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Safety Performance in Construction Micro, Small, and Medium Enterprises in Developing Countries

Ranti Taibat Adebiyi[1]*, Olubola Babalola[2], Zubair Musa Abiodun[1], Ganiyu Amuda-Yusuf[1], Lukman Olarewaju Olorunoje[1], Aminat Damola Amuda[1]

[1] *Department of Quantity Surveying, University of Ilorin, NIGERIA*
[2] *Department of Quantity Surveying, Obafemi Awolowo University, Ile-Ife, NIGERIA*

*Corresponding Author: mohdaffendi@unimap.com.my
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Abstract

Construction Micro, Small, and Medium Enterprises (CMSMEs) play a vital role in infrastructure and manpower development in developing countries. However, workers in these enterprises are susceptible to safety risks because most of their tasks are handcrafted with little or no machine involvement. This study, therefore, analysed the key drivers to improve safety performance in Nigerian CMSMEs with a view to promoting a proactive safety culture among construction stakeholders. A quantitative research approach was employed, involving the administration of a structured questionnaire to project managers, engineers, and workers across 106 CMSMEs in Abuja, Nigeria. A total of 318 copies of questionnaires were distributed, with a 65% response rate. Descriptive statistics, mean score ranking, and factor analysis were used to analyse the data. The results of the analyses revealed sixteen critical drivers influencing safety performance. The top three drivers were the availability of personal protective equipment, the provision of first aid, and the availability of safety policies. Factor analysis revealed eight major dimensions—provision of facilities, resources, capacity building, financial commitment, government intervention, inspection and monitoring, workforce, and documentation—accounting for 66.9% of the total variance. The Kendall's Coefficient of Concordance showed a strong agreement among the groups of respondents regarding the rankings of these drivers (W = 0.6671). The study concluded that improving safety performance in CMSMEs requires a multifaceted approach involving adequate safety resources, continuous training, financial investment, stronger regulatory enforcement, and integration of technology. It recommended targeted policies, stakeholder collaboration, and capacity-building initiatives to promote a proactive safety culture, reduce accidents, and enhance sustainability in the construction sector of developing countries.

1. Introduction

Operations in most Construction Micro, Small and Medium Enterprises (CMSMEs) in developing countries are labour-intensive due to the availability of cheap labour, making construction more economical than equipment-intensive methods (Priya, Kothai & Kohilambal, 2021). The characteristics of these operations often expose workers to significant safety risks because a large proportion of them are unskilled, inexperienced, temporary, and transient workers who move from project to project with differing levels of safety awareness. Under these conditions, achieving effective safety performance is very challenging, as workers often operate within a temporary and fragmented project team. Many of these workers have lost their lives, while some have become permanently disabled due to construction-related injuries, since they perform their tasks manually and are physically involved in the construction activities (Liu *et al.,* 2021). According to Lim *et al.,* (2021), workers may not only face hazards from their own tasks but also be exposed as bystanders to dangers created by other workers nearby.

Safety challenges in CMSMEs are significant, with numerous studies emphasising unsafe working conditions, failure to follow safety standards, and the absence of structured safety management systems (Priya, Kothai & Kohilambal, 2021; Zailani *et al.,* 2022). The complex nature of these problems highlights the need for a detailed examination of the drivers that influence their safety performance. The relative significance and connections among these factors are still not well understood in many CMSMEs within Abuja, Nigeria, and similar developing countries, where resource constraints and informal practices often dominate the industry landscape, along with low levels of technology adoption (Adebiyi *et al.,* 2023). This research work aims to examine the main drivers that enhance safety performance in Nigerian CMSMEs, with a view to providing insights that can inform policy-making, regulatory enforcement, and industry best practices. These insights aim to reduce risks, improve safety outcomes, and promote a culture of prevention within the sector in Nigeria and similar developing countries.

2. Literature Review

2.1 Micro, Small, and Medium Enterprises (MSMEs)

The Micro, Small and Medium Enterprises (MSMEs) are well established in both developing and developed countries and are recognised as engines of socio-economic transformation (Nyanga, 2022; Ametepey, Jnr &, Cobbina, 2022; Ndulue, 2023). They are defined by the National Policy on Micro, Small & Medium Enterprises by their staff strength and asset base, excluding the property value. In Nigeria, Micro Enterprises possess a total asset base of less than five million Naira with a staff strength of not more than ten. Small Enterprises possess a total asset base between five and fifty million Naira, and staff strength between ten and forty-nine. While Medium Enterprises have a total asset base of between fifty and five hundred million Naira, with a staff strength of 50 to 199. These definitions in Nigeria are similar to those in some other developing countries, as shown in Table 1.

MSMEs offer opportunities to drive jobs and wealth creation (Mabasa *et al*., 2023). In Nigeria, MSMEs account for about 97% of all businesses and 60–70% of total employment, emphasising their overwhelming presence in the business sector and affirming their role as major job providers (Aliyu *et al*., 2022; Ndulue, 2023). The research carried out by Mabasa *et al*., (2023), revealed that MSMEs represent about 97% of all businesses in Zambia.

Table 1 *Comparison of NSME definitions in developing countries*

Country	Micro Enterprise	Small Enterprise	Medium Enterprise
Nigeria	< 10 employees; assets < ₦5 million	10–49 employees; assets ₦5m – ₦50m	50–199 employees; assets ₦50m–₦500m
India	Investment ≤ ₹1 crore turnover ≤ ₹5 crore	Investment ≤ ₹10 crore turnover ≤ ₹50 crore	Investment ≤ ₹50 crore turnover ≤ ₹250 crore
Philippines	1–9 employees; assets ≤ ₱3 million	10–99 employees; assets ₱3m–₱15m	100–199 employees; assets ₱15m–₱100m
Kenya	< 10 employees; turnover < KSh 500,000	10–49 employees; turnover KSh 500,000–5m	50–99 employees; turnover KSh 5m–800m
South Africa	< 5 employees; turnover < ZAR 200,000	5–50 employees; turnover ZAR 200,000–R5 million	51–200 employees; turnover ZAR 5m–R20 million
Bangladesh	Fixed assets ≤ BDT 1 million; < 10 employees	Fixed assets BDT 1–15m; 10–49 employees	Fixed assets BDT 15–200m; 50–99 employees

J. of Technology Management and Business Vol. 13 No. 1 (2026) p. 91-105

Indonesia	Assets ≤ IDR 50 million; sales ≤ IDR 300 million	Assets > IDR 50m–500m; sales > IDR 300m–2.5b	Assets > IDR 500m–10b; sales > IDR 2.5b–50b
Ghana	< 5 employees; assets ≤ GHS 10,000	6–29 employees; assets GHS 10,000–100,000	30–99 employees; assets GHS 100,000–1m

2.2 Construction Micro, Small and Medium Enterprises

Micro, Small and Medium Enterprises (MSMEs) in the construction sector are critical in most developing countries. The CMSMEs promote expansion of essential facilities, create job opportunities, and are crucial for societal advancement in these countries (Hatoum *et al.,* 2022; Ndulue, 2023; Ohiwere & Alumbugu, 2025). According to Eze *et al.*, (2020) and Betáková *et al.*, (2022), CMSMEs play a part in executing various construction projects, either residential buildings or public infrastructure. Adzivor *et al.,* (2024) confirmed that CMSMEs in Ghana facilitated not less than 70% of the Gross Domestic Product (GDP) and constituted about 90% of businesses in Ghana. According to Hwang *et al*., (2023), CMSMEs in South Korea make up about 96% of the construction environment. In Nigeria, CMSMEs play an important role in job creation and contribute significantly to sustainable development (Ali 2021; Ohiwere & Alumbugu 2025). According to Ahmed (2023), in Bangladesh, CMSMEs boost construction performance through the provision of facilities. In South Africa, Bolosha, Sinyolo, & Ramoroka (2022) stated that CMSMEs champion construction to enhance a more effective project execution process. Mabasa *et al.,* (2023) noted their role in job creation and skills development in Zambia. They employ a large workforce and provide essential needs, livelihoods, and other opportunities for the vulnerable in most developing societies. CMSMEs serve as informal vocational hubs, providing apprenticeships and practical on-site training that upskill artisans and technicians, building local technical expertise (Mile *et al.,* 2022).

2.3 Safety Performance of Construction Micro, Small, and Medium Enterprises

Safety performance of CMSMEs is a major determining factor that influences their progression, sustainability, and expansion in developing countries (Nyanga 2022). For example, Ghanaian CMSMEs have a high record of fatal and non-fatal injury rates on construction sites despite the significant contributions to the nation's economy (Adzivor *et al.,* 2024). In Malaysia, Chinniah (2024) posited that clients often prioritise cost and schedule over safety, which can result in a culture where safety is undervalued, leading to inadequate safety measures being implemented on-site. Furthermore, when workers perceive that safety is not a priority for management, their motivation to engage in safe practices diminishes. Many CMSMEs struggle with the costs associated with safety training, equipment, and compliance with regulations. Previous research works revealed that the high expenditure on safety measures prevents construction organisations from channeling funds into safety implementation, resulting in a greater incidence on the construction environment (Pham *et al.*, 2020; Kiral & Demirkesen, 2023; Alejo *et al.*, 2024).

When CMSMEs are under pressure to meet targets, they often jeopardize safety practices. Alaloul *et al.*, (2023) asserted that construction projects in Malaysia frequently experience strict timelines, and the need to urgently complete the projects results in undermining safety practices. Khairudin *et al.*, (2021) stated that when workers are rushed, they mostly overlook protective procedures and embark on risky behaviours. Due to strict project timelines, safety is viewed as secondary to productivity, which ultimately led to a higher rate of accidents. A common fallacy in CMSMEs is that safety is mainly the responsibility of the safety officer. This belief most often results in nonparticipation of other workers and supervisors in safety practices (Liu *et al.*, 2021). According to Yoon *et al.*, (2024) achievement of effective safety performance in Korea requires the active participation of all construction stakeholders, regardless of their roles. When safety is viewed as a collaborative responsibility, it builds a culture of accountability and stimulates everyone to focus on safety in all activities (Harahap *et al.*, 2024).

Inadequate legislation surrounding safety performance in construction can considerably impact its effectiveness in CMSMEs. In Nigeria, existing legislation is not stringent enough for the enforcement of compliance with safety practices, or the law lacks clarity, resulting in confusion among the workers (Zailani *et al.*, 2022). Zhang and Zheng (2024) observed that CMSMEs in China do not feel compelled to adhere to safety practices due to weak legislative frameworks. According to Lestari, Herzanita & Latief (2021), safety regulations are unintentionally violated by many workers in Indonesia, as they do not fully understand the regulations that govern their work and therefore embark on unsafe practices. Anjum *et al.*, (2022) indicated that increasing awareness of safety regulations through training can enhance compliance and improve overall safety outcomes of construction activities in Korea.

Existing studies across developing countries consistently identify inadequate training, weak enforcement mechanisms, limited financial investment, and poor safety culture as major barriers to effective safety performance in CMSMEs. However, most previous studies examined these variables independently, with limited effort to empirically categorise them into integrated dimensions that explain safety performance holistically, particularly in the Nigerian context.

3. Drivers of Safety Performance in Construction Micro, Small, and Medium Enterprises

Effective safety performance in CMSMEs in developing countries is critical to ensure workers' safety and project success. Client requirements are regarded as one of the key determinants of safety performance (Ahn, 2022). When clients prioritise safety, they set a standard that CMSMEs must meet, thereby fostering a culture of safety from the outset. For example, in Lebanon, when clients consider safety performance during the selection process, CMSMEs definitely implement comprehensive safety standards to enhance their competitiveness (Hatoum *et al.*, 2022). Aka *et al.,* (2023) highlighted regulatory weakness and limited inspectorate resources as determinants of safety performance. Another study centered in Abuja, Nigeria, identified utilization of PPE and maintenance of hazard-free environments as the most significant predictive drivers to enhance safety performance (Abdullahi & Makinde, 2023). Engaging employees in safety practices is vital to inculcating the habit of safety practices. When workers in China and Saudi Arabia are engaged in matters related to safety from the onset, they adhere to safety protocols and report unsafe conditions (Guo *et al.*, 2021; Alamoudi, 2022). Past studies have revealed that construction companies that involve their workers in safety practices experience fewer accidents and injuries (Zhang, 2021; Bakar *et al.*, 2023).

Technological innovation in safety practices can significantly enhance safety performance in construction. Emerging technologies such as Building Information Modelling (BIM), virtual reality (VR), and Augmented Reality (AR) enhance safety performance (Afzal *et al.*, 2021; Rafindadi *et al.*, 2023). In addition, drones and wearable safety devices give new opportunities for safety. Previous studies have shown that construction organisations that leverage technology and innovation experience improved safety performance, as these emerging tools enable the earlier identification and detection of hazards, assessment of risks, and real-time monitoring of safety conditions (Raza *et al.*, 2022; Verde *et al.*, 2023; Adebiyi *et al.,* 2023). Displaying safety signs and tags is a critical component of accident prevention in construction. OSHA regulations Standard: 29 CFR 1926.200 expected an appropriate display of signage to warn workers of potential hazards (Lim *et al.*, 2021). Important safety information, such as hazard warnings, safety procedures, and emergency contact information, can be communicated through clear and visible signage (Hwang *et al.*, 2023). Safety awareness and promotion can be enhanced among workers through effective display of signage.

3.1 Conceptual Framework for Safety Performance in CMSMEs

Safety performance in CMSMEs is largely driven by organisational, behavioural, regulatory, and resource-related factors. This study embraces a conceptual perspective grounded in occupational safety theory and safety climate principles, which postulate that safety behaviour and accident prevention in CMSMEs are molded by management commitment, training, workplace environment, safety resources, and regulatory enforcement. The study developed a framework that structuralizes the identified safety drivers into eight interrelated dimensions: provision of facilities, safety resources, capacity building, financial commitment, government intervention and regulatory environment, inspection and monitoring, workforce development, and documentation practices. These dimensions jointly shape safety performance outcomes such as accident and injury reduction, compliance with safety regulations, improved worker wellbeing, and enhanced project sustainability.

The framework assumes that adequate safety resources, effective supervision, skilled workforce, and supportive government regulations positively influence safety performance in CMSMEs. Figure 1 presents the conceptual framework adopted for the study.

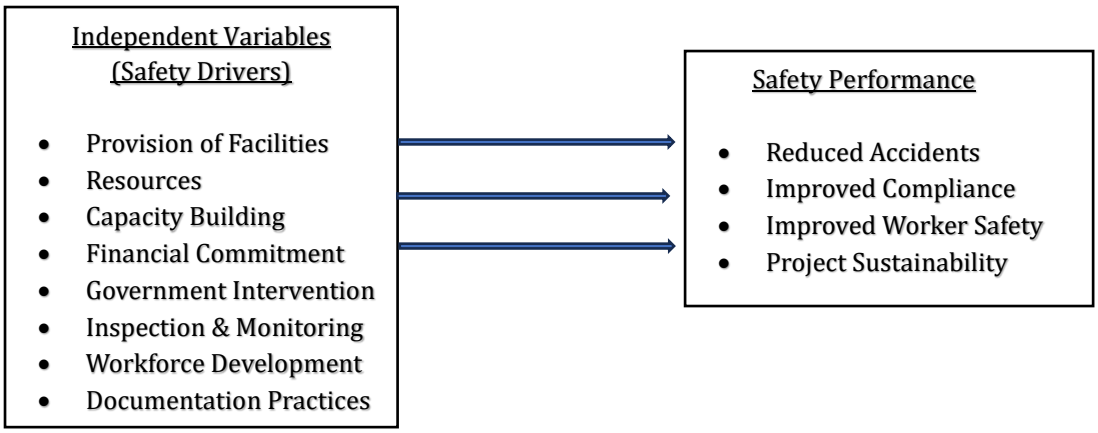

Fig. 1 *Conceptual framework for safety performance in CMSMEs*

3.2 Research Gap

Although previous studies have identified isolated determinants of construction safety performance, there is limited empirical evidence on how these drivers can be categorised into broader underlying dimensions within CMSMEs in developing countries. Furthermore, few studies have applied factor analysis to establish a multidimensional framework for safety performance in Nigerian CMSMEs.

4. Methodology

This research work aims to determine the key drivers influencing safety performance in Nigerian CMSMEs. Findings from the literature review identified a total of twenty-five drivers. The study employed a quantitative research approach, utilising a questionnaire survey to collect data. The questionnaire contents were developed from an extensive literature review on construction safety performance in developing countries. The identified variables were adapted from validated safety-related studies and modified to suit the context of Nigerian CMSMEs. The questionnaire was structured into two sections: demographic information of respondents and drivers influencing safety performance. A five-point Likert scale was used to measure respondents' perceptions of the significance of each driver, where 1 = Not Significant and 5 = Extremely Significant. Prior to the main survey, a pilot study involving 15 construction professionals was conducted to assess the clarity, relevance, and reliability of the questionnaire contents. Feedback obtained from the pilot exercise assisted in refining the wording and structure of the questionnaire before final administration.

The questionnaires were administered physically through direct site visits to the selected CMSMEs in Abuja. Research assistants distributed the questionnaires to project managers, engineers, and workers who voluntarily agreed to participate in the study. This approach enhanced response retrieval and allowed clarification of questionnaire items where necessary.

The respondents were asked to determine the key drivers influencing their safety performance on the sites. According to a recent study by Ohiwere & Alumbugu (2025), there were 506 CMSMEs listed in the National Survey of Micro, Small & Medium Enterprises. Purposive sampling was adopted to pick the respondents from the CMSMEs to collect data, similar to the approach used by Simpeh & Amoah (2023). The respondents sampled were those who had ongoing projects and volunteered to be part of the research. The Research Assistants were able to reach 106 CMSMEs, which were about 21% of the population in the study area. Copies of the questionnaire were administered to 318 respondents who consisted of project managers, engineers, and workers in CMSMEs in Abuja, with a response rate of 65%.

5. Data Analysis and Discussion of Results

5.1 Reliability Test

The consistency of the questionnaire was tested using Cronbach's alpha. This test assesses the reliability or internal consistency of scales or sets of questionnaire items, ensuring that the items work well together to measure the same concept. Findings from the Cronbach's alpha test for the drivers influencing safety performance revealed that they achieved high reliability, with alpha coefficient values of 0.861, as shown in Table 2. These reliability assessment values surpass the minimum standard of 0.7, which indicates good internal consistency and shows that the data collection instrument produced reliable, consistent data that is appropriate for analysis.

Table 2 *Data reliability statistics*

Variable	No. of Items	Cronbach's Alpha	Result
Drivers	25	0.861	> 0.7 (internally consistent)

5.2 Analysis Techniques

To identify and evaluate the key drivers that enhance the safety performance of CMSMEs, Mean Scores (MS) of all the drivers were derived. MS scores were then used to determine the rank of each driver in order of importance. Factor Analysis technique was employed in order to explain relationships among the key drivers contributing to safety performance. To proceed with this technique, it is appropriate that the suitability of data and sampling adequacy must be inquired through the use of a correlation matrix, Kaiser-Meyer-Olkin (KMO) statistics, and the Bartlett test of sphericity. In this regard, Table 3 shows that the Bartlett test of sphericity, with 0.000 significance, shows that the correlation matrix is not an identity matrix.

Table 3 *Kaiser-Meyer-Olkin (KMO) and Bartlett's test*

Kaiser- Meyer-Olkin		*.756*
Bartlett's Test of Sphericity	Approx. Chi-Square	5702.576
	Df	300
	Sig	.000

The Kendall coefficient of concordance was used to determine the degree of agreement among the respondents in their judgments with respect to their rankings of the drivers that enhance the safety performance of CMSMEs. The Kendall coefficient of concordance (W), according to Shbikat & Bwaliez (2025), measures the interrelationship among many variables that were measured on an ordinal scale for them to be ranked in an ordered series. The Kendall coefficient of concordance (W) for the drivers was established in order to show the significance of consensus among the respondents. A similar test by Mallick, Lal & Basumatary (2023) reveals Kendall Coefficient of Concordance ranges of 0.00 to 0.588, which suggests high validity of the instrument.

5.3 Characteristics of Respondents

Copies of the questionnaire were administered to three hundred and eighteen (318) respondents who were executing construction projects under CMSMEs in Abuja, Nigeria. Two hundred and five (205) were retrieved, indicating 65% of the sample size. The authenticity of the study depends on how reliable the sources of data are. This research work, therefore, explored information about the demographic characteristics of the respondents to ensure the reliability of the data as revealed in Table 4.

Table 4 *Demographic characteristics of respondents*

Profile	Frequency	Percentage (%)	Cum %
A. Identity of the Respondents			
Project Managers	65	32	32
Engineers	79	39	71
Workers	61	29	100
B. Modes of Engagement			
Part-time	62	30	30
Full-time	95	46	76
Temporary (daily)	48	24	100
C. Highest Education Qualification			
Secondary School	43	21	21
Bachelor's Degree	134	65	86
Master's Degree	16	8	94
Doctoral Degree	0	0	94
Others	12	6	100
D. Experience with CMSMEs			
0-5 years	52	25	25
6-10 years	45	22	47
11-15 years	76	37	84
Above 15 years	32	16	100
E. Number of projects undertaken in the last Decade			
1-5	29	14	14
6-10	68	33	47
11-15	73	36	83
Above 15	35	17	100

Table 4 shows the details of the demographic characteristics of the respondents, like their educational qualifications, working experience, number of years with the organisation, and the number of projects undertaken in the last decade. The findings revealed that a high number of the respondents are degree holders (74%), about

53% of them have worked in CMSMEs for more than 10 years, and at least 86% of them have participated in more than five projects in the last decade. The implication of these findings showed reliable information.

5.4 Drivers Influencing Safety Performance in CMSMEs

Table 5 shows the descriptive analysis of the twenty-five drivers influencing safety performance in CMSMEs in Abuja, Nigeria. The mean Score for each variable was computed. As shown in Table 5, the use of PPE ranked first by the respondents as a driver that influenced their safety performance, with a mean score of 4.01. The provision of first aid facilities was second with a mean score of 3.89. Availability of safety policies, safety supervisor, and regular inspection and monitoring ranked third, fourth, and fifth with mean scores of 3.82, 3.80, and 3.77, respectively. Flexible schedules ranked least with a 2.24 mean score. The findings established that sixteen key drivers actually influence the safety performance of CMSMEs, with MS greater than the average score (3.364), as shown in Table 5.

Table 5 *Drivers of safety performance of CMSMEs*

Safety Performance Drivers	N	Mean	Ranking
Use of Personal Protective Equipment (PPE)	205	4.0132	1
First aid facilities	205	3.8907	2
Availability of safety policies	205	3.8245	3
Availability of a safety supervisor on-site	205	3.7980	4
Regular inspection and monitoring	205	3.7748	5
Training on safety	205	3.6987	6
Storage, handling and disposal of hazardous substances	205	3.6871	7
Disciplinary policy	205	3.6788	8
Medical examination for the workers	205	3.5877	9
Sufficient safety budget	205	3.5828	10
Provision of welfare facilities and amenities	205	3.5563	11
Safe operational practices	205	3.4768	12
Safe environment	205	3.4437	13
Management commitment to safety programs	205	3.4288	14
Availability of technology	205	3.4056	15
Availability of skilled labour	205	3.3758	16
Availability of legislation, codes and standards	205	3.1921	17
Proper site illumination	205	3.1308	18
Effective accident investigation, recording and reporting system	205	3.1010	19
Regular safety meeting	205	2.9818	20
Provision of standard communication strategies for hazards identification	205	2.9421	21
Provision of adequate site security	205	2.8891	22
Provision of fire protection and prevention measures	205	2.7748	23
Provision of emergency plan and procedures	205	2.6275	24
Flexible schedules	205	2.2384	25
Average Mean Score		**3.364**	

The study emphasised the use of PPE as a key driver influencing safety performance in CMSMEs. This conforms with the research done by Abdullahi & Makinde (2023) that it is a requirement for workers to wear PPE, maintain, and replace the worn-out parts consistently. The importance of first aid facilities, as revealed from the results of the research work carried out by Ali, Habib, and Sharaa (2021), is that construction sites are inherently dangerous, and there is a need to make provision for adequate first aid resources. Availability of safety policies is another key driver to the safety performance of CMSMEs, as was described by Anjum *et al.,* (2022) that with adequate safety policies, accidents and ill-health on construction sites will be reduced.

The Factor Analysis technique was used to determine the relationships among the drivers and to ascertain the key drivers and rank them, which significantly express the observed and correlated variables. The rotated factor matrix was examined for cross-loadings. Following established guidelines, items with loadings of 0.40 or greater on more than one factor were considered cross-loading items. Furthermore, items for which the difference

between the primary and secondary factor loadings was less than 0.20 were regarded as ambiguous indicators of the latent constructs. Such items were reviewed for theoretical relevance.

5.5 Total Variance Explained

Statistics of initial variance explained, extraction sum of squared loadings, and rotation from exploratory factor analysis are revealed in Table 6. The exploratory factor analysis revealed eight factors from the dataset. The results show the amount of variance explained before extraction, after extraction, and after rotation. These eight factors are significant in the explanation of drivers influencing safety performance in CMSMEs. They represent the eight dimensions by which the drivers may be classified.

The extraction of factors was performed using Principal Axis Factoring (PAF). PAF was adopted because the study sought to identify latent constructs underlying the observed variables. PAF focuses on common variance among variables and is robust to departures from multivariate normality, making it particularly suitable for exploratory factor analysis of survey data collected using Likert scales.

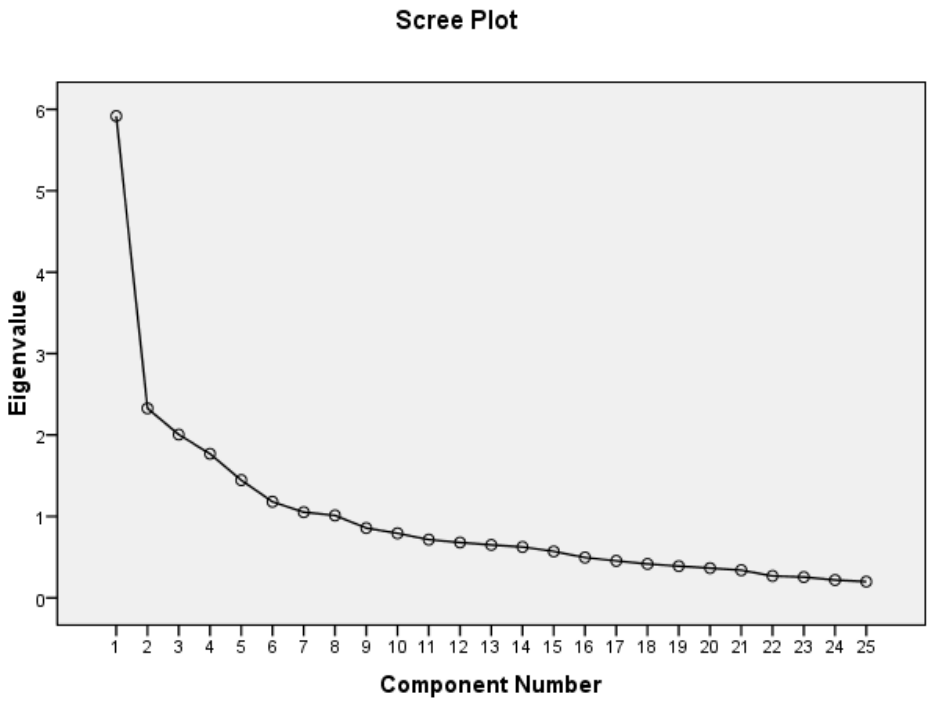

Fig. 2 *Scree plot of the 25 variables*

Table 6 *Total variance explained*

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loading		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.997	23.989	23.989	5.551	22.202	22.202	3.038	12.153	12.153
2	2.490	9.962	33.951	2.053	8.212	30.414	1.733	6.933	19.086
3	1.912	7.646	41.597	1.447	5.786	36.200	1.611	6.445	25.531
4	1.489	5.957	47.554	1.027	4.107	40.307	1.537	6.149	31.679
5	1.396	5.582	53.136	.968	3.872	44.179	1.414	5.655	37.334
6	1.268	5.073	58.208	.755	3.020	47.199	1.331	5.325	42.660
7	1.168	4.673	62.882	.744	2.978	50.176	1.329	5.315	47.975
8	1.004	4.018	66.900	.501	2.002	52.179	1.051	4.204	52.179

Extraction method: Principal axis factoring

J. of Technology Management and Business Vol. 13 No. 1 (2026) p. 91-105

The retention of eight factors was based on the Kaiser criterion, which recommends retaining factors with eigenvalues greater than 1.0. The eigenvalues of the eight factors range from 1.004 to 5.997. According to Durdyev *et al.,* (2017), eigenvalues are used to accept factors or decline them. Eigenvalues ≥ 1.0 are accepted, indicating significant factors to the study; in contrast, factors with eigenvalues of less than 1.0 are insignificant. The scree plot in Figure 2 also confirmed the appropriateness of the eight-factor structure. The Figure 2 shows the 25 variables listed along the x-axis, and the eigenvalues along the y-axis.

Together, these eight factors explain 66.90% of the total variance in the original variables. After extraction, the eight retained factors explain 52.179% of the total variance. This means that the extracted factor solution accounts for approximately 52.18% of the variation in the dataset. Since social science studies generally regard a cumulative variance of 50% or above as acceptable, the extracted factor solution can be considered adequate. Following rotation, the total variance explained remains 52.179%, but the variance is redistributed more evenly across the eight factors.

The communalities obtained after extraction range from 0.433 to 0.721, demonstrate that the retained factors explained a substantial proportion of the variance in the observed variables. Although a few variables exhibited communalities slightly below the conventional threshold of 0.50, they were retained due to their theoretical relevance and satisfactory factor loadings. According to common guidelines for exploratory factor analysis, communalities above 0.40 are generally acceptable in social science research, particularly when the overall factor solution is interpretable and explains more than 50% of the total variance. The eight-factor solution explained 52.179% of the total variance, indicating an adequate representation of the latent constructs underlying the data.

The first major factor explains 23.99% of total variance with an eigenvalue of 5.997 and loads highly and positively on provision of welfare facilities and amenities; safe environment; provision of fire protection and prevention measures; provision of adequate site security; and provision of emergency plan and procedures. This factor was labelled 'provision of facilities. The second factor justifies 9.96% of the total variance with an eigenvalue of 2.490 and has high positive loading on the provision of PPE and first aid facilities. This factor represents a group of variables describing the availability of resources and is therefore labelled 'safety resources'. The third factor provides an explanation for 7.65% of the variance with an eigenvalue of 1.912 and has high positive loadings on the availability of a safety supervisor on-site, training on safety, and the availability of technology. The factor represents a set of variables describing the building capacity of the workers and is therefore labelled 'capacity building'. The fourth factor represents 5.96% of the total variance with an eigenvalue of 1.490 and loads heavily and positively on only one variable – sufficient safety budget. Although single-item factors are generally considered less stable and may not adequately represent a latent construct, the item was retained because of its statistical and theoretical considerations. The item demonstrated a high factor loading and satisfactory communality, suggesting that it was strongly associated with the underlying construct. Moreover, the item did not cross-load on any other factor, confirming its conceptual uniqueness. Given its importance within the context of construction safety performance and the exploratory nature of the analysis, retaining the factor was considered more appropriate than eliminating a potentially meaningful dimension of the construct domain. This approach is consistent with recommendations that theoretically important single-item factors may be retained in exploratory studies, since their limitations are explicitly acknowledged. This factor describes financing and is therefore termed 'financial commitment'.

Table 7 *Factor loading on the components*

	Factor							
	1	2	3	4	5	6	7	8
Provision of welfare facilities and amenities	.664							
Safe environment	.646							
Provision of fire protection and prevention measures	.622							
Provision of adequate site security	.594							
Provision of emergency plan and procedures	.500							
Provision of standard communication strategies for hazards								
Use of Personal Protective Equipment (PPE)		.773						
First aid facilities		.652						
Flexible schedules								
Availability of a safety supervisor on-site			.634					
Training on safety			.588					

	Factor							
	1	2	3	4	5	6	7	8
Availability of technology			.506					
Sufficient safety budget				.808				
Management commitment to safety programs								
Availability of safety policies					.666			
Availability of legislation, codes, and standards					.568			
Disciplinary policy					.558			
Regular inspection and monitoring						.627		
Medical examination for the workers								
Regular safety meeting								
Safe operational practices							.684	
Availability of skilled labour							.520	
Storage, handling and disposal of hazardous substances								
Effective accident investigation, recording and reporting system								.634
Proper site illumination								

Extracted method:Principal axis factoring
Rotation method: Varimax with Kaiser normalization

The fifth factor accounts for 5.58% of the total variance with an eigenvalue of 1.396 and loads highly and positively on the availability of safety policies, availability of legislation, codes, and standards, and disciplinary policy. This group of variables described the intervention from the government and was therefore labelled 'government intervention and regulatory environment'. The sixth factor accounts for only 5.07% of the total variance with an eigenvalue of 1.268 and has a high positive loading on only regular inspection and monitoring. The only dominant variable here was retained because it represents a unique and theoretically important aspect of safety performance that has been consistently identified in previous studies, otherwise the factor would have been removed. In most cases a single-item factor is considered weak or problematic in exploratory factor analysis. The factor replaces the variable describing the activities of safety officers and is therefore termed 'inspection and monitoring'. The seventh factor accounts for only 4.673%of the total variance with an eigenvalue of 1.168 and has high positive loading on careful operations and availability of skilled labour. This factor describes the construction workforce and is therefore termed 'workforce development'. The eighth factor accounts for 4.07% of the total variance with an eigenvalue of 1.004 and has high positive loadings on effective accident investigation, record keeping, and reporting system. The factor described process of documentation and is therefore labelled 'documentation'.

Some variables such as regular safety meetings, proper site illumination, and hazard communication strategies, did not load significantly on any factor after rotation. This may indicate weak correlations with the extracted constructs or overlapping relationships with multiple dimensions. Such variables were therefore excluded from the final factor structure to improve interpretability and validity of the extracted dimensions. However, these variables may still possess practical relevance in safety management and should not be entirely disregarded in future studies.

5.6 Level of Agreement Among The Groups of Respondents with Respect to Rankings of the Drivers

To quantitatively measure the agreement in ranking among groups of participants, the Kendal Coefficient of Concordance was used. Kendall's Coefficient of Concordance indicates the association among many variables. Table 8 revealed the level of agreement among the three groups of respondents concerning their rankings of the drivers that influence the safety performance of CMSMEs, and the computed value $\boldsymbol{x^2}$ and $\boldsymbol{x^2}$ critical table.

Table 8 *Computed value X^2 and X^2 critical table*

Variables	Kendall's Coefficient of Concordance (W)	Chi-square Statistic as x^2 = k(N-1)W	Computed Value x^2	Critical Table x^2 at 0.05	Inference
Drivers	0.6671	3(25) 0.6671	83	41.33	Significant

The high value of the Kendall Coefficient of Concordance (W = 0.6671) indicates high level of agreement among the respondents on the ranking of all the drivers. Therefore, it was inferred that there is a significant degree of agreement among the three groups of respondents regarding how they ranked the drivers.

6. Discussion of Findings

Findings from the factor analysis revealed eight major dimensions - provision of facilities, resources, capacity building, financial commitment, government intervention, inspection and monitoring, workforce, and documentation—that provided an explanation for 66.9% of the total variance in safety performance.

Provision of Facilities

The findings show that the provision of welfare facilities, safe work environments, fire prevention systems, and emergency plans emerged as the most critical determinants of safety performance in Nigeria. This points out that in CMSMEs, the safety of workers depends greatly on the availability of essential facilities and the level of emergency preparedness. This was evidence from the research carried out by Lim *et al.,* (2021), on suggestions for accident prevention in the construction industry, that providing necessary supports, proactive and continuous planning, reduces accident severity.

Safety Resources

The provision of PPE and first aid facilities also ranked highly. These findings suggest that CMSMEs with stronger investment in PPE, first aid facilities, and safety supervision are more likely to achieve proactive safety cultures. This demonstrates that safety performance is not solely dependent on worker behaviour, but also on organisational commitment and resource availability.

Capacity Building

Factor analysis revealed that safety training, digitalization, and engagement of safety officers by the CMSMEs were critical to safety performance. Studies by Zhang (2021) and Bakar *et al.,* (2023) showed similar findings that training and monitoring of workers on safety measures significantly reduce the rate of accidents.

Financial Commitment to Safety

The provision of a safety budget was revealed as an important factor in accident prevention. The CMSMEs in Abuja, Nigeria have limited resources to embark on safety investments. The research discovered that these construction firms often describe safety investments as huge financial burdens rather than a sustainable strategy that enhances productivity.

Government Intervention and Regulatory Environment

Safety policies, enforcement legislation, codes, and standards are visible factors enhancing safety performance. The findings from this study revealed that these factors are critical in achieving a safe culture within CMSMEs. Weak legislative frameworks in CMSMEs in many developing countries, according to Zailani *et al.,* (2022) and Zhang & Zheng (2024), lead to poor safety management practices.

Inspection and Monitoring

Safety inspection and monitoring prevent accidents and ensure compliance with regulations. Legislation framework alone is not sufficient without regular inspections and monitoring. This supports the view of Lestari *et al.,* (2021) that to educate workers on accident prevention, there must be adequate campaign and safety awareness.

Workforce Development

Having an adequate number of skilled workers for the required job is crucial to safety practices. Inexperience and unskilled workers create a potential danger in Nigerian CMSMEs. When workers are experienced in safety practices, it fosters the act of responsibility and accountability, leading to proactive safety habits. Similar, findings were reported in the studies conducted in Ghana and Malaysia by Adzivor *et al., (*2024) and Alaloul *et al.,* (2023). The studies revealed that engagement of unskilled workers leads to skipping of safety measures especially to meet project deadlines.

Documentation Practices and Technological Integration

Although the low mean scores for accident investigation systems and safety communication tools reveal a gap in systematic documentation and real-time safety reporting, which are critical for continuous improvement in safety performance. However, technology adoption ranked moderately; its positive factor loading suggests growing awareness of tools such as Building Information Modelling (BIM), drones, and wearable safety devices in improving hazard identification and risk management.

Overall, the findings confirm that safety performance in CMSMEs in Abuja, Nigeria is multidimensional, requiring simultaneous attention to resource provision, training, regulation, financial commitment, and technology adoption. These findings strengthen the assertion of Priya *et al.,* (2021) and Nyanga *et al.,* (2022) that construction safety in some developing countries is driven by weak regulations, low budgets, workers' attitudes, and supervisory commitment.

6.1 Degree of Agreement Among Respondents

The Kendall's Coefficient of Concordance (W = 0.6671) revealed a significant agreement among project managers, engineers, and workers regarding the relative importance of the identified drivers. This indicates that different groups of stakeholders in CMSMEs display a high level of concern for safety practices. Harahap *et al.,* (2024) supported these findings that when stakeholders support agreed-upon policies on safety and are jointly accountable for safety decisions.

6.2 Limitations of the Study

This study is limited to CMSMEs operating within Abuja, Nigeria; therefore, the findings may not fully represent all CMSMEs in other regions of Nigeria or other developing countries. Second, the study relied on questionnaire responses, which may be affected by respondents' subjective perceptions and response bias. Third, although factor analysis was useful in reducing variables into dimensions, some variables did not load significantly, which may have affected the comprehensiveness of the factor structure. Despite these limitations, the study provides useful empirical insights into safety performance dimensions within CMSMEs in developing countries. Future studies may employ longitudinal approaches and broader geographical coverage to enhance generalisability.

7. Conclusion

The objective of this research is to analyse the drivers enhancing safety performance in CMSMEs in Abuja, Nigeria, as a typical developing country. The research adopted descriptive statistics, mean score ranking, and factor analysis. A total of twenty-five drivers were analysed, and sixteen of them were significant. The factor analysis displayed eight major dimensions accounting for 66.9% of the total variance in safety performance. To ensure the safety performance of CMSMEs, the results revealed that the provision of basic safety facilities and resources, such as PPE, first aid facilities, fire prevention systems, and welfare facilities, is crucial. In addition, the research found that capacity building, that is, training of workers on safety practices, engagement of skilled and experienced workers, effective monitoring and supervision, are critical to improve workers' safety performance. The study also revealed the importance of Government intervention in the safety performance of CMSMEs in Abuja, Nigeria. For the workers to record high safety performance, there must be effective legislation on safety policies and regular inspections to monitor compliance. The level of financial commitment to safety was also reported to be important. Many CMSMEs in Abuja do not have sufficient budgets for safety management. Furthermore, the adoption of emerging technology was also reported as an important driver that enhances safety performance. The high degree of agreement among different groups of respondents shows a shared recognition of safety performance as essential to project delivery. The safety of workers is paramount to project success. This study contributes to construction safety literature by proposing a multidimensional conceptual structure for understanding safety performance drivers in CMSMEs operating in resource-constrained environments.

Recommendations to CMSMEs and Government Agencies

The following recommendations have been made based on the findings of the study:
CMSMEs should provide PPE, first aid and welfare facilities, emergency response systems, safety training programmes, improve the budget allocated to safety activities, and adopt emerging technologies in safety management.

The government, through the Federal Ministry of Labour and Employment, should review legislation on safety policies. The Federal Ministry of Works and Housing, along with the Standard Organization of Nigeria, should inspect and monitor safety practices on construction sites.

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Conflict of Interest

The authors declared that there is no conflict of interest regarding the publication of this research.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Ranti Taibat Adebiyi, Olubola Babalola;* ***data collection:*** *Zubair Musa Abiodun, Aminat Damola Amuda;* ***analysis and interpretation of results:*** *Ranti Taibat Adebiyi, Ganiyu Amuda-Yusuf, Zubair Musa Abiodun;* ***draft manuscript preparation:*** *Lukman Olarewaju Olorunoje, Ranti Taibat Adebiyi. All authors reviewed the results and approved the final version of the manuscript.*

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