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Effect of Digital Safety Reporting Systems on Aviation Safety Performance in Uganda's Aviation Sector

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Abstract:

Purpose: *This study examined the effect of Digital Safety Management Systems (DSMS) on aviation safety performance in Uganda's aviation sector, focusing specifically on Digital Safety Reporting Systems (DRS). The study sought to establish whether digital safety reporting systems, through electronic hazard reporting, incident documentation, confidential reporting, continuous accessibility and feedback mechanisms, significantly influence aviation safety performance as measured through accident and incident prevention, regulatory compliance and safety standards, and operational safety efficiency.*

Material/methods: *The study was anchored on High Reliability Organization (HRO) Theory and adopted an explanatory research design using a quantitative approach. The target population comprised 414 personnel drawn from 46 aviation organizations operating in Uganda. The respondents were selected from Safety Management, Operations and Quality Assurance offices because of their involvement in implementing, monitoring and evaluating aviation safety management systems. Yamane's formula was used to determine a sample size of 204 respondents at a 5% margin of error. Proportionate stratified random sampling was employed to select respondents. Primary data were collected using structured questionnaires based on a five-point Likert scale. A total of 197 questionnaires were returned, of which 180 valid questionnaires were retained for analysis, representing an effective response rate of 88.24% of the targeted sample. Data were analyzed using descriptive statistics, Pearson correlation analysis and hierarchical multiple regression analysis, with organizational size and professional experience treated as control variables. Statistical analysis was conducted using SPSS version 25.*

Findings: *The findings revealed a strong positive and statistically significant relationship between Digital Safety Reporting Systems and Aviation Safety Performance ($r = .833$, $p < .001$). Descriptive findings indicated that respondents generally held neutral perceptions regarding the availability, accessibility, usability, confidentiality and feedback mechanisms of digital safety reporting systems, with mean scores ranging from 2.99 to 3.01. Hierarchical regression analysis further established that the explanatory power of the regression model increased from 2.3% to 72.4% following the introduction of digital safety reporting systems, representing an additional 70.1 percentage points in explained variance. The second regression model was statistically significant ($F = 91.284$, $p < .001$), with an adjusted R^2 of .716. In contrast, organizational size and professional experience did not demonstrate statistically significant relationships with aviation safety performance. These findings demonstrate that digital safety reporting systems are strongly associated with improved aviation safety performance in Uganda's aviation sector.*

Conclusion: *The study concluded that Digital Safety Reporting Systems are an important determinant of aviation safety performance in Uganda's aviation sector. Effective digital reporting mechanisms strengthen the timely identification, documentation and communication of safety hazards, incidents and operational irregularities, thereby supporting accident and incident prevention, regulatory compliance and operational safety efficiency. The findings further suggest that aviation safety performance depends not merely on organizational size and accumulated employee experience but also on the effectiveness of institutionalized digital safety reporting mechanisms. Consequently, integrating accessible, confidential and responsive digital reporting platforms into organizational safety management processes is essential for strengthening proactive safety management and continuous improvement in aviation operations.*

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Value: *The study contributes to High Reliability Organization Theory by demonstrating how digital safety reporting systems operationalize the HRO principles of preoccupation with failure, sensitivity to operations and continuous organizational learning through systematic identification, documentation and communication of safety information. The findings provide practical insights for aviation organization managers, policymakers, particularly the Uganda Civil Aviation Authority (UCAA), and aviation industry practitioners on the importance of investing in secure digital reporting infrastructure, employee training, confidential reporting mechanisms and timely feedback systems. The study also provides empirical evidence on the contribution of digital safety reporting to aviation safety performance in a developing aviation market, thereby offering a foundation for further research on digital safety risk management, safety data analysis and the moderating role of organizational safety culture.*

Keywords: *Digital Safety Management Systems, Digital Safety Reporting Systems, Aviation Safety Performance, Accident and Incident Prevention, Regulatory Compliance, Operational Safety Efficiency, High Reliability Organization Theory, Uganda*

Paper Type: *Research Article*

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1. Introduction

Aviation safety performance is gaining greater importance as an indicator of the effectiveness, reliability and sustainability of aviation operations across the globe. As air traffic becomes more complex and technology is advancing, a paradigm changes from reactive to proactive, data-driven safety management (Wiegmann et al., 2004; Li & Harris, 2021) is needed. The effectiveness of safety management systems within organizations in accident and incident reduction, risk management and compliance with regulations has become a growing concern for aviation safety performance. According to Chen and Chen (2012), the safety management systems are composed of safety policies, management commitment, safety promotion and emergency preparedness, which help to boost safety performance at organizational and individual levels. This change has made Digital Safety Management Systems (DSMS) more relevant and valuable to hazard identification, Safety Risk Assessments, Incident Reporting and Continuous Safety Monitoring. ICAO (2023) stresses on institutionalized safety management in Annex 19, which aims at the implementation of systematic procedures to identify hazards, evaluate safety risks and take necessary action to reduce safety risks. Likewise, the International Air Transport Association (IATA, 2022) view digitalization as a key factor of good safety management with real-time reporting and enhanced safety information management and predictive risk analysis. Digital technologies, therefore, offer aviation organizations opportunities to enhance operational reliability, regulatory compliance and accident and incident prevention.

Although these developments have occurred, there is concern about obtaining a consistent aviation safety performance, especially in the developing aviation markets where technological capacity, institutional resources and organizational practices vary. Aviation organizations in Sub-Saharan Africa are under pressure to bolster safety oversight and operational risk management as a result of the growth of air transport activities in the region. Based on the report by the African Civil Aviation Commission (AFCAC, 2023), the region experienced significant increases in its passenger traffic levels between 2021 and 2023, thus the need to build up their safety management capacities. In East Africa, the Civil Aviation Safety and Security Oversight Agency (EAC-CASSOA, 2022) has been promoting harmonized safety standards and enhanced safety reporting among the member states. However, gaps in safety documentation, data management and digital tech use still hinder safety management efforts. This study by Ioannou et al., 2017, found that poor safety management can impede the ability of

aviation service providers to develop and implement effective safety performance indicators. Likewise, ICAO (2023) revealed that 54% of the Eastern and Southern African states did not have effective documentation and data management of SMS in place. The challenges highlight that regulatory compliance and the presence of digital technologies are not enough to ensure better aviation safety performance.

The aviation industry in Uganda is still evolving and aviation safety continues to be a key regulatory and operational concern. The Uganda Civil Aviation Authority (UCAA, 2020) gives the regulatory framework for safety management under the Civil Aviation (Safety Management) Regulations, 2020 that contain the requirements of ICAO Annex 19. Additionally, the Uganda Safety Reporting Portal (USAIR) was introduced by UCAA (2023) to enhance the reporting and management of aviation safety occurrence. But there remains a concern about implementation and use of safety management practices. According to New Vision (2024) the Air Operator Certificate was suspended due to safety data records and reporting. In addition, 41% of the aviation professionals surveyed in the report by Aviation Safety Journal (2023) said they had not been formally trained in Digital Safety Management Systems in the last year. These advancements have cast doubts on digital safety reporting, safety risk management and safety data analysis in the context of accident and incident prevention, operational safety efficiency and regulatory compliance. According to Chen & Chen (2012), one of the key elements of a functional aviation safety management is management commitment, safety promotion and effective safety documentation. Likewise, Ioannou et al. (2017) mention that safety management practices are not strong enough, and this could be a challenge in establishing meaningful safety performance indicators. So, the Ugandan aviation context demands empirical studies to determine if the implementation and application of digital safety management technologies leads to better safety results.

Aviation organizations can use digital Safety Management Systems as an important technological tool to enhance safety performance. Digital safety reporting and communication enables timely recording, communication and monitoring of hazards and safety occurrences, and digital safety risk management enhances systematic risk identification, assessment and mitigation. Digital safety data analysis systems also allow organizations to spot new safety trends, monitor operational risks, and make informed safety decisions. Confidential hazard reporting systems and systematic safety risk management processes are critical components to effective safety management practices and organizational safety culture, according to Robertson (2016). Chen and Chen (2012) also prove that documentation, safety promotion and training and executive management commitment are among the key aspects of good safety management system in the airline industry. The networking of these systems can help to enhance the ability of an organization to prevent accidents and incidents, to meet safety requirements and to make the operation more reliable. The success of DSMS, however, is not only dependent on the availability of the technology, but also on the organizational context in which systems are in place and used. Wiegmann et al. (2004) list as important aspects of aviation safety culture organizational commitment, management involvement, and reporting systems and accountability. Likewise, Gibbons et al. (2006) show the value of organizational commitment, management involvement, reporting systems and accountability in evaluating safety culture in commercial flight operations. Safety culture at the organization level, as evidenced by management support, safety communication, and employee participation, could then influence the effectiveness of digital safety technologies in achieving better safety results (Fernández-Muñiz et al., 2022; Wu et al., 2024).

While literature acknowledges the role the digital technologies and organizational safety culture play in aviation safety management, there is limited empirical evidence that links various dimensions of DSMS to aviation safety performance in Uganda. Chen and Chen (2012) explored the scope of safety management systems in an airline industry, and Ioannou et al. (2017) reviewed the study on safety management practices that affect the formulation of safety performance indicators among aviation service providers. These studies, however, cannot isolate the impact of the digital safety reporting systems, digital safety risk management systems, and digital safety data analysis systems on aviation safety performance in the aviation sector in Uganda. Moreover, Kimeria et al. (2022) presented that organizational culture has a significant impact on SM systems performance among the service providers in civil aviation in Kenya. Robertson (2018) also found relationships among implementation of safety management systems, safety promotion, and management commitment and safety culture in collegiate flight schools. However, the impact of organizational safety culture on the relationship between individual components of the digital safety management system and aviation safety performance is not fully understood in Uganda. This is because aviation organizations can invest in digital safety technologies without seeing a corresponding improvement in safety results where the management commitment and employee participation and organizational communication are lacking. The study therefore focused on the impact of Digital Safety Management Systems on Aviation Safety Performance in the aviation industry in Uganda with specific emphasis on moderating role that organizational safety culture plays in aviation. The study helps to better understand the impact of digital safety reporting and risk management and data analysis capabilities on aviation safety performance when interacting with aviation organizational practices.

2. Theoretical Background

2.1. High Reliability Organization (HRO) Theory

The High Reliability Organization (HRO) Theory was first developed by researchers who have studied organizations that work in complex, dangerous and unpredictable environments with very low rates of failure. The theory is more specifically linked to Roberts (1989) work on HROs, and the later work of Weick, Sutcliffe and Obstfeld (1999) who introduced the elements of high reliability as collective mindfulness. Weick and Sutcliffe (2001) extended the theory, by defining the organizational practices that facilitate organizations in predicting, noticing, and controlling unforeseen events before they turn into a major failure. While its core contributions predate 2020, current uses focus on conditions that are necessary to attain high reliability: organizational mindfulness, continuous learning, and operational preparedness and proactive risk management.

The premise behind HRO Theory is that organizations in high-risk environments can become successful in their overall performance if they create organizational capabilities that will help them detect potential threats, respond to operational challenges and reduce the risk of catastrophic failure. The theory outlines five basic principles: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise. These principles focus on ongoing recognition of safety hazard, thorough analysis of operational data, understanding of new risks, and contingency recovery and utilization of technical expertise for key safety decisions. In the modern context of safety management, these principles offer a valuable foundation for the understanding of how these processes are essential to

improving the safety performance of an organization, namely by systematic monitoring, sharing of information, organization learning and coordinated decision-making.

The relevance of HRO Theory to aviation safety is most clearly demonstrated when aviation organizations are dealing with complex technologies, interdependent operational processes, human factors and potentially serious consequences of failure. For aviation safety, though, adherence to the procedures is not enough, it's an ongoing challenge of recognizing and tackling fresh threats to safety in organizations. In a systematic literature review, Cantu et al. (2020) concluded that a culture of reliability is essential to maintaining and upholding the five HRO principles. Likewise, Cantu et al. (2020) noted that organizations that aim to achieve high reliability are increasingly implementing organizational interventions such as process redesign, staff training and organizational restructuring to improve the reliability of their operations. These views illustrate that aviation organizations need to embrace a safety culture and not rely solely on individual reactions to accidents and incidents.

In this study, Digital Safety Management Systems (DSMS) inform the relationship between safety management systems and aviation safety performance in the aviation sector in Uganda, explaining how aviation safety can be enhanced by the use of digital technologies to strengthen aviation safety vigilance, risk identification and operational reliability. In particular, the theory offers a framework that can be used to better understand the role of digital safety reporting systems in aviation safety performance. The principle of preoccupation with failure is that organizations need to constantly seek to discover possible hazards, near misses and safety deficiencies before they escalate into a serious incident. Digital safety reporting systems simplify this by allowing aviation users to electronically document, communicate and track safety events. This, in turn, enhances hazard identification and incident reporting and facilitates preventive interventions. This relationship aligns with HRO principles, which have a focus on learning from failure and near-miss incidents as means of ensuring no disruption occurs in the next incident (Cantu et al., 2020; Dwyer et al., 2023).

The theory also contributes to the understanding of digital safety risk management systems' role in aviation safety performance. The reluctance to simplify interpretations indicates that aviation safety threats can be complex and many are difficult to be captured by simple explanations. Digital safety risk management systems assist in conducting a full hazard assessment, hazard classification, potential consequence analysis and safety risk mitigation. Moreover, the principle of "sensitivity to operations" cautions against being constantly vigilant of the operational conditions and potential safety issues that are encountered. Aviation organizations can leverage digital risk monitoring and documentation to better identify operational weaknesses and be able to make timely decisions to ensure safety. In support of this theoretical explanation, Dwyer et al. (2023) highlight the need for the application of HRO principles in organizations who are working in complex and high-risk scenarios.

Furthermore, HRO Theory describes the importance of digital safety data analysis systems to help enhance aviation safety performance. Commitment to resilience defines the ability of organizations to learn from an operational disruption, adjust and rebuild from an unexpected event. Digital safety data analysis systems let aviation organizations bring together safety data, find trends in incidents, track safety patterns and get evidence for corrective and preventative measures. These services improve organizations learning, and help to achieve ongoing accident and incident prevention, regulatory compliance and operational safety efficiency. Cantu et al. (2020) and Dwyer et al. (2023) corroborate the significance of organizational learning, information systems and continuous improvement in implementing high reliability practices.

The theory also serves to support the theoretical argument to include organizational culture as a moderating variable in the relationship between DSMS and aviation safety performance. HRO Theory considers that technology alone cannot ensure reliability of operation without an organizational culture that values safety, open communication, employee involvement and management commitment to safety. Cantu et al. (2020) describe a new approach, a culture of reliability, as a key foundation that supports the five principles of HRO and allows for collective mindfulness. Likewise, Sutcliffe (2023) highlights the role of organizational culture in enabling adaptive learning, as well as in establishing reliable organizational performance. Hence, the aim of this study is to find whether an organization culture will improve or hinder the effectiveness of digital safety reporting, digital safety risk management and digital safety data analysis systems in enhancing aviation safety performance.

Moreover, the principle of deference to expertise also reinforces the significance of including personnel who possess expertise in the technical and safety management aspects of the digital safety information in the interpretation of the information and in decision making for operations. This is especially critical in Uganda's aviation industry where safety management and operations and quality assurance departments must work together to make the best use of DSMS. In the case of implementing HRO principles, it is necessary to have organizational practices that support effective coordination, learning and responses to operational risks, as shown by Dwyer et al., (2023). In this way, the theory can be used to explain the relationship between organizational communication and the translation of the digital safety information into practical safety improvements, as well as the relationship between safety culture and organizational commitment and the translation of the translated information.

To summarize, the theory of HRO suits this study as it can account for how aviation organizations can strive to increase their safety performance by continually identifying hazards, systematically assessing risks, using data for decisions, learning from incidents and a positive safety culture. It offers the theoretical basis for studying the impact of digital safety reporting systems, digital safety risk management systems, and digital safety data analysis systems on aviation safety performance and to elucidate the moderating effect of organizational culture. The theory thus guided the conceptual proposition in the study that effective integration of digital safety management technologies with effective organizational safety culture can promote accident and incident prevention, regulatory compliance and operational safety efficiency in the aviation industry in Uganda.

3. Empirical Review

Ombasa and Ngugi (2014) performed a study in Kenya on the impact of reporting safety concerns on aviation safety in the general aviation industry: A case study of Wilson Airport Kenya. The research explored how well the systems were implemented and the level of commitment to reporting aviation safety concerns within the study's organizations to determine the impact of safety occurrence reporting systems on aviation safety. The study was designed as a case study with 39 respondents from the general aviation industry at Wilson Airport. Results demonstrated that a safety occurrence reporting process was significant in aviation safety and was an effective method of identifying potential hazards in aviation. The study validated the effectiveness that safety concerns can be reported to assist the identification and management of operational risks, ultimately leading to improved performance in aviation safety. The study, however, only focused on Wilson Airport and was not specifically based on digital safety reporting technologies and how they contribute to aviation safety performance.

Jausan, Silva and Sabatini (2017) carried out a study in a military aviation organization which they called A Holistic Approach to Evaluating the Effect of Safety Barriers on the Performance of Safety Reporting Systems in Aviation Organizations. The study focused on the barriers that affect the performance of aviation safety reporting systems at organizational, workplace and individual level. The study employed quantitative research method and questionnaire data was gathered from the employees of a military aviation organization. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to analyses the collected data in order to determine the direct and indirect effect of various reporting barriers. The results showed that the barriers for safety reporting system performance were related to organizational, working environment and individual barriers, and that the lowest barrier was lack of organizational commitment. The study confirmed that there are organisational forces to be overcome and commitment to make safety reporting systems more effective. These results show that effective reporting systems mean reliable safety-related information is available and can help improve aviation safety management and risk assessment.

Lyle and Siao (2021) performed a study in the United States called Analysis of the Differences in Perceptions of Safety Reporting Systems between Collegiate Aviation Students and Airline Pilots. This study investigated the perception and use of safety reporting systems among a group of university aviation students and a group of pilots from a major airline. The researchers' research design was cross sectional survey research design done on airline pilots and college students in aviation. Questionnaires were used to gather data and analyzed statistically to determine the differences in the safety reporting behavior and perceptions of the reporting system. The results indicated that the airline pilots reported more safety incidents than the college aviation students, while both groups reported the same number of safety incidents. The study also confirmed that concerns about confidentiality were a factor in determining the willingness of aviation students to report safety incidents. The results showed that the success of aviation safety reporting systems relies on accessibility and confidentiality, and on aviation personnel's willingness to report safety issues. This means that reporting systems that are effective help to identify safety hazards and aid organisational action to prevent aviation incidents.

Siebericchs and Kluge (2021) studied the feasibility of the optimal usage of flight data monitoring and incident reporting in an airline in Sweden. This study examined the relationship between flight data monitoring systems and incident reporting systems and how they can be integrated to enhance proactive flight safety management. The researchers used a qualitative case-study method by analysing available information technology systems and interviews with managers in critical operational and safety management roles of an airline with about 1100 employees. The study has focused on the use of flight data monitoring information and incident reporting records for the detection of operational risks and benefits for the safety management. The results showed that too much data, arbitrary monitoring limits, a lack of integration between information sources, and rigid incident reporting interfaces limited the ability to use safety information effectively. The study also determined that poor reporting practices and ambiguous responsibilities contributed to a decrease in reported incidents. The researchers found that the use of flight data monitoring in conjunction with incident reporting systems could enhance the ability to identify unsafe operational patterns, support organisational learning and bolster flight safety. The results illustrate the value of digital safety reporting systems for the safe and timely identification of hazards, evidence-based decision making and aviation safety performance.

The Dynamics between Voluntary Safety Reporting and Commercial Aviation Accidents was the subject of a study by Gao, Hao, Wang and Wu in the United States (2021). The research investigated the link between voluntary aviation safety reporting and the rates of commercial aviation accidents for Part 121 air carriers. This study used a quantitative longitudinal design with historical time-series data from the Aviation Safety Reporting System (ASRS) regarding aviation safety reports, accidents and flight traffic volumes. The relationships among safety reporting and aviation accidents in the short and long term were examined through the use of bounds testing for the ARDL model and modelling in VAR. The results showed a statistically significant relationship between aviation accidents and subsequent voluntary safety reporting over time, and revealed that aviation accidents are Granger-cause of subsequent safety reports. Safety reporting was determined to be the highest during the fourth and fifth quarters after aviation accidents. The study highlighted the need to systematically gather, analyses and use aviation safety reports to gain insight into new operational threats and to aid in evidence-based safety management decision Making.

H1: Digital safety reporting systems has significant effect on aviation safety performance in Uganda's aviation sector.

4. Research Methodology

An explanatory research design was adopted to examine the relationships between Digital Safety Management Systems (DSMS) and aviation safety performance in Uganda's aviation sector, with organisational culture as a moderating variable. A quantitative approach was used to measure variables and analyze relationships. The unit of observation comprised personnel working in the Safety Management, Operations and Quality Assurance offices, while the unit of analysis was the aviation organizations operating in Uganda.

The target population consisted of 414 personnel drawn from 46 aviation organizations in Uganda. The respondents were selected from the three functional offices because of their involvement in implementing, monitoring and evaluating safety management systems. Yamane's (1967) formula was used to determine the sample size at a 5% margin of error, yielding 204 respondents. Proportionate stratified random sampling was adopted to ensure representation of the three functional offices. The population was divided into strata according to office, and the sample for each stratum was determined proportionately using the formula $n_h = (N_h/N) \times n$. Simple random sampling was then used to select respondents within each stratum.

Data were collected using a structured questionnaire with a five-point Likert scale. The questionnaire measured DSMS through digital safety reporting systems, digital safety risk management systems and digital safety data analysis systems; aviation safety performance through accident and incident prevention, regulatory compliance and safety standards, and operational safety efficiency; and organisational culture through safety culture, organisational communication and management commitment to safety. A pilot study was conducted in Entebbe Municipality, Wakiso District, involving 21 respondents, representing approximately 10% of the sample. The pilot assessed the clarity, relevance, validity and reliability of the questionnaire, and the feedback informed revisions before the main data collection. Content validity was assessed through expert review of the questionnaire, while construct validity was examined using principal component analysis and the Kaiser–Meyer–Olkin (KMO) measure. A KMO value above 0.60 was considered acceptable. Reliability was assessed using Cronbach's alpha coefficient, with a minimum acceptable value of 0.70 indicating internal consistency.

Measurement of Variables

Table 1: Measurement of Variables

Variable	Type	Main Dimensions	Measurement	Sources
Aviation safety performance	Dependent Variable	Accident and Incident Prevention Regulatory Compliance and Safety Standards Operational Safety Efficiency	5-pointLikert scale items	International Civil Aviation Organization (ICAO, 2018); Kenya Civil Aviation Authority (KCAA, 2023); Aviation safety performance measurement literature (2017).
Digital safety reporting systems	Independent Variable	Digital safety reporting systems	5-point Likert scale items	International Civil Aviation Organization (ICAO, 2018); International Civil Aviation Organization (ICAO, 2021); Kenya Civil Aviation Authority (KCAA, 2023).

Source: Author, 2026

Data Analysis and Model Specification

The study employed quantitative data analysis techniques involving both descriptive and inferential statistics, using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including means, standard deviations, percentages, minimum and maximum values, were used to summarize respondents' demographic characteristics and the study variables. Inferential statistics were also applied to establish the relationships between the study variables through correlation and regression analyses. Specifically, hierarchical multiple regression analysis was conducted to examine the effects of the independent variables on business strategy and test the formulated hypotheses. The following regression models were specified:

Model1: Testing the effect of the control variables on aviation safety performance

$$Y= \beta 0 +C \ldots\ldots\ldots 1$$

Model 2: Testing the effect of the independent variables on aviation safety performance

$$Y= \beta 0 +C+ \beta 1 X1 + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Y: aviation safety performance

X1: Digital safety reporting systems

5. Findings

A total of 204 questionnaires were distributed to selected respondents in Uganda's Aviation Sector. Of these, 197 questionnaires were successfully returned, representing a response rate of 96.57%. After data cleaning and screening for completeness, consistency, and accuracy, 180 questionnaires were found suitable for analysis. The usable questionnaires therefore represented 91.37% of the questionnaires returned and 88.24% of those distributed. The achieved response rate was considered adequate for statistical analysis, as a response rate exceeding 70% is generally satisfactory for survey research (Mugenda & Mugenda, 2019). The resulting dataset provided sufficient information to examine the effect of to examine the effect of digital safety reporting systems on aviation safety performance in Uganda's aviation sector.

Table 2: Response Rate

Distributed Questionnaires	Received Questionnaire	Usable Questionnaires	Response Rate
204	197	180	88.24%

Source: Primary Data (2026)

Descriptive Statistics for Aviation Safety Operations

The descriptive statistics for aviation safety performance were analyzed using 15 measurement items grouped into three dimensions: accident and incident prevention, regulatory compliance and safety standards, and operational safety efficiency. The analysis involved 180 respondents and examined the minimum, maximum, mean and standard deviation for each measurement item. The study employed a five-point Likert scale, where 1 represented strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree. The mean scores were used to establish the respondents' overall perceptions of aviation safety performance, while the standard deviations indicated the extent of variation in their responses.

For AI1, which examined whether the organization consistently implements preventive safety measures to minimize the occurrence of aviation accidents, incidents and other safety-related events during daily operations, the results indicated a mean of 2.99 and a standard deviation of 0.927. The mean score, which was approximately 3.00, suggests that respondents generally held a neutral position regarding the consistent implementation of preventive safety measures in their organizations. This implies that the implementation of accident and incident prevention measures may not be sufficiently established or consistently experienced across the organizations represented in the study. The standard deviation of 0.927 indicates a moderate variation in responses, suggesting that respondents had relatively different experiences regarding the effectiveness of preventive safety measures.

For AI2, which assessed whether employees are regularly trained on aviation safety procedures and risk prevention practices to enhance their ability to identify and address potential hazards before they result in accidents or incidents, the findings revealed a mean of 2.98 and a standard deviation of 0.921. The mean score indicates that respondents were generally neutral regarding the adequacy and consistency of employee training on aviation safety procedures. This suggests that regular safety training and risk prevention programs may not be sufficiently implemented or consistently accessible to all employees. The standard deviation of 0.921 demonstrates a moderate dispersion of responses, indicating some differences in respondents' experiences concerning the availability and effectiveness of aviation safety training.

For AI3, which examined whether the organization conducts regular safety inspections and risk assessments to identify operational weaknesses that could contribute to aviation accidents and incidents, the findings revealed a mean of 3.01 and a standard deviation of 0.931. The mean indicates a generally neutral perception among respondents regarding the regularity and effectiveness of safety inspections and risk assessments. This suggests that although safety inspections and risk assessments may be undertaken, their consistency and effectiveness in identifying operational weaknesses may require further improvement. The standard deviation of 0.931 indicates moderate variability in responses, implying that respondents did not have entirely similar experiences regarding the implementation of safety inspections and risk assessments.

For AI4, which assessed whether the organization effectively uses safety reports, incident records and operational data to identify recurring safety risks and develop

appropriate preventive interventions, the results indicated a mean of 2.99 and a standard deviation of 0.942. The mean score suggests that respondents generally maintained a neutral position regarding the effective utilization of safety information and operational data for accident and incident prevention. This implies that the application of safety reporting systems and incident records in identifying recurring risks and developing preventive interventions may not be sufficiently effective. The standard deviation of 0.942 indicates moderate variation in responses, suggesting differences in respondents' perceptions concerning the organization's ability to utilize safety information for proactive risk management.

For AI5, which examined whether management ensures that corrective and preventive actions arising from previous accidents, incidents and safety investigations are implemented promptly to prevent similar occurrences, the findings revealed a mean of 2.99 and a standard deviation of 0.960. The mean score indicates that respondents were generally neutral regarding management's commitment to implementing corrective and preventive actions. This suggests that the translation of safety investigation findings into timely corrective interventions may require strengthening to ensure that previously identified safety weaknesses do not recur. The standard deviation of 0.960 represents moderate variation in responses, indicating differences in respondents' experiences concerning management's implementation of corrective and preventive safety measures.

For RC1, which examined whether the organization consistently complies with applicable national and international aviation safety regulations, policies and operational standards in the execution of its activities, the results indicated a mean of 3.04 and a standard deviation of 0.938. The mean score suggests that respondents had a generally neutral perception, although slightly inclined towards agreement, regarding organizational compliance with aviation safety regulations and operational standards. This implies that regulatory compliance practices may be present within the organizations but may not be consistently demonstrated across all operational activities. The standard deviation of 0.938 indicates moderate variation in responses, suggesting differences in respondents' perceptions of the extent to which their organizations adhere to established aviation safety requirements.

For RC2, which assessed whether employees are regularly informed about changes in aviation safety regulations and receive appropriate guidance on implementing the required safety standards, the findings revealed a mean of 2.96 and a standard deviation of 0.942. The mean score indicates that respondents generally maintained a neutral position regarding the communication of regulatory changes and provision of implementation guidance. This suggests that organizations may need to strengthen internal communication mechanisms and employee awareness programs to ensure that changes in aviation safety regulations are effectively communicated and understood. The standard deviation of 0.942 demonstrates moderate variation in responses, implying that employees may experience different levels of access to regulatory information and implementation guidance.

For RC3, which examined whether the organization conducts regular internal safety audits and compliance assessments to identify and address deviations from established aviation safety requirements, the results indicated a mean of 3.04 and a standard deviation of 0.912. The mean score suggests that respondents generally held a neutral perception, with a slight inclination towards agreement, regarding the implementation of internal safety audits and compliance assessments. This implies that although internal audits and compliance assessments may be undertaken, their consistency and effectiveness in identifying and addressing regulatory deviations may require

improvement. The standard deviation of 0.912 indicates moderate dispersion in responses, suggesting some differences in respondents' experiences regarding the implementation of internal safety audits.

For RC4, which assessed whether management ensures that adequate resources, procedures and institutional support are provided to facilitate compliance with aviation safety regulations and industry standards, the findings revealed a mean of 2.98 and a standard deviation of 0.948. The mean indicates that respondents generally held a neutral perception regarding the adequacy of management support and resource allocation for regulatory compliance. This suggests that organizations may need to strengthen the provision of financial, human, technological and institutional resources necessary for effective implementation of aviation safety requirements. The standard deviation of 0.948 indicates moderate variability in responses, suggesting differences in respondents' experiences concerning the level of management support available for regulatory compliance.

For RC5, which examined whether the organization consistently implements recommendations arising from regulatory inspections, safety audits and compliance assessments to strengthen adherence to aviation safety standards, the results indicated a mean of 2.99 and a standard deviation of 0.918. The mean score suggests that respondents were generally neutral regarding the consistent implementation of recommendations arising from regulatory inspections and safety audits. This implies that organizations may need to strengthen follow-up mechanisms to ensure that recommendations from compliance assessments are translated into practical corrective actions. The standard deviation of 0.918 indicates moderate variation in responses, suggesting that respondents had differing experiences concerning the implementation of regulatory and audit recommendations.

For OR1, which examined whether the organization effectively coordinates daily aviation operations to minimize operational disruptions, reduce safety-related delays and maintain safe service delivery, the results revealed a mean of 2.99 and a standard deviation of 0.888. The mean score indicates that respondents generally maintained a neutral perception regarding the effectiveness of coordination in daily aviation operations. This suggests that coordination mechanisms may not be sufficiently effective in minimizing operational disruptions and ensuring consistently safe service delivery. The standard deviation of 0.888 indicates moderate variation in responses, suggesting that respondents had relatively different experiences concerning the effectiveness of operational coordination.

For OR2, which assessed whether employees have access to adequate safety information, operational resources and appropriate technological systems to support efficient and safe execution of their assigned responsibilities, the findings revealed a mean of 3.03 and a standard deviation of 0.900. The mean score indicates a generally neutral perception, although slightly inclined towards agreement, regarding employees' access to safety information, operational resources and technological systems. This implies that the availability of the necessary operational support may be moderate but may not be adequate or consistent across all organizational departments. The standard deviation of 0.900 indicates moderate variability in responses, suggesting differences in employees' experiences concerning access to operational resources and technological support.

For OR3, which examined whether the organization consistently monitors operational activities to identify safety inefficiencies and implement timely corrective measures that improve overall operational performance, the results indicated a mean of 2.99 and a standard deviation of 0.937. The mean score suggests that respondents generally held

a neutral perception regarding the effectiveness of operational monitoring and implementation of corrective measures. This implies that organizations may need to strengthen continuous monitoring mechanisms to identify operational safety inefficiencies and address them promptly. The standard deviation of 0.937 indicates moderate variation in responses, suggesting that respondents experienced different levels of effectiveness in operational monitoring and corrective action implementation.
For OR4, which assessed whether communication and coordination among different operational departments are effective in ensuring that aviation safety procedures are implemented efficiently and consistently, the findings revealed a mean of 2.97 and a standard deviation of 0.936. The mean score indicates that respondents generally held a neutral perception regarding interdepartmental communication and coordination in implementing aviation safety procedures. This suggests that communication and coordination mechanisms may require strengthening to promote information sharing, operational consistency and effective implementation of safety procedures across departments. The standard deviation of 0.936 indicates moderate variation in responses, implying that respondents had differing experiences concerning the effectiveness of communication and coordination within their organizations.
For OR5, which examined whether the organization regularly evaluates operational safety performance indicators to identify opportunities for improving efficiency, minimizing operational risks and strengthening aviation safety outcomes, the results indicated a mean of 2.99 and a standard deviation of 0.903. The mean score suggests that respondents generally maintained a neutral position regarding the regular evaluation of operational safety performance indicators. This implies that organizations may need to strengthen performance measurement and evaluation practices to ensure that operational safety information is consistently used to identify inefficiencies, monitor risks and guide continuous improvement initiatives. The standard deviation of 0.903 indicates moderate variation in responses, suggesting differences in respondents' perceptions regarding the use of operational safety performance indicators.
Overall, the findings revealed that aviation safety performance recorded an aggregate mean of 2.9974 and a standard deviation of 0.82293, based on 180 respondents. The aggregate mean of approximately 3.00 indicates that respondents generally held a neutral perception regarding the level of aviation safety performance in their organizations. This suggests that the three dimensions of aviation safety performance, namely accident and incident prevention, regulatory compliance and safety standards, and operational safety efficiency, were not strongly demonstrated from the respondents' perspectives. The standard deviation of 0.82293 indicates a relatively moderate dispersion of responses around the aggregate mean, suggesting that respondents' perceptions were reasonably concentrated, although some differences existed.

Table 3: Descriptive Statistics for Aviation Safety Operations

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
AI1	180	1	5	2.99	.927
AI2	180	1	5	2.98	.921
AI3	180	1	5	3.01	.931
AI4	180	1	5	2.99	.942
AI5	180	1	5	2.99	.960
RC1	180	1	5	3.04	.938
RC2	180	1	5	2.96	.942

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
RC3	180	1	5	3.04	.912
RC4	180	1	5	2.98	.948
RC5	180	1	5	2.99	.918
OR1	180	1	5	2.99	.888
OR2	180	1	5	3.03	.900
OR3	180	1	5	2.99	.937
OR4	180	1	5	2.97	.936
OR5	180	1	5	2.99	.903
ASP	180	1.07	5.00	2.9974	.82293
Valid N (listwise)	180				

NOTE: AI: Accident and Incident Prevention, RC: Regulatory Compliance and Safety Standards OR: Operational Safety Efficiency, ASP: Aviation safety performance.

Descriptive Statistics for Digital Safety Reporting Systems

For DR1, which examined whether the organization has a digital platform for reporting safety hazards and incidents, the mean was 2.99, with a standard deviation of 0.939. This indicates that respondents' average assessment was approximately at the midpoint of the five-point Likert scale. The finding suggests that the availability and implementation of digital platforms for reporting safety hazards and incidents were not strongly acknowledged by employees. The standard deviation indicates moderate variation in responses, suggesting that respondents had somewhat different experiences regarding the availability of digital safety reporting platforms within their organizations. For DR2, which assessed whether the digital reporting system is easy to use, the mean was 3.00, with a standard deviation of 0.928. This suggests a neutral level of agreement regarding the user-friendliness of digital safety reporting systems. The finding implies that although digital reporting platforms may be available, their ease of use is not sufficiently established among employees. The standard deviation demonstrates moderate variation in responses, indicating that employees may have experienced different levels of usability when interacting with the digital reporting systems. For DR3, which examined whether the digital reporting system can be accessed at any time (24/7), the mean was 3.01, with a standard deviation of 0.915. This was slightly higher than the other digital reporting system indicators, suggesting a marginally more favorable assessment of the accessibility of digital reporting platforms. However, the mean remains close to the neutral midpoint, implying that continuous accessibility is not consistently experienced or fully recognized by respondents. The standard deviation indicates moderate variation in responses, suggesting differences in employees' experiences regarding the availability of digital reporting systems when safety incidents occur. For DR4, which assessed whether staff can report safety incidents confidentially or anonymously through the digital system, the mean was 2.99, with a standard deviation of 0.900. This indicates a neutral assessment of the confidentiality and anonymity features of digital reporting platforms. The finding suggests that employees were not particularly convinced that the existing systems adequately protect their identities when reporting safety concerns. The relatively low standard deviation compared with the other indicators suggests that respondents' opinions were relatively consistent. This highlights the importance of strengthening confidentiality safeguards to encourage employees to report hazards and incidents without fear of victimization. For DR5, which examined whether staff receive

timely feedback on reports submitted through the digital system, the mean was 2.99, with a standard deviation of 0.903. This indicates that respondents were generally neutral regarding the effectiveness of feedback mechanisms within digital safety reporting systems. The finding implies that employees may not consistently receive timely communication concerning the actions taken following the submission of safety reports. The standard deviation suggests moderate variation in responses, indicating that experiences with feedback mechanisms differ among employees. This demonstrates the need to strengthen communication and reporting follow-up processes to improve employee confidence in digital safety reporting systems.

Table 4: Descriptive Statistics for Digital Safety Reporting Systems

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
DR1	180	1	5	2.99	.939
DR2	180	1	5	3.00	.928
DR3	180	1	5	3.01	.915
DR4	180	1	5	2.99	.900
DR5	180	1	5	2.99	.903

DR: Digital safety reporting system

Correlation Analysis

Correlation analysis was undertaken and the results show that the Digital Safety Reporting Systems (DRR) was significantly and strongly related to Aviation Safety Performance (ASP) ($r = 0.833$; $p = 0.000$; $N = 180$). This means that greater use and effectiveness of digital safety reporting systems is correlated with better aviation safety performance. The discovery is that early reporting of safety issues, incidents and operational irregularities via digital platforms improves risk identification and safety intervention measures. Likewise, As to the control variables, the organization size (OSS) was not found to be significantly related to ASP ($r = 0.115$, $p = 0.125$). This means that there is no clear link between increasing organisational size and improvements in aviation safety performance. Likewise, years of professional experience (EXX) showed a non-significant and low positive correlation with the aviation safety performance (ASP) ($r = 0.089$, $p = 0.237$), which suggests that experience alone does not necessarily contribute to better aviation safety performance. Furthermore, OSS and EXX were not significantly correlated with DRR ($r = -0.026$, $p = 0.731$) and ($r = 0.026$, $p = 0.732$), respectively. As a whole, the results show that digital safety reporting systems are more associated with aviation safety performance than the control variables.

Table 5: Correlation Analysis

		OSS	EXX	DRR	ASP
OSS	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	180			
EXX	Pearson Correlation	-.088	1		
	Sig. (2-tailed)	.239			
	N	180	180		
DRR	Pearson Correlation	-.026	.026	1	
	Sig. (2-tailed)	.731	.732		
	N	180	180	180	
ASP	Pearson Correlation	.115	.089	.833**	1
	Sig. (2-tailed)	.125	.237	.000	
	N	180	180	180	180

Regression Analysis and Hypothesis Testing

The first regression model was found to jointly explain 2.3% of the variability in aviation safety performance (ASP) with an R-square of 0.023 and an adjusted R-square of 0.012, when explaining the variability of the control variables: organisational size (OSS) and experience (EXX). However, the model was not statistically significant (F = 2.081, p = 0.128) suggesting that size and experience of the organization alone were not significant in explaining the variance in aviation safety performance. The relationships between aviation safety performance and organisational size and experience were positive but not statistically significant at 0.123 (p = 0.100) and 0.099 (p = 0.184) respectively. Model 2: additional of independent variable. The model summary had a correlation coefficient (R) of 0.851, an R square of 0.724 and an adjusted R square of 0.716. The R-square value indicates that organizational size, experience, digital safety reporting systems, explained 72.4% of the variation in aviation safety performance. The adjusted R-square value of 0.716 means that the model accounts for about 71.6% of the variance after taking into account the number of explanatory variables and the sample size. This is a significant improvement over the first model which accounted for just 2.3% of the variation in aviation safety performance. The improvement of the model indicated that the model's explanatory power was significantly increased by the addition of digital safety management. The ANOVA results also showed that the second regression model was statistically significant with an F-statistic of 91.284, the degrees of freedom equal to 5 and 174 and the significance (p) value equal to 0.000.

Table 6: Summary of Model Results

Regression model	R^2	Adjusted R^2	F-statistic	Significance
Model 1: Control variables	0.023	0.012	2.081	0.128
Model 2: Control and digital systems	0.724	0.716	91.284	0.000

6. Discussion of Findings

The findings revealed Digital Safety Reporting Systems (DRR) is positively related to Aviation Safety Performance (ASP) in aviation sector in Uganda with a strong relationship and is statistically significant (r = 0.833, p = 0.000). This implies that better

digital safety reporting systems are associated with better safety performance in aviation organizations, both in identifying, documenting and communicating safety hazards, incidents and operational irregularities. Moreover, the hierarchical regression results showed the significance of the digital safety reporting systems in the aviation safety performance explanation. Organization size and professional experience explained only 2.3% of the variation in aviation safety performance ($R^2 = 0.023$), with digital safety reporting systems (DSPs) adding to the explanatory power of the model to 72.4% ($R^2 = 0.724$; adjusted $R^2 = 0.716$). The second model was statistically significant ($F = 91.284$, $p = 0.000$) showing that the addition of digital safety reporting systems significantly increased the power of the model. In contrast, there were no significant relationships found between aviation safety performance and organisational size ($r = 0.115$, $p = 0.125$), or professional experience ($r = 0.089$, $p = 0.237$). The results indicate that in addition to organisational size and staff experience, technological capabilities and systematic management of safety information is a key factor in enhancing aviation safety performance.

7. Conclusion

The study concludes that Digital Safety Reporting Systems play an important role in enhancing aviation safety performance in Uganda's aviation sector. Highly positive correlation between the digital safety reporting system and aviation safety performance ($r = 0.833$, $p = 0.000$) indicates that there is a strong connection between effective digital reporting systems and safety outcomes in aviation. Also, the hierarchical regression results showed that the inclusion of the digital safety reporting systems significantly increased the explanatory power of the regression model from 2.3% to 72.4%. The statistically significant second model ($F = 91.284$, $p = 0.000$) offers additional support for the importance of computer-based safety reporting systems in accounting for differences in aviation safety performance. The results also showed that organisational size and professional experience alone were not enough to explain the results as control variables. This means that the aviation safety performance should not be measured based on organisational characteristics and accumulated experience of employees but also on the effectiveness of established institutionalized digital safety reporting mechanisms. As such, Ugandan aviation operators should increase the use, availability, and appropriate use of digital reporting systems to help facilitate prompt identification of hazards, communication, security surveillance, and implementation of action. The study shows the need for embedding digital safety reporting in the safety management processes of organizations, and embedding it in these processes to ensure continual improvement in aviation safety performance.

8. Recommendations of the Study

8.1. Managerial Recommendations

On the basis of the results, aviation organization managers in Uganda should give special attention to the implementation and continuous improvement of Digital Safety Reporting Systems as a part of aviation organization safety management system. The positive correlation between digital safety reporting systems and aviation safety performance ($r = 0.833$, $p = 0.000$) suggests the need for effective digital reporting systems to facilitate better safety outcomes. It is important, therefore, that managers invest in a secure reporting system that allows employees to report hazards, incidents, near misses and irregularities of operations quickly and easily. Aviation organizations also need to have clear internal processes for receiving, analyzing, investigating and reacting to safety reports that ensure that reported information is delivered into appropriate corrective and preventative actions. Management should also enable a

culture where employees can report a safety issue without fear of victimization or unnecessary disciplinary action. Employees' training should be provided routinely to build competency in digital reporting and to enhance awareness of safety reporting procedures. Otherwise, managers should set up metrics for monitoring reporting frequency, response time, corrective action completion and reoccurring safety incidents. For managers, having a smaller or larger organization or more experienced employees does not itself guarantee better aviation safety outcomes, therefore they should not focus on the size of the organization and length of professional experience but instead on the effectiveness of the aviation safety management. Such interventions will enhance the accountability of organizations and the continuous effort to improve safety.

8.2. **Policy Makers' Implications**

The results are significant for aviation policy makers and regulatory authorities like Uganda Civil Aviation Authority (UCAA) in improving the regulation of digital safety management in the aviation industry in Uganda. The high positive correlation coefficient of Digital Safety Reporting Systems and Aviation Safety Performance ($r = 0.833$, $p = 0.000$) and the significant increase in the explanatory power of the regression model from 2.3% to 72.4% indicate the significance of digital reporting systems in aviation safety management. Accordingly, there is a need for policy makers to reinforce the regulatory requirements for aviation organisations to create functional, accessible and secure digital reporting systems for safety. The UCAA should establish consistent policies and procedures for electronic safety reporting, incident documentation, information sharing, data protection and timely corrective action. Moreover, periodic inspections and compliance evaluation by the regulatory authorities on the use of digital reporting information in aviation organisations for hazard identification and operational risk management should be conducted to determine the effectiveness of such use. Policymakers also need to foster investments in digital infrastructure and capacity-building programs, especially for smaller aviation organizations, where financial and technical challenges could hinder the use of more sophisticated reporting technologies. Furthermore, there should be provisions in the regulation to encourage reporting of safety information that are confidential and non-punitive. These would enhance regulatory authority, institutional accountability and evidence-based aviation safety interventions in the aviation sector in Uganda.

8.3. **Theoretical Recommendations**

The results offer theoretical underpinning for the use of High Reliability Organisation (HRO) Theory to explain aviation safety performance. The strengths of organisations in high-risk environments that can perform reliably in the face of potential failures and risk, through paying attention to potential failures, being operationally aware, learning and managing unexpected events are the focus of HRO Theory. The strong positive correlation between Digital Safety Reporting Systems and Aviation Safety Performance ($r = 0.833$, $p = 0.000$) confirms the relevance of this theoretical approach as it shows that systematic collection and communication of safety information are crucial in aviation operations. In addition, the regression model had an explanatory power of 2.3% before the addition of the digital safety reporting systems and 72.4% afterwards, which indicates that the introduction of digital safety reporting systems brings a valuable organisational skill, supporting decision making about safety. Accordingly, the study suggests the potential for the application of HRO Theory to be extended to include digital safety reporting as a significant method to operationalize high reliability practices in today's aviation organisations. Digital hazard reporting,

rapid communication of hazards, learning from organisations and continuous feedback should be a particular focus of the theory, as these are tools that can enhance reliability. Theoretical applications in the future should also include the importance of the relationship between digital safety reporting and aviation safety performance in relation to the cultural and management commitment of the organization. This would give a wider theory-based understanding of how the technological systems and organizational practices work together to ensure reliable aviation operations.

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