Trust of Security Systems Among Airport Stakeholders on the Increased Complexity of Security Technology – A study

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Abstract

The airports as one of the most complex systems in modern society continues to increase in complexity of security control on the increased expansion in global air traffic. The critical role of the airport security systems in preventing the influx of threat has become central to safeguarding citizens and infrastructure against many forms of external attacks. For this reason, airports continue to play a fundamental role in the global socio-economic landscape and modern societies. However, the need to meet all stakeholder security needs, in the course of increasing complexity of operations, have utterly become a challenging endeavour. In this view, trust of security systems by the various stakeholders has become a major cause of concern to airports service quality and performance. In an elaborative case of Dubai International Airport (DXB), the essential socio-economic role of this airport in the UAE, GCC region, and the global aviation industry is rapidly expanding but without clear implications to service quality. The present paper critically analyses the case of DXB using available literature and publicly available data to pave way for future research.

I. INTRODUCTION

The airport is no doubt a complex system, which is becoming even more multifaceted on the continues expansion in global air traffic [1]. As one of the most complex systems in modern society, the complexity in airport systems is the result of the need for careful integration between a variety of large-scale components giving no room for errors, but with the highest level of efficiency at stake [1][2]. Some of the interacting systems in the airport include the security and logistics systems, procedures including emergency scenarios, and most importantly the need to satisfy each individual stakeholders' interests across these systems [3].

Globally, airports remain the main operational centre for airlines and money-making machinery for the airline industry. The airport service industry is currently valued at over US\$ 3 trillion and supports over 65.5 million jobs globally [5]. This industry accounts for close to

4% of the global domestic product (GDP) [4], hauling over 4.3 billion passengers worldwide and 4.5 million travellers anticipated for 2019 [5] – more than half the world population.

The vital role of airports in the socio-economic domain makes it essential that adequate security measures are installed. Among the various security scope is the need for effective and efficient security performance to thwart the endless attempts by criminals to sabotage, criminalise and terrorise travellers including diplomats [6]. The need to strengthen aviation security is not only within the interest of the airport but has national security implications going beyond the borders of the country to regional and global security needs. Regulators of airports have rarely remained inbound to their respective nations but have often developed in the forms of regional inter- connectedness – these include the Transportation Security Administration (TRA), International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO) and the European Civil Aviation Conference (ECAC). All these regulators have among other areas remained concerned about the need to promote aviation safety standards.

Despite the contribution of these local, regional and international agencies, significant security lapses continue to remain in the face of growing passengers and challenging management of peak hour demands [7]. These changes have caused airlines to increase security alerts and implement a variety of proactive measured, with the intention to boost security control systems. However, these systems are not always welcomed and often misunderstood even by those who are employed to implement them [8][9][10]. The lack of trust of these systems do not only hinder service quality performance but leads to the overall ineffective security measures, especially when underrated by the airport security officials.

On the increased adoption of new and upcoming security systems, it remains imperative that critical aspects of airport security challenges are understood by considering the various stakeholders' perspectives on these systems. Meeting the requirements for airport stakeholders is critical to overall performance; evidence in this area is not new [3][11][12][7]. Ultimately, gaining an understanding of airport security systems whilst satisfying stakeholder needs has remained an essential aspect of airport operations and quality management [13][14][15]. Trust of airport security has, therefore, remained a central area of interest that undermines the advancements in airport security [16][17][18][19].

Adding to the subject of human trust in airport security and operations management systems [16][17], the increased complexity of technology and airport security systems creates fertile grounds within which trust of installed system is increasingly becoming a security decision with direct implications to quality. This is based on the premise that airports are not only economic but social institutions with a complex inter-dependent set of stakeholders playing unique roles within the larger system. Trust of systems must not only be considered relative to how airport passengers see airport security systems; evidence exists that airport employees have refused to trust the security technology due to the perceived inability to match the situation at need, and with wrong judgement of their co-human passengers [42]. Ref [16] and [43] observe that trust remains a major issue not only associated with technology systems but between humans in the security control [44].

On the lack of trust of security systems, processes and systems, the likelihood of non-compliance of both passengers, airport staff, and security personnel increases, reducing the overall quality of airport services [45]. Improving trust of the rapidly evolving security and airport operational management system is critical to keep up with the overall performance of the airport as an institution, through the improvement of quality. The present paper critically examines the various scopes of trust of security control, and the role of trust in airport service quality through airport service quality. It seeks to build and connect the rich pool of literature on airport security and systems trust with the element of quality, with special reference to literature and public evidence surrounding the case of Dubai International
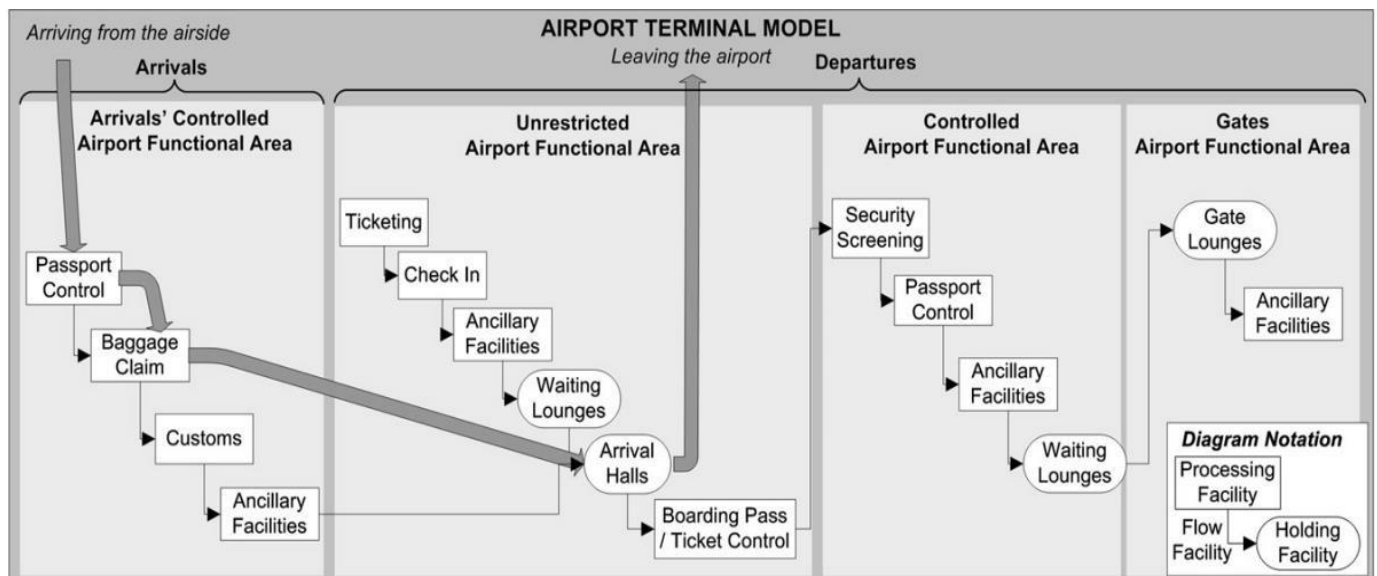
Airport (DXB).

II. BACKGROUND OF THE DUBAI INTERNATIONAL AIRPORT AND CONTEXT OF THE AIRPORT TERMINAL

In Dubai Airport remains one of the world's busiest and popular airport centres globally [23]. The ever-increasing growth in air transport implies increasing demand for airport services, which further propagates into the need for providing more efficient airport terminal services. The airport terminal constitutes a major element of the airport system, since increased congestion levels in airport terminals may cause delays in flights and deteriorate passenger perception on the level of service offered.

The airport terminal constitutes a major element of the airport landside, as it is the boundary of the airport towards the airside. It is associated with the processes and the facilities that airport customer groups visit while at the airport [46]. Most airport decision-makers are interested in addressing a standard set of issues pertaining to airport terminal operations, such as capacity, delays, level of service, and mainly security (Figure 1.0). As presented in Figure 1.0, a systemic mapping of passenger flow across the various facilities or departments remains critical to the success and operationalisation of the entire airport system. Both restricted and unrestricted territories of the airport are carefully monitored using state of the art security control systems with the support of human personnel, even though security is tightened in the restricted territories.

FIGURE 1. AIRPORT TERMINAL MODEL APPLICABLE TO DUBAI AIRPORT

Source: Manataki & Zografos [46]

With primary focus on the Dubai International Airport Terminal One, this terminal serves about 80,000 travellers per day, approximately 30% of the entire traffic of DXB. It also serves as the workplace of approximately about 200 aviation and airline trade and another 1500 workers in the areas of commercial trading activities. About 540 security personnel are stationed at this terminal within the 24-hour period with 3 shifts of 180 security personnel every 8 hours.

III. LITERATURE REVIEW

A. Trust and Service Quality Frameworks in Airport Security Control

Within the domain of security control, trust frameworks have not only gained social relevance but have matured into a legally enforceable set of specifications, rules, and agreements that govern a multi-party system established for a common purpose. These

enforceable specifications are designed for conducting specific types of transactions among a community of participants and bound by a common set of requirements [47]. Stakeholders do not only have to trust one another, but they must as well trust the data, systems and procedures in place to create a common identity management platform. Mutual recognition and harmonisation of standards across stakeholder interests are critical to meet the actual performance of airport operations. Airport security must capture complete trust and privacy within the scope of dependability [47].

Focusing on the discussion of trust from the traveller's perspective, it must be mentioned that travellers are only able to perceive what is observable at the airport without an understanding of why security controls were introduced and how they work or operate. Trust is, therefore, a key measure of what is observable [48]. Moreover, on the trust between human security personnel and travellers, the security official and travellers are all aware of common social life elements which make terrorists identifiable by appearance, yet with the knowledge that terrorist hind behind normal appearances [49]. For security personnel, they cannot trust all that they see, and for passengers, they can easily mistakenly be considered as terrorists based on their nationality or appearance. Even though security protocols involve random sampling for suspicious behaviour – evidence stipulates that this is not so random as anticipated, and in no way generalizable. The conflicting and deceiving nature of awareness that appearances play a critical role in airport security surveillance and control, stems from the very element of trust of security systems. Ref [17] adds that a passenger would attempt to look normal in order not to appear suspicious even though they are in no way attempting to be deceptive.

In an elaboration of the role of trust in airport security operations, it is important to state that some categories of stakeholders such as the airline crew, have already been cleared and judged by some amount of trustworthiness - reducing the level of scrutiny required at the various security checkpoints within the airport.

The excessive trust of such crew and aviation trade personnel can convert an airline into a terrorist instrument without the need to carry any dangerous ammunition or weapon to make it possible. Ultimately, the very operability of the aviation security system is based on the principle of limited trust. All processes and security control measured installed are undertaken to inspect and detect prohibited and terrorist gadgets and the suspicion of unlawful interference [41].

Focusing on airport customer groups, and their perceptions of other humans and technology within the system, quality has remained a critical matter of concern in customer perception and customer satisfaction in the airport operations management [50]. Quality has remained critical to meet customer expectations, prioritize service delivery and ensure that airport managers are knowledgeable about what the customer groups want. Airport quality mediated key performance metrics including servicescape, service personal characteristics and actual service delivery [51]. For this reason, trust may be considered from the three main security control perspectives of airport security control structure, security control procedures, and security control operation schedule [15].

B. Stakeholder Groups in Airports Operations Management

A large number of studies have considered multiple stakeholder perspectives and their interests in airport operations management. The need to consider stakeholder perspective on the increasing modernization of airports in delivering more efficient and high-quality services to increasingly diversified revenue base has often been justified [52]. The complexity of airports makes it even more relevant that diverse perspectives are considered in airport operations management [13].

Ultimately, airport stakeholders have remained integral to the definition of the performance measurement of airport systems. From airport passengers, local governments, regulators, and community members and others are usually non-financial parties – all these stakeholders are equally relevant to defining airport performance [54]. Other stakeholder

groups include air careers [12][7], general users [12], investors [7], communities and NGOs as environmental pressure groups [11]. Ref [14] categorise these stakeholders into three main groups; these include the main customer group, service packages and business network. Principally, the airport firm houses key stakeholder groups such as airlines, aeronautical business units, infrastructural services, consultancy services and other non-business stakeholders.

Each of these stakeholders has key interests within the airport system that must be met. Passengers want to move quickly and have access to low fares; airlines, on the other hand, aspire to maximize passenger traffic volumes and ensure that a high number of destinations are served; the government has concern for security at the airport, and airport businesses aspire to maximize accessibility to moving passengers [55]. As the stakeholder goals come into focus, Ref [55] argue that the stakeholder goals are interconnected. The goals interact in a complex pool of inter-relationships within the airport environment. It is based on these inter-relationships that the contribution of the airports to the larger socio-economic environment is maximized.

C. Airport Terminal and associated complexities of security control

Airports security systems are highly complex but work on three main principles [16]. These include the absolute denial of terrorists attempts to gain access to the airport and civil aviation facilities, the possibility to detect and prevent the advancement of terrorists in case they breach the first principle, and the management to a high extent to negate any damage, providing a chance for the passengers to survive. These principles in the area of airport security systems are not only handled by technology but require that key roles are performed by humans. Finding out how people work with, think about, and behave in relation to these security control systems is therefore directly in line with airport performance [13].

Ultimately the complexity of airport systems has an effect on the decision making and implementation processes in airport operations

management. Practically, less attention has been paid to the need for a generic took that provides flexibility to adapt to unique conditions of the airport terminal in a user- friendly way. Trust is, therefore, a central aspect of airport security control that is rather challenging to achieve on the increased complexity of airport security control systems [16][17][19].

IV. METHODOLOGY

The present paper is based in a comprehensive review of literature, online expert analysis and other publicly available rating data on Dubai International Airport (DXB). The use of online ratings and such public data in study evaluation of airports is not new and has often been commended due to the nature of the airports as a complex institution of interconnected stakeholders [20]. Moreover, the airport remains a rather busy and security-sensitive location that must be void of any form of interference of the passenger traffic process. The literature and public findings on DXB are presented and subsequently discussed. Conclusion and future recommendations for future research are then presented towards the end of the paper.

V. RESULTS AND DISCUSSIONS

A. Results- The Case of DXB

Dubai International Airports (DXB) has gained high presence in the global media platform with the introduction of breakthrough technology. In period press releases, the airport has emphasized on its quest to provide breakthrough technology accessibility to passengers and airport workers alike. The supply of free WOW-Fi at DXB in 2017 marked the fastest free wi-fi connection at an airport [21]. The airport also recorded itself as the most preferred international passenger airport across the globe [22]. DXB has remained concerned about remaining atop in terms of media branding and ensuring that passengers are fully engaged [23]. The airports have witnessed the introduction of several technologies directed at ensuring a memorable passage for airline passengers and maintain a peaceful airport environment [24]. Most of these published events constitute press releases from Dubai Airports, with very little to no third-party insight on the airport affairs.

Considering rare insight by third parties, it is not strange that extremely little attention has been directed at the world's third busiest airport [25][26]. A few studies have considered the airport operations and quality management from a distance, with very little to completely no focus on the actual operations of the airport, service quality, trust or performance [27][28][29][30][31]. Many such papers exist with no clear focus on DXB; a sharp contrast to evidence existing on the service quality of other global leading airports such as Heathrow Airport [32][33]. With no critical insight into the airport's operations, academic papers have predominantly touched on the passenger volume, airline connection with the operations of the airport, and general operational strategy as intended on creating a strong market position [34].

Despite narrow nature of public released news articles and the narrow attention of evidence existing to this effect, the use of other public rating websites remains the only means of assessing service quality performance and other passenger perceptions regarding the airport performance. On Google Reviews, the Airport has 4.4/5 rating from a total of 18,377 reviewers [35]. On Skytrax airline quality website – a platform that collects data from verified travellers – DXB has 4/10 rating from over 512 reviews [36]. The airport also has some reviews in connection on third-party platforms such as Emirates Airlines and Dubai International Airport Hotel. A rate of 3.1/5 was also recorded on Sleeping in Airports website.

A general search for the keyword of trust on Google reviews reveal only 2 reviews all rating 2/5; a reasonable section of the reviews that came up after searching for the keyword "quality" also had unfavourable scores. Even though these findings are based on the search for keywords, a closer analysis of keywords in the pool of reviews will better define customer and employee perceptions on the Airport. Access to data would permit a detailed analysis of all reviews, critical to understand the differences in the results from the various platforms and comprehend the issue of trust and service quality from a more holistic perspective.

B. *Discussion*

As the third busiest airport globally, maintaining security control over 90 million passengers has become a major challenge. It has become imperative that the trust of these security systems is thoroughly examined in order not to jeopardise service quality at the expense of airport performance. Over the years, a variety of technological and security systems have been introduced. The system has matured from the implementation of e-gate systems to smart gate systems where artificial intelligence control systems build on registered data in well-secured databases to register passengers as they simply walk across a corridor. Also, usually, counter operations have improved and are equipped with the latest technology to conduct traditional checks on other passenger groups who are not registered in the airport security database or require special consideration before entry. The system in place significantly reduces traffic at the terminals and ensure efficient operations of the Airport.

Despite these improvements, and as one of the most world's advanced airport, significant security lapses remain. A high number of entrants from nationalities still require close observation due to the possibility of a blocked person to re-enter by using another person's passport. Such blacklisted individuals, especially criminals, are a serious threat to the UAE when not controlled at the point of entry. However, due to current limitations in the technology systems, the inability of the smart gates for instance to check all previous countries of visits over the last six months inhibits the full security check of entry persons. Moreover, some training programs are recommended due to high erroneous profiling by airport security personnel and other opportunities for improvements.

Considering the case of Dubai Airports, the threat to critical transport infrastructure is no different from other global regions. Nonetheless, as a general challenge, the security domain of airports, traditional systems engineering approaches do not sufficiently capture the role and interests of the human entities, both passengers and staff, play within a system [37][38][39]. They are sometimes considered so fragmented that the performance of these airport systems operates in isolation, with little regard for the individual needs of involved stakeholders [40].

Considering the stakeholder perspective to trust of airport security systems is therefore in the right direction to support evidence in this area by building on the evidence from one of the world's busiest airport; the Dubai International Airport. There is the ultimate need for a new pool of research to focus on modelling airport terminal operations and performance evaluation but from the stakeholders' trust and quality service perspective. These studies will argue that trust is not only associated with external parties but require the commitment of internal stakeholders to improve overall quality towards airport operations performance improvement.

VI. CONCLUSION AND FUTURE RESEARCH

Trust of airport security systems may easily be overlooked due to indirect relevance from a security perspective [16][17][18][19]. Nonetheless, airport stakeholder studies have considered security implications to different stakeholders [3][11][12][7], and very little attempt have been directed the trust of airport security systems from multiple stakeholder perspectives. This research gap remains despite overwhelming evidence that careful aviation policy planning that acknowledges the interests of all stakeholders is critical for overall performance [1][15].

To close this research gap. It is important to re-emphasise that trust of security systems have become critical aspects of airport operations, and quality service delivery [51] and this observation stem from the core of improperly defined modelling requirements of airport operational terminal systems [56]. Ref [56] observe that it is not new that system requirement and actual usage within the organisational process are mismatched. Taking into consideration actual usage concerns in the event of modelling will be critical to meet stakeholder concerns an ensure the full utilisation and interpretation of airport systems.

Considering the case of DXB is in the right direction to observe how trust by airport stakeholders' manifests in an environment of complex technology application, without jeopardizing service quality and airport performance. Such an attempt would be the first time in the modern history of the airport and possess a significant contribution to the surrounding literature.

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