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Effect of Aircraft Ground Handling Practices on Aviation Safety Performance in Kenya

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Abstract

The goal of this study was to examine the effect of ground handling practices on Aviation safety performance in Kenya. Specifically, the study sought to establish the effect of passenger handling practices and cargo handling practices on aviation safety performance in Kenyan context. This study employed an explanatory research design. The target population consisted of 258 staff directly engaged in passenger & cargo handling procedures from five domestic passenger airlines operating from Jomo Kenyatta International Airport (JKIA) Kenya. A census survey of the entire population was carried out, respondents were drawn from four departments; safety, flight operations, ground operations & dispatch. Results revealed a positive and statistically significant effect of passenger handling practices on aviation safety performance *($\beta = .722$, $p = .000$, <0.05)*. It was also established that cargo handling practices had a positive and significant effect on aviation safety performance *($\beta = .140$, $p = .006$, <0.05)*. The findings of this study underscore the need for the development and implementation of standardized cargo handling procedures, rigorous training programs for personnel, and the adoption of best practices in ground handling. Such measures are essential for minimizing risks associated with cargo operations and improving the safety culture within the aviation industry. Aviation corporations need to focus on training and development programs for ground handling personnel, especially those engaged in passenger and cargo operations. This will guarantee that personnel possess the requisite skills and knowledge to perform their duties efficiently. The original contribution of this study lies in its focus on ground handling practices and their impact on aviation safety performance in a developing country. In conclusion, it contributes to the existing body of knowledge on aviation safety management and may serve as a basis for further research and policy development in this area.

Keywords: *Aviation Safety, Aircraft Ground Handling, Passenger Handling, Cargo Handling, Aviation Industry.*

Introduction

In the recent past, aviation industry has witnessed a drop in the number of air accidents, especially in commercial aviation, due, among other things, to the widespread introduction of safety management systems in aviation organizations and continuous improvement of them. However, this has not been the case in Kenya. Aviation safety performance is the result of work in quality and quantity achieved by an organization in carrying out its functions from all components of the flight operating system so that it can create a sense of security without danger by maintaining or reducing the risk of flight accidents through compliance with infrastructure, regulations, and aviation safety standards as requirements (Majid et al., 2022). Aviation safety performance at Kenya's Jomo Kenyatta International Airport (JKIA) is still relatively low as shown by the number of incidents and accidents related to passenger & cargo handling practices, this can be attributed to lack of optimal implementation of safety risk management. According to the International Civil Aviation Organization (ICAO) Annex 19 (2013), safety is the state in which risks associated with aviation activities are reduced and controlled to an acceptable level. Alamdari, (2018) avers that air transportation is crucial for the movement of people and goods across long distances, serving as a fundamental component of both national and global economies. Commercial aviation is essential, having undergone significant safety innovations since its inception. Despite significant global expansion, the aviation industry has demonstrated an impressive safety record (Koestner, 2019). The expansion has been driven by the broader context of global economic progress, alongside breakthrough technology, and the impacts of deregulation, liberalization, and privatization. Significant safety enhancements in commercial aviation reflect the collaborative efforts of multiple industry stakeholders (Kirschenbaum, 2018). Stakeholders include airlines, manufacturers of engines and aircraft, governmental bodies, and regulatory agencies.

From the UN Sustainable Development Goals to AU Agenda 2063 to Kenya Vision 2030, the aviation sector greatly helps different national and international economic strategies. The aviation sector must flourish and satisfy its production and safety targets if it is to carry out these strategies (IATA, 2022). Conversely, data from the Flight Safety Foundation (2022) indicate that aircraft accidents and incidents persist at local, regional, and global levels. The Flight Safety Foundation study (2022) indicates a 16% increase in total accidents over a 10-year period, with the fatality risk rising from 0.13% in 2020 to 0.23% in 2021.The Aviation Safety Report indicates that Kenya's trend remains concerning, with one aviation accident or event occurring annually since 2009.

Statement of the Problem

Despite the implementation of a safety management system in the aviation industry aimed at preventing such regrettable incidents (ICAO 2019). The reported figures raise concerns for investors and implementers of various blueprints, as well as for the flying public and policymakers in Kenya, particularly in the context of enhancing control over the regional aviation hub (Omondi & Kimutai, 2018). Numerous ground operations activities enhance aircraft safety through meticulous management of baggage, proper servicing of aircraft, efficient passenger boarding, and thorough refueling procedures require a high level of accuracy and attention to detail (Park, 2019). Mitigating potential safety risks in the African aviation sector relies on comprehensive understanding and proficient implementation of ground handling techniques. Kenya is among Africa's leading aviation hubs, which calls for effective ground handling techniques in the interest of safety.

Research Hypotheses

Ho_1: There is no significant relationship between passenger handling practices and Aviation safety performance in Kenya.

Ho_2: There is no significant relationship between cargo handling practices and Aviation safety performance in Kenya.

Literature Review

Theoretical Review

Risk Management Theory

Risk management theory was coined by Daniel Bernoulli a Swiss mathematician in 1738, he made significant contributions to the field of risk management and economics, particularly through his work on expected utility theory**,** which he presented in the 18th century. Risk management theory provides structured approaches and methodologies for systematically identifying, evaluating, mitigating, and monitoring potential risks within various contexts, such as business, operations, or projects (Button, 2017). This theory aims to enhance decision-making by addressing uncertainties and potential adverse events, ultimately promoting the preservation of assets, the achievement of objectives, and the optimization of outcomes while minimizing the negative impact of risks. The study's relevance on the effects of ground handling practices on aviation safety performance in Kenya is significantly augmented by the incorporation of risk management theory (Koo, 2018). Given the intricate and safety-sensitive nature of aviation operations, this theory provides a structured framework to systematically evaluate and mitigate potential hazards associated with various dimensions of ground handling practices.

Aviation Safety Performance

Aviation safety is traditionally managed based on the analysis of accidents and incidents, a high general level of safety should be ensured in civil aviation to reduce the number of accidents and incidents. Even if the number of safety events has remained fairly constant over the last decade (Patriarca, *et.al,* 2019). According to the International Civil Aviation Organization (ICAO) Annex 19 (2013) as cited by (Panagopoulos & Sikora, 2017). Safety is the state in which risks associated with aviation activities are reduced and controlled to an acceptable level. Since 2009, in an effort to improve Safety Performance (SP) and to achieve an Acceptable Level of Safety (ALoS) in civil aviation that would be met by all operators, the ICAO has launched Standard and Recommended Practices (SARPs) for the implementation of Safety Management Systems (SMS) in the Air Transport industry (Panagopoulos & Sikora, 2017; ICAO, 2010a, b and 2009). On May 2013, the ICAO Safety Management Manual (SMM) Doc 9859/AN/474 introduced the concept of a Performance-Based (PB) approach to safety that complements the existing compliance-based approach and could achieve an ALoS performance (ICAO, 2013a). Safety management is an ongoing enhancement process that mitigates risks and averts incidents in aviation, historically, corporations have evaluated their safety performance using lagging indicators like as fatalities or incident rates. Nonetheless, as safety has enhanced and the incidence of incidents has diminished, mishap rates have become an ineffective measure of safety performance. Industries susceptible to catastrophic consequences from breakdowns in intricate human technology systems are termed High-Risk Industries (Button, 2017).

Aviation safety performance is the outcome of an organization's efforts in both quality and quantity in executing its functions across all elements of the flight operating system, aimed at fostering a sense of security by mitigating or minimizing the risk of flight accidents through adherence to infrastructure, regulations, and aviation safety standards as prerequisites (Susanto et al., 2020; Remawi *et al.*, 2011). The primary source of aviation safety and risk management is the safety management system (SMS) mandated by ICAO, which all aviation stakeholders must implement.

Ground Handling Practices

Ground handling operations represent the airside activities at airports in charge of processing passengers, cargo, facilities and supplies at and around parked aircraft, most of these operations are performed by different service providers, using vehicles as Ground Support Equipment (GSE) which is specific to each type of operation. Ground handling is not considered a prominent activity within the Air Transportation System (ATS), however this activity is an important enabler for efficient airport operation and its management is an important issue (Alonso & Mora-Camino 2017). The ground handling tasks are usually defined and contracted using a Service Level Agreement (SLA) that defines the scope, price and quality level desired and Key Performance Indicators (KPI) as well. According to (Bakir & Akan, 2021) Ground-handling services are important for effective aircraft operations in the air transportation system. Air transportation refers to a combination of different services and facilities that complement each other. Ground-handling, in this respect, is one of the most important services. Ground handling operations include activities airside at airports that refer to the processes in charge of passengers, freights and supplies in accordance with the standards of international aviation organizations. Ground-handling services are one of the key components that must be considered in order for air transport activities to be safe, efficient and cost-effective (Studic et al., 2017; Bakir & Akan, 2021). Ground handling services affect the customers' perception of overall service quality directly or indirectly (Rezaei *et al*., 2014; Bakir & Akan, 2021). Ground handling operations are one of the most important work performances in the civil aviation flight cycle. Ground handling refers to the wide variety of activities for the flight operations, such as passenger services, flight operations, catering, and baggage handling (Durmaz, *et al.,* 2021). In handling aircraft while refueling, cleaning, loading/unloading, towing, and so forth, effective and safe performance needs to be achieved. The ramp area is also risky both for personnel and operations. Improper use of ground handling equipment, careless and untrained staff may increase safety concerns (Durmaz, *et al*., 2021). Ground handling operations also enable the formation and development of collaborations with aviation sector stakeholders.

Passenger Handling Practices

Passenger handling services encompass a range of essential functions aimed at facilitating a hassle-free travel experience for airline passengers. From check-in procedures to baggage handling and boarding assistance, these services are exactly designed to cater to the diverse needs of travelers, special attention is given to passengers with reduced mobility (PRM), ensuring that they receive the assistance they require to navigate the airport with ease (Wahab 2024). Passengers come in various types, each with their own needs and preferences. Understanding these different types of passengers is essential for providing excellent customer service and ensuring a smooth travel experience for all. Zhou and Chen (2020) avers that airport terminals should meet passenger demand and provide an adequate level of service in terms of waiting times in queues, crowdedness level and delays, considering government restrictions due to terrorism, infectious disease outbreaks and extreme weather events.

Cargo Handling Practices

Shipping by air is a fast and efficient means of transport for goods, airlines transport over 52 million metric tons of goods a year, representing more than 35% of global trade by value but less than 1% of world trade by volume. Cargo handling is the segment of the supply chain which processes goods landside in the cargo facility, from the delivery at the airport of origin until it is ready for loading on the plane, to the unloading at destination and handover to the consignee/freight forwarder, many steps are involved with cargo handling that must be closely followed to ensure shipments are delivered safely and securely (IATA 2021). Passengers' expectations are simple: they want to check-in as quickly as possible with their bags, then at their destination to be speedily reunited with their undamaged bags. After check-in luggage disappears behind a wall, and if everything works correctly it reappears on a reclaim arrival carousel at the destination airport. Effective, economical baggage handling is therefore critically important, but failure of just one component within the system can shut down the whole facility for many hours. This can cause thousands of bags to miss flights, causing significant inconvenience and a negative financial impact, not just for the passengers, but all those affected, especially airports, airlines and their stakeholders (Koenig & Kumar, 2019).

Conceptual Framework

The conceptual framework captures the direct effects of hypotheses; H01; Passenger handling practices and H02; cargo handling practices on Aviation Safety performance.

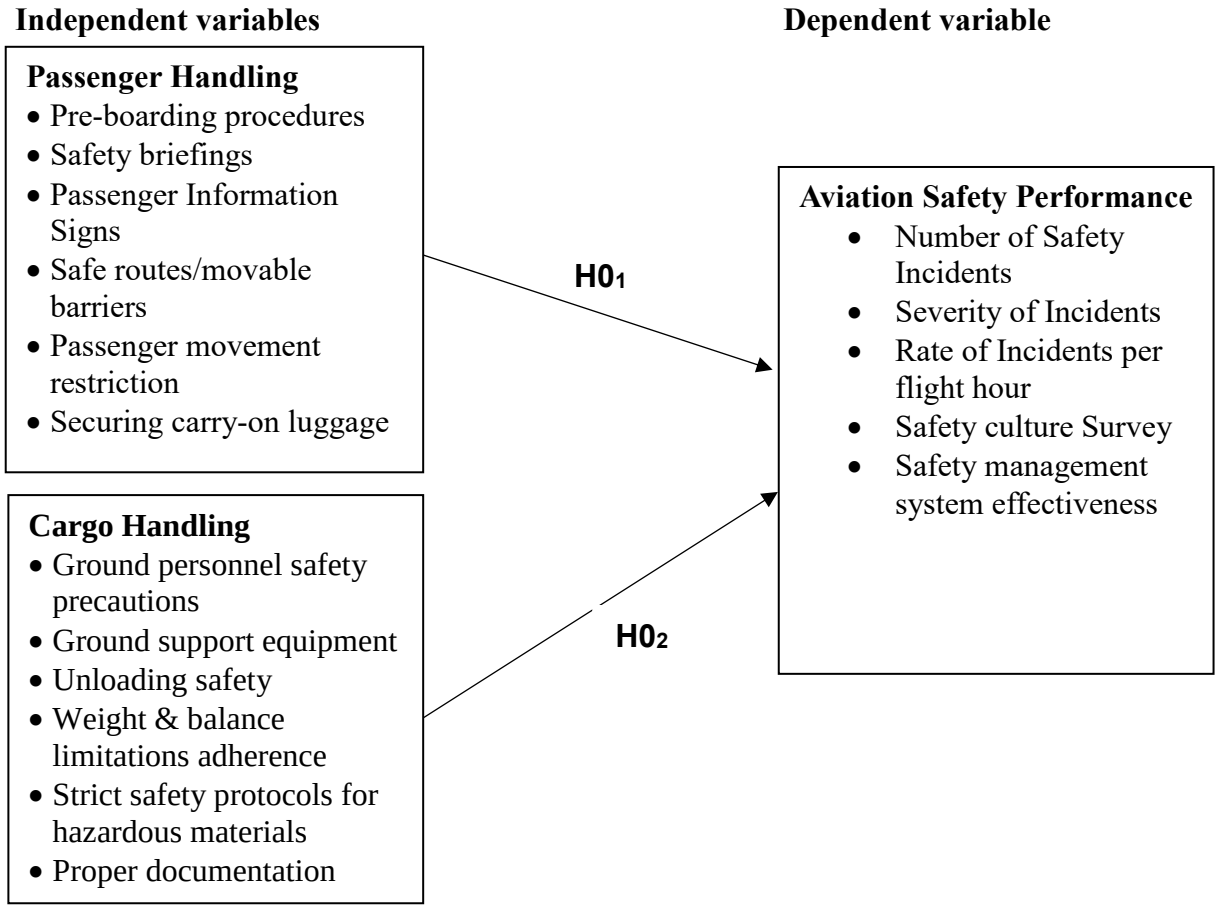

Figure 2.1: Conceptual Framework

Research Methodology

This section covers research design, population of the study, reliability & validity of the questionnaire, factor analysis, construct measurement and model specification.

This study employed an explanatory research design. It was deemed suitable for the study as it allows the researcher to perform the investigation in authentic environments and employs probability sampling. The target population consisted of staff directly engaged in passenger and cargo handling procedures from five domestic passenger airlines operating from Jomo Kenyatta International Airport (JKIA) Kenya. The five airlines serve as the unit of analysis, while the personnel directly responsible for airline safety constitute the unit of observation. The five airlines are; Kenya Airways, JamboJet, Bluebird, Skyward, and Safari Link. The personnel were drawn from five departments; safety, ground operations, flight operations and dispatch. Closes ended structured questionnaires were personally administered for data collection.

A census survey of the entire population of 258 was carried out using self-administered questionnaires, of the 258 participants in the poll, 85 did not respond. A total of 173 valid questionnaires were obtained, yielding a response rate of 67.1 percent. The stated response rate aligns with Creswell's (2019) assertion that response rates of 70 percent or above are deemed extraordinary, rates of 60 percent are regarded as good, and rates of 50 percent are acceptable for data analysis. Following the removal of 9 data cases identified as significant outliers due to their divergence from the normal distribution, a total of 164 valid data sets were utilized for subsequent analysis in the study.

The data collected was subjected to stringent testing to verify its authenticity and reliability. The reliability findings demonstrate that Cronbach's Alpha coefficients for passenger handling (0.728), cargo handling (0.725), and aviation safety performance (0.721) are all above (0.7), they are considered reliable and appropriate for further investigation. Face validity was ensured through continuous oversight by the supervisor, involving a comprehensive review of all aspects of the instrument, including recommendations regarding the addition or reduction of questions. Content validity was assessed using the Average Variance Extracted (AVE) test, to obtain an AVE measurement exceeding the threshold of 0.5.

The principal components factor analysis yielded a KMO test statistic of 0.749. Kaiser (1974) asserts that KMO values exceeding 0.5 are statistically adequate. The score of 0.749 in this study indicates that the sampling was sufficient. Alongside the KMO test, Bartlett's test of sphericity produced a very significant value of 1962.065 with 105 degrees of freedom and $P<0.05$. Bartlett's Test of Sphericity yields a P value of 0.000, indicating a robust connection among the components in the sample. The findings herein underscore the necessity for further statistical analysis to be conducted. The factor analysis yielded the discovery of four components, each possessing Eigenvalues exceeding 1. This signifies that each factor can account for greater variance than an individual variable. The four factors combined represent 76.05% of the variance.

The variables utilized in this study were evaluated using scales derived from previous studies, with minor adjustments made to align with the specific setting of the current study. Respondents were asked to rate each of the main constructs on multi-item scales using a five-point ordinal scale (1 strongly disagree to 5 strongly agree) on passenger handling, cargo handling and aviation safety performance. In this study, the dependent variable aviation safety performance. Consistent with other studies this variable was measured using the retained items after factor analysis on a five Likert scale. Passenger handling and cargo handling were retained independent variable which were measured using retained items after factor analysis on a five

Likert scale. The study respondents were asked to indicate on a five-point Likert scale their level of agreement on statements describing the study variables.

Model Specification

To test the hypotheses, the study adopted a linear regression model for the purpose of analysis. The equation below was used.

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

Where: Y: Represent: Aviation safety performance, X_1: Represent: Passenger handling practice, X_2: Represent: Cargo handling practice, β_0: Represent: Constant, $\beta_1 - \beta_2$: Represent: Regression coefficients and ε: Represent: Error term

Tests of assumptions are important for the examiner to verify the characteristics of the data and determine the appropriate model for the study, which guarantees unbiased, consistent, and efficient estimations. The study established that the all the assumptions of regression results were not violated.

Descriptive Statistic, Correlation Analysis and Multicollinearity Test

Table 1 shows the summary statistics for the sampled variables. Passenger Handling (PH) had a mean of (M=3.91 and SD = 0.96). Cargo Handling (CH) had a mean of (M = 3.73, SD = 1.18) and Aviation Safety Performance (ASP) had a mean of (M = 3.74, SD = 0.97). The variables were assessed for their correlations using Pearson's correlation analysis (Bougie & Sekaran, 2019). According to the findings presented in Table 1, the variables exhibit a positive correlation. The data shown in Table 1 depict results of the correlation which revealed that all the variables were positively and significantly related with firm performance.

Table 1:

Descriptive Statistic Correlation Analysis

	Mean	SD	ASP	PH	CH
ASP	3.75	0.97	1		
PH	3.91	0.96	.678**	1	
CH	3.73	1.18	.421**	.410**	1

Regression Analyses Results

Test for Direct Effect

The first objective of this study sought to establish the effect of passenger handling practices on Aviation safety performance in Kenya. It was hypothesized that there was no significant relationship between passenger handling practices and Aviation safety performance in Kenya. Regression analysis results revealed a positive and statistically significant effect of passenger handling practices and aviation safety performance (β = .722, p = .000, <0.05). It was thus concluded that passenger handling practices affect aviation safety performance in Kenya. The study further sought to determine the effect of cargo handling practices on Aviation safety performance in Kenya. It was postulated that there is no significant relationship between cargo handling practices and Aviation safety performance in Kenya. Regression results showed that cargo handling practices had a positive and significant effect on aviation safety performance (β = .140, p = .006, <0.05).

Table 2:

Regression analysis results

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	.381	.276		1.379	.170
	Passenger Handling	.722	.074	.608	9.803	.000
	Cargo Handling	.140	.051	.171	2.758	.006

Discussion of Findings

The first objective of the study sought to establish the effect of passenger handling practices on Aviation safety performance in Kenya. Findings revealed a positive and statistically significant effect of passenger handling practices and aviation safety performance. This aligns with the findings of (Lei, 2024), which indicate that passenger handling positively influences aviation safety. Aviation safety performance is essential in the aviation sector, and the efficient functioning of ground handling personnel is vital for ensuring a secure airport environment. Ground handling personnel are integral to numerous operations, including aircraft marshalling, baggage management, refueling, and aircraft pushback. Consequently, comprehending the elements that affect their function is crucial for enhancing aircraft safety. The study lends support to the quantitative results of a study by Musa and Isha (2021) which showed the industry's safety culture performance and its influence on the safety performance outcome constructs.

The second objective sought to establish the effect of cargo handling practices and Aviation safety performance in Kenya. Consistent with the findings of Ochola and Were (2017) this study, established that cargo handling had a strong a strong positive correlation to the performance of air cargo handling projects. Ground handling practices play a crucial role in ensuring the smooth operation and performance of air transportation. Airlines and their cargo handlers must adhere to strict protocols and standards to maintain high levels of safety, efficiency, and customer satisfaction in the aviation industry.

Conclusion

The findings suggest that passenger handling practices have a significant impact on aviation safety performance. This highlights the importance of ensuring effective and efficient passenger handling processes to enhance overall safety in the aviation industry. It can be concluded that investing in passenger handling practices, such as efficient boarding and deplaning procedures, streamlined security checks, and effective communication with passengers, can contribute to improved aviation safety performance.

The study underscores the importance of providing comprehensive training for cargo handlers to ensure that they understand and adhere to best practices for safe and efficient cargo handling. This training should cover proper loading techniques, weight distribution, and securing of cargo to prevent shifting during flight. Airlines must prioritize strict adherence to established protocols and standards for cargo handling. This includes following industry regulations,

aircraft manufacturer guidelines, and specific procedures outlined by the airline itself. The research reinforces the importance of cultivating a strong safety culture within airlines and their associated cargo handling operations.

This includes promoting open communication about safety concerns, encouraging reporting of potential hazards or incidents, and fostering a mindset that prioritizes safety above all else.

Recommendations

These findings offer multiple management and policy implications. It is essential for aviation corporations to focus training and development programs for ground handling personnel, especially those engaged in passenger and cargo operations. This will guarantee that personnel possess the requisite skills and knowledge to perform their duties efficiently. Moreover, regulatory agencies must establish more stringent guidelines and requirements for ground handling methods. Regulatory organizations can enhance aviation safety performance by requiring adherence to best practices in passenger and cargo handling. Moreover, it is imperative for aviation corporations to invest in contemporary technology and equipment that can improve efficiency and safety in ground handling operations. This may encompass automated baggage handling systems, sophisticated cargo screening technology, and enhanced communication systems between ground personnel and flight crews.

The government should establish a thorough framework for monitoring and reviewing ground handling practices in the aviation industry. This may entail routine inspections, audits, and evaluations of ground handling protocols to guarantee adherence to safety standards. The study's findings underscore the essential impact of ground handling methods on aviation safety performance. By tackling these issues through strategic investments in training, technological integration, regulatory supervision, and policy formulation, the sector can strive for enhanced safety and operational excellence.

There is a need to hence aviation safety training programs. There is a need to develop comprehensive training programs for ground handling staff focused on both passenger and cargo handling practices. This training should emphasize safety standards, emergency procedures, and the importance of compliance with established protocols to ensure that all personnel are well-versed in safety. The management in the aviation industry needs to establish and enforce standardized operating procedures for both passenger and cargo handling. These SOPs should be regularly updated to reflect best practices and regulatory requirements, ensuring consistency across the board. Regular performance of safety audits and assessments of ground handling operations to identify potential risks and areas for improvement. These audits can help ensure that safety practices are being followed and can lead to the implementation of corrective actions where necessary. By implementing these recommendations, stakeholders in the aviation industry in Kenya can significantly enhance safety performance related to ground handling practices, ultimately leading to safer and more efficient aviation operations.

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