AN ASSESSMENT OF THE FACTORS INFLUENCING AIRPORT SECURITY AT NAMIBIAN AIRPORTS: A CASE STUDY OF HOSEA KUTAKO INTERNATIONAL AIRPORT, 2018-2023

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ABSTRACT

Airports are regarded as unique entities that have insightful economic, social, and environmental effects on a local, regional, and even international level. Therefore, because of its crucial impact, the subject of airport security has taken the centre of discussions of numerous studies. A Security audit conducted in Namibia by the International Civil Aviation Organisation in 2018 revealed that some aspects of airport security at Namibian airports needed improvements. The audit suggested that Namibia needed to improve in various security aspects such as, the screening of passengers, screening of baggage and cargo, certifying of screeners, and employing of internal quality control measures to ensure quality assurance. Against this background, the purpose of this study was to examine the key factors that influence the effective and efficient execution of airport security at Hosea Kutako International Airport. The main security factors that were assessed are Human Resources, Regulations and Supervision, Machinery and Equipment, and Stakeholders. This was done by analysing opinions of airport security practitioners including managers on the security factors by using the Analytical Hierarchy Process method. A questionnaire was used to obtain data from selected respondents. The study population comprised of aviation security practitioners at Hosea Kutako International Airport from the Namibia Airports Company, Namibian Police, and the contracted security service provider the Namibia Protection Services. The study employed a case study design, and the collected data were analysed using Microsoft Excel software and interpretations were made from the results of analysis. The findings of the study show that the main factor of Human Resource is rated the most important factor, followed by the Machinery and Equipment, Regulations and Supervision, and Stakeholders respectively. Other sub-factors and criteria were used in determining the level of importance of the main factors of airport security. The study formulated a model of airport security systems which, in conjunction with the decision model can assist in addressing operational and administrative security challenges. This model can be used by airports authorities to effectively deploy its limited resources by directing it to the security factors that are considered of great importance than other factors in enhancing airport security system. Furthermore, it may also be used to address the gap that may exist within the airport security systems. The study concluded that human resource is one of the important factors in airport security and therefore, to enhance efficiency and effectiveness of airport security it is recommended that qualified and well-trained personnel be employed.

Keywords: Aviation Security, Security Audit, Airside, Landside, Annexes

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AHP	Analytical Hierarchy Process
AvSec	Aviation Security
AUI	Acts of Unlawful Interferences
CAPs	Corrective Action Plans
CLM	Caprivi Liberation Movement
ETD	Explosive Trace Detector
HKIA	Hosea Kutako International Airport
ICAO	International Civil Aviation Organisation
IATA	International Air Transport Association
NAC	Namibia Airports Company
NamPol	Namibian Police
NPS	Namibia Protection Services
UASA	Universal Aviation Security Audit
USAP	Universal Security Audit Programme

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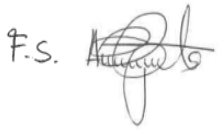
This study is dedicated to my wife Fenny and my sons Lucas Trust, and Phillip Etuhole, and my daughter Phillia Tugamena with whom I could not spend valuable time due to commitments of this study.

DECLARATIONS

I, Angula Fillipus Shekupe, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution. No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form, or by means (e.g., electronic, mechanical, photocopying, recording or otherwise) without the prior permission of the author, or The University of Namibia in that behalf. I, Angula Fillipus Shekupe, grant The University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which The University of Namibia may deem fit.



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CHAPTER 1: INTRODUCTION

1.1 Chapter Introduction

This chapter presents the study background and highlights the study problem as well as the study objectives. Furthermore, the significance of the study is discussed together with the limitations and delimitations of the study.

1.2 Background of the study

According to Ashford et al. (2011), airports are regarded as unique entities that have insightful economic, social, and environmental effects on a local, regional, and even international level. He further adds that, airports provide the means for the efficient movement of passengers and goods to virtually anywhere in the world, playing a vital role in the trend toward globalization and the interconnections between international trade and local economies. In other words, airports are an integral component of the world economy.

Airports play an important role in air travel growth and aviation industry in general thus, they have become a potential target for Aviation Terrorists and criminals or at least a subject of Acts of Unlawful Interference (AUI) which, therefore makes them strategic areas where rigorous security is an unconditional requirement. An airport is a network of relative elements, which form an interdependent system. It is comprised of such components as passenger terminals, control tower, radio equipment, runways, depots, aprons, access roads, the perimeter fence etc. The airport is generally divided into two areas, namely the Airside, which is regarded as a security restricted area where aircrafts are brought into service and where air operations are conducted, while the Landside is an area that is not restricted and is accessible to the general public and passengers (Nowak, et al., 2019).

> Duchesneau (2015, as cited in Duchesneau & Langlois, 2017, p. 343) defines Aviation Terrorism as a political act against civil aviation carried out by non-state actors who systematically target civilians and intentionally use violence in order to create terror and coerce authorities, at times by making demands.

> On the other hand, Nowak et al. (2019, p.2) referred Acts of Unlawful Interference in civil aviation to actions or attempted acts to undertake measures that threaten the safety of civil aviation, these acts include but not limited to: unlawful seizure of aircraft; destruction of aircraft in use; hostage-taking of an aircraft in flight or on ground; seizure of an aircraft, unlawful interference on the premises of an airport or an airport facility; introducing on board the aircraft or onto the airport area a weapon or a dangerous device or a material used for criminal purposes; using an aircraft as a weapon to cause death, serious injury or serious damage to property or the environment; transfer of incorrect information aimed to endanger an aircraft during a flight or on the ground, including its passengers, crew, ground staff or the general public, at the airport or an aviation facility.

These definitions bring to light that, the threat facing the aviation industry is enormous, therefore it is very important that airport security is heavily safeguarded and kept at highest level of effectiveness and efficiency.

Some of the recent threat of acts of unlawful interference with civil aviation include terrorist attacks at civil aviation facilities such as the explosion at Domodedovo airport in 2011, the explosion of the A-321 over the Sinai Peninsula in 2015, the series of explosions in Brussels in 2016, the explosions at Istanbul airport in 2016 and the increasing terrorist threat worldwide (Askew, 2004). Given the above incidents, it is clear that the world requires strengthened regulatory actions aimed at increasing the aviation security, especially at airports that serve civil aviation as well as developing efficient and effective aviation security systems. Namibia as an active actor in civil aviation is not spared from these dynamics and therefore, it is imperative to evaluate

and assess factors of airport security at Namibian airports in relation to their importance in enhancing airport security.

The southern Africa region is arguably the most stable region in Africa; however, the region is not immune to challenges affecting peace and security being experienced around the world. De Albuquerque and Wiklund (2015) argued that issues such as armed conflict, political crises, democracy, and governance deficits are some of the issues that are contributing to state and human insecurity in the region. Southern African Development Community [SADC] (2022) add that other global and continental emerging issues like terrorism, terrorist insurgencies, trans-border crime, cyber-attacks and the proliferation of weapons of mass destruction are threatening the peace and stability of the region. This is evident from especially, the political and security situations experienced in the Democratic Republic of Congo (DRC), Mozambique, Madagascar, Zimbabwe, and Lesotho in which to some extent the intervention of the body was undertaken.

Even though Namibia currently enjoys political and security stability, the presence of certain groups such as the Caprivi Concerned Group (CCG) and other affiliated movements who are advocating for secession of the Zambezi region from Namibia cannot be ignored as it has the potential to change the political and security situation in the country. According to Amupanda et al. (2020), in August 1999, armed insurgents belonging to the Caprivi Liberation Movement (CLM) attacked various government installations, including the airport in Katima Mulilo.

This was in an effort to secede the former Caprivi region from Namibia. Although the CLM have ceased to exist since their purported attacks and subsequent arrest of some of the members by the Namibian security forces, their ideology and belief of having

an independent Caprivi still exist within individuals of the Zambezi community. This is supported by Amupanda and others, who postulates that even though the state successfully suppressed the insurgence in 1999, it seems it has not successfully dealt with the main concerns that led to the insurgency. History has taught us that perpetrator of aviation terrorism mostly are insurgents turned terrorists who carry out violent acts against the civilians in order to persuade governments to meet their demands.

Although the issues discussed above are not directly aviation related security issues, it is a proven fact that terrorists and insurgents are perpetrators of aviation security. According to Duchesneau and Langlois (2017), terrorism and insurgency arguably are different acts, there is a very thin line between the two as they share some significant features for example, both are forms of violence employed by nonstate actors to advance political objectives. Considering the history of aviation security incidents, aviation security threats come from these groups because they often target aviation industry due to its vulnerability, the nature of operations and the effect it has on a country/government.

Despite the small Namibian aviation industry, aviation activities are fast increasing in the country. As per a report by Trading Economics (2021), air transport passengers' volume in Namibia increased in recent years being reported at 602893 passengers in 2018. As much as this is good news in terms of economic benefits, this might as well be a cause for concern to the Namibian aviation industry, this is because the increase in air traffic typically comes with probable increased risk of threats of acts of unlawful interference against the civil aviation especially at airports. This can be ascribed to the fact that Namibian airports are still developing in terms of infrastructures and, safety and security systems to be at par with most advanced airports in the world. The threat

of security risks increases because some of these airlines landing at Namibian airports originate from high-risk terrorist countries or from those countries that harbour recognisable active cells of terrorist organisations while, other flights transport VIPs such as politicians and diplomats who might be persons of interest to terrorists and criminals.

In summary, it is evident that aviation is susceptible to political conflicts especially insurgents and terrorist who conducts aviation terrorism. This means that having active groups/cells of insurgents in Namibia presents an increased security risk. With this probable risk, Namibia consequently needs to enhance her airport security systems to ensure that existing security vulnerabilities and gaps are eliminated and may not be exploited by the perpetrators of aviation security. This can only be successfully achieved through a well-structured amalgamation of all important factors that impact airport security.

1.3 Statement of the problem

In November 2018, the International Civil Aviation Organisation (ICAO) conducted a Universal Aviation Security Audit (UASA) in Namibia. According to Nakale (2019), the audit found that the Namibia Airports Company, which is the country's airports administrator needed to improve its airport security systems to be in full compliance with the international standards. Nakale further noted that the proposed improvements inter alia, were on, the screening of passengers, baggage, and cargo, certification of AvSec screeners, and the implementation of internal quality control measures to warrant quality assurance of its operations. The ICAO expected Namibia to come up with some corrective action plans (CAPs) to address the identified problems and where feasible to implement the recommendations proposed by the audit team.

In addition, since the year 2008, Namibia has been recording an increase in air traffic within and through its airspace, with larger airlines among others, Qatar Airways, KLM airlines, Lufthansa airlines, Turkish airlines and recently Euro Wings Discover commencing their flights to and from Namibian international airport (Namibia Airports Company [NAC], 2021). However, some of the airlines using HKIA for departures have expressed dissatisfaction with the screening of passengers and baggage that it was not effective enough to completely prevent the carriage or introduction of restricted articles on board aircraft. Therefore, these airlines introduced secondary screening points before the boarding of an aircraft to ascertain themselves that all passengers were clear of the prohibited items before they are allowed to board the aircraft.

During secondary searches several prohibited items such as knives, spoons, long hair pins, martial arts equipment, liquids of more than 100ml quantity and many more were discovered on possession of the passengers who were assumed to be sterile of any prohibited item. This could be a great concern as it can be assumed that the security screening/searches at HKIA were not effective enough to completely eliminate/clear all prohibited items from passengers as these discovered items during secondary searches could be taken into the aircraft and could end up being used to commit an act of unlawful interference (AUI) with the flight.

After the terrorist attacks of September 11, 2001, and many security incidents according to Harris (2002), the effectiveness of the security systems has come under scrutiny. Because of the above narrated problems, there was a need to conduct this study to assess priority security factors that could be considered by the airports authority to increase effectiveness and efficiency of its airport security systems.

1.4 Study Objective

1.4.1 Main objective of the study

The main objective of the study was:

To assess aviation security key factors influencing the level of airport security at Hosea Kutako International Airport (HKIA).

1.4.2 Secondary objectives

1. To determine the importance level of factors affecting airport security in relation to one another, at HKIA.
2. To outline sub-factors/criteria that determine the relative importance of key factors of airport security.
3. To develop a model of Airport Security Systems necessary for the achievement of the efficiency and effectiveness of airport security .

1.5 Significance of the study

Determination of the relative importance of key factors in airport security as well as developing an airport security system model as the study output, might help the Namibian airports administrator improve its airport security system's performance, effectiveness, and efficiency. Airports operators can use the airport security system model as a guidance in establishing appropriate corrective actions to be taken to close a particular security deficiency. The study also applied the assessed factors and criteria into a decision model of importance in relation to their weight of importance.

The decision model can easily guide airport operators to make informed decision on what factors are most likely to instantly enhance airport security systems due to their level of importance/priority. This simply means that the study was worth undertaking because, it produced both administrative and operational guidance which are

beneficial, particularly to airport security actors. From an administrative viewpoint, the factors and their weighted importance identified by this study can serve as a roadmap for airport administrators as well as a tool for benchmarking airport security systems to make comparisons with other airports. Furthermore, administrative, and operational decisions can be made by considering the outputs of this study to improve the quality of the airport security system. Finally, Namibia has limited literature in the field of Airport Security, it is therefore expected that this study could contribute to the existing body of knowledge and may be used as a basis for future studies.

1.6 Limitations

Aviation security is one of the departments that deal with sensitive and classified information. The researcher encountered incidents where respondents were sceptical to participate in the study because of the fear of sharing security information. This however did not affect the results of the study as the minimum number of participants was achieved. Moreover, the researcher is an aviation security practitioner at a supervisory level; therefore, it is believed that this eliminated the fear of information disclosure to the researcher.

Lack of prior research/studies on aviation security especially in the Namibian context was another limitation. However, the researcher outsourced relevant information from already existing literatures and contextualised it into the study. Lastly, the study was initially planned to include Walvis Bay International Airport as a study area, but due to the restrictions of the COVID-19 protocols at the time of data collection, this could not be achieved. The study was therefore only conducted at Hosea Kutako International Airport as a result.

1.7 Delimitation of the study

The study was restricted to assessing factors of airport security at Hosea Kutako International Airport only as the Namibian flagship international airport. Which is consequently the benchmark airport for Namibia in terms of ICAO audits and inspections. When the International Civil Aviation Organisation conducts inspections and audits for Namibia, it is only conducted at HKIA and then the findings of the inspection/audits are generalised to all other airports in the country. The obtained results of the study are qualitative owing to the type of methodological approach used.

1.8 Chapter Summary

In this chapter , the study background was discussed whereby the importance and challenges of aviation security were highlighted. Also, the main problems that necessitated the study were discussed. The identified problem highlighted is the security findings of an audit by ICAO for Namibia and the increase of air traffic at Namibian airports which is likely to increase the risk of acts of unlawful interference. the main and secondary objectives of the study were presented followed by a justification of the study as well as the experienced limitations of the study and an explanation of what the study was delimited to. The next chapter presents the review of the literature and the conceptual framework.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Chapter Introduction

This chapter presents the detailed review of the relevant literature through three main components namely, evolution of aviation security, security incidents in aviation, the factors influencing the level of airport security and the models of airport security factors. The last part of the chapter discusses the adopted conceptual framework for the study, Annex 17: Aviation Security.

2.2 Literature Review

2.2.1 Evolution of Aviation Security

It was much easier for passengers to board planes before the 9/11 attacks, however nowadays, traveling by air is a much more complicated affair (Roberts, 2016). Things completely changed, various circumstances and practices were considered to pose a danger to the passengers and aviation industry after the 11 September 2001 incident, and since then security restrictions were stepped up. Roberts add that those traveling were required to arrive at the airport few hours before departure, the screening of both the passengers and their luggage coming into the airport is conducted very thoroughly. This change has brought the use of body scanners, explosive detection scanners and luggage perusal by airport security personnel. In addition, nowadays visitors that are getting into the country are required to give in-depth explanations of the reasons for their visit and the date they intend to depart from the country (Johnstone, 2006).

According to Bülbül and Ergün (2016, as cited in Bülbül and Ergün, 2019), terrorists always aim to inflict heavy causality, financial and emotional damage as well as drawing as much attention as possible, therefore they consider conducting illegal

activities which will have tremendous impact and can serve their intended malicious purposes. Nowackit and Paszukow (2018) adds that the way airline transportation system activities are performed, for instance the busy traffic at airports, the impossibility of interfering with an emergency in an aircraft after its take-off, the ability to tarnish the affected country's image through attacks and the significant contribution made by worldwide aviation activities to national economies make it to be a prime target for terrorists. Also, because of the various services provided by airports and the above reasons, ensuring security in aviation through new technologies and maintaining security through qualified human resources are of supreme importance.

2.2.2 Security Incidents in Aviation

Thomas (2008) and Paul (2009) postulate that in 1931 a first aircraft hijack occurred when Peruvian revolutionaries commandeered a Ford Tri-motor, while the first major airport attack was noted to have taken place in 1970. Thomas further adds that, between the years 1968 and 1973, a total of 364 hijackings took place, whereby 87 occurred in 1969. In 1937, terrorists were believed to have planted a bomb on the Hindenburg Zeppelin, exploding it at Lakehurst, New Jersey, argues Paul. He further adds that the first hijacking of a commercial aircraft was in 1948, which has resulted in the crash of a Cathay Pacific aircraft in the ocean near Macao. Following these incidents, in early 1973, the US Federal Aviation Administration, which aims to ensure that aviation systems operate effectively and efficiently at the international level, made the screening of all passengers and accompanying baggage compulsory (Yoo and Choi 2006). This norm was adopted by aviation authorities worldwide and it is currently the order of the day at all airports serving civil aviation.

Although Africa is the lowest ranked continent in aviation activities and growth i.e., passenger movements and aircraft movements, by the year 2008 it was the leading continent in international air accidents lists with a crash rate reportedly seven times above the world record (Kapchangah, 2008). Though this staggering record has improved, much still need to be done by African states to ensure that they catch up with the rest of the world in terms of aviation security. Like the rest of the world, Africa has had its share from Acts of Unlawful Interferences perpetrated against civil aviation.

Kapchangah further points out a notable aviation security incident which resulted from aviation terrorism, whereby a civilian aircraft carrying Presidents Habyarimana of Rwanda and Ntaryamira of Burundi in 1994 was shot down in what is believed to be a SAM 7 missile attack, both presidents perished in this attack. Although most of the aviation security incidents and accidents involve terrorists, it is worth noting that other offenders such as asylum seekers also commits Acts of Unlawful Interference. As noted by Addis Insight (2021), one such act happened on November 23rd, 1996, when an Ethiopian Airlines Flight 961 was hijacked by three men who stormed the cockpit and demanded that the pilot fly the aircraft to Australia or else, they would blow up the aircraft. While attempting to fly to Australia, the aircraft run out of fuel and the aircraft crash landed in the sea resulting in the death of 125 of the 175 people on-board.

In another incident, an Ethiopian Airlines flight ET-702 from Addis Ababa, Ethiopia, destined for Rome, Italy, was hijacked during the flight by the co-pilot. According to Hardiman (2022), the co-pilot locked himself in the cockpit once the captain had to gone to the toilet, then he diverted the flight to Geneva, Switzerland where he sought

asylum. Furthermore, a scheduled passenger flight operated by Daallo Airlines of Somalia carrying 76 people suffered an explosion on 2nd February 2016 (Smith, 2016). An explosion occurred 20 minutes into the flight when the aircraft took off from Mogadishu to Djibouti, luckily, all but one passenger survived the incident. It was reported that the explosion was caused by a bomb which was detonated by a suspected suicide bomber. Smith added that although no group claimed responsibility at the time, the Al-Shabaab group known to be responsible for many violent attacks in and around Somalia was believed to be behind the explosion. Noting the above incidents, it is clear that aviation industry is vulnerable and prone to all forms of attacks. This therefore means that stringent security measures are required to be employed especially at airports, a place where passengers board flights and disembark from aircrafts, and most aircrafts depart and land.

2.2.3 Factors influencing the level of Airport Security

According to Gladwell (2001), the history of airport security shows that when one component of security gets tightened, this may force determined terrorists to seek and exploit weaknesses in other components. Generally, it is almost impossible to close all potential gaps in airport security as this may result in the overstretching of the system and disruption of air traffic system, which is the main aim of the terrorists. How can then the system be managed effectively? Harris (2002) suggests that what is required, instead, is a system which is sufficient and flexible to meet anticipated security threats with timely and appropriate responses.

Harris further suggested integrated and coordinated components that the airport security system should consist of; security teams of selected, cross-trained, motivated personnel performing appropriate tasks, with continuing measurement and feedback of their performance; an arsenal of technologies and procedures that can be quickly

configured and deployed to meet probable threats; and a timely intelligence continuously disseminated to security teams on probable adversaries and threat scenarios. These components helped the study to draw up some of the sub-factors considered for assessment under main airport security factors.

Civil Aviation is protected against acts of unlawful interference mainly to prevent restricted articles and hazardous materials from being taken onboard the aircraft and end being used to endanger the safety of passengers and air infrastructure (Nowak et. al., 2019). After the publication of a regulatory document, Annex 17 on Aviation Security by the ICAO in 1974, all member states were required to start performing regular security procedures (Bülbül & Ergün, 2019). International Civil Aviation Organisation [ICAO] (2022, p.1.) defines Aviation Security as "safeguarding civil aviation against acts of unlawful interference, this objective is achieved by a combination of measures and human and material resources".

There are three main components that this definition outlines, these components are Human resources, Machinery/equipment, and Regulations. In principle, the mentioned components are the core factors of achieving aviation security. Therefore, for the purpose of this study these components were regarded and assessed as the main airport security factors. Various literature indicate that the problems related to civil aviation security are mostly evident at airports and the gap in the security system results in the penetration of people and hazardous materials into the airport area.

Yoo and Choi (2006) conducted a study in which they identified relative importance of airport security factors which enhance passengers security checks, with the Analytical Hierarchy Process (AHP). The major factors considered under their study were Human resources, Facility/equipment, Procedures/responsibilities. Their study

found that the most important factor was human resources followed by Facility/Equipment and, Procedures/Responsibility as shown in Appendix 7 to this study. Their evaluation was conducted between two groups, the Supervisor group and the Screeners group.

The considered major factors are clearly the most important factors of airport security, benched marked to the definition of Annex 17 which is the main framework of aviation security. Considering that the evaluation study results from the two assessed groups are different, it makes it difficult for the consolidated results to yield a decisive conclusion on the most important factors. This present study combined all the assessed groups (Managers, Supervisors and Screening/Security officers) into a single group of assessment. As a result, the final results of the study were able to be presented as collective judgement of the airport security practitioners.

In addition, Bülbül and Ergün (2019) conducted a similar study in which they analysed and evaluated the factors that affect airport security services. Their assessed factors correlate to Yoo and Choi (2006) 's factors, however, a factor of Shareholders and Procedures was introduced to replace Procedures/Responsibility considered by Yoo and Choi. Although their study yielded similar results to the one of Yoo and Choi, the subsidiary factors considered under both studies are seemingly not comprehensive enough, this was substantiated by a recommendation by Bülbül and Ergün who suggested that a more detailed factor structure needed to be created to analyse the components that are effective in a more in-depth means.

This present study considered this recommendation and sought to add more factors by combining factors considered in previous studies and newly introduced factors. Costs as a factor of airport security was however not considered by this study because it was

regarded negligeable due to the low scores it obtained from Bülbül and Ergün's study. The security screening and check point principles as outlined by Sakano et. al. (2016), were adopted by this study to formulate various determinant factors and sub-factors of considerations under the main factors of airport security.

Although the main factor Human Resources was assessed in detail, some of its sub-factors such as personnel experience and initial training were not considered, however literature emphasise that these determinant factors are crucial to consider in human resource. Thus, these sub-factors were included in this study. Harris (2002) in his work titled "How-to Really Improve Airport Security", suggests that intelligence on threats and adversaries can be the starting point for setting up a flexible system to meet security threats and to focus enhanced security measures mainly on high-risk individuals or threat.

He further noted that, channels of information and coordination need to be established between airport security systems and the intelligence-gathering and analysis agencies. This is necessary to be established in order to avoid another intelligence failure as that of the 9/11 incident as narrated by Zelikow's report, "National Commission on Terrorist Attacks". The reviewed literatures on airport security factors seemed to have less focus on these important aspects namely, coordination and intelligence, in enhancing airport security and therefore, they were considered under this study under a major factor of Stakeholders.

2.2.4 Models of Airport Security factors

A study on airport security tasks and factors influencing the performance of airport security services was conducted by Yoo (2009) to determine factors that influence security tasks and to decide the right entities for these tasks. The study produced a

decision model (Appendix 4), which could be used in assigning security tasks to relevant entities. The decision model contained relevant factors, security tasks, and responsible entities which makes it easier for aviation security actors to assign different security tasks to the right entities.

The model however seems to lack statistical evidence of the evaluation, thus making it ambiguous on which factors, tasks and entities could be of highest in enhancing the performance of airport security. Moreover, Bülbül and Ergün (2019) also developed a decision model (Appendix 5) of security factors that improve airport checkpoint security services performance. Their model presents the hierarchical level of the considered factors; however, it also lacks statistical values of the factors to easily guide users to make informed decisions. In addition, it did not demonstrate the collective relationship between main factors, factors and subfactors.

Considering the identified gaps, the present study aimed to construct a more detailed factor structure with more factors to identify the relative importance of the main factors involved in airport security. The study also sought to improve the decision models by Yoo (2009) and, Bülbül and Ergün (2019) by developing a comprehensive decision model **(**Figure 15) which comprised of several factors at all levels and their weighted values. Furthermore, the study developed a model of airport security systems rooted from the resulting decision model. This model demonstrates the interconnectedness of all factors, and it is aimed to offer guidance to airport security actors in solving identified deficiencies within the airport security systems. It is believed that determining the relative importance of the main factors, factors and sub-factors will help in enhancing airport security efficiency and effectiveness. It will further assist in

the delivery of security services at the desired level by enabling a more efficient and effective use of available resources.

2.3 Conceptual Framework

2.3.1 Annex 17: Aviation Security

Following the Chicago Convention on International Civil Aviation in 1944, civil aviation frameworks known as Annexes were developed, and adopted by the International Civil Aviation Organization (ICAO) member states on 22 March 1974 (ICAO, 2022). According to the International Air Transport Association [IATA] (2023), ICAO is the specialised agency of the United Nations (UN) that establish air traffic standards and recommended practices for member states through the 19 annexes which are technical guidance. Furthermore, the ICAO regulates civil aviation by conducting regulatory oversights of member states. From the 19 annexes to the Chicago Convention, Annex 17 named *Aviation Security: Safeguarding International Civil Aviation against Acts of Unlawful Interference* is the main ICAO annex which outlines security standards and recommended practices; therefore, it serves as the main framework.

For the purpose of this study, Annex 17 was adopted as the conceptual framework from which the study was anchored. As previously defined, Aviation Security is the safeguarding of civil aviation against acts of unlawful interference which is achieved by a combination of measures and human and material resources (ICAO, 2022). This definition clearly points out the two main concepts of consideration with regards to ensuring aviation security, namely the measures and resources (human and material). The identified concepts are a constituent of various components hence they will be discussed in detail to unpack their constituents and outline their relations to one another as a conceptual framework.

a. Measures

Aviation Security is implemented through various measures such as regulations and management of the system through supervision. Aviation Security is largely dependent on the regulatory bodies or organizations, both international and national. For example, the ICAO develops the standards and recommended practices that should be adopted by all member states worldwide to enhance civil aviation operations. These regulations are then embedded in states' legislations. Moreover, the Civil aviation Authorities (CAAs) craft the civil aviation regulations which civil aviation actors such as airport operators should implement to safeguard civil aviation against any acts of unlawful interference. In Namibia, the Namibia Civil Aviation Authority (NCAA) develops the local civil aviation regulations called the Namibia Civil Aviation Regulations and Technical Standards NAMCARs/NAMCATS.

Apart from the regulations, the other important measure is the management of the security system through effective supervision. The supervision includes guidance to achieve minimum compliance to the regulations as well as well as the measuring of compliance levels in the implementation of the standards and regulations. The ICAO measures the level of compliance of the state to the international standards through the Universal Security Audit Programme (USAP) , while the NCAA carryout security oversights to civil aviation operators to ensure compliance to the national regulations through the National Oversight Program. This is supported by ICAO (2012) who confirms that the ICAO Council approved the aaviation ssecurity plan of action which was aimed at enhancing aviation security. This plan included periodic mandatory inspections which are conducted to assess the level of aviation security in all member states. At local level, operators such as Airport Operators, Aircraft Operators, Cargo Operators, Ground Handling Operators, Aircraft Maintenance Operators and Catering

Service Operators measure their level of compliance to the national and local regulations through their Internal Quality Control Programs. These programs are implemented by conducting audits, inspections, and tests to verify the compliance.

The achievement of minimum-security compliance requirements is however largely dependent on various stakeholders/actors. These can be the directly related or indirectly related stakeholders. For instance, the attitudes of the regulator, operators and aviation security practitioners may affect the effective implementation of the measures at the airport. In addition, good coordination between the civil aviation actors, airport operator and the regulator as well as the law enforcement agency enhance the effectiveness and efficiency of the aviation security system. This is owing to, for example, the sharing of intelligence and security responsibilities.

b. Resources

Humans are one of the most important resources in the implementation of security measures at the airport. They conduct screening of passengers and their luggage and cargo consignments. The effectiveness of the security screeners is mostly affected by two main factors, the qualification, and the available number of screeners. For instance, if a screener is not well trained and inexperienced, they are most likely to experience challenges with detecting prohibited items which may result in prohibited items being taken onto onboard aircraft. One of the screeners' requirements is that they should be trained and certified for them to be allowed to conduct screening duties. The quantity of security staff available is another factor that must be considered to achieve effective and efficient aviation security operations. There needs to be an adequate number of personnel in the shift for them to be able to manage a screening checkpoint successfully. The aviation security regulations outlines that the minimum required number of staff to man a security checkpoint is six (6), each with their dedicated tasks.

If there are not enough personnel it might lead to poor performance of the screeners due to exhaustion.

Material resources such as equipment and machinery are the most important components of aviation security. Equipment is used to aid in the detection of prohibited items during screening of passengers, baggage, staff and cargo at the airport. The equipment that are used for screening are the x-ray machine, walk through and handheld metal detectors and explosive trace detectors vary in detection capabilities. Therefore, it is important that the personnel using or operating them are well trained to ensure maximum effectiveness of the equipment. In addition to security screening, employing of advanced technology to profile individuals at the airport is crucial in prevention of acts of interference with civil aviation. It important especially in early detection of perpetrators such as criminals and terrorists. Biometrics systems and facial recognition software are being used in modern day airport to achieve this objective.

The above breakdown of the Annex 17 outlines the relationship between various concepts of aviation security. The main concepts identified as measures and resources encompass the different factors that enhance aviation security. From the two main concepts, factors like human resources, machinery and equipment, regulation and supervision and stakeholders were deduced. Furthermore, subfactors such as qualifications and quantity of security staff, advanced technology, passengers & baggage screening, level of security compliance and legislations, directly related and indirectly related stakeholders were identified. For each of the subfactors determinant criteria were also identified. Noting that the study sought to assess the aviation security factors in terms of their level of importance, the adopted conceptual framework clearly structures, describes, and explains the concepts used in the study.

2.4 Chapter Summary

This chapter reviewed the relevant literatures that are related to the study, this was done by looking into evolution of aviation security, security incidents in aviation internationally and at African level, as well as examining the factors influencing the level of airport security. This was followed by an analysis of the existing security factors models from the reviewed literature and lastly the adopted conceptual framework for the study was described. The review revealed that although there have been major incidents of acts of unlawful interferences recorded in the past, the incidents of the famous 9/11 changed the whole aviation industry. More strict measures were introduced to try averting the situation from escalating or history repeating itself. Aviation has been a prime target for the terrorists because of its fragility and ability to inflict more casualties at once.

Incidents such as aircraft hijackings, aircraft explosions and airport attacks were among the aviation security incidents that were highlighted by different literatures. Various studies showed that Human Resources, Facilities and Equipment, Stakeholders and Procedures, Regulation and Supervision are some of the major factors of airport security. Under these major factors, factors and sub-factors were identified to help in assessing the level of airport security. From the above-mentioned major factors, Regulations and Supervision, and Stakeholders were specially added to be assessed in this study. Among the factors and sub-factors, personnel experience, initial training, and coordination and intelligence were also added to this study for assessment. In the final analysis, the Annex 17: Aviation Security, as the conceptual framework from which the study is anchored was described in brief. Furthermore, the linkage of the different factors to the objectives and problem of the study was made. The methodology adopted by this study is discussed next in the following chapter 3.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Chapter Introduction

This chapter discusses the study methodology by describing the research design, the population and sample as well as the instrument of data collection. In addition, the procedures and data analysis are explained followed by the highlighting of ethical issues encountered.

3.2 Research Design

According to Kumar (2011), a research design is a plan, structure and strategy of investigation so considered as to obtain answers to research questions or problems. Moreover, the plan is the complete scheme or programme of the research, and it includes an outline of what the investigator will do from the beginning until the end of the research. This study was carried out to determine and assess the key factors that influence the effective and efficient execution of airport security. This was done by analysing opinions of airport security practitioners on those factors using the Analytic Hierarchy Process. The study was a qualitative study, and the design adopted by the study was a case study which is descriptive in nature.

3.3 Population

According to Creswell (2013), a research population is generally a large collection of individuals or objects that are the focus of the study. For this study, the population comprised of the aviation security service providers/practitioners at Hosea Kutako International Airport namely, the Namibia Airports Company's Aviation Security division, the Namibian Police Aviation Security Unit and the contracted Security Company (Namibian Protection Services). The study population comprised of 139 aviation security personnel.

3.4 Sample

A sample is a fraction of the population selected by the researcher from the population to participate in a study (Kothari, 2012). This study adopted a non-probability sampling design where a purposive sampling technique was employed. The sample frame of the study was determined by using the Slovin's formula, $n = N/(1 + Ne^2)$. Where n is sample size, N =139 is the total study population and e = 0.1 is the Margin of Error. The calculations were done as follow: $n = 139/(1 + 139(0.1)^2)$, therefore n=58 was the determined sample size. Out of the 58-questionnaire distributed, four (4) were not received back, as a result only 54 participants were assessed as the final sample of the study.

3.5 Research Instruments

The researcher designed an AHP questionnaire which was used as the instrument for data collection of this study. The questionnaire (Appendix 3) comprised of closed ended questions for which participants were required to assign a predetermined value (from 1-9) to each question as a representation of their opinions on the degree of importance of a factor in comparison to other factors. An AHP is a multi-criteria decision-making method that is widely used in decision problems that involves multiple criteria with complex structure (Saaty, 1990).

This method has the ability to handle and analyse phenomena, even if they are complex and multi-dimensional. Furthermore, this instrument was chosen over others because, as suggested by Saaty, it allows users to assess the relative weight of multiple criteria or multiple options against given criteria in an intuitive manner. The questionnaire was administered physically by the researcher to the respondents in order to gather data

from airport security staff and supervisors/managers who have the responsibility to oversee and uphold security at HKIA.

3.6 Procedure

Firstly, the researcher obtained ethical clearance and permission to conduct the study from the University of Namibia and thereafter permission from the airport's administrator, Namibia Airports Company, was obtained. Consent from the participants was also obtained and subsequently, questionnaires were administered personally by the researcher to the respondents. Respondents were given a period of two weeks to respond to the questionnaire. After two weeks, all completed questionnaire were collected from the respondents.

3.6.1 Data analysis procedures

Table 1: Steps of the AHP

1	Define the Problem/Goal
2	Develop a Hierarchical Decision Schema
3	Construct Pairwise Comparison Matrices
4	Perform Judgement for Pairwise Comparisons
5	Synthesize Pairwise Comparisons
6	Check for Consistency
7	Repeat steps (3-6) for all levels in the Hierarchy
8	Develop Overall Priority Ranking

Source: Saaty (1990)

Steps set by Saaty (1990) were followed as shown in Table 1. above to answer the objectives and to arrive to the final results of the study. These steps are explained in detail as follows below. Respective Formulas and Equations used are presented below, after the explanation of the steps.

1. The decision problem was identified and formulated into a Goal as illustrated in Table 8.
2. A hierarchical decision schema was constructed by decomposing the decision problem (Goal) into its decision elements (factors and sub-factors) hierarchically for each level, from top to bottom as shown in Table 8.
3. The importance or preferences of the decision elements were examined in a pairwise comparison to the elements in the hierarchy by using pairwise matrices (size nxn) (Matrix A) for each of the lower levels with one matrix for each element in the level immediately above by using a relative scale measurement in Table. 2.
4. Every element of matrix A below is the importance of one factor over another. (aij=importance of factor i over factor j). In order to identify the important percentage distributions of the factors, a column vector was created for each factor using Equation 2, based on the pairwise comparison matrix A (in (1)). The C matrix (in (4)) was then created by compiling the vector B (in (3)), in a matrix form.
5. From the resulting C matrix, the important percentage distributions, referring to the comparative importance values of the factors, were obtained as a priority vector W (in (6)) using equation 5. Each value (cij) was divided by the total number of factors (n).
6. Consistency for the priority vectors was then checked by using equation 11. This is because the consistency level in the inter-factorial pairwise comparisons made by the participants, is known to directly affect the results of the analyses. The determined priority vector was tested for consistency, and thus the consistency of one-to-one comparisons among the factors. The

calculation of the CR was based on a comparison of the factor number and principal eigenvalue (λ).

7. For the calculation of λ, firstly, the D column vector in (7) was obtained from the matrix multiplication of comparison matrix A and the priority vector W.
8. As shown in Equation 8. below, by a division of the corresponding elements of the obtained D column vector and the W column vector, a basic value (E) for each assessment factor was obtained. The arithmetic mean of these values was calculated by using formula (9).
9. The Consistency Indicator (CI) was calculated using formula (10).
10. The CR value (in equation 11) is calculated by dividing the obtained CI value by the random consistency (RI) of the factor number in Table 3.
11. Steps 3-10 were repeated for all levels in the hierarchy by using Microsoft Excel software, which simplified the implementation of the AHP's steps by replicating most of its computations.

After the whole computation and analysis was done, the main factors, factors and sub-factors were placed on a decision model (Figure 15) according to their level and importance values. The model presents the hierarchical level of importance and a determined weight for each main factor, factor and sub-factor.

Table 2: Relative Scale Measurement

Degree of importance	**Definition**
1	Equal importance
2	Moderate importance
3	Weak or slight
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very strong or demonstrated importance
8	Extremely strong
9	The most extreme importance

Source: Saaty (1990)

3.6.2 Formulas and Equations of computation

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{n} \\ \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & a_{nn} \end{bmatrix} \quad (1)$$

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad (2)$$

$$B_i = \begin{bmatrix} b_{11} \\ b_{21} \\ \vdots \\ b_{n1} \end{bmatrix} \quad (3)$$

$$C = \begin{bmatrix} C_{11} & C_{12} & C_{1n} \\ C_{21} & C_{22} & C_{2n} \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ C_{n1} & C_{n1} & C_{nn} \end{bmatrix} \quad (4)$$

$$w_i = \frac{\sum_{i=1}^{n} c}{n} \quad (5)$$

$$W = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} \quad (6)$$

$$D = A*W = \begin{bmatrix} a_{11} & a_{12} & a_{1n} \\ a_{21} & a_{22} & a_{2n} \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ a_{n1} & a_{n1} & a_{nn} \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} \quad (7)$$

$$E_i = \frac{d_i}{w_i} \quad (8)$$

$$\lambda = \frac{\sum_{i=1}^{n} E}{n} \quad (9)$$

$$CI = \frac{\lambda - n}{n-1} \quad (10)$$

$$CR = \frac{CI}{RI} \quad (11)$$

A CR value smaller than 0.10 is considered acceptable, because it means that the calculations are consistent (Saaty, 1990).

Table 3: Random Index

N	RI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24

Source: (Saaty, 1990)

3.7 Data analysis

The Analytic Hierarchy Process (AHP) in combination with Microsoft Excel software were used to analyse data. The AHP which was developed by Saaty, is a powerful and flexible weighted scoring decision making process to help people set priorities and make the best decision (Yoo, 2009). In addition, Elmurugan et. al. (2011) affirms that the AHP has been widely used to solve problems of multi-criteria decision making in both academic research and in industrial practice. Moreover, AHP has been implemented in almost all applications related to decision-making and is currently predominantly used in the theme of selection and evaluation, adds Yoo. Data of collected by this study were analysed using Microsoft Excel software, thereafter the results were entered into an AHP decision model, interpreted and then conclusions were drawn.

3.8 Research Ethics

One of the ethical issues that was encountered was the unwillingness to participate in the study. The researcher first obtained the respondents' informed consent to participate in the study and highlighted the relevance and usefulness of the study to

the participants. In addition, the researcher promised confidentiality and guaranteed participants anonymity. The airports company was hesitant to give permission for a study about the security of the airport as this was deemed to expose security of the airport. Assurance was made to the company that information obtained were strictly for the purpose of the study and would be treated with utmost confidentiality and hence this ethical concern was mitigated. Furthermore, the researcher has a security background and at the time of the study an employee of the NAC aviation security division, at a supervisory level, (although not stationed at the study area) this was of advantage to the researcher as it might have mitigated the fear of participants to partake in the study concerning security.

3.9 Chapter Summary

This chapter explains and describes the methodology that was assumed by this study. This study is a descriptive type of study, and it adopted a case study method. The population and study samples were discussed in depth where the study population was selected to be comprise of aviation security practitioners at HKIA, the initial determined sample was 58 personnel which was determined by using the Slovin's formula, however the assessed participants were 54. The researcher used AHP questionnaire to collect data. A detailed explanation of the steps and procedures were given. Furthermore, the process of data analysis was detailed followed by the research ethics. The following chapter will present the results and discuss the findings of the study.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 RESULTS

4.1.1 Section A: Demographic Data

The questionnaires were administered to a total number of 58 respondents. Out of the determined respondents only 54 participants were assessed for the final evaluation. After the due date of collecting the questionnaires from respondents, four questionnaires were not received back despite several follow ups. As a result, a response rate of 93% was achieved.

Table 4**:** Response Rate

Response Rate	Frequency	Percentage
Administered Questionnaires	**58**	**100**
Received Back	**54**	**93**
Not Received Back	**4**	**7**
Assessed Participants	**54**	**93**

From the 54 participants that were assessed, six (6) respondents were at management level while seven (7) were at supervisory level and 41 respondents were Aviation Security Screeners/officers who carry out screening duties at the airport.

Table 5**:** Occupational Position/Title level

Respondents Position level		Total
AvSec Security Screener		41
Management level		6
Supervisory level		7
Total		**54**

In terms of years of working experience, eight respondents had worked at the airport for more than 10 years, while those that have been at the airport for five years to ten

years are 15. about 14 participants worked at the airport for a period of three to four years and 17 had worked at the airport for a period less than three years. This indicate that the majority of respondents are familiar with the airport environment and aviation security specific duties since they have worked at the airport for over three years.

Table 6: Years of Working Experience

Years of Working Experience at Airport	Respondents	Percentage
More than 10 years	8	14.8
Between 5-10 years	15	27.8
Between3-4 years	14	25.9
Less than 3 years	17	31.5
Total	**54**	100

81.5% of the participants had received tertiary including vocational or equivalent education and a proportion of 18.5 percent had reached until secondary education level. This means that the aviation security practitioners possess a reasonable level of education to understand their duties and responsibilities as well as the capabilities to answer the questions.

Table 7**:** Education Level of Participants

Level of Education	Participants	Percentage
Tertial education	44	81.5
Secondary education	10	18.5
Total	**54**	**100**

Furthermore, in terms of Aviation Security specific qualifications Over 72% of the participants had professional AvSec qualifications, while only over 18% participants had both academic and professional AvSec qualifications. Only a 9.3% had academic qualifications. This means that the aviation security practitioners possess a reasonable level of education and qualifications to understand their duties and responsibilities.

Table 8: Participant Qualification Level

AvSec Qualification	Distribution	Percentage
Academic (only)	5	9.3
Professional/Specialised Training (only)	39	72.2
Both Academic & Professional	10	18.5
Total	**54**	**100**

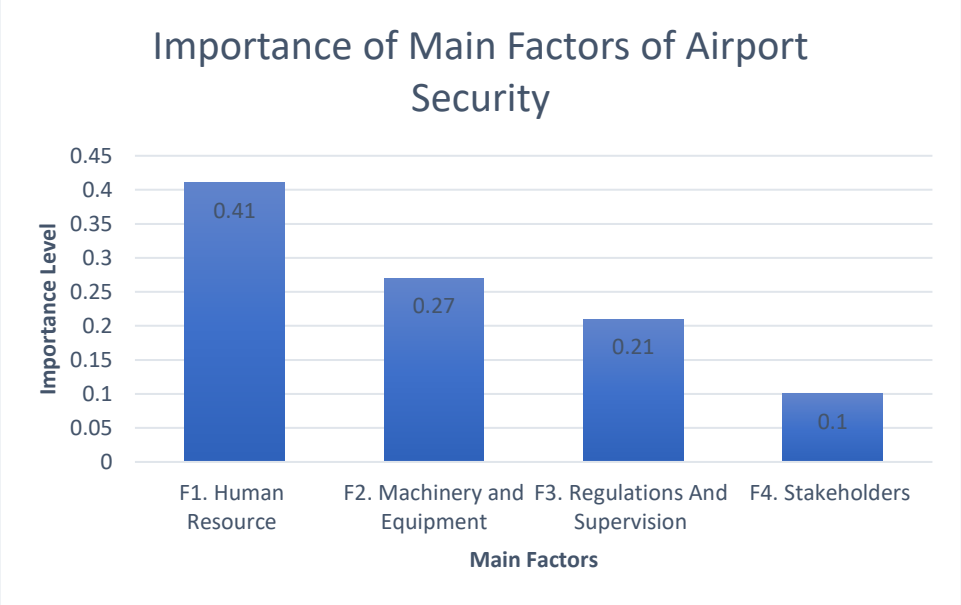
4.1.2 Section B: Findings to the study objectives

This section presents the findings of the study with respect to the study objectives.

The results are first discussed and interpreted in relation to the main factors and then with respect to factors and sub-factors under each main factor.

a. Level of Importance of Airport Security Main Factors

Figure 1: Level of Importance of Airport Security Main Factors by 54 participants

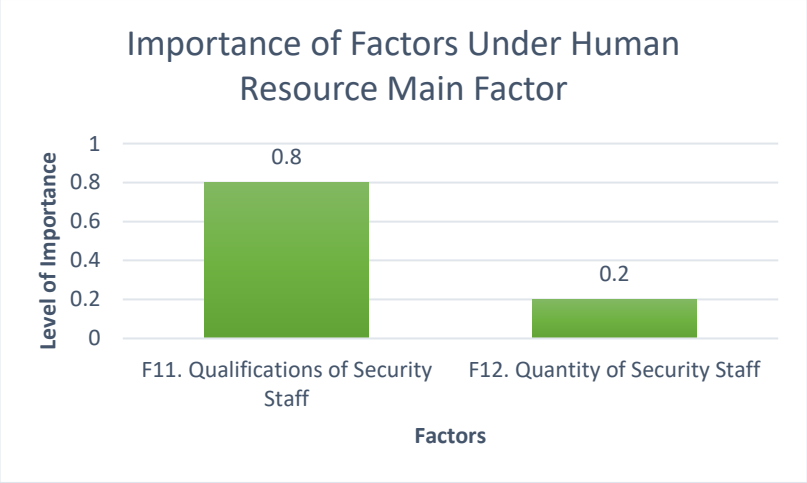


Five main factors of airport security, namely, human resources, machinery and equipment, regulation and supervision and stakeholders were assessed to determine their level of importance with respect to one another. From the assessed main factors, the most important major factor in enhancing airport security was found to be Human Resources at 41 percent. The second most important main factor was found to be Machinery and Equipment with 27 percent, while Regulation and Supervision, and Stakeholders were rated the least in enhancing airport security with 21% and 10% respectively.

b. Level of importance of airport security factors under main factors

Human Resource

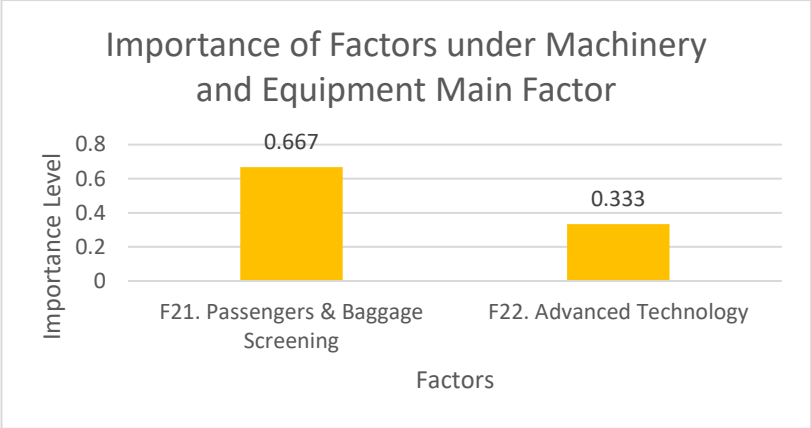
Figure 2: Importance of airport security factors under the human resource main factors for 54 participants



Under the main factor of human resource, qualifications of security staff and quantity of security staff were assessed. The study found that qualifications of security staff were rated the most important factor to be considered in human resource. It obtained an importance level of 80%. On the other hand, quantity of security staff obtained an importance level of 20%.

Machinery and Equipment

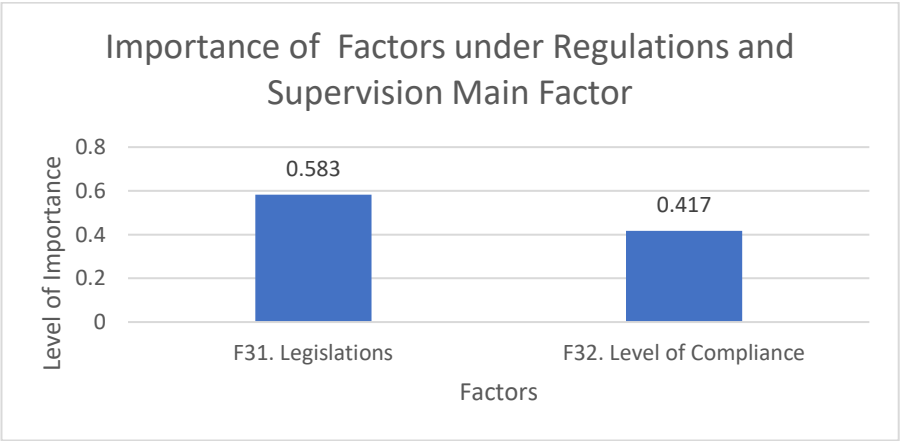
Figure 3: Importance of factors under Machinery and Equipment main factor for 54 participants



Machinery and Equipment as a main factor of second importance of airport security factor, has two factors which were assessed under it. Advanced technology factor was compared to passengers & baggage screening factor. The most important of the two was found to be the Passengers & Baggage Screening factor, with 67% while the latter received 33%.

Regulation and Supervision

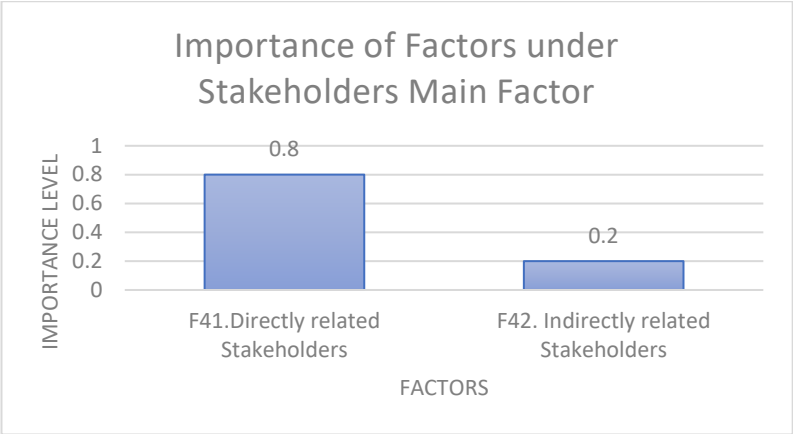
Figure 1: Importance of factors under Regulations & Supervision main factor for 54 participants.



Level of Security Compliance and Legislations were considered as factors under the main factor regulation and supervision. The level of importance of these factors were found to be 585 to 42% as indicated in figure 4 above.

Stakeholders

Figure 5: Importance of factors under Stakeholders main factor for 54 participants

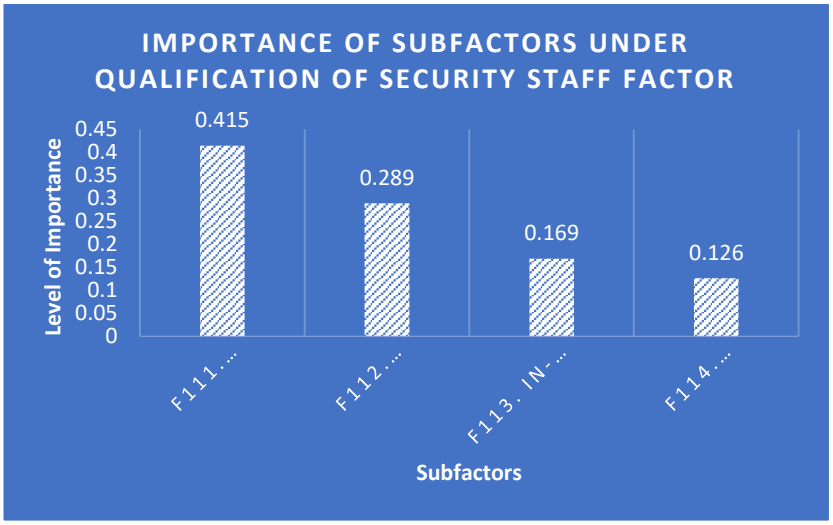


The main factor stakeholders were assessed through directly related and indirectly related stakeholder factors. The least rated in terms of importance of these factors was the indirectly related stakeholders at 20%. Directly related stakeholders received the highest preference of importance of 80%.

c. Level of importance of sub-factors under the factors of airport security.

Qualification of Security Staff

Figure 6: Importance of subfactors under Qualification of Security Staff factor for 54 participants

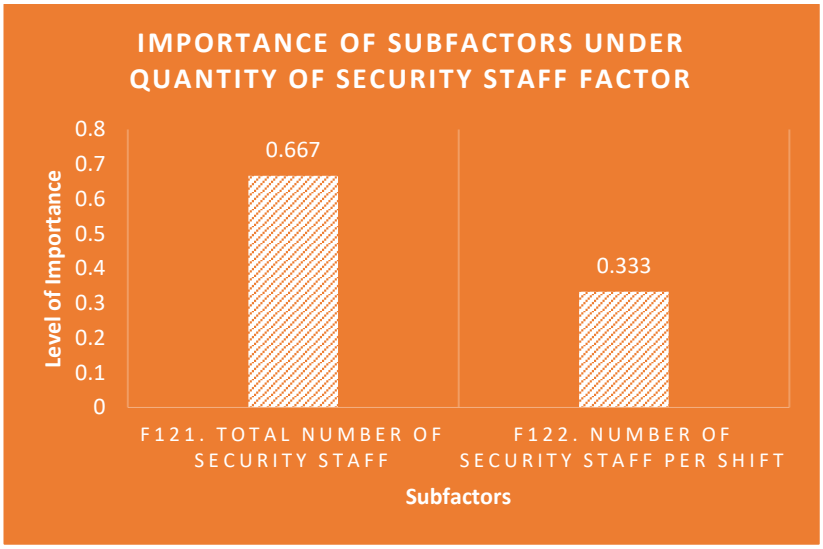


Among the four sub-factors that were assessed under the factor of qualification of security staff, professional qualification was the most important rated at 42% followed

by basic or initial training at 29%. In-service training and personnel experience were the least important sub-factors under the qualification of security staff, rated below 18 percent.

Quantity of Security Staff

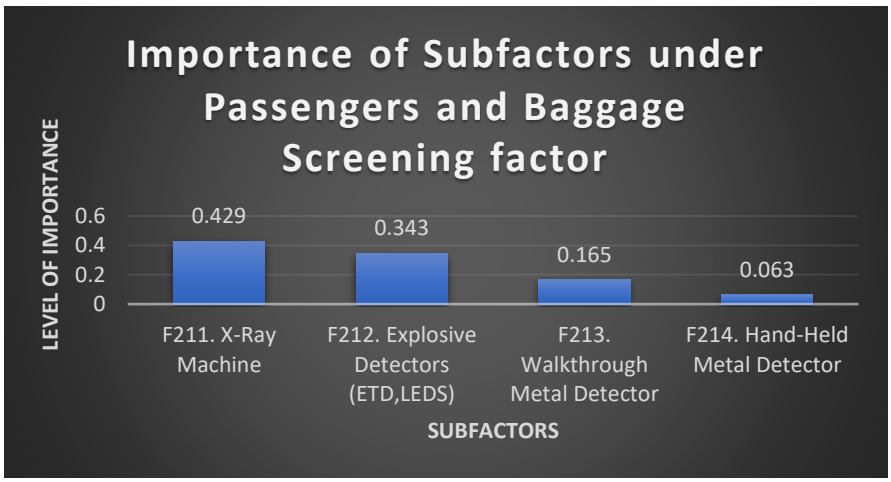
Figure 7: Importance of sub-factors under Quantity of Security Staff factor for 54 participants



Total number of security staff was deemed to be the most important sub-factor when considering the quantity of security staff. However, the total number of security staff per shift was found to be of less importance as it only scored about 33% as compared to 67% of the total number of security staff.

Passengers & Baggage Screening

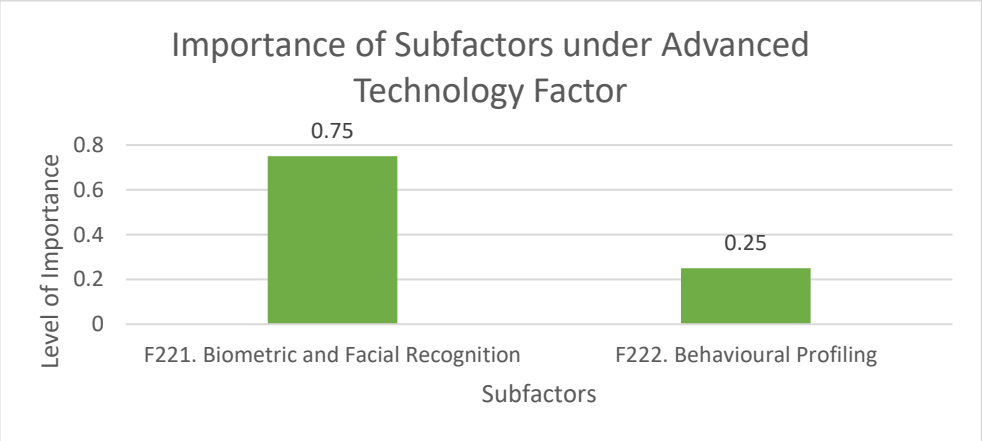
Figure 8: Importance of sub-factors under Passengers & Baggage Screening factor for 54 participants



When the airport security factor of passengers & baggage screening was assessed the determinant sub-factors such as X-Ray machine, explosive detectors, walkthrough metal detector and hand-held metal detector were used. Of the highest importance among these sub-factors was the X-Ray machine rated at 43%. The second important factor was explosive detectors at 34%, followed by the walkthrough metal detector and hand-held metal detector at 17 and six percent correspondingly.

Advanced Technology

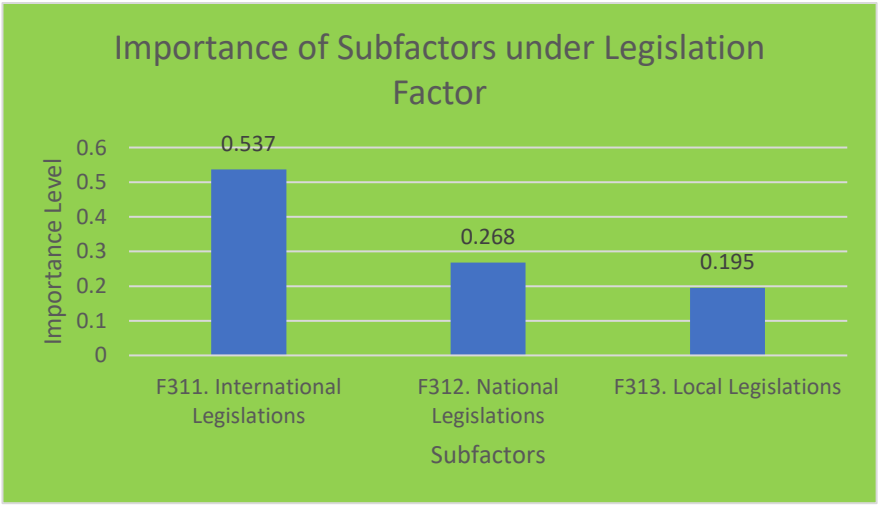
Figure 9: Importance of sub-factors under Advanced Technology factor



Under the factor advanced technology, the sub-factor biometric and facial recognition was rated the most important with a score of 75%. Behavioural profiling was found to be 25 percent important.

Legislations

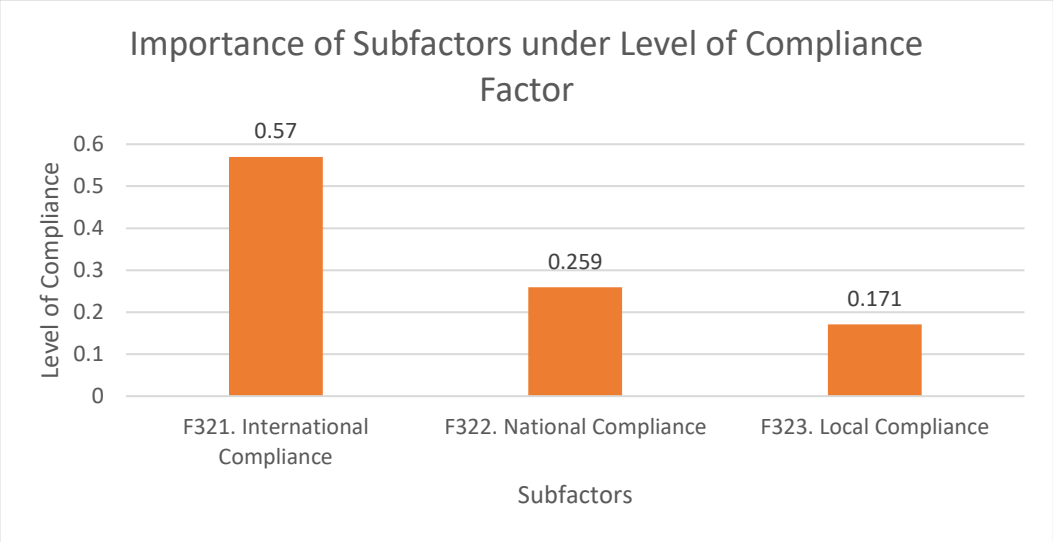
Figure 2: Importance of sub-factors under Legislation factor for 54 participants.



International legislations were found to be the most important sub factor under legislations, it was found to be 53% important when compared to other sub-factors under the legislation factor. National legislations were the second important sub-factor with a percentage of 27, while the least rated sub-factor was the Local legislation with 20%.

Security Compliance

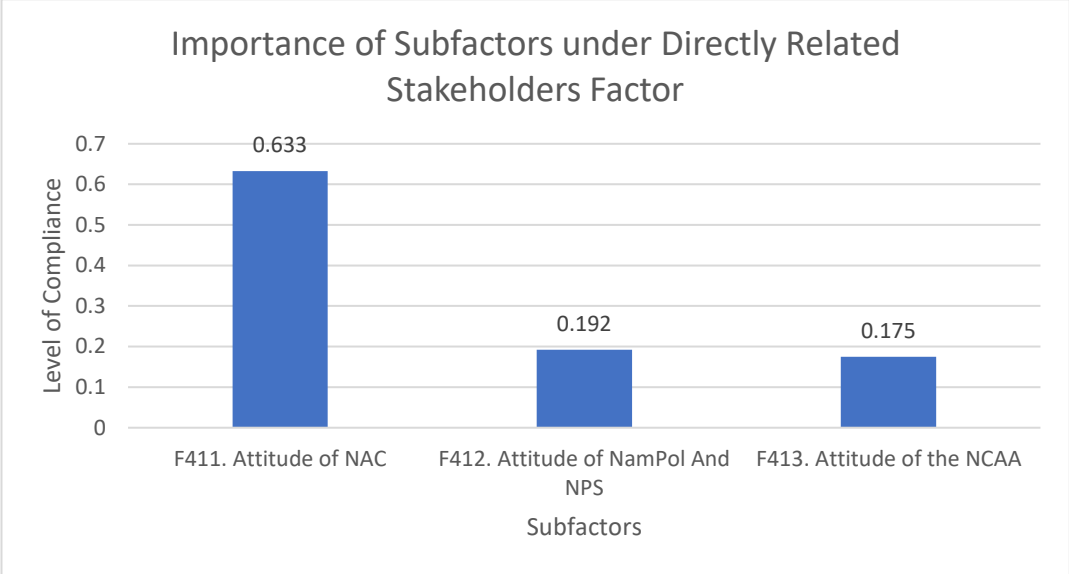
Figure 11: Importance of sub-factors under Security Compliance factor for 54 participants



In considering the security compliance factor, three sub-factors namely local, national and international compliance were assessed. The most important sub-factor was found to be international compliance with 57%, while National and Local compliance were rated least important with 26% and 17 % respectively.

Directly related stakeholders.

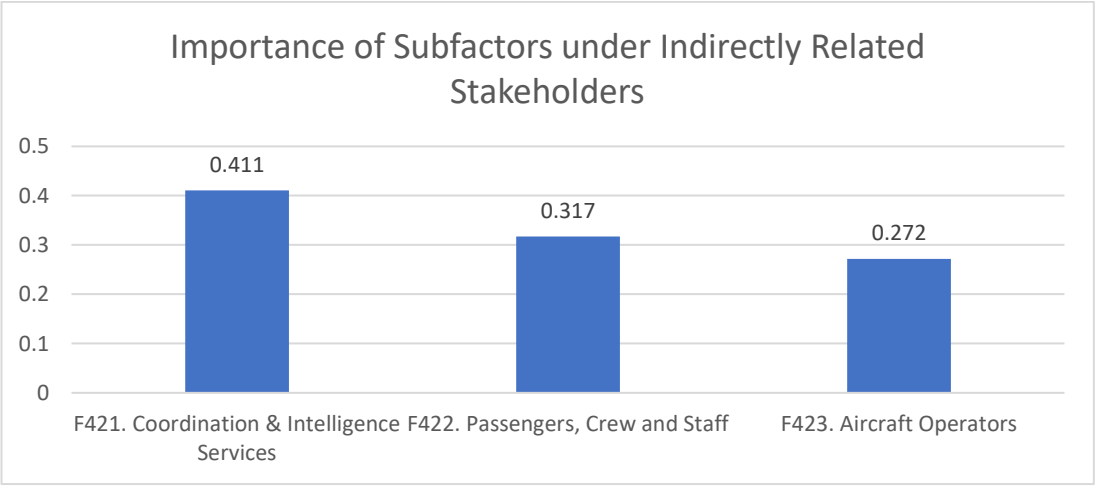
Figure 12: Importance of sub-factors under Directly related stakeholder factor for 54 participants.



Under directly related stakeholders, the sub-factor considered most important was the attitude of the airport administrator NAC with a score of 63%. The attitude of the aviation security service providers, Nampol and NPS was the second rated sub-factor at 19%. The sub-factor of least importance was the attitude of the civil aviation regulator NCAA which was rated at 18 percent.

Indirectly related stakeholders

Figure 13: Importance of sub-factors under Indirectly related stakeholders' factor for 54 participants



Three sub-factors were assessed under the factor of indirectly related stakeholders, the sub-factor of the highest importance was found to be coordination and intelligence services with a rating of 41%. Passengers, crew and airport staff were of second importance with 32 percent rating. The least important sub-factor was found to be aircraft operators, at 27%.

4.1.3 Importance of main factors, factors, and sub-factors of airport security

Figure 14**:** The AHP Analysis Results

Goal (Level 1)	**Main Factors/Alternatives (Level 2)**	**Factors/Criteria (Level 3)**	**Sub-factors/Sub-criteria (Level 4)**
Enhancing the efficiency and effectiveness of Airport Security	F1. Human Resource (0.41)	• F11. Qualifications of Security Staff (0,80)	• F111. Professional qualification (0.42) • F112. Basic/Initial Training (0.29) • F113. In-service Training (0,17) • F114. Personnel Experience (0.13)
		• F12. Quantity of Security Staff (0,20)	• F121. Total Number of Security Staff (0.67) • F122. Number of Security Staff per Shift (0.33)
	• F2. Machinery and Equipment (0.27)	• F21. Passengers & Baggage Screening (0.67)	• F211. X-Ray Machine (0.43)

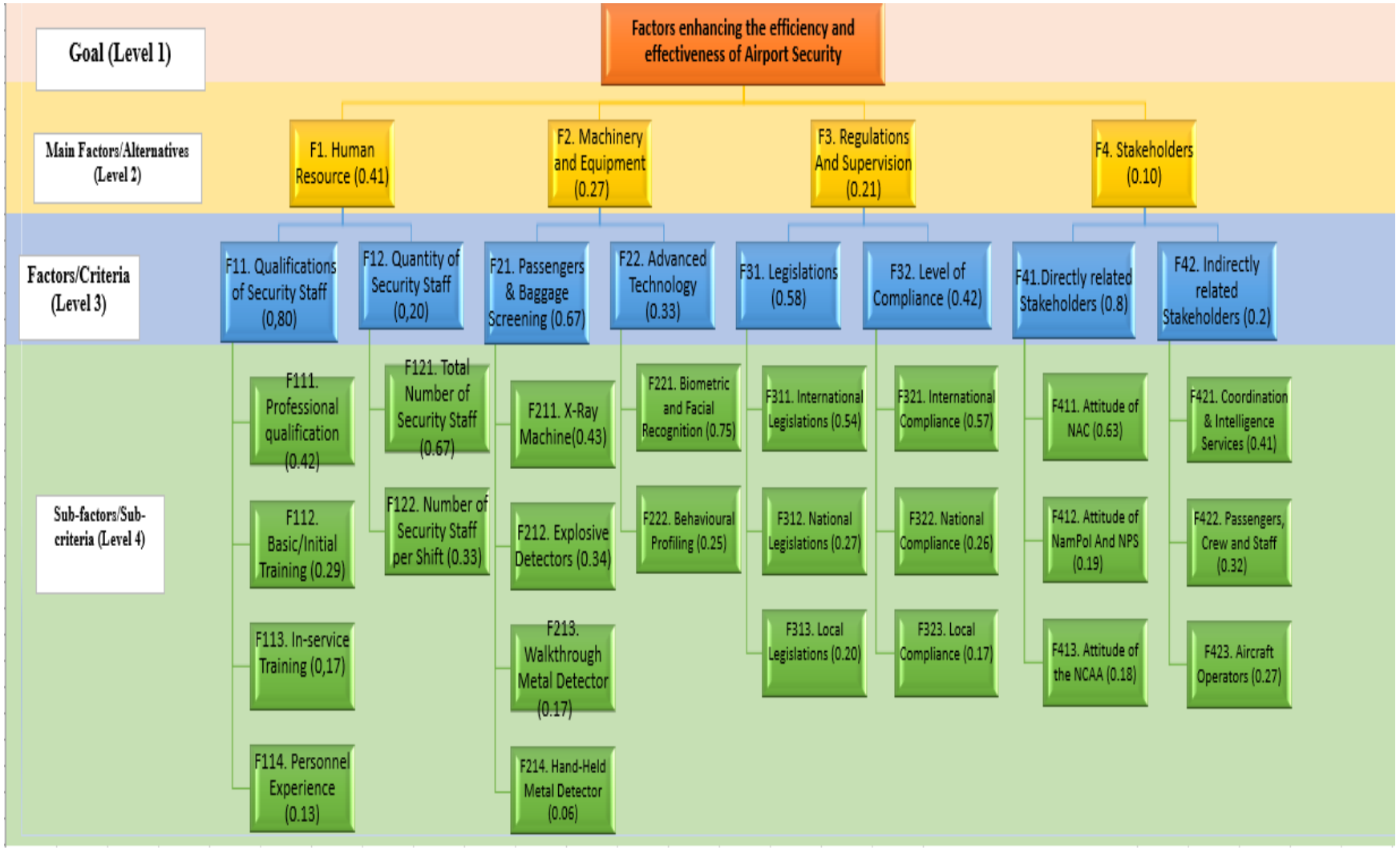
		• F22. Advanced Technology (0.33)	• F212. Explosive Detectors (0.34) • F213. Walkthrough Metal Detector (0.17) • F214. Hand-Held Metal Detector (0.06) • F221. Biometric and Facial Recognition (0.75) • F222. Behavioral Profiling (0.25)
	• F3. Regulations And Supervision (0.21	• F31. Legislations (0.58) • F32. Level of Compliance (0.42)	• F311. International Legislations (0.54 • F312. National Legislations (0.27) • F313. Local Legislations (0.20) • F321. International Compliance (0.57)

			• F322. National Compliance (0.26) • F323. Local Compliance (0.17
	• F4. Stakeholders (0.10)	• F41.Directly related Stakeholders (0.8)	• F411. Attitude of NAC (0.63) • F412. Attitude of NamPol and NPS (0.19) • F413. Attitude of the NCAA (0.18)
		• F42. Indirectly related Stakeholders (0.2)	• F421. Coordination & Intelligence Services (0.41) • F422. Passengers, Crew and Staff (0.32) • F423. Aircraft Operators (0.27)

Note: Numbers in ( ) show proportional weighting of factors within each category. Each category on each level =1.
F1 means the **main factor** of 1st importance, F11 means a **factor** of first importance under the first main factor, F111 means a **subfactor** of first importance under the first factor of first main factor. The same is done for each category/level.

4.1.4 Decision Model

Figure 15: Factors and Criteria's Importance Decision Model



4.2 DISCUSSION

4.2.1 Discussion and interpretation of airport security main factors

Determination of airport security factors could greatly help in enhancing the effectiveness and efficiency of airport security services. The results are discussed and interpreted first, in terms of the main factors and then the factors and sub-factors under each main factor. Among the evaluated main factor namely, human resources, regulation and supervision, machinery and equipment, and stakeholders, the main factor of highest degree of importance was found to be Human Resource (Figure 15). Harris (2002) postulates that until human factors are considered in the design of airport security jobs, technological responses to security breaches are most likely to fail to achieve their desired end. Furthermore, airport security staff in carrying out these duties need to ensure that machinery and equipment are used efficiently to yield effective results.

Participants rated this as one of the most critical factors that influence airport security in general which may enhance its effectiveness and efficiency. These results replicate Yoo and Choi (2006), and Bülbül and Ergün (2016, as cited in Bülbül and Ergün, 2019) ‘s study findings in which the human resource factor was ranked the most important factor of all the considered factors. This finding could be ascribed to, as suggested by Harris (2002) the reason that human operators continue to play an important role in the detection process by interpreting X-Ray images, resolving metal detector alarms, conducting body searches with metal detection wands, conducting physical searches of baggage and persons, and maintaining order at screening checkpoints.

Machinery and Equipment was found to be the second important main factor of airport security. This can be interpreted to mean that respondents are of the opinions that apart from a capable human resource, airport security services are implemented with the help of machinery and equipment as devices of support. The respondents may also have a perception that these devices of support greatly increase the effectiveness and efficiency in airport security application. For example, the use of X-ray machines to detect improvised explosive devices and other restricted articles that may be concealed in baggage or electronic devices has improved the effectiveness of airport security. Moreover, security screeners can now clear more passengers through the security checkpoint in a short period of time, thanks to the use of machines and equipment. Despite the importance of Machinery and Equipment main factor, Human Resource remain the most important factor due to the fact that the security staff will still be required to make judgements and decisions based on the interpretation of information gathered from the equipment and machinery.

The main factor of a third degree of importance was Regulations and Supervision. This may be because of the understanding of aviation security practitioners that, airport security duties are carried out within the frameworks of the established procedures and supervisions which are derived from specific regulations. The capability of human resources to be employed effectively for the purpose of ensuring airport security is directly connected to the regulations Bülbül and Ergün (2016, as cited in Bülbül and Ergün, 2019). However, the same study found that main factors of Facilities and Equipment, and stakeholder were more important than Regulations and Supervision. This was attributed to the perception that, if the regulations do not match an airport's

physical structure, workflow procedures, or stakeholder objectives, the security services will be adversely affected.

Machinery and Equipment are generally used in accordance with the set regulations and effective supervision to yield the desired results. The ICAO for instance has set regulatory standards the security equipment should meet before they can be accepted for use in aviation security screening purposes. Although regulations and supervision are important in enhancing the efficiency of a security system, human resource in combination with machinery and equipment are the backbones of airport security screening and therefore are the most important aspect in ensuring effectiveness and efficiency.

The last and fourth important main factor of airport security was found to be the Stakeholders. As suggested by Bülbül and Ergün (2019), this result might be driven by an insight that disruption in security services arises from services provided or action by related stakeholders and their attitudes. In addition, increased security measures, although believed to be necessary, it can cause all stakeholders in the aviation system to suffer (Eldar, 2010). It can also be argued that the attitude of the security service providers, as one of the directly related stakeholders, towards the security services they provide is important in terms of effectiveness and efficiency. Although attitudes of stakeholders can impact the application of security services at the airport, if the right human resource is employed, reliable machinery and equipment are deployed, regulations are being strictly adhered to and there is adequate supervision, the effectiveness of the security system can be easily achieved. Moreover, participants might be of the view that indirectly related stakeholders have less impact in the

application of security services at the airport, because they mostly are recipient of these services or merely support services of which the absence of their services may not hinder the execution of security duties at the airport.

4.2.2 Discussion and interpretation of airport security factors under the Human Resources main factor.

Under the main factor of Human Resources, two factors namely, Qualifications of Security Staff and Quantity of Security Staff were considered. The study found that Qualifications of Security Staff was more important than the factor of Quantity of Security Staff. This could be interpreted to mean that airport security staff need to be well qualified for their job positions. The quantity may not have significant impact on the effectiveness and efficiency of airport security systems as long as the minimum legal number of security staff required to carry out specific security duties is met as per the aviation security regulations. Furthermore, it can be said that it is more important to have a well-qualified staff with relevant knowledge, skills, and experience than to have an airport full of security staff who do not understand or have required knowledge and skills on the job specific tasks.

Under the factor Qualification of Security Staff, the sub-factor Professional Qualification was ranked the most important followed by Basic/Initial Training, In-service Training and lastly Personnel Experience. These results can be attributed to the perception that a security staff with a professional qualification is deemed to be equipped with both advanced knowledge and skills in job specific duties. Due to various recent acts of unlawful interferences committed at airports, many airports are fast implementing the use of advanced technology, there is no doubt that the success of these technological advanced equipment is highly dependent on the quality of the

security staff. Personnel Experience was rated the least important subfactor, this could be due to the fact that for a staff to become experienced they need to undergo a Basic Training to be equipped with the basic job specific skills and then the Inservice Training to continue developing their skills and knowledge further while working.

In considering the factor Quantity of Security Staffs the second important factor of Human Resources, the sub-factor Total Number of Security staff was rated as the sub-factor of high importance than the Number of Security Staff per Shift. This might be because of the participant's perception that the total number of security staff has a direct impact on the number of staff in a shift and this may negatively impact the execution of security duties if the available number is inadequate. For a security checkpoint at the airport, ICAO has recommended a minimum number of required security personnel to man the checkpoint. If the total number of security staff of a given airport is insufficient, it will be then difficult to meet the minimum number requirements for the screening checkpoint.

4.2.3 Discussion and interpretation of airport security factors under the main factor of Machinery and Equipment

Machinery and Equipment was assessed through the factors of Passengers & Baggage Screening and Advanced Technology. The ranked most important factor of the two was Passengers & Baggage Screening, this could be due to the fact that it is important to ensure that the passengers, baggage and everything that is placed on the aircraft or being introduced into the security restricted are of the airport are screened to ensure that they do not possess/contain articles that could be used to commit an act of unlawful interference. several literatures show that the articles that have been used to commit acts of unlawful interferences had been carried by passengers or hidden in baggage. Therefore, this highlights the necessity to screen passengers and their belongings.

On the other hand, screening equipment used nowadays are considered of an advanced technology. When an airport is equipped with technologically advanced machinery this of course increase the efficiency and effectiveness of the airport security services, thus Advanced Technology cannot be left out in enhancing effective airport security. Despite the efficiency and effectiveness, technology may fail sometimes, but the security personnel should make sure that passengers and baggage should go any form of screening before allowed to board an aircraft or access the sensitive areas of the airport.

The most important sub-factor when carrying out passenger and baggage screening was determined to be the X-Ray machine. According to Bülbül and Ergün (2016), this finding may be related to technology which aid in providing speed and comfort by X-Ray machines. They further added that X-Rays are capable of notifying security staff by detecting the type of potential threats as well as pointing out their possible locations. In addition, it has multi-capabilities to detect both metals, liquids, and explosives. Therefore, there is no doubt that an X-Ray machine is the most important equipment in enhancing the security effectiveness at the airport.

The sub-factor of second importance was Explosive Trace Detectors (ETDs). The ETDs can be used to detect traces of explosives on passengers and or their baggage. This is crucial especially in the detection of plastic or liquid explosive devices. The fact that it requires extra procedures, and it lacks speed and comfort as compared to X-Ray machine may be the reason of its lower rating. The sub-factors Walk Through Metal Detector and Handheld Metal Detectors were the third and fourth most important sub-factor respectively; this can be attributed to the reason that these equipment's capabilities are limited in a large proportion. Metal detectors are at most

capable of detecting metals and cannot detect for instance plastic explosives, hence can be less recommended to be used to screen baggage.

The two sub-factors considered under the factor of advanced technology were Biometric and Facial Recognition, and Behavioural Profiling. Biometric and facial recognition was found to be of highest importance than Behavioural Profiling. This may be attributed to perception of the participants that biometric and facial recognition are almost specific, direct and expeditious in identifying an individual. These systems use unique features of an individual to aid in their recognition. Terrorists and other criminals can easily be identified once they enter the airport premises without having to alert them and also before reaching the strategic points of the airport. Behavioural profiling on the other hand requires high level of training and it may be time consuming hence its low rating on importance. The security staff at the monitoring screens need a bit of time to successfully profile an individual and their behaviours.

4.2.4 Discussion and interpretation of airport security factors under Regulations and Supervision main factor.

Regulations and Supervision, the third important main factor of airport security was assessed under two factors namely, Legislations and Level of Security Compliance. The factor of the highest priority was rated to be Legislations. This could be due to the reason that security compliance is wholly dependent on the legislations and laws. Namibia being a member state to international regulatory bodies, she needs to be in full compliance with the found regulations before she is a compliant nation. For example, the Audit that was conducted by ICAO in Namibia in 2018 found that Namibia was not compliant to some international standards therefore the state was compelled by ICAO to implement some corrective measures to be compliant with the international standards.

The sub-factors international legislations, national legislations and local legislation were assessed under the factor of legislations. International legislation was the most preferred in terms of importance followed by National and Local legislations respectively. This could be because it is widely known that the aviation industry is regulated by international bodies such as the ICAO, IATA etc. All member states to these bodies are required to implement standards and regulations as set by these bodies. Member states are required to draw their national regulations from these bodies to ensure international uniformity in compliance. Therefore, it can be claimed that international regulations shape security services to a large extent (Bülbül & Ergün, 2016). Local legislations such as standard operating procedures are duty specific and hence, they also play a crucial role in enhancing the effectiveness and efficiency of airport security. Members on the ground are guided by their post's standard operating procedures.

Legislations alone cannot fully enhance security at the airport, but it also requires a high level of compliance attitude to ensure that the set regulations are being followed. One may have the best legislations in place but if no one complies with them, it is of less impact on the bid to ensure airport security. International compliance, National compliance and Local compliance were the sub-factors under the level of compliance factor. International compliance was ranked the most important of all followed by national compliance and local compliance being the least important. This could mean that for the efficiency of national security system to be realised, those at local level (airport) need to have high regard for compliance for international compliance to be achieved.

4.2.5 Discussion and interpretation of airport security factors under the main factor of Stakeholders

Under the Stakeholders main factor are the directly related stakeholders and indirectly related stakeholder factors. Among these two factors, directly related stakeholders was ranked the first important factor and indirectly related stakeholders the second. The participants may have arrived at such a conclusion due to the notion that those stakeholders that are directly involved in the application and regulation of security at airports have a much bigger influence on the effectiveness of the security system than stakeholders that are not directly involved in airport security. For instance, the attitudes of the airport operator, the regulator and the contracted security service providers including the police is of great influence on the security system. As sub-factors under the factor Indirectly related stakeholders, Attitudes of NAC was selected as the most important sub-factor. This could mean that participants perceived NAC as the airport operator, that she has the responsibility of providing security equipment, enforcing security regulations, and conducting security oversight at her airports. Therefore, her attitudes towards security may highly influence the level of security at the airports.

The sub-factor of second importance was found to be the attitudes of the security service providers namely, the Namibian Police and the Namibia Protection Services. This finding may be as a result of perceptions that the security service providers are usually at the core of conducting security duties at the airport. Their attitudes in carrying out these duties may also have a noticeable influence on the overall airport security system. Yoo and Choi (2006, P. 46) notes that “screeners who do not have a serious sense of accountability may allow passengers or their carry-on luggage to go through the screening process without proper inspection, for example when screeners encounter ambiguous situations during peak passenger traffic hours.” Positive

attitudes of the security service providers toward security tasks may enhance the effectiveness of airport security; however, the airport administrator has an immense impact on the attitudes of these service providers as they highly rely on the airport administrator for procedures and the manner in which the security tasks should be carried out.

Attitude of the regulator which is the Namibia Civil Aviation (NCAA) was determined to be the sub-factor of least importance. This might be due to the perception that the regulator only provides regulation and guidance on the best security practices to the airport operator. Moreover, although NCAA conduct security oversight of the airport operator, this may not be of massive impact on security application at the airport as compared to the entities on the ground and the airport administrator itself. It can be argued that the national regulator caps its framework from the international regulatory bodies but these regulations although nationalised they are still generic and need to be localised to fit the specifications and environments of individual airports.

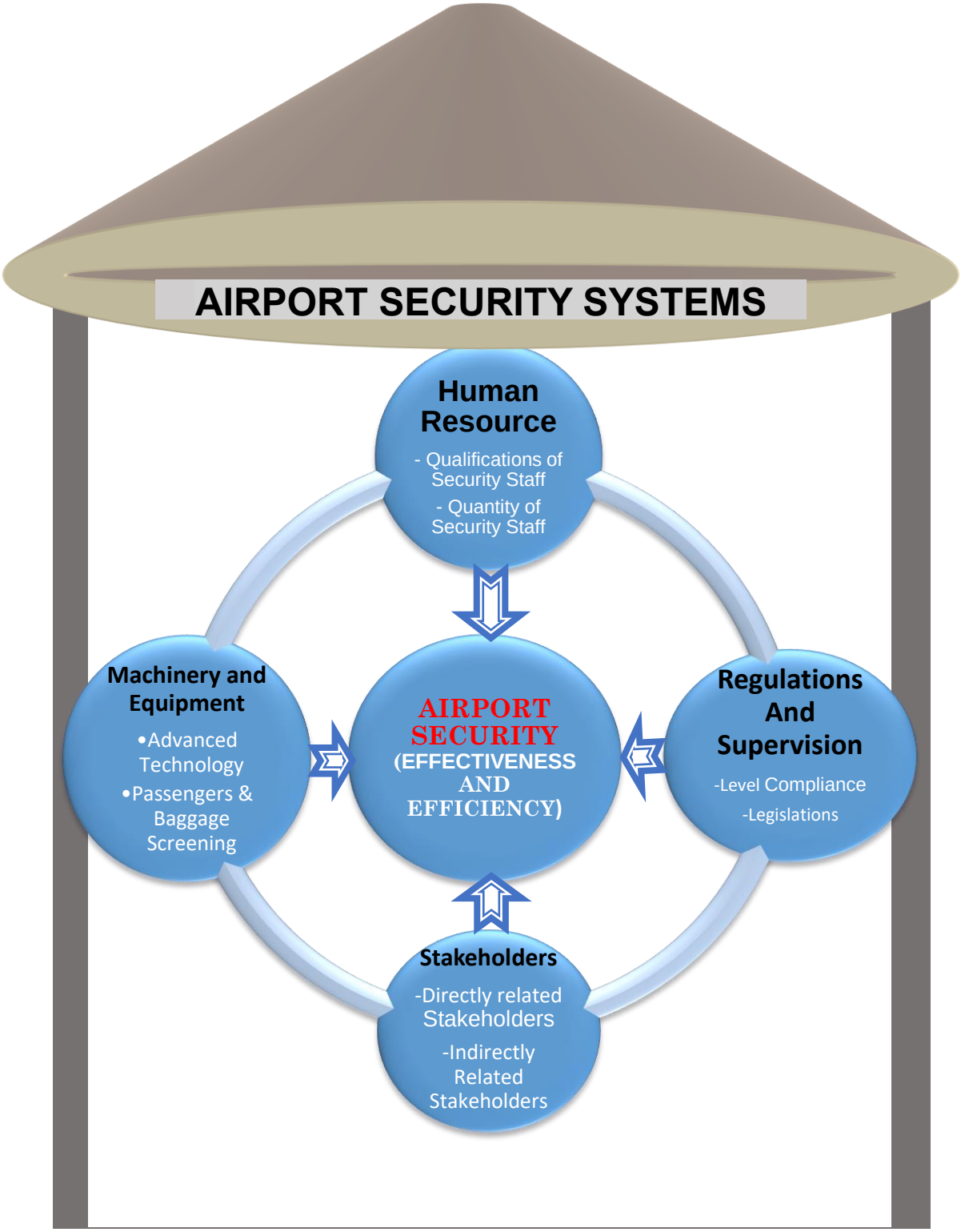
The factor, indirectly related stakeholders was assessed through sub-factors of Aircraft Operators, Passengers, Crew and Staff, and Coordination & Intelligence Services. The sub-factor Coordination & Intelligence Services was rated the highest among others, this could be linked to the perception that for a security system to function adequately there is a need for proper coordination between stakeholders. It is almost impossible for a system to function in isolation and achieve the highest level of efficiency. Eldar (2010) espoused that airport checkpoint security services require different staff members from different departments, such as law enforcement, the customs department, the immigration department, and airport operator staffs to work together. Therefore, it can be said that the airport operator should ensure effective coordination between these units. Intelligence Services is another aspect of importance, it is

responsible for providing vital intelligence information and tip-offs to the security team. With all the advanced technology in place, the security system may still fail if relevant intelligence information is lacking. The provision of accurate intelligence information may greatly enhance the effectiveness and efficiency of airport security because it means timely actions such as accurate preventative measures will be employed.

The second important sub-factor was Passengers, Crew and Staff. This could mean that participants consider that, since security measures are also applied to these stakeholders, disputes often occur between them and screeners because of physical contact, delayed processes, or confiscation of prohibited items. The attitudes of these stakeholders may impact the confidence level of security staff that can as a result affect the overall level of airport security. The third important sub-factor was found to be Aircraft Operators, this result could be because of the fact that different service providers at airports, especially aircraft operators, want passengers to complete the process as swiftly as possible and to ensure that flights take off as per the flight schedule (Kirschenbaum et. al., 2012). However, this does not intensely affect the process of enforcing security procedures because security is the number one priority over other factors such as facilitation, meaning that security staff may not be rushed into completing the process without following the right procedures. Since the security services and airline operator processes in the air transport system must be coordinated with one another, the sub-factor of Coordination & Intelligence Services correctly takes the leading spot ahead of other sub-factors under indirectly related stakeholders.

4.2.6 Airport Security Systems

Figure 16: Airport Security Factors Model



Apart from applying the assessed factors into an existing decision model as shown in figure 15, this study developed a model of airport security systems (figure 16)in which the main factors and their subsidiary factors are interactively grouped as a system. In the model, airport security is placed in the centre to depict the core subject of consideration for which the effectiveness and efficiency is sought. Airport Security main factors and their subsidiary factors are found all around the centre/core. This arrangement shows that despite the different levels of importance or priority levels, the factors of airport security are interlinked, and no single factor can achieve efficiency and effectiveness of airport security without the involvement of other factors. Airport Security actors can use this model as a guidance to solve operational challenges that they might be facing. The actor needs to identify the problems and challenges being experienced and group them under relevant factor group. Once placed under a factor group, a corresponding subsidiary factor can guide to the likely needed intervention.

For example, one of the ICAO Audit findings for Namibia was the certification of security screeners. To arrive to an effective course of action for the corrective action of that finding, the deficiency can be placed under Human Resource factor. Whereby the relevant factor is qualification of security staff. Then, further consideration with the help of the decision model (Figure 15) can be made to establish the type of qualification necessary by considering their position on the hierarchy. The type of qualification in this case can be Initial/basic, professional training/qualification, Inservice training or level of experience. Once the exact need has been identified, the right corrective action can then be undertaken by considering the importance levels of the factors. The decision model can be used concurrently with this model to find solutions to identified challenges through establishing the priority level of a factor in

relation to other factors. In a nutshell, the developed model offers a simple guidance in choosing the right course of action in achieving airport security efficiency and effectiveness.

4.2.7 Chapter Summary

This chapter presents and discusses the main findings of the study. Section A gives the demographic data about the participants while section B gives detailed findings of the study. The results show that among the main factors of airport security, human resource was found to be the most important, and the factors of most importance under the main factors were found to be qualifications of security staff, passengers and baggage screening, legislations as well as directly related stakeholders. The study applied the final results into a hierarchical decision model, a replica model to the model developed by Bülbül and Ergün in 2016 as reported in their 2019 ‘s study. Furthermore, the study developed a model of airport security systems which can be used to find right course of actions to achieve airport security effectiveness and efficiency. The last chapter gives the conclusion and study recommendations as well as then proposed areas of future studies.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Chapter Introduction

This chapter provides the summary of key findings, conclusion to study findings as well as recommendations and prospective areas of future studies.

5.2 Summary of key findings

Among the evaluated main factor of airport security, Human Resources, was found to be the main factor of highest degree of importance followed by Machinery and Equipment, Regulation and Supervision, and lastly the Stakeholders. Under the main factor of Human Resources, two factors namely, Qualifications of Security Staff and Quantity of Security Staff were considered. The study found that Qualifications of Security Staff was more important than the factor of Quantity of Security Staff. Furthermore, Professional qualification was ranked the most important sub-factor followed by Basic/Initial Training, In-service Training and, Personnel Experience under the factor of Qualifications of Security Staff. Between the sub-factors under Quantity of Security Staff, Total Number of Security Staff was rated as the sub-factor of high importance than the Number of Security staff per Shift.

Machinery and Equipment main factor under airport security was assessed through the factors of Advanced Technology and Passengers & Baggage Screening. The study found that the most important factor of the two was Passengers & Baggage Screening. The most important sub-factor when carrying out passenger and baggage screening was determined to be the X-Ray Machine, while the sub-factor of second importance was Explosive Trace Detectors (ETDs), Walk Through Metal Detector and Handheld Metal Detectors were the third and fourth most important sub-factors respectively. The

two sub-factors considered under the factor of advanced technology were Biometric and Facial Recognition, and Behavioural Profiling. Biometric and facial recognition was found to be of highest importance than Behavioural Profiling.

Additionally, Regulations and Supervision, the third important main factor of airport security was assessed under two factors namely, level of security compliance and legislations. The factor of the highest priority under regulations and supervision was rated to be legislations followed by level of security compliance. In the same vein, sub-factors international legislations, national legislations, and local legislation were assessed under the factor of legislations where international legislation was the most preferred sub-factor in terms of importance followed by national and local legislations sub-factors respectively. International compliance, national compliance and local compliance were the sub-factors under the level of compliance factor. International compliance was ranked the most important of all followed by national compliance, and local compliance being the least important factor.

Under the Stakeholders main factor of airport security are the directly related stakeholders and indirectly related stakeholder factors. Among these two factors, directly related stakeholders was ranked the first important factor and indirectly related stakeholders the second. As sub-factors under the factor Indirectly related stakeholders, Attitudes of NAC was selected as the most important sub-factor. The sub-factor of second importance was found to be the attitudes of the security service providers namely, the Namibian Police and the Namibia Protection Services. Attitude of the regulator which is the Namibia Civil Aviation (NCAA) was determined to be the sub-factor of least importance. The factor of indirectly related stakeholders was assessed through sub-factors of Coordination & Intelligence Services, Passengers,

Crew and Staff, and Aircraft Operators. The sub-factor Coordination & Intelligence Services was rated the highest among others, while Passengers, Crew and Staff and, Aircraft Operators was ranked the second and third important sub-factors respectively.

5.3 Conclusion

This study aimed to assess key factors that influence the effectiveness and efficiency of airport security by determining the level of importance of these factors in relation to one another, as well as to determine factors and sub-factors that could be considered in enhancing the effectiveness and efficiency of airport security. Therefore, to achieve this goal, there was a need to determine the relative importance of main factors, factors, and sub-factors of airport security. From the study findings it can be concluded that amongst the key factors considered to influence the level of airport security, Human Resource was the most important factor of all. Furthermore, the study concluded that the main factor Machinery and Equipment has a second degree of importance when it comes to enhancing airport security, most important than Regulation and Supervision factor which is more important than the main factor of Stakeholders in enhancing airport security.

Similarly, the study identified and assessed the factors under each main factor. Conclusion was drawn that Qualification of Security Staff, Passengers and Baggage screening, Legislations and Directly related Stakeholders were determined as factors of highest priorities under each main factor. In the same vein, the study concluded that although Quantity of Security Staff, advanced technology, level of compliance, and Indirectly Related Stakeholders were considered factors of less priority in enhancing the level airport security, it is important that they are considered to ensure a complete effective and efficient security system therefore they cannot be neglected.

Lastly, from the identified sub-factors under the factors of airport security, the study concluded that professional qualification, total number of security staff, international compliance, international legislations, biometric and facial recognition, x-ray machine, coordination & intelligence services, and attitude of the airport operator (NAC) were the most important sub-factors. These sub-factors play a major role in determining which of the main factors are more important and why. The sub-factors of second degree of importance were concluded to be basic/initial training, number of security staff per shift, national compliance, national legislations, behavioural profiling, explosive detectors, walkthrough metal detector, attitude of NamPol and NPS and, passengers, crew and staff. They are equally essential sub-factors, however when it comes to prioritising, they can be considered at the second level of priority. In addition, the study concluded that sub-factors that could be considered at final levels of prioritisation are such as In-service Training, local compliance, local legislations, hand-held metal detector, aircraft operators and attitude of NCAA.

In the final analysis, an exhaustive investigation of the main factors of airport security system together with their determining criteria (factors and sub-factors) have both administrative and operational benefits. From an administrative perspective, the factors and their weighted importance identified by this study can serve not only as a roadmap for administrators but also as a tool for benchmarking the airport security services at airports to compare one airport with another. With the administrative decisions made by considering the results of this study, it will be possible to improve the efficiency and effectiveness of airport security services in the aspects of aviation security operations.

5.4 Recommendations

Based on the findings, the study made the following recommendations, which if considered and implemented would enhance the effectiveness and efficiency of airport security not only at Hosea Kutako International Airport but also at other airports both locally and internationally.

1. The Decision Model of airport security factors and their weight of importance determined by this study can be used by airport administrators such as NAC to make critical administrative and operational decisions to enhance security systems at her airports.
2. The model of airport security systems together with the decision model, can be used by the airports authority to identify necessary possible solutions to identified challenges or deficiencies.
3. The main factor of Human Resource as a most important factor of consideration in enhancing airport security should be prioritised by airports authority to maximise the effectiveness of airport security systems.
4. The NAC management should highly consider the most important determining criteria of Human Resource namely, the qualification of security staff to assist in addressing the problem of security screeners' certification, an area that was recommended for further improvements by the ICAO audit.
5. To improve the screening of passengers, baggage, and cargo as proposed by the ICAO, the NAC can invest more on technologically advanced X-Ray machines and Explosive Detectors. Furthermore, security staff should be well trained and qualified to carry out screening duties, close supervision and adherence to local, national, and international regulations should be enforced.

6. To ensure quality assurance of security operations as suggested by the audit, NAC may need to adopt a high level of security compliance by ensuring that legislations whether locally, nationally, or internationally are complied with.

5.5 Recommended Areas for further studies

This study only analysed the opinions of airport security practitioners at HKIA, and it did not include experts' opinions or that of different stakeholders and passengers, opinion of the said groups may vary from the opinions of the airport security practitioners. It is therefore recommended that a further similar study be undertaken to include aviation security experts and stakeholders. Another possible area of study can be examining the effect of security screening on customers and stakeholders 'satisfaction. Considering that emergency preparedness of an airport is very crucial element of security, further studies could look into assessing the effectiveness of Airport Security Crisis Management Plans at Namibian airports. The proposed areas of further studies are critical especially, in enhancing the general airport security. It is also believed that these further studies may contribute to the body of literature and knowledge especially owing to limited available literature on aviation security in Namibia.

5.6 Chapter Summary

This chapter summarized the key findings of the study and provided the conclusion and recommendations drawn from the findings. In addition, recommendation for further studies were proposed. The study concluded that among the key factors that influence airport security, Human Resource was the most important factor followed by the main factor, Machinery and Equipment and, Regulations and Supervision main factor. however, Machinery and Equipment was determined to be more important than

the factor of Regulation and Supervision and, Stakeholders. The study concluded that, for critical administrative and operational decisions to be made and to enhance security systems at her airports, NAC could make use of the decision model and the airport security system model crafted by this study. It is also recommended that when considering the human resource, quality of the human resource should be highly prioritised. The study recommends that a similar study could be undertaken to include the stakeholders and security experts. Other suggested areas of further studies were on the effects of security searches of passengers, and the effectiveness of aviation Security Crisis Management Plan.

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APPENDICES

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UNAM
UNIVERSITY OF NAMIBIA

APPENDIX 1 : Unam Support Letter

11th May 2021

Dear Sir/Madam

REQUEST FOR PERMISSION TO CARRY OUT RESEARCH

Research is an integral part of postgraduate studies at the University of Namibia (UNAM). It is carried out in partial fulfilment of the requirements for the award of Postgraduate degrees. Against this background, I write to kindly request your permission to allow **Angula FS**. (Student number : 201311016) who is completing his/her Master of Security Studies (MASSS) degree at the School of Military Science, UNAM, carry out studies in your facility.

The titled of the study is, ***AN ASSESSMENT OF FACTORS INFLUENCING AIRPORT SECURITY AT NAMIBIAN INTERNATIONAL AIRPORTS: AN AHP MODEL APPROACH*** The student will use the methods of questionnaire and interview to collect data from stakeholders. The data collected will be used specifically for academic purposes and will not be passed on to a third party in accordance with research ethics and UNAM's confidentiality policy.

It would be highly appreciated if your good office would facilitate the student's study by granting him permission to carry out his/her study in your organisation. I thank you for your continued support and kind consideration of our request.

Yours Sincerely

Dr. Iroanya Richard Obinna
Acting Associate Dean
School of Military Science
University of Namibia, Windhoek

APPENDIX 2: NAC Approval Letter

Namibia Airports Company Limited
(Registration No. 98/472)
Established in terms of Act 25 of 1998
P.O. Box 23061, Windhoek
5th Floor, Sanlam Centre
145 Independence Avenue
Tel: +264 61 2855000
Fax: +264 61 2855022
E-mail: communications@airports.com.na
Website: www.airports.com.na

Enquiries: HR
Tel: 061 285 5115

11 June 2021

Mr. Filipus Angula
Chief AVSEC
Eros Airport
Namibia Airports Company

Dear Mr. Angula,

PERMISSION TO CONDUCT ACADEMIC RESEARCH AT NAMIBIA AIRPORTS COMPANY (NAC)

The NAC hereby wishes to inform you that your request to conduct academic research has been approved. This permission is granted to the extent that the questionnaire does not require the disclosure of confidential matters and the information you gather is strictly for academic purposes as mentioned in your request letter.

Therefore, you are advised to observe all protocols and abide to the general research ethics, and you are requested to submit a copy of your final research paper to the NAC: Human Resources Department.

I wish you all the best in your academic studies.

Yours faithfully,

Josephine Soroses
STRATEGIC EXECUTIVE: HUMAN RESOURCES

APPENDIX 3: Questionnaire and Consent Letter

Dear Participant,

I invite you to participate in a research study titled; **AN ASSESSMENT OF FACTORS INFLUENCING AIRPORT SECURITY AT NAMIBIAN INTERNATIONAL AIRPORTS,** being conducted by **Angula Fillipus** a postgraduate student of the Master of Arts in Security and Strategic studies at the University of Namibia. The purpose of this study is to assess the factors influencing the level of Airport Security at Hosea Kutako International Airport and Walvis Bay International Airport.

The study is prompted by the recent increase in aircraft and passenger movements at Namibian International Airports as well as by the recent Acts of unlawful interferences perpetrated at airports and against civil aviation around the world.

This study consists of a questionnaire which will be administered to individual participants with Aviation Security responsibilities at these airports. You will be asked to fill in a pairwise comparison questionnaire by indicating the value of importance of one factor over the other: this will help determine the relative importance of factors influencing Aviation Security at international airports in Namibia.

Please note:

- Your participation in this study is completely voluntary.
- There are no known risks to participation beyond those encountered in everyday life.
- Your responses will remain confidential and anonymous.
- Data from this study will be reported only as a collective combined total.
- No one other than the researchers will know your individual answers to this questionnaire.

If you agree to participate in this project, please answer the questions on the questionnaire as best you can. It may take approximately 25 minutes of your time to complete. Upon completion of the questionnaires, it should be returned to the researcher.

Should you require further information do not hesitate to contact Mr Angula FS. (The researcher) on the contact details given below.

Thank you for your assistance in this important endeavour.

Sincerely yours,

Angula Fillipus S.

_____

(Researcher)
0813785667
angulafs@gmail.com

Only the occupational positions of participants are required for the analysis. Name and Corporate information are not required.

Occupational Position: …….

Thank you for your participation!

Section A: Demographic Information

Circle the appropriate answer!

1. What is your occupational position/title level?
   a. Management level
   b. Supervisory level
   c. Instructor
   d. AvSec Security staff
2. How long have you worked at the airport (aviation security)?
   a. More than 10 years
   b. More than 5 years
   c. Between 3-4 years
   d. More than 2 years
   e. Less than 2 years
3. What is your highest level of education?
   a. Tertial education
   b. Secondary education
   c. Junior secondary education
   d. Primary education
4. Do you have any Aviation Security qualification? Tick appropriate Box.

AvSec Qualification	**Yes**	**No**
Academic		
Professional/Specialised Training		

Section B: Pairwise Comparison

Instructions

Key factors in airport security services

The aim of this study is to determine the relative importance of key factors that determine the effectiveness and efficiency of airport security services. Identifying which of these factors are more important than others will facilitate the choice of the most important factors to be considered to maximize the effectiveness and efficiency of airport security.

In this context, a comparison of each factor with others in its relevant title is needed. I request that participants fill out a **pairwise comparison survey** with respect to **Table A** below to indicate the importance of one factor over the other one. This survey is in three parts. The first is a comparison of **main factors**, the second one is a comparison of **factors**, and the last part is a comparison of **sub-factors**.

Degree of importance	**Definition**
1	Equal importance
2	Moderate importance
3	Weak or slight
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very strong or demonstrated importance
8	Extremely strong
9	The most extreme importance

Table: A

Example:

A comparison between two factors (factor A and factor B) may be indicated as follow, let us say you think:

1. Factor A is of "Strong importance" than factor B.

Factors																		
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Factor A					**x**													Factor B

2. Factor B is of "Moderate importance" than Factor A.

Factors																		
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Factor A										**x**								Factor B

Part I: Main Factors (Alternatives)

For the following table, please indicate the importance of one factor over another.

1. With respect to the main goal of effective and efficient airport security, how important are these main factors (alternatives) when compared to one another?

1. Effectiveness and Efficiency of Airport Security																		
	Level of Importance																	
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Human Resource (personnel)																		Regulations and Supervision
Human Resource (personnel)																		Machinery and Equipment
Human Resource (personnel)																		Stakeholders
Regulations and Supervision																		Machinery and Equipment
Regulations and Supervision																		Stakeholders
Machinery and Equipment																		Stakeholders

Part II: Factors (Criteria)

For the following tables, please indicate the importance of one factor over another.

2. With respect to the main factors of airport security, how important are these factors (criteria) when compared to one another?

2. Human Resources																		
	Level of Importance																	
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Qualifications of Security Staff																		Quantity of Security Staff

3. Machinery and Equipment																		
	Level of Importance																	
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Passengers & Baggage Screening																		Advanced Technology

4. Regulations And Supervision																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Legislations																		Level of Compliance

5. Stakeholders																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Directly related Stakeholders																		Indirectly related Stakeholders

Part III: Sub-factors (Sub-criteria)

For the following tables, please indicate the importance of one sub-factor over another.

3. With respect to the factors (criteria) of airport security, how important are these Sub-factors (Sub-criteria) when compared to one another?

6. Quality of Security Staff																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Professional qualification																		Basic/Initial Training
Basic/Initial Training																		In-service Training
Basic/Initial Training																		Personnel Experience
In-service Training																		Professional qualification
Personnel Experience																		Professional qualification
Personnel Experience																		In-service Training

7. Quantity of Security Staff																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Total Number of Security Staff																		Number of Security Staff per Shift

8. Passengers and Baggage Screening																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
X-Ray Machine																		Walkthrough Metal Detector
Walkthrough Metal Detector																		Explosive Detectors (ETD,LEDS)
Walkthrough Metal Detector																		Explosive Detectors (ETD,LEDS)
Walkthrough Metal Detector																		Hand-Held Metal Detector
Hand-Held Metal Detector																		Explosive Detectors (ETD, LEDS)
Hand-Held Metal Detector																		X-Ray Machine
Explosive Detectors (ETD,LEDS)																		X-Ray Machine

9. Advanced Technology																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Biometric and Facial Recognition																		Behavioural Profiling

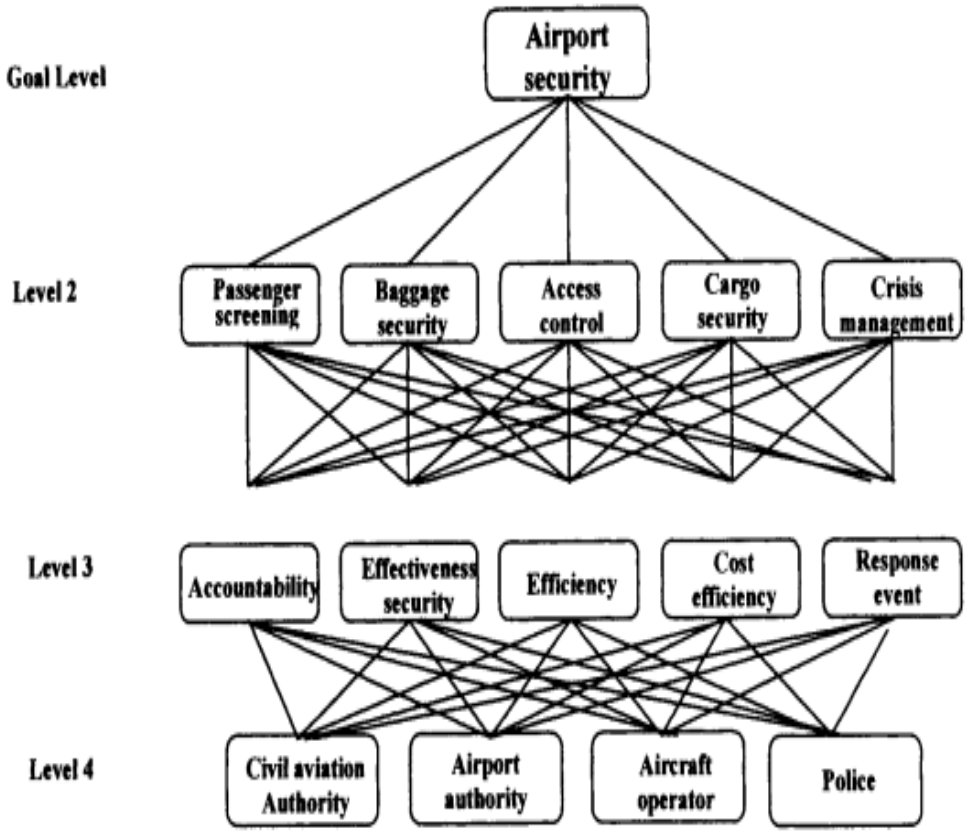
10. Legislations																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
International Legislations																		National Legislations
National Legislations																		Local Legislations
Local Legislations																		International Legislations

11. Level of Security Compliance																		
	Level of Importance																	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
International Compliance																		National Compliance
National Compliance																		Local Compliance
Local Compliance																		International Compliance

12. Directly Related Stakeholders																		
	Level of Importance																	
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Attitude of NAC																		Attitude of the NCAA
Attitude of the NCAA																		Attitude of NamPol And NPS
Attitude of NamPol And NPS																		Attitude of the NCAA
Attitude of NAC																		Attitude of NamPol And NPS

13. Indirectly Related Stakeholders																		
	Level of Importance																	
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Aircraft Operators																		Passengers, Crew and Staff
Passengers, Crew and Staff																		Coordination & Intelligence Services
Coordination & Intelligence Services																		Aircraft Operators

APPENDIX 4 : AHP Decision Model by Yoo (2009)



APPENDIX 5 : AHP Decision Model by Bülbül & Ergün (2019)

APPENDIX 6 : Results from Bülbül & Ergün (2016)

Goal (level 1)	Main factors (level 2)	Factors (level 3)	Sub-factors (level 4)
Improving the Airport Checkpoint Security Procedures	U_1. Human Resources (0.59)	U_{11}. Quantity of SS (0.43)	U_{111}. Total SS Number (0.39)
			U_{112}. Number of SS on Shift (0.61)
		U_{12}. Quantity of SS (0.35)	U_{121}. The Basic Qualification Required from SS (0.49)
			U_{122}. Contribution of In-service Training (0.31)
			U_{123}. Effect of Staff Turnover (0.19)
		U_{13}. Workplace Environment (0.21)	U_{131}. Shift System and Period (0.49)
			U_{132}. Workplace Environment (0.18)
			U_{133}. Salary Level (0.34)
	U_2. Facility and equipment (0.19)	U_{21}. Luggage Screening (0.61)	U_{211}. X-Ray Device (0.45)
			U_{212}. Explosive Detector (PIT-ETD, LEDS) (0.33)
			U_{213}. Manual Search (baggage) (0.22)
		U_{22}. Passenger Screening (0.39)	U_{221}. Walk-Through Metal Detector (0.50)
			U_{222}. Hand-held Metal Detector (0.25)
			U_{223}. Hand Search (0.25)
	U_3. Shareholders and procedures (0.22)	U_{31}. Shareholders (0.62)	U_{311}. Airport Authority (0.52)
			U_{312}. Contracted Security Company (0.22)
			U_{313}. GDCA (SHGM) (0.25)
		U_{32}. Procedures (0.38)	U_{321}. Passenger Screening Procedures (0.51)
			U_{322}. Hand Luggage Screening Procedures (0.29)
			U_{333}. Prohibited Item Handling Procedures (0.20)

APPENDIX 7 : Results from Yoo And Choi (2006)

Result of AHP analysis (supervisor group)

Goal (level 1)	Major factors (level 2)	Elements (level 3)	Sub-elements (level 4)
Enhancing security performance	Human resources C_1 (0.500)	Quantity of screeners C_{11} (0.143)	Total number of screeners C_{111} (0.470)
			Number of screeners at a shift C_{112} (0.530)
		Quality of screeners C_{12} (0.449)	Basic quality C_{121} (0.319)
			Quality of training C_{122} (0.221)
			Labor turnover rate C_{123} (0.460)
		Work condition C_{13} (0.408)	Shift hour C131 (0.260)
			Work environment C_{132} (0.413)
			Wage level C_{133} (0.327)
	Facility/equipment C_2 (0.250)	Luggage screening C_{21} (0.571)	X-ray machine C_{211} (0.550)
			Explosives detector C_{212} (0.240)
			Manual search facilities C_{213} (0.210)
		Passenger screening C_{22} (0.429)	Walk-through metal detector C_{221} (0.311)
			Hand-held metal detector C_{222} (0.493)
			Private search facilities C_{223} (0.196)
	Procedures/responsibility C_3 (0.250)	Responsibilities C_{31} (0.550)	Airport authority C_{311} (0.618)
		Procedures C_{32} (0.450)	Contracted screening company C_{312} (0.297)
			Government C_{313} (0.086)
			Passenger screening procedure C_{321} (0.280)
			Carry-on luggage screening procedure C_{322} (0.280)
			Prohibited item handling procedure C_{323} (0.312)
			Screening checkpoint configuration C_{324} (0.127)

Result of AHP analysis (screener group)			
Goal (level 1)	Major factors (level 2)	Elements (level 3)	Sub-elements (level 4)
Enhancing security performance	Human resources C_1 (0.450)	Quantity of screeners C_{11} (0.20)	Total number of screeners C_{111} (0.333)
			Number of screeners at a shift C_{112} (0.667)
		Quality of screeners C_{12} (0.380)	Basic quality C_{121} (0.250)
			Quality of training C_{122} (0.250)
			Labor turnover rate C_{123} (0.500)
		Work condition C_{13} (0420)	Shift hour C_{131} (0.218)
			Work environment C_{132} (0.151)
			Wage level C_{133} (0.630)
	Facility/equipment C_2 (0.200)	Luggage screening C21 (0.667)	X-ray machine C_{211} (0.418)
			Explosives detector C_{212} (0.260)
			Manual search facilities C_{213} (0.327)
		Passenger screening C_{22} (0.333)	Walk-through metal detector C_{221} (0.210)
			Hand-held metal detector C_{222} (0.550)
			Private search facilities C_{223} (0.240)
	Procedures/responsibility C_3 (0.350)	Responsibilities C_{31} (0.480)	Airport authority C_{311} (0.390)
			Contracted screening company C_{312} (0.410)
			Government C_{313} (0.200)
		Procedures C_{32} (0.520)	Passenger screening procedure C_{321} (0.289)
			Carry-on luggage screening procedure C_{322} (0.290)
			Prohibited item handling procedure C_{323} (0.246)
			Screening checkpoint configuration C_{324} (0.175)