



Volume 112

2021

p-ISSN: 0209-3324

e-ISSN: 2450-1549

DOI: <https://doi.org/10.20858/sjsutst.2021.112.14>



Journal homepage: <http://sjsutst.polsl.pl>

Article citation information:

Nwaogbe, O.R., Odiobulu, S.P., Omoke, V. Study of a category one airport operational safety and security in Abuja, Nigeria. *Scientific Journal of Silesian University of Technology. Series Transport*. 2021, **112**, 171-189. ISSN: 0209-3324.

DOI: <https://doi.org/10.20858/sjsutst.2021.112.7.14>

Obioma R. NWAOGBE¹, Somtochukwu P. ODIOBULU², Victor OMOKE³

STUDY OF A CATEGORY ONE AIRPORT OPERATIONAL SAFETY AND SECURITY IN ABUJA, NIGERIA

Summary. This study assesses the operational safety and security of a category one airport in Nigeria, using the Nnamdi Azikiwe International Airport, Abuja (NAIA) as the case study airport. Data were sourced using structured questionnaire and oral interviews. A total of 180 questionnaires were administered and 165 questionnaires were retrieved, amounting to a 91.7% rate of response. The structured questionnaire used aimed at identifying various safety and security parameters in the study area. This study examined the trend of the effectiveness of safety and security variable in airport operations, safety and employee's attitude towards safety risk management using the Multicriteria Decision Analysis model to achieve this objective. The results show the weighty level, satisfaction index and effective index of the safety and security parameters used in the analysis with their score and effective index graph. Recommendation on how to improve the airport safety operations were made following policy implication on how to improve the safety management system of the airport.

Keywords: safety management system, risk management, airport

¹ Department of Marine Transport and Logistics, Nigeria Maritime University, Okerenkoko, Warri.
Email: obioma.nwaogbe@futminna.edu.ng. ORCID: <https://orcid.org/000-0002-7520-4628>

² Department of Transport Management Technology, Federal University of Technology, Minna.
Email: praise11@gmail.com. ORCID: <https://orcid.org/0000-0002-4385-9021>

³ Department of Marine Transport and Logistics, Nigeria Maritime University, Okerenkoko, Warri.
Email: victor.omoke@futminna.edu.ng. ORCID: <https://orcid.org/0000-0001-5251-6592>

1. INTRODUCTION

The airport and air transport as an important asset of a nation are charged with the role of transporting passengers and cargo from one region, nation to another. They are placed where the other modes of transportation link with a nation's aviation system. It is the responsibility of the federal government to regulate and manage the operations of air traffic that interlink the state; they also own and manage most airports. Because of this, [1] stated that airports being important national assets need to have their technology improved and their industry developed to advance the socio-economic activity of the nation. Moreover, the airport offers a touchdown and taxing path [2]. In addition, it is a hub for businesses, shops, car parks and other logistics and supply chain services.

The Nigeria aviation industry in 2012, according to the Punch newspaper [3], experienced a mishap as, Dana Airline, one of Nigeria's popular airlines, suffered a plane crash. This accident claimed the lives of 159 people. The cause of the crash according to the final report of the accident investigation bureau, AIB, was a failure of the two engines and poor decision of the pilot. This can be narrowed down to poor operational safety and security of the airliner. This was supposed to adversely affect the level of patronage of Dana airline in the country. However, there are positive impacts that cannot be ignored, with regards to report of [4] in the THISDAY newspaper, the Federal Airport Authority of Nigeria (FAAN) annual report of 2018, noted that about 15.2 million passengers travelled through Nigerian airports making a total of 227,834 aircraft movements. This report revealed the increasing growth of passengers to 2.5 million, these passengers passed through Nigerian airports with a percentage increase of 19.11% of the 12 million passengers documented in 2017.

Considering the number of aircraft movements and the fervour of passengers going to different places for various reasons, it is clear that the number of passengers at the airports is increasing. In recent times, Nigeria has experienced a notable level of growth in its aviation sector, particularly, in cargo and passenger movements, through the contribution of the private sector. In developing nations, people are enthusiastic about embarking on journeys. Hence, creating overcrowding and delays at stations, thereby posing a safety risk to airport users [1, 5].

The need for safe, secured air transport operations cannot be overemphasised. Thus, [6] and [7] noted the crucial nature of safety in the operations of air transport. For safe and effective air transport, standards, procedures and measures have to be in place for incident and accident prevention at various airports. However, from the definition of [8], as the highest civil aviation regulatory body, safety is the reduction of potential harm or dangers, which can be lessened and subjected to a minimum ratio by a constant way of identifying hazards and management of risk. Operational safety and security of the airport are paramount, and thus, calls for the steady watch of international bodies and agencies concerned with safety and security operations in the aviation industry. Therefore, there is a need to put safety and security services in place by making standard recommended procedures and practices in airport operational services.

The operations of the airport are sensitive, and therefore, requires careful handling of the air passengers and operators involved in the process. Hence, airport operations comprise several components of the airport area where safety and security are paramount for an efficient and effective operation. These operations are carried out in the various component of the airport, which includes airside, terminal building and landside. More so, these three major areas of the airport are linked with operational activities requiring the safety and security of passengers, cargo and aircraft.

The operational vulnerability of airports is shown through proactive measures in the form of procedures, instruction, training, tutoring and innovations. A coordinated approach is a safety requirement expected by several individuals, administration and interested party and workers at airports. A wide range of measures is used by the facility management to examine the level of performance from monetary measures to pointers of decision-making actions together with further effective measures [9]. Over time, safety in aviation has undergone several transitions in developed states from the reactive to the proactive and then the predictive model, approximately some developing countries find it difficult to react effectively to incidents in the terminal. In the year 2000, in the United States, the introduction of the safety management system as a scientific method of confronting safety challenges in the aviation industry gained increased recognition [7]. Ensuring the safety of passengers is part of security in aviation, which is carefully outlined on information intelligence, steps, technologies, and security staffs. In this study, the operational safety and security of airports are important to Nigeria, hence, the federal government, as recommended, should commit resources to its improvement. Airport operations are delicate, comprising passengers, staff and cargo involved in the process, and thus, requires safety and security precautionary measures and equipment in carrying out its activities. Consequently, new measures are adopted and more efforts are inputted into aviation safety.

The occurrence of accidents in airports cannot be eliminated since there will always be risks at airports. Airport safety programmes according to [10], discussed wide-ranging areas of safety starting from the runway together with the safety management system (SMS) to boost cognizance and improve safety. The main support for effective execution of SMS deliberated because of the FAA is safety risk management (SRM). The safety risk management process helps in identifying risk and mitigating dangers. SRM procedure of danger identification is related to actions at the airport, which also controls the dangers associated with these threats. Intolerable hazards are evaluated, reduced and checked constantly in the organisation. To assess the airport present standards and evaluation, safety performance is vital.

According to the International Civil Aviation Organisation's (ICAO) definition, safety management system is managing safety systematically, which involves essential managerial arrangement, responsibilities, rules, procedures and guidelines. Civil aviation functional and operational guidelines, rules, standards and procedures, are according to ICAO's prescription. In the Nigerian aviation industry, the highest body for regulation is the Nigeria Civil Aviation Authority (NCAA). NCAA is charged with the supervision of the entire aviation industry ranging from airports, airstrips, airlines, all service providers, aviation training institution, etc. [11]. Furthermore, other bodies that oversee airport operations, management and control are FAAN, charged to develop and profitably manage customer-centric airport facilities for safe, secured and efficient carriage of passengers and goods at a world-class quality standard. Equally, the Nigeria Airspace Management Authority (NAMA) is charged with the responsibility of keeping the Nigeria airspace safe and securing operations of flights concerning air traffic. Despite all the overseeing of these agencies, Nigeria aviation still experiences several incidents and accidents within the country.

According to the Daily Trust newspaper [12], Nigeria recorded an air traffic growth of 10 million domestic passengers. With the growing number of air traffic over the years, it has become imperative for safe and secured airport procedures to be established in its operations. The operational safety and security of an airport is a very significant issue as it concerns the lives and properties of the people in a nation. There is an essential need to examine and address this risk/security.

Therefore, airport operational safety and security is very significant and worth considering especially in the Nigerian aviation sector. The airport system consists of several components, which are made up of different operations. It requires efficient and effective safety and security in its daily operations, as the operational capacity of these airports is being reached. Additionally, the safety and security measures put in place might not be enough to match increasing air traffic demand. However, the safety and security measures in Nigerian airports operations are not planned for, they only react to accidents and incidents (either to control the situation on the ground or manage the mishap), sometimes causing flight delays, cancellation or a stop in operations. The airport safety and security operation applied in Nigerian airports is a reactive one called the “fly-crash-fix-fly” approach. Here, safety and security procedure are only employed or put in place when there has been a mishap, that is, a post-incident and -accident measure instead of a pre-incident or -incident measure [13] and [14]. This approach has led to the countless loss of lives and properties over the years, denting the image of the Nigerian aviation industry and probably cause tension among persons/individuals who patronise this means of transportation.

With several incidents and accidents occurring daily within airports operations, this research attempts to assess the operational safety and security within the airport of study in Nigeria. Furthermore, this study strives to bring to the fore the safety and security challenges faced in the operations of airports in Nigeria. There have been incidents and accidents amounting to huge losses of monies and properties. This suggests the need to put into cognizance the recommended measures, ensuring that they are effective according to FAA and ICAO recommendation that associations and airports actualise SMS and measure their security execution to assess their present norms. The FAA guarantees that SMS distinguishes and mitigates dangers, advances wellbeing, and improves security mindfulness [15]. Therefore, in Nigeria, the NCAA Implementation of SMS distinguishes preparing needs and surveys the present information on representatives. In this way, estimating security execution, therefore, approves the viability of handling danger.

Study Area

The examination zone of this exploration work was at the Nnamdi Azikiwe International Airport in the Federal Capital Territory (FCT), Abuja, Nigeria. Abuja lies between latitude 8°5' and 9°0'N of the equator and longitude 6°5' and 7°9'E of the Greenwich meridian (Coordinates: 9.066667°N and 7.483333°E). The aerodrome is situated on latitude 09°0'N and longitude 07°5'E and at height 314.98 m. The aerodrome is about 49 km away from the city centre. The airport sort is open, rise is AMLS 1.123 ft/342 m, runways heading is 04/22 and length is 3.609 m/11.842 ft [16].

2. LITERATURE

The expression "airport operations" at first impression triggers the perspective of travellers being moved via aircraft. Further thinking brings about a series of events that would legitimately affect or influence passenger operation, for example, passenger screening, cargo handling, maintenance and security of passenger. Certainly, airport operations comprise of different stages; concourses, runways, stopping, carriers, baggage terminal administrators, fuel warehouses, retail, cleaning, cooking and many associating individuals including voyagers, specialist co-ops and guests. The offices are appropriated and fall under different legitimate locales towards related safety and security, traditions, isolate and security. For the airport to

work, these various frameworks must cooperate [17]. The airport operations need to be well planned, managed and implemented, consisting of several systems involving adequate safety and security performance in its operations which similarly need to be assessed.

Moreover, according to [18], the essential target for airport operations is to securely move departing travellers (and different partners), packs, and freight from landside (free access and transportation territories), through the terminal or other related offices, and afterwards to the airside (secured areas and flight tasks) segments of the air terminal. This procedure is reversed for arriving (showing up) travellers. This goal must be supported while working in numerous dynamic and high-chance working conditions, for example, enormously shifting climate conditions and consistent varieties in travellers recurrence and related requests or needs.

In the aviation industry, the need for the assessment of risk cannot be undermined due to the delicate nature of aviation safety and security. Hence, advanced technologies and procedures are being put in place for its optimal performance and operation, thereby making it the safest means of transport. When investigating hazards in aviation, it is traced to safety and security. The aviation industry is a place where constant hazard surveying is fundamental. Besides, the advancement with the improvement of innovation and strategies makes it one of the safest means of transportation. Albeit fundamentally, examination of perils is towards safety and security, the current economic-financial circumstance together with the savage challenge between airport, carriers and other partners have made it imperative to develop better approaches for surveying dangers. Unmistakably, a solitary unanticipated occasion can bring about the complete breakdown of an airport and aircraft, which given the extreme effect, fitting control measures ought to be executed and continuously observed. The need to upgrade the present hazard appraisals to incorporate fiscal qualities as an extra factor is elaborated in this paper through a business contextual analysis. In the paper, we consider an airport conclusion after a lethal aircraft mishap as the direst outcome imaginable.



Fig. 1. Map of Nigeria presenting the Nnamdi Azikiwe International Airport, Abuja, with other airports

Leib and Lu in their exploration in Taiwan [19], conducted a whole examination of airport wellbeing utilising the ICAO SMS Perspectives. Safety is basic to the achievement of the flight business, creating worldwide solutions, connecting more individuals and spots, thus, the institutionalisation of safety in aviation has been and will continually be a global concern. ICAO has built up a thorough structure for safety; the executives at aircraft and airports, known as Doc. 9859 Safety Management Manual (SMM). SMS have since been required to be executed by all ICAO part states starting January 2010. Taiwan, controlled by the Republic of China (ROC), is in a one of a kind situation as a non-part territory of ICAO that is unequivocally associated with the framework of the aviation world. Utilising the Delphi Procedure and helpful testing, this exploration is a contextual analysis of how aviation safety is overseen at a significant global airport in Taiwan following ICAO's SMS norms. Meetings and centre gatherings were directed by members from three significant associations working at the reviewed airport: air traffic controllers, the airport administration organisation, and a ground administrations supplier. Results found that notwithstanding Taiwan's non-part status with ICAO, the executives' security was exceptionally reliable with ICAO SMS norms, particularly in the regions this examination concentrated on; safety programmes and goals, safety risk management, safety confirmation, and safety advancement [19].

3. MATERIALS AND METHOD

The study population was 180 persons including staff/employees who carry out airport operations, safety and security management. The questionnaires were administered in one major airport in Nigeria, the Nnamdi Azikiwe International Airport. This study utilised the Likert scale of 1-5 to assess the safety performance, security and attitude towards risk management.

3.1. Data collection

Questionnaire was designed and administered to gather data for the assessment of operational safety and security in the case study airport. The assortment of this information was done essentially, that is, the organised survey, oral meeting and auxiliary information were sourced from diaries, web and coursebook.

3.2. Data analysis techniques

Multicriteria analysis was used to analyse the research. This method was applied to derive the variables of the alternatives regarding the selection attributes and the overall ranking variables of the alternative. The overall ranking criteria m alternatives and n decision criteria. The multicriteria equation is shown below

$$A_i \text{ WSM-score} = \sum_{j=1}^n w_j a_{ij}, \text{ for } i = 1, 2, 3, \dots, m \quad (1)$$

that is, the higher the values are, the better it is. Where:

w_j denotes the relative weight of importance of the criterion,

C_j and a_{ij} is the performance value of alternative,

A_i when it is evaluated in terms of criterion,

C_j . the total importance of alternative.

For the maximisation case, the best alternative is the one that yields the maximum total performance value

4. RESULTS AND DISCUSSION

This section presents the results of the findings from the field survey carried out in the Nnamdi Azikiwe International Airport, Abuja. This study aimed to assess the operational safety and security in the airport. The results were presented based on the airport's operational safety and security, trend of effectiveness of safety and security variables in the airport operations and safety performance and the attitude of employees towards the airport operational safety and security procedures.

4.1. Multicriteria analysis of runway and apron, bird, and wild management

Tab. 1.

Multicriteria analysis of runway and apron, bird, and wild management

	Statements	Weighty (%)	Satisfaction index (%)	Effective Index (%)
RUNWAY AND APRON	The airport runway is properly lighted	4.29	93.32	0.83
	The apron is properly lighted	4.17	79.66	0.81
	The runway is properly marked	4.32	93.22	0.72
	The apron is properly marked	4.28	77.25	1.09
	Runway incursion is properly marked	4.44	77.71	1.01
	Marshallers are properly equipped	4.19	86.64	1.32
	There is a runway safety team	4.52	79.61	0.49
	There is fuel spillage at the apron	4.22	61.54	1.66
	There is an apron safety management system	5.7	41.31	1.62
	Movement area maintenance	5.56	38.5	1.42
	Movement of persons in the apron and runway are strictly authorised	6.83	82.66	2.65
	Aerobridge are in good condition	5.69	42.15	1.61
	Provision for disabled passengers	4.7	53.48	1.65
	The runway and apron staff have personal protective equipment	5.7	45.07	1.13

	There is provision of reflective jackets for staff and authorised persons	3.25	33.99	0.74
	The operational safety of the runway and apron is satisfactory	4.56	48.19	1.88
BIRD AND WILD MANAGEMENT	Staff attend recognised bird and wildlife control training	4.18	86.7	1.41
	There is a routine check of staff	4.21	88.2	0.29
	Bird strike risk assessment is carried out	4.06	63.7	1.04
	Staff log all their bird control activities	4.01	81.6	0.86
	Birds sticks are often experienced	3.46	40.3	0.52
	Terrestrial animals are often experienced	3.78	41.5	0.41
	There is a proper provision of handling equipment for bird and wildlife management	4.11	87.7	0.31
	There is a safety management system adopted to handle bird and wildlife	4.09	49.9	0.96

Source: authors' field survey

Various safety parameters and trend of effectiveness

Operational safety of the airport was examined using the multicriteria analysis. Runway and apron, bird and wild management, foreign object damaged (FOD) prevention and aircraft rescue and firefighting were analysed. Table 1 shows the analysis of the runway and apron and bird and wild management, revealing variation in the percentage weighty score, satisfaction index and effective index.

Runway and apron

Table 1 shows that movement of persons in the apron and runway are strictly authorised had the highest weighty percentage score of 6.83, a satisfaction index of 82.66 and 2.65 effective index. This indicates strict adherence to the procedure concerning airport apron and runway movement. Table 1 shows that provision of reflective jackets for staff and authorised persons had the lowest weighty percentage score of 3.25, a satisfaction index of 33.99 and 0.74 effective index. This indicates that the provision of reflective jackets for staff and authorised persons does not determine adherence to procedures.

Bird and Wild Management

Table 1 similarly reveal from the bird and wild management analysis at the airport, that there is a routine check of staff had the highest weighty percentage score of 4.21, a satisfaction index of 88.2 and an effective index of 2.1. Terrestrial animals are often experienced had the lowest weighty percentage score of 3.46, a satisfaction index of 40.3 and 0.52 effective index.

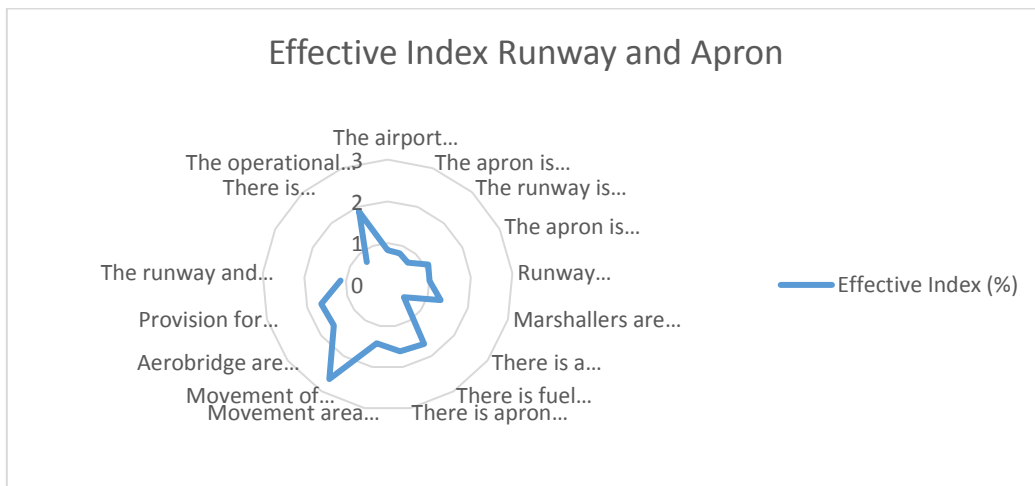


Fig. 2. Percentage of effective index of runaway and apron

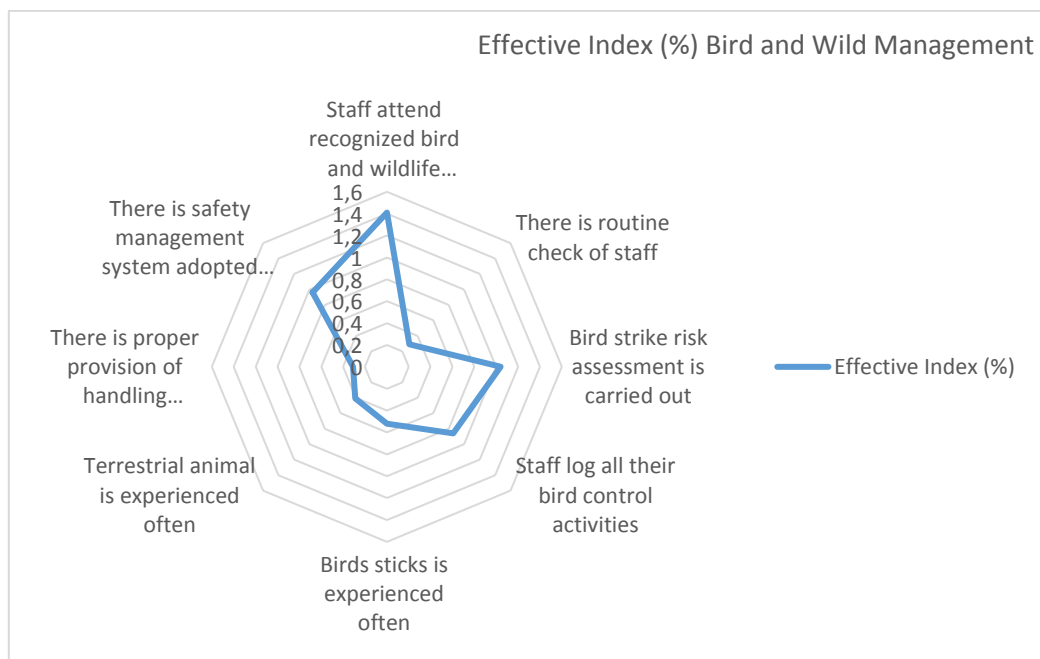


Fig. 3. Percentage of effective index of bird and wild management

Foreign object damage prevention

Table 2 shows the multicriteria analysis for foreign object demand prevention and aircraft rescue and firefighting. The analysis showed that the airport training programme to control FOD at the airport had the highest weighty percentage score of 7.73, a satisfaction index of 82.31 and an effective index of 2.1. This was closely followed by FOD observed at this airport with a weighty percentage score of 6.13, a satisfaction index of 87.3 and an effective index of 1.21. In addition, it was discovered that there is damaged to aircraft due to FOD in the airport has the least weight percentage score of 3.06, 40.32 satisfaction index and 0.95 effective index.

Tab. 2.

Multicriteria analysis of foreign object damaged (FOD)
prevention and aircraft rescue and fire fighting

	Statements	Weighty (%)	Satisfaction index (%)	Effective Index (%)
FOREIGN OBJECT DAMAGED (FOD) PREVENTION	There is airport training programme to control FOD	7.73	82.31	2.1
	FOD is observed at this airport	6.13	87.3	1.21
	The staff are adequately trained for the job	4.71	81.34	0.92
	Staff log all their FOD activities	6.13	80.07	1.32
	There is routine check of FOD at airfield	5.04	77.54	1.11
	There is safety management system adopted to manage FOD at the airport	4.78	74.23	1.04
	There is proper provision of equipment for the handling of FOD	4.25	43.89	1.66
	There is damaged to aircraft due to FOD in the airport	3.06	40.32	0.95
AIRCRAFT RESCUE AND FIRE FIGHTING	The staff are adequately trained for the job	5.56	56.87	2.72
	During accident/fire outbreak emergency response is on the spot	6.83	66.32	2.12
	Personnel are properly protected with necessary equipment	7.22	71.9	2.87
	Staff log all their activities	6.2	7.96	2.63
	There is a proper provision of handling equipment for aircraft rescue and fire outbreak management	4.9	56.88	2.23
	There is a safety management system adopted to handle aircraft rescue and fire outbreak	5.5	61.22	1.65

Source: authors' field survey

Aircraft rescue and firefighting

Table 2 demonstrates the aircraft rescue and firefighting assessment response, showing that during accident/fire outbreak emergency response is on the spot had the highest weighty percentage scores of 6.83, a satisfaction index of 66.32 and an effective index of 2.12. Issue on proper provision of handling equipment for aircraft rescue and fire outbreak management had the lowest weighty percentage score of 4.9, 56.88 satisfaction index and 1.23 effective index.

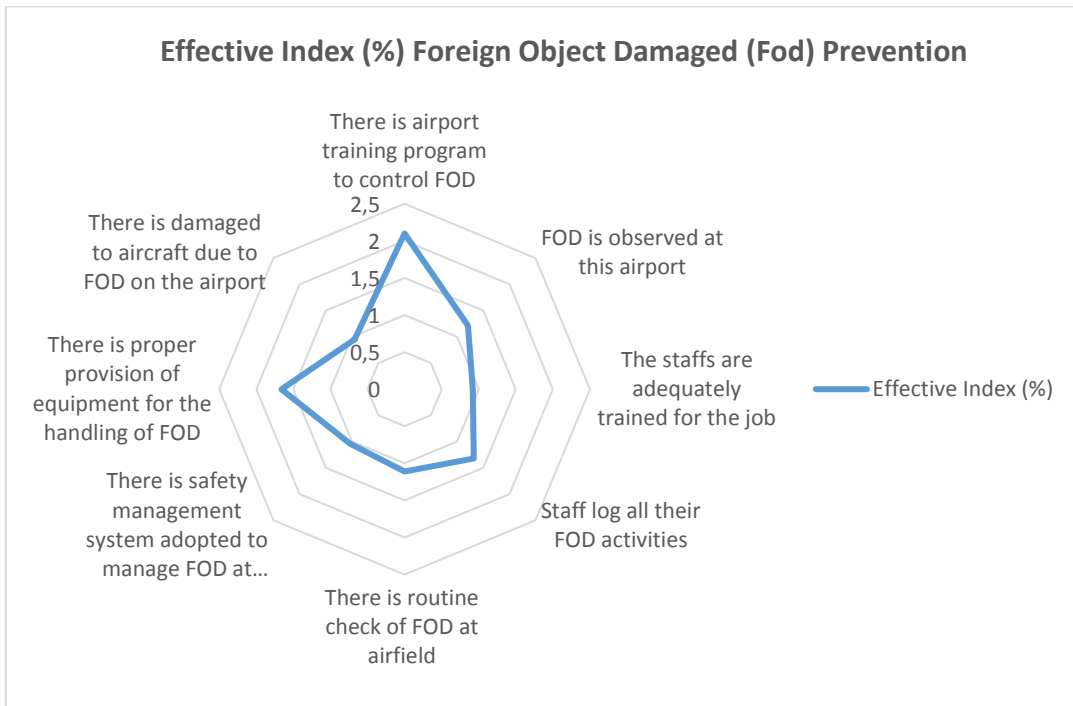


Fig. 3 Percentage of effective index foreign object damaged (FOD) prevention

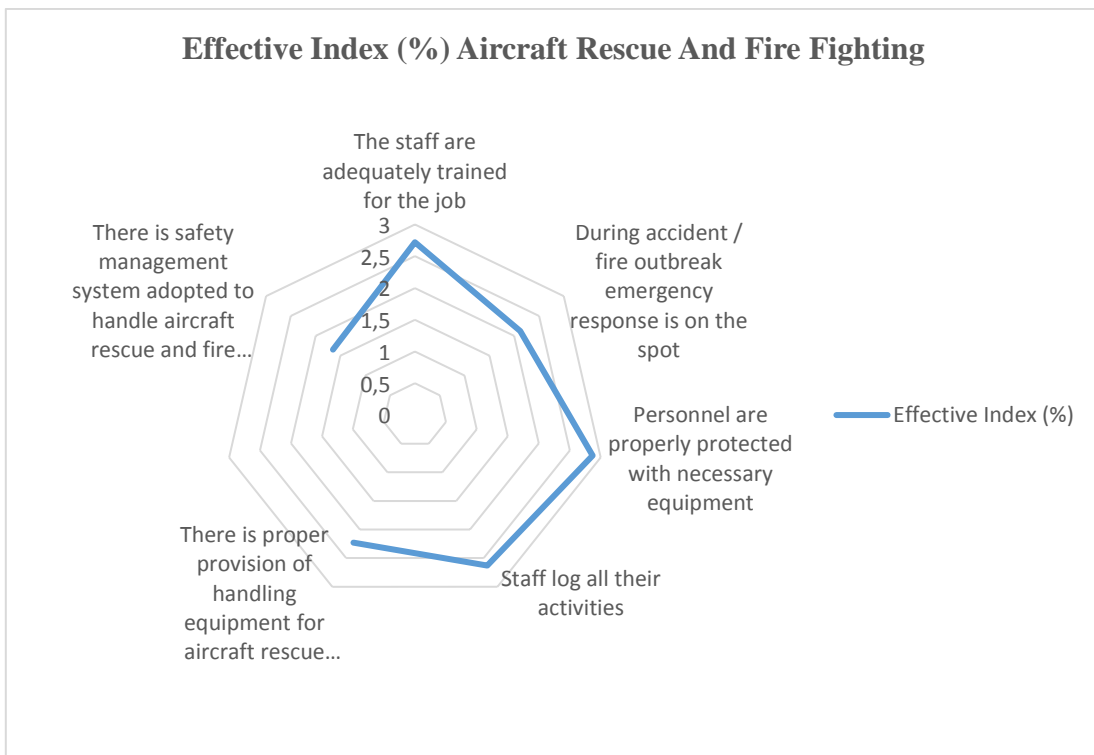


Fig. 4. Percentage of effective index of aircraft rescue and fire fighting

Tab. 3.

Multicriteria analysis of cargo screening and passenger screening

	Statements	Weighty (%)	Satisfaction index (%)	Effective Index (%)
CARGO SCREENING	Cargo operations is concentrated in a single main area	4.11	64.11	0.73
	There is permission of cargo trucks to enter the airport operation area	4.35	66.3	0.99
	There are access control points to airport operation area dedicated to cargo use only	4.7	51.1	1.01
	There are third party ground handlers currently serving cargo operations at the airport	4.19	88.8	0.41
	There is proper provision of handling equipment for cargo screening exercise	4.64	90.2	0.31
	There is a safety management system adopted for cargo screening	5.04	71.54	0.73
	There is a cargo access control point security system in place at the airport	4.11	64.11	1.01
	The staff are adequately trained for the job	4.15	43.29	1.06
PASSENGER SCREENING	Passenger operations is concentrated in a single main area	4.06	55.32	1.15
	There has been incident of smuggling in the airport	5.56	71.87	2.72
	There have been cases of illegal immigration of passengers	3.83	66.32	0.12
	There has been incident of terrorist attack	3.22	71.9	2.87
	There is proper provision of handling equipment	4.11	51.6	1.21
	There is a risk management system adopted for passenger screening	4.19	88.8	0.41
	There is passenger access control point security system in place at the airport	4.64	90.2	0.31
	I am confident	4.22	59.9	1.21

Source: authors' field survey

Security parameters and trend of effectiveness

Multicriteria analysis of security operations at the airport was based on cargo screening and passenger screening. Table 3 shows variations in the weighty score, satisfaction index and effective index of each of the statements.

Cargo screening

There is a safety management system adopted for cargo screening had the highest weighty percentage score of 5.04, a satisfaction index of 71.54 and an effective index of 1.11. Then, there is permission of cargo trucks to enter the airport operation area was 4.35 weighty percentage score, 66.3 satisfaction index and 0.99 effective index while cargo operations is concentrated in a single main area had the least score of 4.11 weighty percentage score, 59.3 satisfaction index and 0.73 effective index as shown in Table 3 above.

Passenger screening

Table 3 observes that passenger screening assessment, incident of smuggling in the airport had the highest weighty percentage score of 5.56, 71.87 satisfaction index and 2.72 effective index while cases of illegal immigration of passengers had the least weighty percentage score of 3.83, a satisfaction index of 66.32 and an effective index of 0.12.

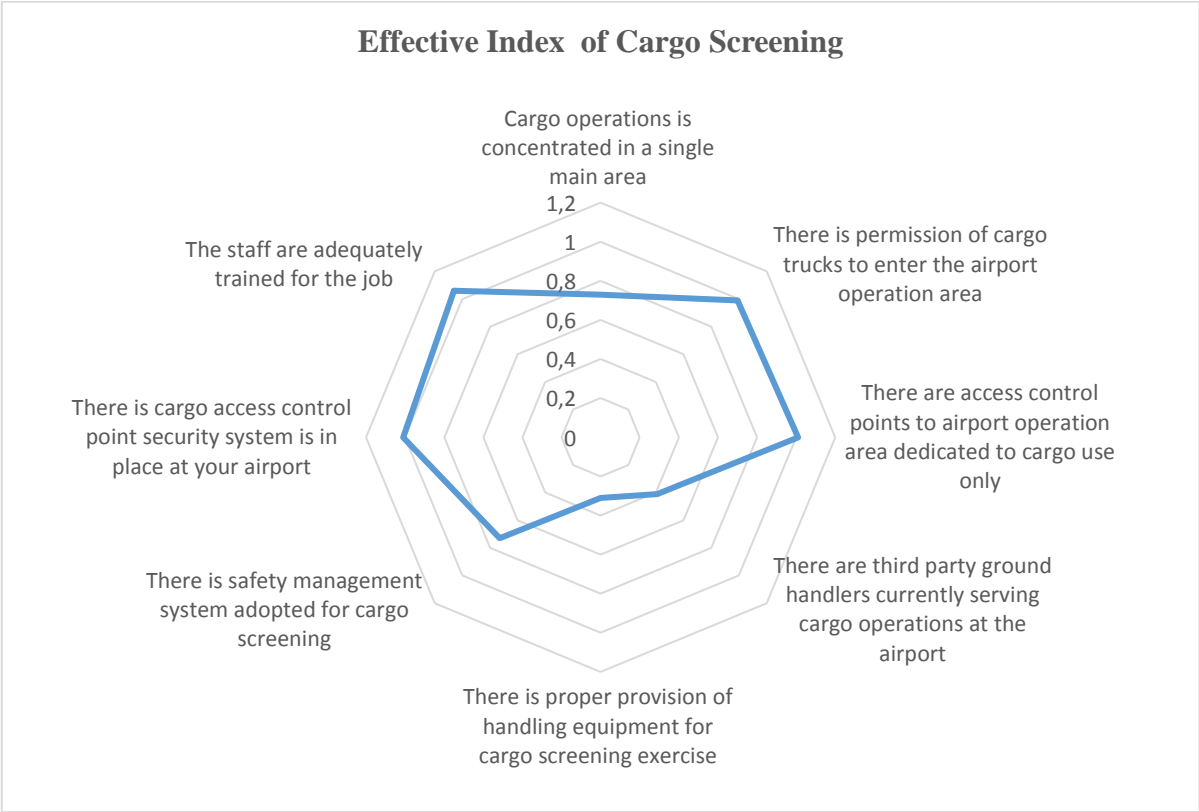


Fig. 5. Percentage of effective index of cargo screening

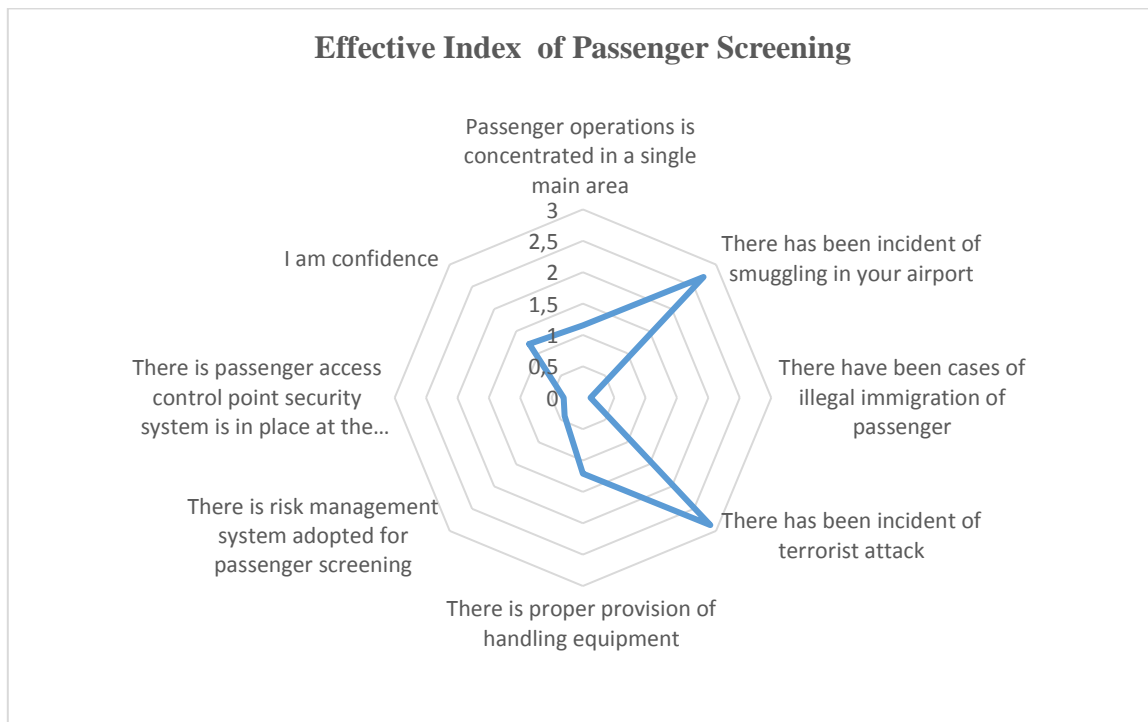


Fig. 6. Percentage of effective index of passenger screening

Safety performance and the attitude of employees towards the airport

Operational safety and security of the airport were examined, and Table 4 shows that the respondents answered based on safety performance and attitude towards safety risk management.

Safety performance

In Table 4, multicriteria analysis showed the safety performance variations in weight, satisfaction index and effective index. Airport management provides enough safety and security training had the greatest weighty percentage score in safety performance of 4.44%, 77.71 satisfaction index and 1.01 effective index. Airport has a well-functioning safety and security committee had the lowest weighty percentage score of 4.17, 79.66 satisfaction index and 0.81 effective index.

Attitude of employees towards safety risk management

Table 4 likewise shows the analysis of respondents on attitude towards safety risk management at the airport; There were variations in their responses. Safety risk management is important had the highest weighty percentage score of 4.64, 9.0 satisfaction index and 0.31 effective index, closely followed by I am willing to communicate with my co-workers about safety risk management at the airport with a weighty percentage score of 4.45, a satisfaction index of 81.6 and an effective index of 0.86.

Tab. 4.

Multicriteria analysis of safety performance and attitude of
employees towards safety risk management

	Statements	Weighty (%)	Satisfaction index (%)	Effective Index (%)
SAFETY PERFORMANCE	All new employees are provided with sufficient safety and security training	4.29	93.32	0.83
	Airport has a well-functioning safety and security committee	4.17	79.66	0.81
	Airport has a well-articulated emergency response program	4.32	93.22	0.72
	Airport management provides enough support for safety and security communication	4.28	77.25	1.09
	Airport management provides enough safety and security training	4.44	77.71	1.01
	Airport management conducts a sufficient amount of safety and security audit	4.19	86.64	1.32
	There is provision of sufficient safety and security training to perform my duties	4.52	79.61	0.49
	When incident/accident occur, they are treated appropriately to avoid possible reoccurrence	4.22	61.54	1.66
ATTITUDE TOWARDS SAFETY RISK MANAGEMENT	I am interested and willing to acquire	4.21	86.7	0.41
	I do not have to pay attention	4.43	88.2	0.29
	My duties are enjoyable and stimulating	4.23	63.7	1.04
	I am willing to communicate with my co-workers about safety risk management at the airport	4.45	81.6	0.86
	I have never liked safety	4.11	51.6	1.21
	I am willing to report safety and security	4.19	88.8	0.41

	Safety risk management is important	4.64	90.2	0.31
	I am confident	4.22	59.9	1.21

Source: authors' field survey



Fig. 7. Percentage of effective index of safety performance

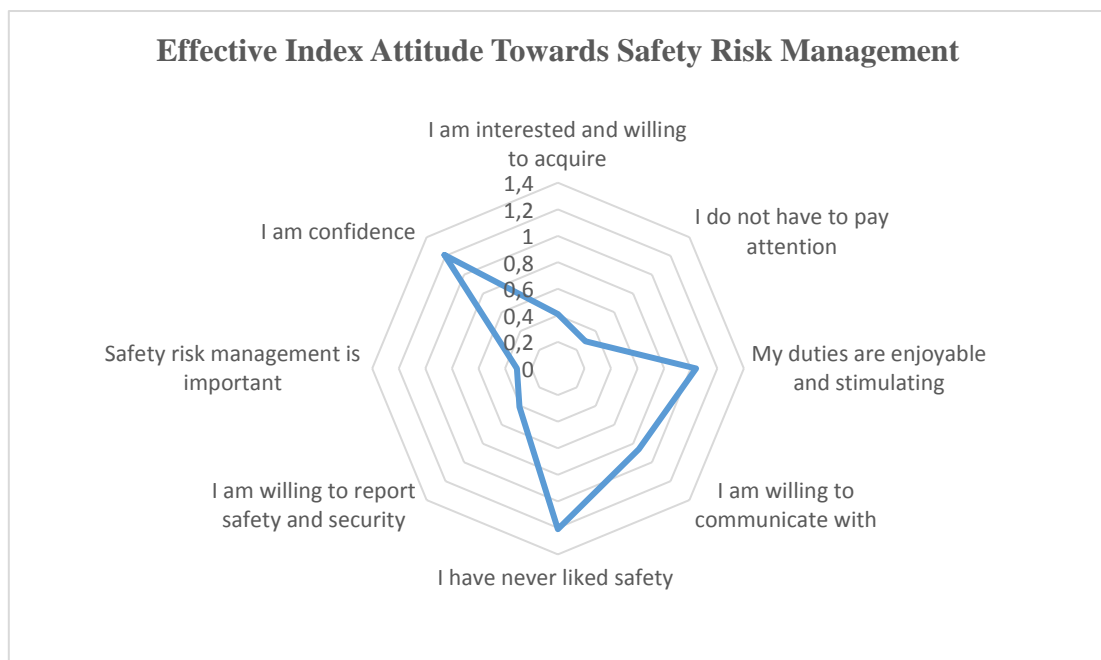


Fig. 8. Percentage of effective index of employee attitude towards safety risk management

Discussion

From the analysis, the result in Table 1 shows the runway and apron, bird and wild management, revealing the percentage weighty score, satisfaction index and effective index. The weighty percentage score for runway and apron was the highest - 6.83, a satisfaction index of 82.66 and an effective index of 2.65. While the bird and wild management noted the highest weighty percentage score of 4.21, a satisfaction index of 88.2 and an effective index of 2.1. Furthermore, the analysis observed that there is airport training programme to control FOD at the airport with highest weighty percentage score of 7.73, a satisfaction index of 82.31 and an effective index of 2.1. The FOD is observed at the airport with a weighty percentage score of 6.13, a satisfaction index of 87.3 and an effective index of 1.21. Furthermore, regarding the firefighting assessment response, the result showed that it had the highest weighty percentage score of 6.83, a satisfaction index of 66.32 and an effective index of 2.12. While issues of provision of handling equipment for aircraft rescue and fire outbreak management had the lowest weighty percentage scores.

Moreover, the multicriteria analysis of security operation showed the results of the cargo screening and passenger screening. The result of cargo screening had the highest weighty percentage score of 5.04, a satisfaction index of 71.54 and an effective index of 1.11. In addition, permission of cargo trucks to enter the airports operation area showed a weighty percentage score of 4.35, a satisfaction index of 66.3 and an effective index of 0.99. The passenger screening assessment incident of smuggling in the airport had the highest weighty percentage score of 5.56, 71.87 satisfaction index and an effective index of 2.72. Concerning safety performance and attitude of employees towards safety risk management, the result of safety performance in Table 4 shows that airport management provides enough safety and security training, the result showed the greatest weighty percentage score in safety performance of 4.44%, 77.71 satisfaction index and an effective index of 1.01. While the airport has a well-functioning safety and security committee had the lowest weight percentage score of 4.17, a satisfaction index of 79.66 and an effective index of 0.81.

Finally, the result in Table 4 also shows the variation in the response of safety risk management and its importance with the highest weighty percentage score of 4.64, a satisfaction index of 90.2 and 0.31 effective index.

4. CONCLUSION

Airport operations are characterised by several activities that are needed to be performed, which involves the safety and security of the entire process. The assessment of airport operational safety and security is the major objective of this study. The assessment was conducted with the use of a structured questionnaire, which was administered to the respective personnel during the safety and security survey at the research airport. The data obtained was subjected to the multicriteria decision analysis model to determine the facts. In analysing the data using the multicriteria decision analysis, the result showed the various significant relationships that exist between operational safety and safety issues, operational security and security issues, and as well safety effectiveness, safety performance satisfaction and employees attitude towards safety. The various safety and security variables were weighted and scored to know which of them is lacking or needs improvement. The results showed the parameters of the safety with the highest weight and the ones with the lowest weight, the effectiveness and satisfaction scores. Therefore, this study recommends that those parameters with lower percentage scores be upgraded by working towards ensuring that all safety and security

apparatus and training at the category one airport in Abuja, meet the ICAO Recommended Practices concerning safety. Furthermore, it is recommended that the airport provides reflective jackets for its staff and authorised persons. Finally, adequate enforcement for constant usage of the reflective jacket at the airport, proper training and retraining of staff on system management system procedure be carried out regularly. New technologies in aviation should be incorporated into the system for better operational performance since there are advanced technologies in the airport industry.

References

1. Pius A., O.R. Nwogbe, U. Akerele, S. Masuku. 2017. "Appraisal of airport terminal performance: murtala muhammed international airport (MMIA)". *International Journal of Professional Aviation Training and Testing Research* 9(1): 1-21. Available at: <https://ojs.library.okstate.edu/osu/index.php/ijpatr/index>.
2. Ravizza Stefan, Jun Chen, Jason A.D. Atkin, Edmund K. Burke, Paul Stewart. 2013. „The trade-off between taxi time and fuel consumption in airport ground movement”. *Public Transport* 5: 25-40.
3. Aviators Africa. 2017. „Engine Failure, Human Error Caused Dana Air plane crash – AIB”. Available at: <https://theaviatorsafrica.com/2017/03/14/engine-failure-human-error-caused-dana-air-plane-crash-aib/>.
4. Chinedu E. 2019. „Nigerian Airports Record 15.2m Passengers, 227,834 Aircraft Movement”. *THISDAY*. Available at: <https://www.thisdaylive.com/index.php/tag/nigeria-airports-record-15.2m-passengers>.
5. Siergiejczyk Mirosław, Karolina Krzykowska. 2014. „Some issues of data quality analysis of automatic surveillance at the airport”. *Diagnostyka* 15(1): 25-29.
6. Lang C.M. 2012. „Airport safety”. *ACI livingston*.
7. Lu, C.T., S. Schreckengart, J. Jia. 2011. „Safety risk management, assesment and promotion: a hazard management systems to budget-constrained airports”. *Journal of Aviation Technology and Promotion*. DOI: 10.5703/1288284314630.
8. ICAO. 2014. „Safety Management Manual. Mexico”. Available at: <http://www.icao.int/document>.
9. Amaratunga D., D. Baldy. 2003. „A conceptual framework to measure facilities management performance & property management”. P. 171-189.
10. FAA. 2015. „Federal aviation authority”. Available at: https://www.aspmhelp.faa.gov/index.php/OEP_35.
11. NCAA. 2019. „Nigeria civil aviation authority”. Available at: <http://www.ncaa.gov.ng>.
12. Aliyu A. 2019. „Nigeria records air traffic growth with 10million domestic passengers”. *Daily Trust*. Available at: <https://www.dailytrust.com/ng/nigeria-records-air-traffic-growth-with-10mdomestic-passengers.html>.
13. Kandarp K., F. Umrigar, L. Zala. 2013. „Capacity analysis of ahmedabad airport case study”. *Journal of International Academic Research for Multi-disciplinary*.
14. Ludwig D., C. Andrew, Jestertenveen N., C. Laqui. 2007. *Safety Management Systems for Airports*. Transportation Research Board of the National Academies.
15. Halford C. 2016. *Implementing safety management system in aviation*. Routledge.
16. Abdulazeez O.H. 2009. *Effect of weather on air transport*. Ahmadu Bello University, Zaria.

17. Saeid N., C. Doug, J. Micheal, T.-L. Vu. 2009. „Airport operations: A system-of-systems approach”. In: Jamshidi Mo (ed). *Systems of systems engineering : principles and applications*. CRC Press, Boca Raton, Fla. P. 403-419. ISBN: 9781420065886.
18. Price J.C., J.S. Forest. 2016. *Practical airport operations, safety and emergency management. Protocols for today and the future*. ISBN: 978-0-12-800515-6. Butterworth-Heinemann. DOI: <https://doi.org/10.1016/C2013-0-15991-0>.
19. Leib S., C.-T. Lu. 2013. „A Gap Analysis of Airport Safety Using ICAO SMS Perspectives”. *Journal of Aviation Technology and Engineering*. DOI: <http://dx.doi.org/10.7771/2159-6670.1078>.

Received 17.03.2021; accepted in revised form 28.06.2021



Scientific Journal of Silesian University of Technology. Series Transport is licensed under a Creative Commons Attribution 4.0 International License