	-.57	.03
		Low	-.615*	.129	.000	-.97	-.26
	Considerable	Extreme High	.209	.118	.391	-.11	.53
		High	.177	.102	.413	-.10	.46
		Moderate	-.096	.115	.918	-.41	.22
		Low	-.438*	.134	.011	-.81	-.07
	Moderate	Extreme High	.306	.124	.102	-.03	.65
		High	.273	.109	.091	-.03	.57
		Considerable	.096	.115	.918	-.22	.41
		Low	-.341	.139	.105	-.72	.04
	Low	Extreme High	.647*	.142	.000	.26	1.04
		High	.615*	.129	.000	.26	.97
		Considerable	.438*	.134	.011	.07	.81
		Moderate	.341	.139	.105	-.04	.72
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Extreme High	High	-.010	.124	1.000	-.35	.33
		Considerable	-.244	.130	.333	-.60	.11
		Moderate	-.587*	.137	.000	-.96	-.21
		Low	-.990*	.156	.000	-1.42	-.56
	High	Extreme High	.010	.124	1.000	-.33	.35
		Considerable	-.234	.112	.230	-.54	.07

		Moderate	-.577*	.120	.000	-.91	-.25
		Low	-.980*	.142	.000	-1.37	-.59
	Considerable	Extreme High	.244	.130	.333	-.11	.60
		High	.234	.112	.230	-.07	.54
		Moderate	-.343	.127	.055	-.69	.00
		Low	-.746*	.148	.000	-1.15	-.34
	Moderate	Extreme High	.587*	.137	.000	.21	.96
		High	.577*	.120	.000	.25	.91
		Considerable	.343	.127	.055	.00	.69
		Low	-.403	.154	.068	-.82	.02
	Low	Extreme High	.990*	.156	.000	.56	1.42
		High	.980*	.142	.000	.59	1.37
		Considerable	.746*	.148	.000	.34	1.15
		Moderate	.403	.154	.068	-.02	.82
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	Extreme High	High	-.039	.107	.996	-.33	.25
		Considerable	-.422*	.113	.002	-.73	-.11
		Moderate	-.890*	.118	.000	-1.21	-.56
		Low	-1.412*	.135	.000	-1.78	-1.04
	High	Extreme High	.039	.107	.996	-.25	.33
		Considerable	-.382*	.097	.001	-.65	-.12
		Moderate	-.850*	.104	.000	-1.14	-.57
		Low	-1.372*	.123	.000	-1.71	-1.04
	Considerable	Extreme High	.422*	.113	.002	.11	.73
		High	.382*	.097	.001	.12	.65
		Moderate	-.468*	.110	.000	-.77	-.17

		Low	-.990*	.128	.000	-1.34	-.64
	Moderate	Extreme High	.890*	.118	.000	.56	1.21
		High	.850*	.104	.000	.57	1.14
		Considerable	.468*	.110	.000	.17	.77
		Low	-.522*	.133	.001	-.89	-.16
	Low	Extreme High	1.412*	.135	.000	1.04	1.78
		High	1.372*	.123	.000	1.04	1.71
		Considerable	.990*	.128	.000	.64	1.34
		Moderate	.522*	.133	.001	.16	.89
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Extreme High	High	-.021	.120	1.000	-.35	.31
		Considerable	-.441*	.127	.005	-.79	-.09
		Moderate	-.723*	.133	.000	-1.09	-.36
		Low	-1.598*	.152	.000	-2.02	-1.18
	High	Extreme High	.021	.120	1.000	-.31	.35
		Considerable	-.420*	.109	.001	-.72	-.12
		Moderate	-.702*	.117	.000	-1.02	-.38
		Low	-1.577*	.138	.000	-1.96	-1.20
	Considerable	Extreme High	.441*	.127	.005	.09	.79
		High	.420*	.109	.001	.12	.72
		Moderate	-.282	.123	.151	-.62	.06
		Low	-1.157*	.144	.000	-1.55	-.76
	Moderate	Extreme High	.723*	.133	.000	.36	1.09
		High	.702*	.117	.000	.38	1.02
		Considerable	.282	.123	.151	-.06	.62
		Low	-.875*	.149	.000	-1.29	-.46

	Low	Extreme High	1.598*	.152	.000	1.18	2.02
		High	1.577*	.138	.000	1.20	1.96
		Considerable	1.157*	.144	.000	.76	1.55
		Moderate	.875*	.149	.000	.46	1.29
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Extreme High	High	.010	.092	1.000	-.24	.26
		Considerable	-.215	.102	.220	-.50	.07
		Moderate	-.324	.133	.113	-.69	.04
		Low	.676	.312	.199	-.19	1.54
	High	Extreme High	-.010	.092	1.000	-.26	.24
		Considerable	-.225	.090	.094	-.47	.02
		Moderate	-.333	.124	.060	-.68	.01
		Low	.667	.309	.201	-.19	1.52
	Considerable	Extreme High	.215	.102	.220	-.07	.50
		High	.225	.090	.094	-.02	.47
		Moderate	-.108	.131	.923	-.47	.25
		Low	.892*	.312	.038	.03	1.75
	Moderate	Extreme High	.324	.133	.113	-.04	.69
		High	.333	.124	.060	-.01	.68
		Considerable	.108	.131	.923	-.25	.47
		Low	1.000*	.323	.020	.11	1.89
	Low	Extreme High	-.676	.312	.199	-1.54	.19
		High	-.667	.309	.201	-1.52	.19
		Considerable	-.892*	.312	.038	-1.75	-.03
		Moderate	-1.000*	.323	.020	-1.89	-.11

*. The mean difference is significant at the 0.05 level.

Table C-27 ANOVA results for relationships between the passengers' evaluates and demand status in Medina airport

		Sum of Squares	df	Mean Square	F	Sig.
Passenger evaluate for HI based on waiting time	Between Groups	147.416	4	36.854	103.913	.000
	Within Groups	53.909	152	.355		
	Total	201.325	156			
Passenger evaluate for HI Inspection staff based on Efficiency of inspection time	Between Groups	131.196	4	32.799	100.968	.000
	Within Groups	49.377	152	.325		
	Total	180.573	156			
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Between Groups	7.900	4	1.975	3.459	.010
	Within Groups	85.649	150	.571		
	Total	93.548	154			
Passenger evaluate for HI staff based on Knowledge /expertise	Between Groups	6.271	4	1.568	2.564	.041
	Within Groups	91.729	150	.612		
	Total	98.000	154			
Passenger evaluate for PC Inspection based on waiting time	Between Groups	97.310	4	24.327	34.225	.000
	Within Groups	132.209	186	.711		
	Total	229.518	190			
Passenger evaluate for PC Inspection based on processing time	Between Groups	8.764	4	2.191	3.545	.008
	Within Groups	114.953	186	.618		
	Total	123.717	190			

Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Between Groups	54.857	4	13.714	13.420	.000
	Within Groups	190.075	186	1.022		
	Total	244.932	190			
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Between Groups	60.278	4	15.070	14.906	.000
	Within Groups	188.046	186	1.011		
	Total	248.325	190			
Passenger evaluate for PC Inspection staff based on Knowledge /expertise	Between Groups	63.151	4	15.788	15.406	.000
	Within Groups	190.608	186	1.025		
	Total	253.759	190			
Passenger evaluate for BC based on waiting time to collect the baggage	Between Groups	97.489	4	24.372	27.822	.000
	Within Groups	162.940	186	.876		
	Total	260.429	190			
Passenger evaluate for BC based on comfortable space around carousels	Between Groups	66.620	4	16.655	17.469	.000
	Within Groups	177.328	186	.953		
	Total	243.948	190			
Passenger evaluate for BC based on the helpfulness of support staff	Between Groups	39.375	4	9.844	7.820	.000
	Within Groups	234.122	186	1.259		
	Total	273.497	190			
Passenger evaluate for BC based on the availability of baggage carts/trolley	Between Groups	27.212	4	6.803	4.819	.001
	Within Groups	262.578	186	1.412		
	Total	289.791	190			

Passenger evaluate for Customs inspection based on waiting time	Between Groups	146.375	4	36.594	61.205	.000
	Within Groups	111.207	186	.598		
	Total	257.581	190			
Passenger evaluate for Customs inspection based on processing time	Between Groups	5.292	4	1.323	2.448	.048
	Within Groups	100.530	186	.540		
	Total	105.822	190			
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Between Groups	9.289	4	2.322	2.338	.057
	Within Groups	184.784	186	.993		
	Total	194.073	190			
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Between Groups	3.547	4	.887	1.275	.281
	Within Groups	129.322	186	.695		
	Total	132.869	190			
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Between Groups	27.451	4	6.863	6.202	.000
	Within Groups	205.826	186	1.107		
	Total	233.277	190			
Passenger evaluate for UA registration based on waiting time	Between Groups	125.855	4	31.464	47.300	.000
	Within Groups	123.726	186	.665		
	Total	249.581	190			
Passenger evaluate for UA registration based on processing time	Between Groups	228.119	4	57.030	143.636	.000
	Within Groups	73.850	186	.397		
	Total	301.969	190			

Passenger evaluate for UA registration staff based on Efficiency of registration time	Between Groups	13.562	4	3.390	2.738	.030
	Within Groups	230.302	186	1.238		
	Total	243.864	190			
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Between Groups	1.284	4	.321	.414	.799
	Within Groups	144.360	186	.776		
	Total	145.644	190			
Passenger evaluate for UA registration staff based on Knowledge /expertise	Between Groups	5.544	4	1.386	1.341	.256
	Within Groups	192.288	186	1.034		
	Total	197.832	190			
Passenger evaluate for ASB based on duration time of this process	Between Groups	146.256	4	36.564	48.883	.000
	Within Groups	139.126	186	.748		
	Total	285.382	190			
Passenger evaluate for ABS staff based on Efficiency of duration time	Between Groups	16.662	4	4.166	5.846	.000
	Within Groups	132.532	186	.713		
	Total	149.194	190			
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Between Groups	3.195	4	.799	1.424	.228
	Within Groups	103.779	185	.561		
	Total	106.974	189			
Passenger evaluate for ABS staff based on Knowledge /expertise	Between Groups	4.066	4	1.016	1.207	.309
	Within Groups	155.750	185	.842		
	Total	159.816	189			

Passenger evaluate for ABS staff based on Justice (first in, first out rule)	Between Groups	1.982	4	.496	.987	.416
	Within Groups	92.860	185	.502		
	Total	94.842	189			
Passenger evaluate for ABS staff based on Support tools for special need people	Between Groups	5.685	4	1.421	1.671	.161
	Within Groups	108.034	127	.851		
	Total	113.720	131			
Overall passenger evaluate for waiting time in all steps	Between Groups	194.257	4	48.564	148.338	.000
	Within Groups	60.895	186	.327		
	Total	255.152	190			
Overall passenger evaluate for processing time in all steps	Between Groups	8.776	4	2.194	1.579	.182
	Within Groups	258.512	186	1.390		
	Total	267.288	190			
Overall passenger evaluate for Hajj Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)	Between Groups	4.248	4	1.062	3.462	.009
	Within Groups	56.746	185	.307		
	Total	60.995	189			
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Between Groups	2.023	4	.506	1.274	.286
	Within Groups	35.724	90	.397		
	Total	37.747	94			
Overall passenger evaluate for HT facilities based on special needs and disabilities support service	Between Groups	8.472	4	2.118	3.354	.012
	Within Groups	74.520	118	.632		
	Total	82.992	122			

Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Between Groups	9.389	4	2.347	4.560	.002
	Within Groups	95.222	185	.515		
	Total	104.611	189			
Overall passenger evaluate for HT facilities based on information visibility/signs	Between Groups	6.815	4	1.704	2.233	.067
	Within Groups	140.402	184	.763		
	Total	147.217	188			
Overall passenger evaluate for HT facilities based on help and contacts Information service	Between Groups	3.474	4	.868	1.223	.303
	Within Groups	129.232	182	.710		
	Total	132.706	186			
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Between Groups	4.141	4	1.035	1.834	.124
	Within Groups	104.412	185	.564		
	Total	108.553	189			
Overall passenger evaluate for HT facilities based on walking distance inside the terminal	Between Groups	3.314	4	.829	2.516	.043
	Within Groups	60.601	184	.329		
	Total	63.915	188			
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Between Groups	1.084	4	.271	.357	.839
	Within Groups	140.368	185	.759		
	Total	141.453	189			
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	Between Groups	3.333	4	.833	2.969	.021
	Within Groups	51.630	184	.281		
	Total	54.963	188			

Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Between Groups	2.785	4	.696	1.438	.223
	Within Groups	89.578	185	.484		
	Total	92.363	189			
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Between Groups	2.279	4	.570	1.324	.271
	Within Groups	27.547	64	.430		
	Total	29.826	68			

Table C-28 Multiple comparison among passengers with different demand status in Medina airport

Dependent Variable	(I) Demand status	(J) Demand status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Passenger evaluate for HI based on waiting time	Extreme High	High	-1.646*	.185	.000	-2.16	-1.14
		Considerable	-2.297*	.180	.000	-2.79	-1.80
		Moderate	-3.152*	.192	.000	-3.68	-2.62
		Low	-3.571*	.205	.000	-4.14	-3.00
	High	Extreme High	1.646*	.185	.000	1.14	2.16
		Considerable	-.650*	.126	.000	-1.00	-.30
		Moderate	-1.506*	.143	.000	-1.90	-1.11
		Low	-1.925*	.160	.000	-2.37	-1.48
	Considerable	Extreme High	2.297*	.180	.000	1.80	2.79
		High	.650*	.126	.000	.30	1.00
		Moderate	-.855*	.136	.000	-1.23	-.48

		Low	-1.275*	.154	.000	-1.70	-.85
	Moderate	Extreme High	3.152*	.192	.000	2.62	3.68
		High	1.506*	.143	.000	1.11	1.90
		Considerable	.855*	.136	.000	.48	1.23
		Low	-.419	.168	.098	-.88	.05
	Low	Extreme High	3.571*	.205	.000	3.00	4.14
		High	1.925*	.160	.000	1.48	2.37
		Considerable	1.275*	.154	.000	.85	1.70
		Moderate	.419	.168	.098	-.05	.88
Passenger evaluate for HI Inspection staff based on Efficiency of inspection time	Extreme High	High	-1.225*	.177	.000	-1.71	-.74
		Considerable	-1.775*	.172	.000	-2.25	-1.30
		Moderate	-2.758*	.184	.000	-3.26	-2.25
		Low	-3.262*	.197	.000	-3.80	-2.72
	High	Extreme High	1.225*	.177	.000	.74	1.71
		Considerable	-.550*	.120	.000	-.88	-.22
		Moderate	-1.533*	.136	.000	-1.91	-1.16
		Low	-2.037*	.154	.000	-2.46	-1.61
	Considerable	Extreme High	1.775*	.172	.000	1.30	2.25
		High	.550*	.120	.000	.22	.88
		Moderate	-.984*	.130	.000	-1.34	-.63
		Low	-1.487*	.148	.000	-1.90	-1.08
	Moderate	Extreme High	2.758*	.184	.000	2.25	3.26
		High	1.533*	.136	.000	1.16	1.91
		Considerable	.984*	.130	.000	.63	1.34
		Low	-.504*	.161	.018	-.95	-.06

	Low	Extreme High	3.262*	.197	.000	2.72	3.80
		High	2.037*	.154	.000	1.61	2.46
		Considerable	1.487*	.148	.000	1.08	1.90
		Moderate	.504*	.161	.018	.06	.95
Passenger evaluate for HI staff based on Courtesy/ helpfulness	Extreme High	High	.154	.242	.969	-.51	.82
		Considerable	-.214	.235	.892	-.86	.43
		Moderate	-.432	.250	.419	-1.12	.26
		Low	-.410	.267	.539	-1.15	.33
	High	Extreme High	-.154	.242	.969	-.82	.51
		Considerable	-.368	.161	.154	-.81	.08
		Moderate	-.586*	.182	.013	-1.09	-.08
		Low	-.564	.205	.050	-1.13	.00
	Considerable	Extreme High	.214	.235	.892	-.43	.86
		High	.368	.161	.154	-.08	.81
		Moderate	-.218	.172	.713	-.69	.26
		Low	-.196	.196	.855	-.74	.34
	Moderate	Extreme High	.432	.250	.419	-.26	1.12
		High	.586*	.182	.013	.08	1.09
		Considerable	.218	.172	.713	-.26	.69
		Low	.022	.214	1.000	-.57	.61
	Low	Extreme High	.410	.267	.539	-.33	1.15
		High	.564	.205	.050	.00	1.13
		Considerable	.196	.196	.855	-.34	.74
		Moderate	-.022	.214	1.000	-.61	.57
	Extreme High	High	-.154	.250	.973	-.85	.54

Passenger evaluate for HI staff based on Knowledge /expertise		Considerable	-.229	.243	.879	-.90	.44
		Moderate	-.598	.258	.146	-1.31	.12
		Low	-.546	.276	.282	-1.31	.22
	High	Extreme High	.154	.250	.973	-.54	.85
		Considerable	-.075	.166	.991	-.53	.38
		Moderate	-.444	.188	.132	-.96	.08
		Low	-.392	.212	.348	-.98	.19
	Considerable	Extreme High	.229	.243	.879	-.44	.90
		High	.075	.166	.991	-.38	.53
		Moderate	-.369	.178	.238	-.86	.12
		Low	-.317	.203	.525	-.88	.24
	Moderate	Extreme High	.598	.258	.146	-.12	1.31
		High	.444	.188	.132	-.08	.96
		Considerable	.369	.178	.238	-.12	.86
		Low	.052	.221	.999	-.56	.66
	Low	Extreme High	.546	.276	.282	-.22	1.31
		High	.392	.212	.348	-.19	.98
		Considerable	.317	.203	.525	-.24	.88
		Moderate	-.052	.221	.999	-.66	.56
Passenger evaluate for PC Inspection based on waiting time	Extreme High	High	-.207	.251	.922	-.90	.48
		Considerable	-.633	.243	.074	-1.30	.04
		Moderate	-1.183*	.255	.000	-1.89	-.48
		Low	-2.267*	.267	.000	-3.00	-1.53
	High	Extreme High	.207	.251	.922	-.48	.90
		Considerable	-.426	.165	.078	-.88	.03

		Moderate	-.976*	.182	.000	-1.48	-.47
		Low	-2.059*	.198	.000	-2.60	-1.51
	Considerable	Extreme High	.633	.243	.074	-.04	1.30
		High	.426	.165	.078	-.03	.88
		Moderate	-.550*	.172	.014	-1.02	-.08
		Low	-1.633*	.189	.000	-2.15	-1.11
	Moderate	Extreme High	1.183*	.255	.000	.48	1.89
		High	.976*	.182	.000	.47	1.48
		Considerable	.550*	.172	.014	.08	1.02
		Low	-1.083*	.204	.000	-1.64	-.52
	Low	Extreme High	2.267*	.267	.000	1.53	3.00
		High	2.059*	.198	.000	1.51	2.60
		Considerable	1.633*	.189	.000	1.11	2.15
		Moderate	1.083*	.204	.000	.52	1.64
Passenger evaluate for PC Inspection based on processing time	Extreme High	High	-.128	.234	.982	-.77	.52
		Considerable	-.450	.227	.278	-1.08	.18
		Moderate	-.467	.238	.289	-1.12	.19
		Low	-.700*	.249	.042	-1.38	-.02
	High	Extreme High	.128	.234	.982	-.52	.77
		Considerable	-.322	.154	.227	-.75	.10
		Moderate	-.339	.170	.272	-.81	.13
		Low	-.572*	.184	.019	-1.08	-.06
	Considerable	Extreme High	.450	.227	.278	-.18	1.08
		High	.322	.154	.227	-.10	.75
		Moderate	-.017	.160	1.000	-.46	.43

		Low	-.250	.176	.614	-.73	.23
	Moderate	Extreme High	.467	.238	.289	-.19	1.12
		High	.339	.170	.272	-.13	.81
		Considerable	.017	.160	1.000	-.43	.46
		Low	-.233	.190	.735	-.76	.29
	Low	Extreme High	.700*	.249	.042	.02	1.38
		High	.572*	.184	.019	.06	1.08
		Considerable	.250	.176	.614	-.23	.73
		Moderate	.233	.190	.735	-.29	.76
Passenger evaluate for PC Inspection staff based on Efficiency of inspection time	Extreme High	High	.000	.301	1.000	-.83	.83
		Considerable	-.367	.292	.718	-1.17	.44
		Moderate	-1.075*	.306	.005	-1.92	-.23
		Low	-1.433*	.320	.000	-2.31	-.55
	High	Extreme High	.000	.301	1.000	-.83	.83
		Considerable	-.367	.198	.348	-.91	.18
		Moderate	-1.075*	.219	.000	-1.68	-.47
		Low	-1.433*	.237	.000	-2.09	-.78
	Considerable	Extreme High	.367	.292	.718	-.44	1.17
		High	.367	.198	.348	-.18	.91
		Moderate	-.708*	.206	.007	-1.28	-.14
		Low	-1.067*	.226	.000	-1.69	-.44
	Moderate	Extreme High	1.075*	.306	.005	.23	1.92
		High	1.075*	.219	.000	.47	1.68
		Considerable	.708*	.206	.007	.14	1.28
		Low	-.358	.244	.585	-1.03	.31

	Low	Extreme High	1.433*	.320	.000	.55	2.31
		High	1.433*	.237	.000	.78	2.09
		Considerable	1.067*	.226	.000	.44	1.69
		Moderate	.358	.244	.585	-.31	1.03
Passenger evaluate for PC Inspection staff based on Courtesy/ helpfulness	Extreme High	High	.023	.299	1.000	-.80	.85
		Considerable	-.233	.290	.929	-1.03	.57
		Moderate	-1.083*	.304	.004	-1.92	-.24
		Low	-1.433*	.318	.000	-2.31	-.56
	High	Extreme High	-.023	.299	1.000	-.85	.80
		Considerable	-.257	.197	.690	-.80	.29
		Moderate	-1.107*	.217	.000	-1.71	-.51
		Low	-1.457*	.236	.000	-2.11	-.81
	Considerable	Extreme High	.233	.290	.929	-.57	1.03
		High	.257	.197	.690	-.29	.80
		Moderate	-.850*	.205	.000	-1.42	-.28
		Low	-1.200*	.225	.000	-1.82	-.58
	Moderate	Extreme High	1.083*	.304	.004	.24	1.92
		High	1.107*	.217	.000	.51	1.71
		Considerable	.850*	.205	.000	.28	1.42
		Low	-.350	.243	.602	-1.02	.32
	Low	Extreme High	1.433*	.318	.000	.56	2.31
		High	1.457*	.236	.000	.81	2.11
		Considerable	1.200*	.225	.000	.58	1.82
		Moderate	.350	.243	.602	-.32	1.02
	Extreme High	High	.067	.301	.999	-.76	.90

Passenger evaluate for PC Inspection staff based on Knowledge /expertise		Considerable	-.300	.292	.843	-1.11	.51
		Moderate	-1.058*	.306	.006	-1.90	-.21
		Low	-1.500*	.320	.000	-2.38	-.62
	High	Extreme High	-.067	.301	.999	-.90	.76
		Considerable	-.367	.198	.349	-.91	.18
		Moderate	-1.125*	.219	.000	-1.73	-.52
		Low	-1.567*	.238	.000	-2.22	-.91
	Considerable	Extreme High	.300	.292	.843	-.51	1.11
		High	.367	.198	.349	-.18	.91
		Moderate	-.758*	.207	.003	-1.33	-.19
		Low	-1.200*	.226	.000	-1.82	-.58
	Moderate	Extreme High	1.058*	.306	.006	.21	1.90
		High	1.125*	.219	.000	.52	1.73
		Considerable	.758*	.207	.003	.19	1.33
		Low	-.442	.244	.373	-1.12	.23
	Low	Extreme High	1.500*	.320	.000	.62	2.38
		High	1.567*	.238	.000	.91	2.22
		Considerable	1.200*	.226	.000	.58	1.82
		Moderate	.442	.244	.373	-.23	1.12
Passenger evaluate for BC based on waiting time to collect the baggage	Extreme High	High	-.709	.278	.085	-1.48	.06
		Considerable	-1.183*	.270	.000	-1.93	-.44
		Moderate	-2.100*	.283	.000	-2.88	-1.32
		Low	-2.300*	.296	.000	-3.12	-1.48
	High	Extreme High	.709	.278	.085	-.06	1.48
		Considerable	-.475	.183	.077	-.98	.03

		Moderate	-1.391*	.202	.000	-1.95	-.83
		Low	-1.591*	.220	.000	-2.20	-.99
	Considerable	Extreme High	1.183*	.270	.000	.44	1.93
		High	.475	.183	.077	-.03	.98
		Moderate	-.917*	.191	.000	-1.44	-.39
		Low	-1.117*	.209	.000	-1.69	-.54
	Moderate	Extreme High	2.100*	.283	.000	1.32	2.88
		High	1.391*	.202	.000	.83	1.95
		Considerable	.917*	.191	.000	.39	1.44
		Low	-.200	.226	.902	-.82	.42
	Low	Extreme High	2.300*	.296	.000	1.48	3.12
		High	1.591*	.220	.000	.99	2.20
		Considerable	1.117*	.209	.000	.54	1.69
		Moderate	.200	.226	.902	-.42	.82
Passenger evaluate for BC based on comfortable space around carousels	Extreme High	High	-.506	.290	.411	-1.31	.29
		Considerable	-1.050*	.282	.002	-1.83	-.27
		Moderate	-1.542*	.296	.000	-2.36	-.73
		Low	-2.000*	.309	.000	-2.85	-1.15
	High	Extreme High	.506	.290	.411	-.29	1.31
		Considerable	-.544*	.191	.039	-1.07	-.02
		Moderate	-1.036*	.211	.000	-1.62	-.45
		Low	-1.494*	.229	.000	-2.13	-.86
	Considerable	Extreme High	1.050*	.282	.002	.27	1.83
		High	.544*	.191	.039	.02	1.07
		Moderate	-.492	.199	.103	-1.04	.06

		Low	-.950*	.218	.000	-1.55	-.35
	Moderate	Extreme High	1.542*	.296	.000	.73	2.36
		High	1.036*	.211	.000	.45	1.62
		Considerable	.492	.199	.103	-.06	1.04
		Low	-.458	.236	.298	-1.11	.19
	Low	Extreme High	2.000*	.309	.000	1.15	2.85
		High	1.494*	.229	.000	.86	2.13
		Considerable	.950*	.218	.000	.35	1.55
		Moderate	.458	.236	.298	-.19	1.11
Passenger evaluate for BC based on the helpfulness of support staff	Extreme High	High	-.529	.334	.508	-1.45	.39
		Considerable	-1.050*	.324	.012	-1.94	-.16
		Moderate	-1.533*	.340	.000	-2.47	-.60
		Low	-1.300*	.355	.003	-2.28	-.32
	High	Extreme High	.529	.334	.508	-.39	1.45
		Considerable	-.521	.220	.128	-1.13	.08
		Moderate	-1.004*	.243	.000	-1.67	-.34
		Low	-.771*	.263	.031	-1.50	-.05
	Considerable	Extreme High	1.050*	.324	.012	.16	1.94
		High	.521	.220	.128	-.08	1.13
		Moderate	-.483	.229	.220	-1.11	.15
		Low	-.250	.251	.857	-.94	.44
	Moderate	Extreme High	1.533*	.340	.000	.60	2.47
		High	1.004*	.243	.000	.34	1.67
		Considerable	.483	.229	.220	-.15	1.11
		Low	.233	.271	.911	-.51	.98

	Low	Extreme High	1.300*	.355	.003	.32	2.28
		High	.771*	.263	.031	.05	1.50
		Considerable	.250	.251	.857	-.44	.94
		Moderate	-.233	.271	.911	-.98	.51
Passenger evaluate for BC based on the availability of baggage carts/trolley	Extreme High	High	-.622	.353	.400	-1.59	.35
		Considerable	-1.200*	.343	.005	-2.14	-.26
		Moderate	-1.300*	.360	.004	-2.29	-.31
		Low	-1.000	.376	.064	-2.04	.04
	High	Extreme High	.622	.353	.400	-.35	1.59
		Considerable	-.578	.233	.099	-1.22	.06
		Moderate	-.678	.257	.067	-1.39	.03
		Low	-.378	.279	.656	-1.15	.39
	Considerable	Extreme High	1.200*	.343	.005	.26	2.14
		High	.578	.233	.099	-.06	1.22
		Moderate	-.100	.243	.994	-.77	.57
		Low	.200	.266	.944	-.53	.93
	Moderate	Extreme High	1.300*	.360	.004	.31	2.29
		High	.678	.257	.067	-.03	1.39
		Considerable	.100	.243	.994	-.57	.77
		Low	.300	.287	.834	-.49	1.09
	Low	Extreme High	1.000	.376	.064	-.04	2.04
		High	.378	.279	.656	-.39	1.15
		Considerable	-.200	.266	.944	-.93	.53
		Moderate	-.300	.287	.834	-1.09	.49
	Extreme High	High	-.775*	.230	.008	-1.41	-.14

Passenger evaluate for Customs inspection based on waiting time		Considerable	-.917*	.223	.001	-1.53	-.30
		Moderate	-2.167*	.234	.000	-2.81	-1.52
		Low	-2.833*	.245	.000	-3.51	-2.16
	High	Extreme High	.775*	.230	.008	.14	1.41
		Considerable	-.141	.152	.884	-.56	.28
		Moderate	-1.391*	.167	.000	-1.85	-.93
		Low	-2.058*	.181	.000	-2.56	-1.56
	Considerable	Extreme High	.917*	.223	.001	.30	1.53
		High	.141	.152	.884	-.28	.56
		Moderate	-1.250*	.158	.000	-1.68	-.82
		Low	-1.917*	.173	.000	-2.39	-1.44
	Moderate	Extreme High	2.167*	.234	.000	1.52	2.81
		High	1.391*	.167	.000	.93	1.85
		Considerable	1.250*	.158	.000	.82	1.68
		Low	-.667*	.187	.004	-1.18	-.15
	Low	Extreme High	2.833*	.245	.000	2.16	3.51
		High	2.058*	.181	.000	1.56	2.56
		Considerable	1.917*	.173	.000	1.44	2.39
		Moderate	.667*	.187	.004	.15	1.18
Passenger evaluate for Customs inspection based on processing time	Extreme High	High	-.243	.219	.799	-.85	.36
		Considerable	-.150	.212	.955	-.73	.43
		Moderate	-.400	.223	.378	-1.01	.21
		Low	-.567	.232	.110	-1.21	.07
	High	Extreme High	.243	.219	.799	-.36	.85
		Considerable	.093	.144	.967	-.30	.49

		Moderate	-.157	.159	.862	-.59	.28
		Low	-.323	.173	.335	-.80	.15
	Considerable	Extreme High	.150	.212	.955	-.43	.73
		High	-.093	.144	.967	-.49	.30
		Moderate	-.250	.150	.458	-.66	.16
		Low	-.417	.164	.087	-.87	.04
	Moderate	Extreme High	.400	.223	.378	-.21	1.01
		High	.157	.159	.862	-.28	.59
		Considerable	.250	.150	.458	-.16	.66
		Low	-.167	.178	.881	-.66	.32
	Low	Extreme High	.567	.232	.110	-.07	1.21
		High	.323	.173	.335	-.15	.80
		Considerable	.417	.164	.087	-.04	.87
		Moderate	.167	.178	.881	-.32	.66
Passenger evaluate for Customs inspection staff based on efficiency of inspection time	Extreme High	High	-.230	.296	.937	-1.05	.59
		Considerable	.000	.288	1.000	-.79	.79
		Moderate	-.450	.302	.570	-1.28	.38
		Low	-.567	.315	.378	-1.43	.30
	High	Extreme High	.230	.296	.937	-.59	1.05
		Considerable	.230	.195	.763	-.31	.77
		Moderate	-.220	.215	.846	-.81	.37
		Low	-.336	.234	.604	-.98	.31
	Considerable	Extreme High	.000	.288	1.000	-.79	.79
		High	-.230	.195	.763	-.77	.31
		Moderate	-.450	.203	.180	-1.01	.11

		Low	-.567	.223	.086	-1.18	.05
	Moderate	Extreme High	.450	.302	.570	-.38	1.28
		High	.220	.215	.846	-.37	.81
		Considerable	.450	.203	.180	-.11	1.01
		Low	-.117	.241	.989	-.78	.55
	Low	Extreme High	.567	.315	.378	-.30	1.43
		High	.336	.234	.604	-.31	.98
		Considerable	.567	.223	.086	-.05	1.18
		Moderate	.117	.241	.989	-.55	.78
Passenger evaluate for Customs inspection staff based on Courtesy/ helpfulness	Extreme High	High	.129	.248	.985	-.55	.81
		Considerable	.017	.241	1.000	-.65	.68
		Moderate	-.217	.252	.912	-.91	.48
		Low	-.200	.264	.942	-.93	.53
	High	Extreme High	-.129	.248	.985	-.81	.55
		Considerable	-.112	.163	.959	-.56	.34
		Moderate	-.346	.180	.312	-.84	.15
		Low	-.329	.196	.448	-.87	.21
	Considerable	Extreme High	-.017	.241	1.000	-.68	.65
		High	.112	.163	.959	-.34	.56
		Moderate	-.233	.170	.647	-.70	.24
		Low	-.217	.186	.773	-.73	.30
	Moderate	Extreme High	.217	.252	.912	-.48	.91
		High	.346	.180	.312	-.15	.84
		Considerable	.233	.170	.647	-.24	.70
		Low	.017	.201	1.000	-.54	.57

	Low	Extreme High	.200	.264	.942	-.53	.93
		High	.329	.196	.448	-.21	.87
		Considerable	.217	.186	.773	-.30	.73
		Moderate	-.017	.201	1.000	-.57	.54
Passenger evaluate for Customs inspection staff based on Knowledge /expertise	Extreme High	High	-.551	.313	.400	-1.41	.31
		Considerable	-.933*	.304	.020	-1.77	-.10
		Moderate	-1.133*	.318	.004	-2.01	-.26
		Low	-1.400*	.333	.000	-2.32	-.48
	High	Extreme High	.551	.313	.400	-.31	1.41
		Considerable	-.383	.206	.345	-.95	.19
		Moderate	-.583	.227	.082	-1.21	.04
		Low	-.849*	.247	.006	-1.53	-.17
	Considerable	Extreme High	.933*	.304	.020	.10	1.77
		High	.383	.206	.345	-.19	.95
		Moderate	-.200	.215	.884	-.79	.39
		Low	-.467	.235	.278	-1.11	.18
	Moderate	Extreme High	1.133*	.318	.004	.26	2.01
		High	.583	.227	.082	-.04	1.21
		Considerable	.200	.215	.884	-.39	.79
		Low	-.267	.254	.832	-.97	.43
	Low	Extreme High	1.400*	.333	.000	.48	2.32
		High	.849*	.247	.006	.17	1.53
		Considerable	.467	.235	.278	-.18	1.11
		Moderate	.267	.254	.832	-.43	.97
	Extreme High	High	-.817*	.243	.008	-1.49	-.15

Passenger evaluate for UA registration based on waiting time		Considerable	-.933*	.235	.001	-1.58	-.28
		Moderate	-1.750*	.247	.000	-2.43	-1.07
		Low	-2.867*	.258	.000	-3.58	-2.16
	High	Extreme High	.817*	.243	.008	.15	1.49
		Considerable	-.116	.160	.950	-.56	.32
		Moderate	-.933*	.176	.000	-1.42	-.45
		Low	-2.049*	.191	.000	-2.58	-1.52
	Considerable	Extreme High	.933*	.235	.001	.28	1.58
		High	.116	.160	.950	-.32	.56
		Moderate	-.817*	.166	.000	-1.28	-.36
		Low	-1.933*	.182	.000	-2.44	-1.43
	Moderate	Extreme High	1.750*	.247	.000	1.07	2.43
		High	.933*	.176	.000	.45	1.42
		Considerable	.817*	.166	.000	.36	1.28
		Low	-1.117*	.197	.000	-1.66	-.57
	Low	Extreme High	2.867*	.258	.000	2.16	3.58
		High	2.049*	.191	.000	1.52	2.58
		Considerable	1.933*	.182	.000	1.43	2.44
		Moderate	1.117*	.197	.000	.57	1.66
Passenger evaluate for UA registration based on processing time	Extreme High	High	-.933*	.187	.000	-1.45	-.42
		Considerable	-1.383*	.182	.000	-1.88	-.88
		Moderate	-2.483*	.191	.000	-3.01	-1.96
		Low	-3.767*	.199	.000	-4.32	-3.22
	High	Extreme High	.933*	.187	.000	.42	1.45
		Considerable	-.450*	.123	.003	-.79	-.11

		Moderate	-1.550*	.136	.000	-1.93	-1.17
		Low	-2.833*	.148	.000	-3.24	-2.43
	Considerable	Extreme High	1.383*	.182	.000	.88	1.88
		High	.450*	.123	.003	.11	.79
		Moderate	-1.100*	.129	.000	-1.45	-.75
		Low	-2.383*	.141	.000	-2.77	-2.00
	Moderate	Extreme High	2.483*	.191	.000	1.96	3.01
		High	1.550*	.136	.000	1.17	1.93
		Considerable	1.100*	.129	.000	.75	1.45
		Low	-1.283*	.152	.000	-1.70	-.86
	Low	Extreme High	3.767*	.199	.000	3.22	4.32
		High	2.833*	.148	.000	2.43	3.24
		Considerable	2.383*	.141	.000	2.00	2.77
		Moderate	1.283*	.152	.000	.86	1.70
Passenger evaluate for UA registration staff based on Efficiency of registration time	Extreme High	High	-.187	.331	.980	-1.10	.72
		Considerable	-.217	.321	.962	-1.10	.67
		Moderate	-.600	.337	.388	-1.53	.33
		Low	-.833	.352	.129	-1.80	.14
	High	Extreme High	.187	.331	.980	-.72	1.10
		Considerable	-.030	.218	1.000	-.63	.57
		Moderate	-.413	.241	.426	-1.08	.25
		Low	-.646	.261	.101	-1.37	.07
	Considerable	Extreme High	.217	.321	.962	-.67	1.10
		High	.030	.218	1.000	-.57	.63
		Moderate	-.383	.227	.444	-1.01	.24

		Low	-.617	.249	.100	-1.30	.07
	Moderate	Extreme High	.600	.337	.388	-.33	1.53
		High	.413	.241	.426	-.25	1.08
		Considerable	.383	.227	.444	-.24	1.01
		Low	-.233	.269	.908	-.97	.51
	Low	Extreme High	.833	.352	.129	-.14	1.80
		High	.646	.261	.101	-.07	1.37
		Considerable	.617	.249	.100	-.07	1.30
		Moderate	.233	.269	.908	-.51	.97
Passenger evaluate for UA registration staff based on Courtesy/ helpfulness	Extreme High	High	.052	.262	1.000	-.67	.77
		Considerable	-.117	.254	.991	-.82	.58
		Moderate	-.125	.267	.990	-.86	.61
		Low	-.167	.279	.975	-.93	.60
	High	Extreme High	-.052	.262	1.000	-.77	.67
		Considerable	-.169	.173	.865	-.64	.31
		Moderate	-.177	.190	.885	-.70	.35
		Low	-.219	.207	.827	-.79	.35
	Considerable	Extreme High	.117	.254	.991	-.58	.82
		High	.169	.173	.865	-.31	.64
		Moderate	-.008	.180	1.000	-.50	.49
		Low	-.050	.197	.999	-.59	.49
	Moderate	Extreme High	.125	.267	.990	-.61	.86
		High	.177	.190	.885	-.35	.70
		Considerable	.008	.180	1.000	-.49	.50
		Low	-.042	.213	1.000	-.63	.54

	Low	Extreme High	.167	.279	.975	-.60	.93
		High	.219	.207	.827	-.35	.79
		Considerable	.050	.197	.999	-.49	.59
		Moderate	.042	.213	1.000	-.54	.63
Passenger evaluate for UA registration staff based on Knowledge /expertise	Extreme High	High	-.043	.302	1.000	-.88	.79
		Considerable	-.100	.294	.997	-.91	.71
		Moderate	-.425	.308	.641	-1.27	.42
		Low	-.400	.322	.726	-1.29	.49
	High	Extreme High	.043	.302	1.000	-.79	.88
		Considerable	-.057	.199	.999	-.61	.49
		Moderate	-.382	.220	.415	-.99	.22
		Low	-.357	.239	.568	-1.01	.30
	Considerable	Extreme High	.100	.294	.997	-.71	.91
		High	.057	.199	.999	-.49	.61
		Moderate	-.325	.208	.521	-.90	.25
		Low	-.300	.227	.679	-.93	.33
	Moderate	Extreme High	.425	.308	.641	-.42	1.27
		High	.382	.220	.415	-.22	.99
		Considerable	.325	.208	.521	-.25	.90
		Low	.025	.246	1.000	-.65	.70
	Low	Extreme High	.400	.322	.726	-.49	1.29
		High	.357	.239	.568	-.30	1.01
		Considerable	.300	.227	.679	-.33	.93
		Moderate	-.025	.246	1.000	-.70	.65
	Extreme High	High	-.552	.257	.205	-1.26	.16

Passenger evaluate for ASB based on duration time of this process		Considerable	-.550	.250	.183	-1.24	.14
		Moderate	-2.425*	.262	.000	-3.15	-1.70
		Low	-2.033*	.273	.000	-2.79	-1.28
	High	Extreme High	.552	.257	.205	-.16	1.26
		Considerable	.002	.169	1.000	-.46	.47
		Moderate	-1.873*	.187	.000	-2.39	-1.36
		Low	-1.481*	.203	.000	-2.04	-.92
	Considerable	Extreme High	.550	.250	.183	-.14	1.24
		High	-.002	.169	1.000	-.47	.46
		Moderate	-1.875*	.177	.000	-2.36	-1.39
		Low	-1.483*	.193	.000	-2.02	-.95
	Moderate	Extreme High	2.425*	.262	.000	1.70	3.15
		High	1.873*	.187	.000	1.36	2.39
		Considerable	1.875*	.177	.000	1.39	2.36
		Low	.392	.209	.334	-.18	.97
	Low	Extreme High	2.033*	.273	.000	1.28	2.79
		High	1.481*	.203	.000	.92	2.04
		Considerable	1.483*	.193	.000	.95	2.02
		Moderate	-.392	.209	.334	-.97	.18
Passenger evaluate for ABS staff based on Efficiency of duration time	Extreme High	High	-.175	.251	.957	-.87	.52
		Considerable	-.267	.244	.809	-.94	.40
		Moderate	-.692	.256	.057	-1.40	.01
		Low	-.900*	.267	.008	-1.64	-.16
	High	Extreme High	.175	.251	.957	-.52	.87
		Considerable	-.091	.165	.982	-.55	.36

		Moderate	-.516*	.182	.041	-1.02	-.01
		Low	-.725*	.198	.003	-1.27	-.18
	Considerable	Extreme High	.267	.244	.809	-.40	.94
		High	.091	.165	.982	-.36	.55
		Moderate	-.425	.172	.103	-.90	.05
		Low	-.633*	.189	.008	-1.15	-.11
	Moderate	Extreme High	.692	.256	.057	-.01	1.40
		High	.516*	.182	.041	.01	1.02
		Considerable	.425	.172	.103	-.05	.90
		Low	-.208	.204	.845	-.77	.35
	Low	Extreme High	.900*	.267	.008	.16	1.64
		High	.725*	.198	.003	.18	1.27
		Considerable	.633*	.189	.008	.11	1.15
		Moderate	.208	.204	.845	-.35	.77
Passenger evaluate for ABS staff based on Courtesy/ helpfulness	Extreme High	High	.096	.223	.993	-.52	.71
		Considerable	.017	.216	1.000	-.58	.61
		Moderate	-.164	.228	.951	-.79	.46
		Low	-.267	.237	.793	-.92	.39
	High	Extreme High	-.096	.223	.993	-.71	.52
		Considerable	-.079	.147	.983	-.48	.33
		Moderate	-.260	.163	.504	-.71	.19
		Low	-.362	.176	.241	-.85	.12
	Considerable	Extreme High	-.017	.216	1.000	-.61	.58
		High	.079	.147	.983	-.33	.48
		Moderate	-.181	.154	.767	-.61	.24

		Low	-.283	.167	.442	-.74	.18
	Moderate	Extreme High	.164	.228	.951	-.46	.79
		High	.260	.163	.504	-.19	.71
		Considerable	.181	.154	.767	-.24	.61
		Low	-.103	.182	.980	-.60	.40
	Low	Extreme High	.267	.237	.793	-.39	.92
		High	.362	.176	.241	-.12	.85
		Considerable	.283	.167	.442	-.18	.74
		Moderate	.103	.182	.980	-.40	.60
Passenger evaluate for ABS staff based on Knowledge /expertise	Extreme High	High	-.025	.273	1.000	-.78	.73
		Considerable	-.250	.265	.879	-.98	.48
		Moderate	-.287	.279	.841	-1.06	.48
		Low	-.433	.290	.568	-1.23	.37
	High	Extreme High	.025	.273	1.000	-.73	.78
		Considerable	-.225	.180	.720	-.72	.27
		Moderate	-.263	.200	.683	-.81	.29
		Low	-.409	.215	.322	-1.00	.18
	Considerable	Extreme High	.250	.265	.879	-.48	.98
		High	.225	.180	.720	-.27	.72
		Moderate	-.037	.189	1.000	-.56	.48
		Low	-.183	.205	.899	-.75	.38
	Moderate	Extreme High	.287	.279	.841	-.48	1.06
		High	.263	.200	.683	-.29	.81
		Considerable	.037	.189	1.000	-.48	.56
		Low	-.146	.223	.965	-.76	.47

	Low	Extreme High	.433	.290	.568	-.37	1.23
		High	.409	.215	.322	-.18	1.00
		Considerable	.183	.205	.899	-.38	.75
		Moderate	.146	.223	.965	-.47	.76
Passenger evaluate for ABS staff based on Justice (first in, first out rule)	Extreme High	High	-.097	.211	.991	-.68	.48
		Considerable	-.250	.205	.738	-.81	.31
		Moderate	-.338	.215	.517	-.93	.25
		Low	-.200	.224	.899	-.82	.42
	High	Extreme High	.097	.211	.991	-.48	.68
		Considerable	-.153	.139	.806	-.54	.23
		Moderate	-.241	.154	.522	-.67	.18
		Low	-.103	.166	.972	-.56	.36
	Considerable	Extreme High	.250	.205	.738	-.31	.81
		High	.153	.139	.806	-.23	.54
		Moderate	-.088	.146	.974	-.49	.31
		Low	.050	.158	.998	-.39	.49
	Moderate	Extreme High	.338	.215	.517	-.25	.93
		High	.241	.154	.522	-.18	.67
		Considerable	.088	.146	.974	-.31	.49
		Low	.138	.172	.929	-.34	.61
	Low	Extreme High	.200	.224	.899	-.42	.82
		High	.103	.166	.972	-.36	.56
		Considerable	-.050	.158	.998	-.49	.39
		Moderate	-.138	.172	.929	-.61	.34
	Extreme High	High	.062	.329	1.000	-.85	.97

Passenger evaluate for ABS staff based on Support tools for special need people		Considerable	-.240	.324	.947	-1.14	.66
		Moderate	-.350	.347	.851	-1.31	.61
		Low	-.544	.364	.567	-1.55	.46
	High	Extreme High	-.062	.329	1.000	-.97	.85
		Considerable	-.302	.207	.591	-.87	.27
		Moderate	-.412	.242	.435	-1.08	.26
		Low	-.607	.265	.155	-1.34	.13
	Considerable	Extreme High	.240	.324	.947	-.66	1.14
		High	.302	.207	.591	-.27	.87
		Moderate	-.110	.235	.990	-.76	.54
		Low	-.305	.259	.764	-1.02	.41
	Moderate	Extreme High	.350	.347	.851	-.61	1.31
		High	.412	.242	.435	-.26	1.08
		Considerable	.110	.235	.990	-.54	.76
		Low	-.194	.288	.961	-.99	.60
	Low	Extreme High	.544	.364	.567	-.46	1.55
		High	.607	.265	.155	-.13	1.34
		Considerable	.305	.259	.764	-.41	1.02
		Moderate	.194	.288	.961	-.60	.99
Overall passenger evaluate for waiting time in all steps	Extreme High	High	-.428	.170	.092	-.90	.04
		Considerable	-.217	.165	.684	-.67	.24
		Moderate	-1.692*	.173	.000	-2.17	-1.21
		Low	-2.900*	.181	.000	-3.40	-2.40
	High	Extreme High	.428	.170	.092	-.04	.90
		Considerable	.211	.112	.331	-.10	.52

		Moderate	-1.264*	.124	.000	-1.60	-.92
		Low	-2.472*	.134	.000	-2.84	-2.10
	Considerable	Extreme High	.217	.165	.684	-.24	.67
		High	-.211	.112	.331	-.52	.10
		Moderate	-1.475*	.117	.000	-1.80	-1.15
		Low	-2.683*	.128	.000	-3.04	-2.33
	Moderate	Extreme High	1.692*	.173	.000	1.21	2.17
		High	1.264*	.124	.000	.92	1.60
		Considerable	1.475*	.117	.000	1.15	1.80
		Low	-1.208*	.138	.000	-1.59	-.83
	Low	Extreme High	2.900*	.181	.000	2.40	3.40
		High	2.472*	.134	.000	2.10	2.84
		Considerable	2.683*	.128	.000	2.33	3.04
		Moderate	1.208*	.138	.000	.83	1.59
Overall passenger evaluate for processing time in all steps	Extreme High	High	-.355	.351	.849	-1.32	.61
		Considerable	-.433	.340	.708	-1.37	.50
		Moderate	-.733	.357	.245	-1.72	.25
		Low	-.733	.373	.286	-1.76	.29
	High	Extreme High	.355	.351	.849	-.61	1.32
		Considerable	-.078	.231	.997	-.71	.56
		Moderate	-.378	.255	.574	-1.08	.32
		Low	-.378	.277	.649	-1.14	.38
	Considerable	Extreme High	.433	.340	.708	-.50	1.37
		High	.078	.231	.997	-.56	.71
		Moderate	-.300	.241	.724	-.96	.36

		Low	-.300	.264	.786	-1.03	.43
	Moderate	Extreme High	.733	.357	.245	-.25	1.72
		High	.378	.255	.574	-.32	1.08
		Considerable	.300	.241	.724	-.36	.96
		Low	.000	.285	1.000	-.78	.78
	Low	Extreme High	.733	.373	.286	-.29	1.76
		High	.378	.277	.649	-.38	1.14
		Considerable	.300	.264	.786	-.43	1.03
		Moderate	.000	.285	1.000	-.78	.78
Overall passenger evaluate for Hajj Terminal (HT) facilities based on cleanliness of restrooms/ washrooms (WC)	Extreme High	High	.083	.165	.987	-.37	.54
		Considerable	.139	.160	.908	-.30	.58
		Moderate	-.050	.168	.998	-.51	.41
		Low	-.300	.175	.429	-.78	.18
	High	Extreme High	-.083	.165	.987	-.54	.37
		Considerable	.056	.109	.986	-.24	.36
		Moderate	-.133	.120	.802	-.46	.20
		Low	-.383*	.130	.030	-.74	-.02
	Considerable	Extreme High	-.139	.160	.908	-.58	.30
		High	-.056	.109	.986	-.36	.24
		Moderate	-.189	.113	.458	-.50	.12
		Low	-.439*	.124	.005	-.78	-.10
	Moderate	Extreme High	.050	.168	.998	-.41	.51
		High	.133	.120	.802	-.20	.46
		Considerable	.189	.113	.458	-.12	.50
		Low	-.250	.134	.338	-.62	.12

	Low	Extreme High	.300	.175	.429	-.18	.78
		High	.383*	.130	.030	.02	.74
		Considerable	.439*	.124	.005	.10	.78
		Moderate	.250	.134	.338	-.12	.62
Overall passenger evaluate for HT facilities based on quality of restaurant and eating facilities	Extreme High	High	.042	.268	1.000	-.70	.79
		Considerable	-.125	.251	.987	-.82	.57
		Moderate	-.101	.262	.995	-.83	.63
		Low	-.403	.268	.562	-1.15	.34
	High	Extreme High	-.042	.268	1.000	-.79	.70
		Considerable	-.167	.188	.901	-.69	.36
		Moderate	-.143	.202	.955	-.71	.42
		Low	-.444	.210	.222	-1.03	.14
	Considerable	Extreme High	.125	.251	.987	-.57	.82
		High	.167	.188	.901	-.36	.69
		Moderate	.024	.179	1.000	-.48	.52
		Low	-.278	.188	.579	-.80	.25
	Moderate	Extreme High	.101	.262	.995	-.63	.83
		High	.143	.202	.955	-.42	.71
		Considerable	-.024	.179	1.000	-.52	.48
		Low	-.302	.202	.571	-.86	.26
	Low	Extreme High	.403	.268	.562	-.34	1.15
		High	.444	.210	.222	-.14	1.03
		Considerable	.278	.188	.579	-.25	.80
		Moderate	.302	.202	.571	-.26	.86
	Extreme High	High	-.494	.303	.481	-1.33	.35

Overall passenger evaluate for HT facilities based on special needs and disabilities support service		Considerable	-.667	.291	.154	-1.47	.14
		Moderate	-.917*	.311	.031	-1.78	-.06
		Low	-1.020*	.328	.019	-1.93	-.11
	High	Extreme High	.494	.303	.481	-.35	1.33
		Considerable	-.172	.190	.894	-.70	.35
		Moderate	-.422	.219	.309	-1.03	.19
		Low	-.525	.243	.201	-1.20	.15
	Considerable	Extreme High	.667	.291	.154	-.14	1.47
		High	.172	.190	.894	-.35	.70
		Moderate	-.250	.202	.728	-.81	.31
		Low	-.353	.227	.529	-.98	.28
	Moderate	Extreme High	.917*	.311	.031	.06	1.78
		High	.422	.219	.309	-.19	1.03
		Considerable	.250	.202	.728	-.31	.81
		Low	-.103	.252	.994	-.80	.59
	Low	Extreme High	1.020*	.328	.019	.11	1.93
		High	.525	.243	.201	-.15	1.20
		Considerable	.353	.227	.529	-.28	.98
		Moderate	.103	.252	.994	-.59	.80
Overall passenger evaluate for HT facilities based on comfort of waiting areas and seats	Extreme High	High	.032	.213	1.000	-.56	.62
		Considerable	.026	.207	1.000	-.55	.60
		Moderate	-.108	.217	.987	-.71	.49
		Low	-.600	.227	.067	-1.23	.03
	High	Extreme High	-.032	.213	1.000	-.62	.56
		Considerable	-.006	.141	1.000	-.39	.38

		Moderate	-.140	.155	.895	-.57	.29
		Low	-.632*	.168	.002	-1.10	-.17
	Considerable	Extreme High	-.026	.207	1.000	-.60	.55
		High	.006	.141	1.000	-.38	.39
		Moderate	-.134	.147	.891	-.54	.27
		Low	-.626*	.161	.001	-1.07	-.18
	Moderate	Extreme High	.108	.217	.987	-.49	.71
		High	.140	.155	.895	-.29	.57
		Considerable	.134	.147	.891	-.27	.54
		Low	-.492*	.173	.040	-.97	-.01
	Low	Extreme High	.600	.227	.067	-.03	1.23
		High	.632*	.168	.002	.17	1.10
		Considerable	.626*	.161	.001	.18	1.07
		Moderate	.492*	.173	.040	.01	.97
Overall passenger evaluate for HT facilities based on information visibility/signs	Extreme High	High	-.390	.260	.563	-1.11	.33
		Considerable	-.374	.253	.576	-1.07	.32
		Moderate	-.558	.264	.220	-1.29	.17
		Low	-.761	.278	.052	-1.53	.00
	High	Extreme High	.390	.260	.563	-.33	1.11
		Considerable	.016	.172	1.000	-.46	.49
		Moderate	-.168	.189	.900	-.69	.35
		Low	-.371	.207	.382	-.94	.20
	Considerable	Extreme High	.374	.253	.576	-.32	1.07
		High	-.016	.172	1.000	-.49	.46
		Moderate	-.184	.179	.841	-.68	.31

		Low	-.387	.198	.293	-.93	.16
	Moderate	Extreme High	.558	.264	.220	-.17	1.29
		High	.168	.189	.900	-.35	.69
		Considerable	.184	.179	.841	-.31	.68
		Low	-.203	.213	.876	-.79	.38
	Low	Extreme High	.761	.278	.052	.00	1.53
		High	.371	.207	.382	-.20	.94
		Considerable	.387	.198	.293	-.16	.93
		Moderate	.203	.213	.876	-.38	.79
Overall passenger evaluate for HT facilities based on help and contacts Information service	Extreme High	High	-.193	.251	.939	-.88	.50
		Considerable	-.223	.244	.891	-.89	.45
		Moderate	-.123	.256	.989	-.83	.58
		Low	-.510	.270	.327	-1.25	.23
	High	Extreme High	.193	.251	.939	-.50	.88
		Considerable	-.030	.166	1.000	-.49	.43
		Moderate	.070	.183	.996	-.44	.58
		Low	-.317	.202	.520	-.87	.24
	Considerable	Extreme High	.223	.244	.891	-.45	.89
		High	.030	.166	1.000	-.43	.49
		Moderate	.100	.174	.979	-.38	.58
		Low	-.287	.193	.574	-.82	.25
	Moderate	Extreme High	.123	.256	.989	-.58	.83
		High	-.070	.183	.996	-.58	.44
		Considerable	-.100	.174	.979	-.58	.38
		Low	-.386	.209	.348	-.96	.19

	Low	Extreme High	.510	.270	.327	-.23	1.25
		High	.317	.202	.520	-.24	.87
		Considerable	.287	.193	.574	-.25	.82
		Moderate	.386	.209	.348	-.19	.96
Overall passenger evaluate for HT facilities based on ease of finding way through the terminals	Extreme High	High	-.448	.223	.268	-1.06	.17
		Considerable	-.380	.217	.408	-.98	.22
		Moderate	-.425	.227	.338	-1.05	.20
		Low	-.633	.238	.063	-1.29	.02
	High	Extreme High	.448	.223	.268	-.17	1.06
		Considerable	.068	.148	.991	-.34	.48
		Moderate	.023	.162	1.000	-.42	.47
		Low	-.186	.176	.830	-.67	.30
	Considerable	Extreme High	.380	.217	.408	-.22	.98
		High	-.068	.148	.991	-.48	.34
		Moderate	-.045	.154	.998	-.47	.38
		Low	-.254	.168	.560	-.72	.21
	Moderate	Extreme High	.425	.227	.338	-.20	1.05
		High	-.023	.162	1.000	-.47	.42
		Considerable	.045	.154	.998	-.38	.47
		Low	-.208	.181	.781	-.71	.29
	Low	Extreme High	.633	.238	.063	-.02	1.29
		High	.186	.176	.830	-.30	.67
		Considerable	.254	.168	.560	-.21	.72
		Moderate	.208	.181	.781	-.29	.71
	Extreme High	High	-.133	.171	.936	-.60	.34

Overall passenger evaluate for HT facilities based on walking distance inside the terminal		Considerable	-.197	.166	.760	-.65	.26
		Moderate	-.325	.174	.337	-.80	.15
		Low	-.467	.181	.080	-.97	.03
	High	Extreme High	.133	.171	.936	-.34	.60
		Considerable	-.063	.114	.981	-.38	.25
		Moderate	-.192	.125	.540	-.54	.15
		Low	-.333	.135	.103	-.71	.04
	Considerable	Extreme High	.197	.166	.760	-.26	.65
		High	.063	.114	.981	-.25	.38
		Moderate	-.128	.118	.810	-.45	.20
		Low	-.270	.129	.225	-.62	.08
	Moderate	Extreme High	.325	.174	.337	-.15	.80
		High	.192	.125	.540	-.15	.54
		Considerable	.128	.118	.810	-.20	.45
		Low	-.142	.139	.845	-.52	.24
	Low	Extreme High	.467	.181	.080	-.03	.97
		High	.333	.135	.103	-.04	.71
		Considerable	.270	.129	.225	-.08	.62
		Moderate	.142	.139	.845	-.24	.52
Overall passenger evaluate for HT facilities based on courtesy/ helpfulness of airport staff	Extreme High	High	.075	.259	.998	-.64	.79
		Considerable	-.008	.252	1.000	-.70	.69
		Moderate	-.033	.264	1.000	-.76	.69
		Low	-.167	.275	.974	-.93	.59
	High	Extreme High	-.075	.259	.998	-.79	.64
		Considerable	-.083	.171	.989	-.56	.39

		Moderate	-.109	.188	.978	-.63	.41
		Low	-.242	.204	.761	-.81	.32
	Considerable	Extreme High	.008	.252	1.000	-.69	.70
		High	.083	.171	.989	-.39	.56
		Moderate	-.025	.178	1.000	-.52	.47
		Low	-.159	.195	.926	-.70	.38
	Moderate	Extreme High	.033	.264	1.000	-.69	.76
		High	.109	.188	.978	-.41	.63
		Considerable	.025	.178	1.000	-.47	.52
		Low	-.133	.210	.969	-.71	.45
	Low	Extreme High	.167	.275	.974	-.59	.93
		High	.242	.204	.761	-.32	.81
		Considerable	.159	.195	.926	-.38	.70
		Moderate	.133	.210	.969	-.45	.71
Overall passenger evaluate for HT facilities based on cleanliness of arrival domain at Hajj terminals	Extreme High	High	.075	.162	.991	-.37	.52
		Considerable	-.041	.157	.999	-.48	.39
		Moderate	-.093	.164	.980	-.55	.36
		Low	-.343	.171	.270	-.82	.13
	High	Extreme High	-.075	.162	.991	-.52	.37
		Considerable	-.116	.104	.801	-.40	.17
		Moderate	-.167	.115	.589	-.48	.15
		Low	-.417*	.124	.008	-.76	-.07
	Considerable	Extreme High	.041	.157	.999	-.39	.48
		High	.116	.104	.801	-.17	.40
		Moderate	-.052	.108	.989	-.35	.25

		Low	-.302	.119	.086	-.63	.03
	Moderate	Extreme High	.093	.164	.980	-.36	.55
		High	.167	.115	.589	-.15	.48
		Considerable	.052	.108	.989	-.25	.35
		Low	-.250	.128	.293	-.60	.10
	Low	Extreme High	.343	.171	.270	-.13	.82
		High	.417*	.124	.008	.07	.76
		Considerable	.302	.119	.086	-.03	.63
		Moderate	.250	.128	.293	-.10	.60
Overall passenger evaluate for HT facilities based on ambiance of arrival domain at Hajj terminals	Extreme High	High	-.139	.207	.962	-.71	.43
		Considerable	-.010	.201	1.000	-.56	.54
		Moderate	-.275	.211	.688	-.86	.31
		Low	-.300	.220	.652	-.91	.31
	High	Extreme High	.139	.207	.962	-.43	.71
		Considerable	.129	.137	.880	-.25	.51
		Moderate	-.136	.150	.895	-.55	.28
		Low	-.161	.163	.862	-.61	.29
	Considerable	Extreme High	.010	.201	1.000	-.54	.56
		High	-.129	.137	.880	-.51	.25
		Moderate	-.265	.143	.344	-.66	.13
		Low	-.290	.156	.344	-.72	.14
	Moderate	Extreme High	.275	.211	.688	-.31	.86
		High	.136	.150	.895	-.28	.55
		Considerable	.265	.143	.344	-.13	.66
		Low	-.025	.168	1.000	-.49	.44

	Low	Extreme High	.300	.220	.652	-.31	.91
		High	.161	.163	.862	-.29	.61
		Considerable	.290	.156	.344	-.14	.72
		Moderate	.025	.168	1.000	-.44	.49
Overall passenger evaluate for HT facilities based on internet/ wireless access service card	Extreme High	High	.333	.339	.862	-.62	1.28
		Considerable	.273	.325	.917	-.64	1.19
		Moderate	-.067	.339	1.000	-1.02	.88
		Low	-.083	.349	.999	-1.06	.90
	High	Extreme High	-.333	.339	.862	-1.28	.62
		Considerable	-.061	.220	.999	-.68	.56
		Moderate	-.400	.240	.460	-1.07	.27
		Low	-.417	.254	.478	-1.13	.30
	Considerable	Extreme High	-.273	.325	.917	-1.19	.64
		High	.061	.220	.999	-.56	.68
		Moderate	-.339	.220	.538	-.96	.28
		Low	-.356	.235	.558	-1.02	.30
	Moderate	Extreme High	.067	.339	1.000	-.88	1.02
		High	.400	.240	.460	-.27	1.07
		Considerable	.339	.220	.538	-.28	.96
		Low	-.017	.254	1.000	-.73	.70
	Low	Extreme High	.083	.349	.999	-.90	1.06
		High	.417	.254	.478	-.30	1.13
		Considerable	.356	.235	.558	-.30	1.02
		Moderate	.017	.254	1.000	-.70	.73

*. The mean difference is significant at the 0.05 level.

Appendix D Survey of framework validation

Framework for Improving Arrival Processing of Passenger International Airport

Dear Participant,

We sincerely thank you for your contribution and taking time to participate in this study. In this survey, you will be asked a few questions about your previous experience with international airport for a follow-up study and validity the proposed framework. The average completion time of this study is 5 minutes. Your responses will be used for this study only and will be treated with confidence. Your participation in this study is completely voluntary. If you begin the study and do not want to continue with it, you may withdraw at any time during the study for any reason by simply closing the browser window. If you would like

to withdraw your data after submission of the survey, you can contact the researcher for whom contact details have been provided below.

If you need further information about the research, please feel free to contact **Mr Alhussin K Abudiyah** at (abudiyah@cranfield.ac.uk).

We hope you will enjoy engaging with this study and your help is highly appreciate.

- ○ Yes, I consent
- ○ No, I do not consent

Name (option):
Organization (option):
Position (option):
Experience in aviation:
Experience in the Airport industry:

To what extent do you believe that the implementation of this framework in arrival processing at the crowded airport is practically feasible?

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q2 **To what extent do you believe that the implementation of this framework in arrival processing at the crowded airport could help to improve this system in term of service level?**

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q3 **To what extent do you believe that this framework is understandable by airport management and employees?**

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q4 **To what extent do you believe that the implementation of this framework in arrival processing at Hajj terminals or other crowded airports will lead to** eliminating non-added value activities in these terminals.

○ 0 (Completely disagree)	○ 4	○ 8
○ 1	○ 5	○ 9
○ 2	○ 6	○ 10 (Completely agree)
○ 3	○ 7	

Q5 **To what extent do you believe that the implementation of this framework in arrival processing at Hajj terminals or other crowded airports will lead to** reducing the overall processing time.

○ 0 (Completely disagree)	○ 4	○ 8
○ 1	○ 5	○ 9
○ 2	○ 6	○ 10 (Completely agree)
○ 3	○ 7	

Q6 **To what extent do you believe that the implementation of this framework in arrival processing at Hajj terminals or other crowded airports will lead to** reducing the congestion level.

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q7 **To what extent do you believe that the implementation of this framework in arrival processing at Hajj terminals or other crowded airports will lead to** reducing the overall operational cost.

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q8 **To what extent do you believe that the implementation of this framework in arrival processing at Hajj terminals or other crowded airports will lead to** enhance pilgrims' satisfaction.

- ◯ 0 (Completely disagree)
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10 (Completely agree)

Q9 **Any comments about the framework diagram?**

- ◯ No
- ◯ Yes , If yes please explain that:

Table D-1 Description of expert participants of framework validation

Participant	Field	Position	Experience
R1	Airport Industry	Junior Airport Planner	5 Years
R2	Airport Industry	CEO	34 Years
R3	Academia & Airport Industry	Senior lecturer	9 Years
R4	Airport Industry	Head of Airport Security Department	15 Years
R5	Airport Industry	Consultant	18 Years
R6	Airport Industry	Director	20 Years