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An assessment of aviation safety practices among Nigerian CNS/ATM aviation professionals

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Abstract
Issues revolving around aviation safety practices have been gaining traction in recent times. The literature, however, reveals a dearth of research that targets safety practices in the communication, navigation, surveillance/air traffic management working environments. The present study deployed the descriptive survey research design in assessing safety practices among air traffic safety electronics personnel (ATSEP) with a particular focus on an exploration of the relationships between different dimensions of aviation safety practices and key workplace attributes. Two hundred ATSEP participated. Data sources included an Aviation Safety Practices Questionnaire (ASPQ) and an ATSEP Safety Implementation Checklist (ASIC) designed by the researcher. Data were analysed using descriptive statistics, multinomial logistic regression and ANOVA. The study found that while there were positive safety performances in relation to compliance with specific elements of procedural safety practices, there were large-scale shortcomings regarding the implementation of critical aspects of operational/organizational and occupational safety practices. The results also revealed a characteristic homogeneity of the non-significance of the effects of workplace safety practices across workplace hierarchy categories, which suggested the irrelevance of organizational cadres to the implementation of workplace safety practices. In relation to workplace safety practices and workplace hierarchy, though, the study failed to reveal any significant difference in mean workplace safety practices. The results revealed clear safety practices gaps. It was recommended that a practice-based approach to safety should be adopted in the aviation workplaces.

Keywords: Aviation safety practices, ATSEP, operational safety, occupational safety, procedural safety.

1. Introduction

Safety is one of the greatest concerns in the conduct of any industrial activity. Although safety is affected by a wide variety of factors, including environmental, technical, economical, and operational variables (Bala et al., 2013), the construct of safety is difficult to measure, quantify, verify and validate in the field (Georgiev, 2021). This characteristic presupposes that the operationalization of safety within the context of organizational fabrics requires concerted efforts in terms of the cultivation of safety thinking. Safety has been defined as the condition where risks are managed to acceptable levels (Fisher, 2006). Pettersen and Aase (2008) define safety as a collective competence that is learned and maintained in the working environments. Safety has remained the prime reflection as far as the conduct of all aviation activities is concerned (Bala et al, 2013). It is also an essential element for the existence of civil aviation (Mwikya & Mulwa, 2018) especially given the fact that aviation safety is closely

linked to security, efficiency, regularity and environmental sustainability (Osunwusi, 2020a).

Aviation safety is very diverse in terms of its conceptualization and characterization. It is dependent not only on advanced technology or stringent regulations but also on the decisions made by humans (Bhattarai et al, 2022). It is essentially a paradigmatic and multi-dimensional phenomenon that is dependent upon operational, technical, and regulatory exigencies (Osunwusi, 2020a). From a technical point of view, it also goes beyond accident prevention and extends to the political, strategic, and legal realms, including preventive, remedial, and punitive measures (Huang, 2009). This, perhaps, is why Costella et al. (2020) argued that safety interferes with the managerial and operational activities based on the fact that it often becomes necessary to know the risks and conditions associated with the performance of the activities.

From an etymological perspective, the concept of aviation safety is rooted in the Convention on International Civil Aviation (otherwise referred to as the Chicago Convention, 1944) and its Annexes, each of which specifies standards and recommended practices to regulate specific aspects of civil aviation operations on an international scale. The authentic 96 Articles of the Chicago Convention also reflect the elements that are germane to fostering the safety and sustainability of international civil aviation operations. It is this inherent nature of the aviation industry that explains the industry's rigid focus on what Bhattarai et al. (2022) described as an enforcement of high safety standards in order to reduce safety-related occurrences.

Safety practices in aviation emphasize the ability and the capability of both employees and employers within the workplace to develop and implement processes, procedures, and practices that are designed to ensure that aviation activities are carried out in a safe, secure, efficient, and environmentally sustainable manner. Aside from integrating regulatory interventions and the promotion of safety culture and safety training, safety practices deal with critical human factors variables and occupational health issues such as the safety, welfare, health and wellbeing of workers in the workplace as well as issues revolving around physical/mental stress, shifts, schedules and rest cycles. Thus, the use of appropriate toolsets for the performance of specific tasks, the observance of precautionary measures, the use of appropriate personal protective equipment (PPE), a critical appraisal of all the conditions surrounding maintenance and system deployment operations, and adherence to approved checklists and troubleshooting tools are all within the remit of safety practices.

Safety practices are also an integral element of the safety management system paradigm, which was internationalized with the adoption, on February 2013, of Annex 19 (Safety Management) with an applicability date of November 2013 following the publication of Doc 9859 (*Safety Management*) in 2006. Safety Management System (SMS) "is the overall set of procedures, documentation, and knowledge systems as well as the processes using them, which are employed within an organization to control and improve its safety performance." (Stroeve et al., 2022, p. 1). The primary purpose of SMS is the transformation of aviation safety management from a solely regulatory prerogative to an industry-based and an organization-wide best practice. It is also primarily about ensuring the management and regulation of safety (Keselova et al., 2021). It is essentially a product of safety thinking.

Aviation professionals require not only an understanding of the safety risks in their daily environments but also the ability to seek solutions to sustain aviation safety (Civil Aviation Authority of Singapore, 2024). The fact that all professionals in the aviation industry are essentially aviation safety professionals underscores the need for aviation professionals to imbibe the spirit of safety management. According to Lu et al. (2006, p. 115), "finding a better way to continuously audit and promote aviation safety is a perpetual duty for all safety enthusiasts."

Air traffic safety electronics personnel (ATSEP), who are involved in the installation, operation, maintenance, and calibration of communication, navigation, surveillance/air traffic management (CNS/ATM) systems, incur no less responsibility when it comes to aviation safety practices. The ATSEP workplace is known to be fraught with operational risks and hazards, including health risks associated with occupational exposures to non-ionizing radiation (Osunwusi, 2020b). The increasing automation of aviation systems (Brown, 2016; Osunwusi, 2019) and the growing automation and digitalization of the ATM sphere (Kistan et al., 2018), which are fast transforming the tasks of ATSEP, are also reinforcing the need for the emplacement of robust safety practices in the CNS/ATM working environment.

Research focusing on safety practices in the ATSEP working environment is sparse. Whereas a large body of research exists in relation to safety procedures and practices in the unmanned aerial systems sector (e.g., Weldon et al., 2021), line maintenance and MRO operations (e.g., McDonald et al, 2000; Pettersen & Aase, 2008; Plioutsias et al, 2020), aerospace sector (e.g., Leong & Clark, 2018; Shafieenejad et al, 2023) and the airline sector (e.g., Lu et al., 2006), the current state of the literature suggests the paucity or a total lack of empirical or iterative investigations into the institutionalization of aviation safety practices in the CNS/ATM working environment. This study, therefore, aimed to fill this research gap by assessing the different dimensions of safety practices in the ATSEP working environment.

In order to fill the observed gap in research, this study was designed with the following objectives: 1) identify the levels of implementation of safety practices across different categories of the ATSEP working environment, 2) determine whether any relationships exist between ATSEP safety practices (operational, occupational, and procedural) and ATSEP workplace attributes (workplace designation and workforce hierarchy), 3) determine whether mean workplace safety practices differ based on ATSEP workplace designation, and 4) determine whether mean workplace safety practices differ based on ATSEP workforce hierarchy.

The following null hypotheses were also tested at 0.05 level of significance:

$H0_1$: There is no statistically significant relationships between ATSEP safety practices and ATSEP workplace attributes.

$H0_2$: There is no statistically significant difference in mean workplace safety practices based on ATSEP workplace designation.

$H0_3$: There is no statistically significant difference in mean workplace safety practices based on ATSEP workforce hierarchy.

2. Conceptual and Research Frameworks

In the characterization of aviation safety practices in the CNS/ATM techno-operational milieu, the author chose rather to contextualize typical ATSEP activities in the context of the scope defined by air navigation service providers (ANSPs) as well as the regulatory frameworks enshrined in ICAO Annex 10 (*Aeronautical Telecommunications*), ICAO Annex 19 (*Safety Management*), and ICAO Doc 10057 (*Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment*). In this context, the ATSEP Safety Practices framework was characterized as: occupational safety practices, operational/organizational safety practices, and procedural safety practices (see Figure 1).

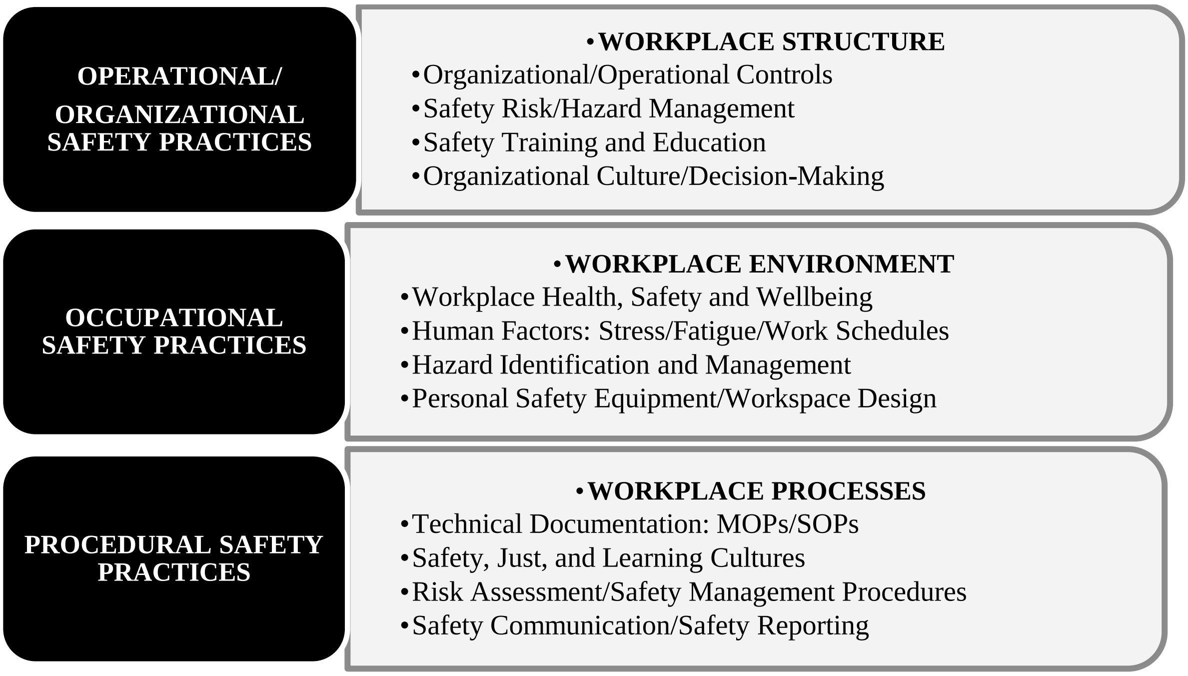

Figure 1: Characterization of Aviation Safety Practices in the ATSEP Working Environment.
Source: The author, (2025).

In the context of the categorization depicted in Figure 1, *Operational cum organizational safety practices* integrate the structures, managerial and organizational processes, controls, and risk management mechanisms established in an organization for the purpose of improving its safety performance. *Occupational safety practices* deal with workplace health, safety and wellbeing as well as the totality of the environmental variables that affect workplace safety, while P*rocedural safety practices* integrate the procedures, strategies, practices and mechanisms for fostering improved safety performance in an organization. Within the framework for the present study, workplace designation and workforce hierarchy were the outcome variables. Workplace designation deals with the categorization of the ATSEP workplace in terms of operational complexity and infrastructure, while workforce hierarchy partitions the ATSEP into unordered hierarchical strata. Organization represents the ATSEP employers in the model.

3. Methodology

3.1 Research Design

This study deployed the descriptive survey research design.

3.2 Sample and Sampling Techniques

Purposive sampling was used to select the subjects ($n = 200$) who were ATSEP engaged with an accredited aviation training organization (ATO) domiciled in a local aerodrome, and ATSEP employed by an air navigation service provider (ANSP) with a presence in over 29 airports, airstrips, aerodromes and remote systems facilities in Nigeria. Recruitment of subjects was facilitated through the National Association of Air Traffic Engineers (NAAE), the professional body of Nigerian ATSEP affiliated to the International Federation of Air Traffic Safety Electronics Associations (IFATSEA). The determination of the sample size was based on the rules of thumb rather than on a sampling frame because of the difficulty in obtaining an accurate sampling frame. However, the sample size ($n = 200$) exceeded the regression analysis sample size proposed in Green's (1991) formula: $104 + k$, where k is the number of independent variables involved. The sample size also exceeded the minimum number of cases required for logistic regression based on the EPV (events per variable) of 10 rules of thumb recommended by Peduzzi et al. (1996) based on the formula: $10k/p$, using $k = 3$ and p (proportion of cases) = 0.20. Based on Ogundimu et al.'s (2016) recommendation of an EPV≥20 for the rule of thumb formula: $n = 100+xi$ (where x = EPV value and i = number of covariates in the model), the adequacy of the study's sample size was also determined based on $EPV \geq 20 \leq 30$.

3.3 Research Instrument

The study deployed two researcher-designed instruments: an Aviation Safety Practices Questionnaire (ASPQ) with statements eliciting self-reported responses regarding operational/organizational, occupational, and procedural safety practices; and an ATSEP Safety Implementation Checklist (ASIC) for measuring the levels of integration of workplace safety practices.

The ASPQ consisted of four sections. The first section targeted personal details such as employer, location of workplace, and position or designation in the organizational hierarchy. Each of sections 2 (Operational/Organizational Safety [OpSaf]), 3 (Occupational Safety [OcSaf]), and 4 (Procedural Safety [PrSaf]) consisted of a six-item Likert-type responses option ranging from Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree, which were graded 5, 4, 3, 2, and 1 respectively. The ASIC was a 15-item checklist with a Yes-or-No response option graded 5 and 1 respectively.

3.4 Validity and Reliability

The instruments were face- and -content validated by two aviation safety specialists. The ASPQ's 2nd, 3rd and 4th sections - initially consisting of 10 items each - were subjected to reliability analysis. After inspecting the Inter-Item Correlation Matrix and the Item-Total Statistics, labels or items whose deletion would improve the value of Cronbach's Alpha were struck out, leaving a total of six items for each of the sections. The reliability coefficient of the final items in the sections were computed and found to be $\alpha = 0.78$, $\alpha = 0.75$, and $\alpha = 0.76$ respectively. The ASIC was pilot-tested on 15 ATSEP based in Lagos using the test-retest method with the test and retest separated by a period of two weeks. An analysis of the test-retest data using the bivariate Pearson Correlation Coefficient analysis yielded a reliability coefficient, $r = 0.949$.

3.5 Data Collection

The online data collection method using a survey hosted on Google® Form was used in this study.

Participants were provided with the link via the national platforms of NAAE. Participants were guaranteed confidentiality and informed that they were at liberty to withhold their consents. The survey was open for two weeks in the first quarter of 2025. After screening the responses of subjects who consented to participating for missing data, a total of 200 responses were utilized for the final analysis.

3.6 Data Analysis

Data collected were collated and analysed using descriptive and inferential statistics. Logit analysis deploying the Multinomial Logistic Regression model was used to test null hypothesis 1, while hypotheses 2 and 3 were analysed using analysis of variance (ANOVA). For the ANOVA analyses, Workplace Safety Practices – integrating the ASIC data - was used as the dependent variable. In the logit analysis of each of the dependent variables (workplace designation and workforce hierarchy), subjects were partitioned into three unordered categories with workforce hierarchy data treated strictly as unordered data. For the purpose of the analyses, organization names and workplace locations were anonymized. The three workplace designation categories were: International (workplaces domiciled in international airports), National (workplaces domiciled in national airports), and Local (workplaces domiciled in airstrips/ local aerodromes and en-route sites). Data were analysed using SPSS Version 25. In the logit analysis, occupational, operational/organizational, and procedural safety practices were used as the covariates or continuous predictor variables, while workplace designation (international = 1, national = 2, local = 3) and workforce hierarchy (junior-cadre = 1, middle-cadre = 2, senior-cadre = 3) were the nominal dependent variables. Organization (coded ANSP = 1, ATO =2) were the factors or nominal predictor variables.

4. Results

4.1 Implementation of Safety Elements in the ATSEP Workplace

Table 1 shows the results of the checklist data relating to the level of implementation of key safety elements within the ATSEP working environment across three categories of the ATSEP workplace. The availability of Manual of Operations (MOP) and Standard Operating Procedures (SOP) documentation and on-site system loggings procedures recorded a 100% “Yes” across workplaces located in international, national, and local airports. The use of personal protective equipment by ATSEP recorded 100% and 98% “No” in international airports and national airports respectively, while a 60% “Yes” response was recorded for local airports. Checklist data on whether management is concerned about issues surrounding the potential radiation exposures of ATSEP recorded overwhelming negative responses with international, national and local airports recording 97%, 98%, and 98% “No” responses respectively.

Table 1: Checklist Data on Implementation of Workplace Safety Environment

ATSEP WORKPLACE SAFETY ELEMENTS	INTERNATIONAL				NATIONAL				LOCAL			
	YES		NO		YES		NO		YES		NO	
	F	%	F	%	F	%	F	%	F	%	F	%
MOPs/SOPs are available in offices and equipment rooms.	62	100	0	0	45	100	0	0	52	100	0	0
Technical documentation in the system areas.	45	73	17	27	35	78	10	22	32	62	20	38
ATSEP are provided with personal protective equipment (PPE).	0	0	62	100	1	2	44	98	31	60	21	40
There is a dedicated maintenance workshop.	8	13	54	87	3	7	42	93	29	56	23	44

Safety signs and symbols are provided in the workplace.	21	34	41	66	30	67	15	33	32	62	20	38
There are dedicated organizational safety cultures and structures.	1	2	61	98	3	7	42	93	33	63	19	37
Workspaces are adequate, secure and well illuminated.	43	69	19	31	36	80	9	20	52	100	0	0
Management is concerned about the radiation exposures of ATSEP.	2	3	60	97	1	2	44	98	1	2	51	98
Tasks are planned prior to any maintenance activity.	20	32	42	68	18	40	27	60	35	67	17	33
Adequate training provided to ensure safe workplace practices.	4	6	58	94	0	0	45	100	12	23	40	77
Provisions are made for system loggings on-site.	62	100	0	0	45	100	0	0	52	100	0	0
Test gears and measurement tools checked and calibrated periodically.	9	15	53	85	3	7	42	93	31	60	21	40
Structures for incidence and safety reporting.	5	8	57	92	2	4	43	96	30	58	22	42
First Aid kits and fire extinguishers.	4	6	58	94	9	20	36	80	26	50	26	50
Spares pool in the station.	1	2	61	98	0	0	45	100	19	37	33	63

4.2 Tests of Hypotheses

Hypothesis 1: There is no statistically significant relationship between ATSEP safety practices and ATSEP workplace attributes. The multinomial logistic regression (MLR) model was used to predict the numerical relationships between the dependent variable and the independent variables.

The dependent variable was workplace attribute (workplace designation, workforce hierarchy) whilst the independent variables were ATSEP workplace safety practices (operational and organizational safety, occupational safety, and procedural safety). Two logit regression analyses were conducted: one, to identify the relationships between workplace designation (international = 1, national = 2, local = 3) and workplace safety practices; and two, to identify the relationships between workforce hierarchy (junior-cadre = 1, middle-cadre =2, senior-cadre = 3) and workplace safety practices. The inclusion of the factor variable (organization) was limited to the second MLR analysis in order to preclude warnings relating to unexpected singularities in the Hessian matrix due to the restriction of the cases in one of the organization categories (ANSP = 1, ATO = 2) to just one workplace designation category.

Prior to performing the MLR analysis, data were analyzed to verify the non-violation of MLR assumptions, including assumptions relating to the exclusivity and independence of the dependent variable. Asymptotic correlation was performed to check for multicollinearity with an inspection of the generated Asymptotic Correlation Matrix showing that all correlations were well under 0.10, thus suggesting that multicollinearity among the explanatory variables in the model was not a problem.

Table 2 shows the results of the two MLR analyses performed. The first analysis showed that Model Fit was significant, χ^2 (6) = 70.146, $\rho<0.001$, Nagelkerke $R^2 = 0.333$, $\rho<0.001$, which suggested a good model fit that explained 33% of the variation in the outcome.

Occupational safety (B = 0.259, Odds Ratio = 1.295, 95% CI [1.058, 1.586]) was a significant predictor with the multinomial odds of exerting significant effect in workplaces in national airports rather those in international airports increasing by 0.137 unit for every one point increase in occupational safety score. Operational/organizational safety (B = 0.244, Odds Ratio = 1.277, 95% CI [1.066, 1.530]) and occupational safety (B = 0.421, Odds Ratio = 1.523, 95% CI [1.240, 1.871]) were also significant predictors with the multinomial odds of exerting significant effect in workplaces in local aerodromes rather than those in international airports increasing by 0.244 and 0.421 units respectively for every one point increases in the variables' scores. All the predictors increased the logit with exponentiated slope coefficients above 1.0, except procedural safety, which exercised no effect (Exp (B) = 1.0). Goodness-of-Fit Test also indicated a good fit, χ^2 (310) = 320.346, ρ>0.05.In relation to the contribution of the interaction effect to the full model, operational/organizational safety (OpSaf), χ^2 (2) = 7.419, ρ = 0.024, and occupational safety (OcSaf), χ^2 (2) = 18.457, ρ<0.001 were significant contributors, while procedural safety (PrSaf), χ^2 (2) = 3.647, ρ = 0.161 was a non-significant contributor. Consequently, the null hypothesis was rejected in relation to OpSaf and OcSaf, and accepted in relation to PrSaf.

Table 2: Multinomial Logistic Regression Parameter Estimates for Workplace Safety Practices.

Effect		**B**	**Wald**	**df**	**ρ**	**Exp(B)**	**Information**
Workplace Designation (WpDes)							
National Airport	Intercept	-11.201	26.540	1	0.0000		
	Operational/ Organizational Safety	0.137	2.210	1	0.137	1.146	Not significant
	Occupational Safety	0.259	6.296	1	0.012	1.295	Significant
	Procedural Safety	0.122	2.398	1	0.122	1.130	Not significant
Local Aerodrome	Intercept	-14.333	40.424	1	0.0000		
	Operational/ Organizational Safety	0.244	7.008	1	0.008	1.277	Significant
	Occupational Safety	0.421	16.087	1	0.0000	1.523	Significant
	Procedural Safety	0.0000	0.0000	1	0.996	1.000	Not significant
Tests		χ^2		**df**	**ρ**		
Likelihood Ratio Test		70.146		6	0.0000	(Significant)	
-2 Log Likelihood of Reduced Model							
Intercept		64.130		2	0.0000		
Operational/Organizational Safety		7.149		2	0.024	(Significant)	
Occupational Safety		18.457		2	0.0000	(Significant)	
Procedural Safety		3.647		2	0.161	(Not significant)	
Notes: The reference category is: international airport; Cox and Snell R2 = 0.296; Nagelkerke R2 = 0.333; McFadden = 0.161							
Workforce Hierarchy (WfHie)							
Middle Cadre	Intercept	-4.712	3.927	1	0.048		
	Operational/ Organizational Safety	0.094	1.147	1	0.284	1.098	Not significant
	Occupational Safety	0.060	0.394	1	0.530	1.061	Not significant
	Procedural Safety	0.052	0.483	1	0.487	1.053	Not significant
	Organization = 1	1.549	7.303	1	0.007	4.708	Significant
	Organization = 2	0^b		0			
Senior	Intercept	-2.948	1.158	1	0.282		

Cadre	Operational/ Organizational Safety	0.162	2.623	1	0.105	1.176	Not significant
	Occupational Safety	-0.127	1.388	1	0.239	0.880	Not significant
	Procedural Safety	0.093	1.183	1	0.275	1.098	Not significant
	Organization = 1	0.407	0.415	1	0.519	1.502	Not significant
	Organization = 2	0^b		0			

Tests	χ^2	**df**	ρ	
Likelihood Ratio Test	15.598	8	0.049	(Significant)
-2 Log Likelihood of Reduced Model				
Intercept	0.0000	0		
Operational/Organizational Safety	2.692	2	0.260	(Not significant)
Occupational Safety	4.456	2	0.108	(Not significant)
Procedural Safety	1.206	2	0.547	(Not significant)
Organization	9.595	2	0.008	(Significant)

Notes: The reference category is: junior-cadre; Cox and Snell R^2 = 0.075; Nagelkerke R^2 = 0.087; McFadden = 0.039

b. This parameter is set to zero because it is redundant.

The second analysis showed that Model Fit was significant, χ^2 (8) = 15.598, ρ<0.05, Nagelkerke R^2 = 0.087, ρ = 0.087, which suggested a good model fit that explained 9% of the variation in the outcome. Goodness-of-Fit test suggested a good fit, χ^2 (314) = 330.064, ρ = 0.256.

OpSaf (B = 0.094, Odds Ratio = 1.098, 95% CI [0.925, 1.304]), OcSaf (B = 0.060, Odds Ratio = 1.061, 95% CI [0.881, 1.279]), and PrSaf (B = 0.052, Odds Ratio = 1.053, 95% CI [0.910, 1.220]) were not significant predictors in relation to junior-middle cadres interaction. In relation to the contribution of the predictor variable (organization), Wald statistics was, however, significant (ρ = 0.007), indicating that the multinomial logit for Organization 1 relative to Organization 2 was 1.549 units higher for ATSEP in the middle-cadre relative to junior-cadre ATSEP, given that all other predictors in the model were held constant. OpSaf (B = 0.162, Odds Ratio = 1.176, 95% CI [0.967, 1.431]), OcSaf (B = -0.127, Odds Ratio = 0.880, 95% CI [0.712, 1.088]), and PrSaf (B = 0.093, Odds Ratio = 1.098, 95% CI [0.929, 1.297]) were also not significant predictors in relation to junior-senior cadres interaction. In relation to the contribution of the predictor variable (organization), Wald statistics was not significant (ρ = 0.519), indicating that the multinomial logit for Organization 1 relative to Organization 2 was 0.407 unit lower for ATSEP in the senior-cadre relative to junior-cadre ATSEP.

In terms of significant contributions, OpSaf, χ^2 (2) = 2.632, ρ = 0.260, OcSaf, χ^2 (2) = 4.456, ρ = 0.108, PrSaf, χ^2 (2) = 1.206, ρ = 0.547 failed to significantly contribute to the model. Wald statistics revealed that all the covariates had no significant effect (ρ>0.05) on specific category membership relative to the reference category. Therefore, the null hypothesis was accepted.

Hypothesis 2: There is no statistically significant difference in mean workplace safety practices based on ATSEP workplace designation. A One-Way (between-subjects) ANOVA was performed to test the null hypothesis:

Ho: $\mu_{international} = \mu_{national} = \mu_{local}$,

where µ represented the mean of the dependent variable (workplace safety practices), and international, national, and local were the 3 independent groups of the independent variable (workplace designation).

Normality checks carried out suggested normality of distribution and the absence of outliers. Equality of variances was also assumed with a Levene's Test statistics significance, ρ>0.05. There was a significant difference in mean Workplace Safety Practices [F (2, 197) = 19.520, ρ<0.001, MS_{error} = 75.002, α = 0.05] in relation to the workplace designation groups. Post-Hoc comparisons using the Tukey test were performed. There was a statistically significant difference between the international vs. local groups ($\rho<0.001$) with local ATSEP

Showcasing, on an average of 8.1, better safety practices performance than ATSEP in international workplaces. There was also a significant difference between the national vs. local groups ($\rho<0.001$) with local ATSEP performing better on an average of 7.9. Post-hoc comparisons also revealed statistically significant differences between local vs. international and local vs. national groups ($\rho<0.001$) with the local groups also outperforming international and national groups by factors of 8.1 and 7.9 respectively. The null hypothesis was, therefore, rejected in relation to the international-local and national-local interactions and accepted in cases involving national-international interactions.

Hypothesis 3: There is no statistically significant difference in mean workplace safety practices based on ATSEP workforce hierarchy. A One-Way (between-subjects) ANOVA was performed to determine the existence of a significant difference between workplace safety practices and workplace hierarchy (junior, middle, senior).

Normality checks and Levene's test ($\rho>0.05$) conducted suggested that assumptions were met. The ANOVA results revealed no statistically significant difference in mean workplace safety practices [F (2, 197) = 1.861, $\rho = 0.158$, $MS_{error} = 88.199$, $\alpha = 0.05$] in relation to the interactions between the workforce hierarchy groups. Post-hoc comparisons confirmed the non-significance of mean differences across the junior vs. middle ($\rho = 0.205$), the junior vs. senior ($\rho = 0.938$), the middle vs. junior ($\rho = 0.205$), the middle vs. senior ($\rho = 0.364$), the senior vs. junior ($\rho = 0.938$), and the senior vs. middle ($\rho = 0.364$) interacting groups. The null hypothesis was, therefore, accepted, meaning that there was no significant effect of the workforce hierarchy groups on workplace safety practices.

5. Discussion

This study provides several important findings regarding aviation safety practices in the CNS/ATM working environment. Results based on the checklist data regarding the implementation of critical safety elements revealed positive compliance with regulatory requirements in the aspects of the availability of Standard Operating Procedures and Manual of Operations as well as procedures relating to on-site system loggings, which constitute two critical aspects of procedural safety practices. The results also show non-compliance with basic safety practices relating to the use of personal protective equipment (PPE) across international and national airports. The sixty percentage point compliance rate recorded at the local airports might be ascribed to compliance rate at the ATO. The implication, therefore, is that the ANSP is not paying due attention to complying with critical safety elements. The preponderance of responses across the three workplace categories also revealed organizational insensitivity regarding the radiation exposures of personnel as well as the establishment of robust organizational safety cultures.

The MLR findings regarding the statistical significance of operational, and occupational safety practices underline the integration of safety practices in the ATSEP workplace, albeit national and local aerodromes were well ahead of international airports. The non-significance of procedural safety practices underscores the lack of robust structures for adhering to procedural safety elements particularly in national and international airports as corroborated by the data in Table 1. The homogeneity characteristic of the non-significance of the effect of workplace safety practices across the workplace hierarchy categories revealed the irrelevance of organizational cadres to the implementation of workplace safety practices. The findings, however, revealed that the integration of safety practices in the context of organizational cadres was largely a function of organizational framework. In this regard, the study revealed that the probabilities of specific ATSEP cadres assuming higher or lower safety practices performances are greatly dependent on the safety structures existing in their organizations.

An interesting finding from the ANOVA analyses conducted revealed a significant difference in mean workplace safety practices with ATSEP in local aerodromes showcasing higher safety practices than those in international- and national-domiciled workplaces, a situation that also stresses the significance of organizational framework rather than workplace designation. In relation to workplace safety practices and workplace cadres, though, the study failed to reveal any statistically significant difference, which suggested that the question of cadres in organizational contexts has nothing to do with the levels of integration of workplace safety principles and processes into an organization.

6. Conclusion:

The present study undertook an assessment of safety practices among aviation professionals involved in the maintenance, operation, and calibration of critical air traffic safety systems. The study has documented specific elements that illuminate an understanding of safe work practices in the CNS/ATM workplace. The findings serve as a pointer to the imperativeness of pragmatic approaches to building organizational frameworks that allow safe work practices to thrive. Findings regarding the gaps identified in the human factors-related dimensions of aviation safety practices require the adoption of a practice-based approach to safety with a focus on the training and competence ramifications of safety practices. The results of this study support all the hypotheses with the exception of: 1) hypothesis 1 in relation to operational/organizational safety practices and occupational safety practices relative to workplace designation, and 2) hypothesis 2. The results also underline the need for a paradigm shift towards the prioritization of safety management and the institutionalization of an organizational safety culture that permeates the organizational fabrics.Further empirical and iterative studies are needed to interrogate issues revolving around safety procedures and practices with a view to further improving safety performances in the aviation workplace.

7. References

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