WAYFINDING VARIABLES AND USER SAFETY IN PUBLIC STADIA SITUATED IN SOUTH-EAST AND SOUTH-SOUTH ZONES OF NIGERIA

Nwanguma, Ephraim Ogechi

Department of Architecture, Imo State University, Owerri. Imo State. Nigeria

Abstract

Coordinating human movement in large public spaces such as the stadia and wayfinding are critical issues in user safety. This article is part of a wider research on the impact of wayfinding on user safety in public stadia situated in South-East and South-South zones of Nigeria. The research design was survey design. The survey instruments were obtained through direct operationalization of the Table of variables definition. Thirteen wayfinding variables were deployed to investigate three research questions; "to what extent do physical conditions of the stadia impact on user safety, in the study area", to what extent do socio-economic characteristice of users impact on user safety in the study area"; and to what extent are there relative contributions of physical conditions socio-economic characteristics of users and safety infrastructure to stadia user safety in the study area?" After statistical tools of analyses were applied at 95% confidence level, the null hypotheses were rejected, and the alternates chosen. It was found statistically that physical, socio-economic and safety infrastructural variables significantly contribute to user safety in public stadia in the study area. Realizing that adverse architectural design impedes wayfinding in complex public facilities such as the stadium, the paper recommends that design professionals must expunge irrationality of wayfinding settings in their floor plan configurations. It also recommends that maintenance staff in the public stadia be retrained and sensitized to the fact that signage materials are vulnerable and fragile, and must be handled with diligence and caution. Professionals and public stadia operators therefore, should consider the incorporation of effective wayfinding systems and materials in the design and management of the facilities to mitigate potential dangers and overwhelming navigational challenges to users.

Keywords: *wayfinding, user safety, signage, public stadia.*

Introduction

Ancient Greek and Roman Civilizations evolved the foundations for modern wayfinding techniques. They adopted images and words to direct people to safe shelter, or to notify people of specific land uses such as a hunting ground (Purple, 2020). In 1970 the society for Environmental Graphic Design followed the footprints of Lynch (1960) adopting the term "wayfinding" to direct people through public spaces. Today wayfinding signage involves digital wayfinding solutions such as wayfinding kiosks, dynamic maps, indoor positioning systems (IPS) and Global Positioning System (GPS). Deployment of blue dot mobile apps can direct users in a complex venue to the exact space/seat they need to be in (Purple, 2020). Wayfinding as a phenomenon seeks to inform users of their surroundings, educating them of the features, amenities and functions of the environment. (Wordhippo, 2022).

Wayfinding may be used interchangeably with navigation, helmsmanship, map-reading, chart-reading, seamanship, and steermanship. It is an act by which a user finds a way to a particular place.While potential materials used for wayfinding signage include verometal which can be deployed to create colourful and legible wayfinding signage, other materials such as plastics, assorted vinyl, painted wall graphics are invaluable in signage.

Two key vocabularies of wayfinding elements are arrows and pictograms. Typography, colour, texture, and plant masses are also effective components for signage which integrate signage and map design, symbols, typography, colour and tactile texture to navigate users through space (Almeida, 2015). Wayfinding design offers visual cues to people to their destinations effortlessly (Salam, 2022), and enables users escape from dangerous situations to safety. Wayfinding signage includes; regulatory signage - warns users, sometimes gives information on potential dangers, and prohibitions; informational signage; directional signage and identification.

Literature Review

Lavastar (2021) suggested 5 critical design principles in wayfinding such as: establishment of identity at each location, creation of zones of contrasting visual character, use of landmarks as cues for orientation, elimination of overwhelming navigational options, and evolution of finite routes. Denis and Pontille (2013) identified signage materials in public spaces as vulnerable, and fragile, especially in the hands of maintenance staff. It further posits that fragility is a mode that must be considered in choice of material for signage in public domain.

Siyanbola, et al (2022) identified the importance of a wayfinding system in places and coordinating human movement in space. It also suggested that people visiting a building are desirous of fulfilling their aim within the shortest possible time devoid of anxiety and negative feelings. Thus, the relevance of a functional wayfinding system in a public stadia where crowds thrive without experiencing spatial stress need not be overemphasized. Effective signage system is a collection of correlated signs used with a coherent design and purpose. It conveys information to users with utmost ease (Abhinar, 2014). Contributing in the discuss, Marquardt (2011) identified flow plan typology and environmental cues as critical in supporting wayfinding abilities of people with dementia. Additional interventions such as furnishing, signage, colours and lighting, though important, cannot compensate for adverse architectural design. Wan, Li, and Wang (2019) Identified irrationality of wayfinding settings, and required information as user challenge in crowded public domain, and recommended that refining the elements of signage system would make it sustainable in the interest of users.

Jamshidi, Ensafi, and Pati (2020) reported that wayfinding is an issue in complex facilities which yield negative psychological and physiological outcomes. Wayfinding in crowded environments such as stadia is influenced by the actions of other people, even their mere presence. It involves both individual and group-level decision making (Dalton, Holscher, & Montello, 2019). According to Salam (2022) inadequate signage systems and architectural design engender uneven access to users of hospital buildings during wayfinding, causing stress, uncertainty, and unpleasant experience for users. The study recommended that conceptual design and placement of signage, and other inclusive navigational components should be purposefully and suitably installed, simple and appealing for inclusive access, meaning and interpretation. Giudice, Guenther, Jensen, and Haase (2020), identified accessible interactive maps as excellent tools for conveying normally in-accessible environmental information for leveling the "spatial" playing field for blind and visually impaired (BVI) wayfinders. State of the art vibro-audio maps (VAM) support environmental learning, wayfinding effort on the basis of non-visual sensing.

Methodology

This study is part of a wider research on the impact of wayfinding on user safety in public stadia situated in South-East and South-South zones of Nigeria. The research design was survey design. The survey instruments were obtained through direct operationalization of the table of variables definition depicted in Table1 to ensure reliability and validity of the findings. Thirteen variables were deployed in the investigation to address three research questions; *"to what extent do physical conditions of the stadia impact on user safety in the study area?*; *to what extent do socio-economic characteristics of users impact on user safety in the study area and to what extent are there relative contributions of physical conditions, socio-economic characteristics of users, and safety infrastructure to stadia user safety in the study area?*

Table 1: Definition of Variables

V/N	Description	Code	Measure-ment	Values	Categories
	Variables for measuring physical conditions				
V1	Ease of finding parking space in stadium	EPSS	Ordinal	1-5	1-(Not Easy) 2-(Somewhat Easy), 3-(Moderate Easy) 4-(Easy), 5-(Very Easy)
V2	Satisfaction with directional signs in the stadium	SOSS	Ordinal	1-5	1-(least satisfied) 2-(satisfied), 3-(neither satisfied), 4-(more satisfied), 5-(most satisfied)
V3	Frequency of pushing by others after ticket purchase	FPTP	Ordinal	1-5	1-(least often), 2-(often), 3-(neither), 4-(more often), 5-(most often)
V4	Stadium staff helpful in showing exits in emergency evacuation	SSEE	Ordinal	1-5	1-(least often), 2-(often), 3-(neither), 4-(more often), 5-(most often)
	Socio-economic Variables				
V5	Users use short-cuts to access stadium	SUSS	Nominal	1-2	1-(yes) , 2-(No)
	Safety Infrastructure Variables				
V6	Supply of Electricity	SE	Ordinal	1-5	1-(least regular), 2-(regular), 3-(Neither), 4-(more regular), 5-(most regular)
V7	Alternative sources of Power supply	ASPS	Nominal	1-2	1-(yes), 2-(No)
V8	Type of alternative Power source	TAPS	Nominal	1-4	1-(Generator set), 2-(inverter), 3-(Solar system), 4-(Others)
V9	Warning signs clearly show exits and entrances	WSEE	Ordinal	1-5	1-(least shown), 2-(shown), 3-(weather), 4-(more clearly shown , 5-(most clearly shown)
V10	Attended night event in stadium	ANES	Nominal	1-2	1-(yes), 2-(No)
V11	Difficulty in finding your way in the stadium at night	DFSN	Ordinal	1-5	1-(lest difficult), 2-(difficult), 3-(neither), 4-(more difficult), 5-(most difficult)
V12	Frustrated in stadium by difficulty in reaching important destinations	FDRD	Ordinal	1-5	1-(least frustrated), 2-(frustrated), 3-(Neither), 4-(More frustrated), 5-(most frustrated)
V13	Stadium staff helpful in showing exits in emergency evacuation	SSEE	Ordinal	1-5	1-(least often), 2-(often), 3-(neither), 4-(more often), 5-(most often)

Source: *(Nwanguma, 2020))*

Multi-stage random sampling method was applied in the selection of the sample. The population universe consisted of the 7 public stadia within the study area (See Table 2), out of which 4 stadia were selected through multi- stage random sampling. The respondents were users of the stadia, and staff.

Table 2: List of Public Stadia in South-East and South-South geo-political zones of Nigeria by on ownership

S/N	State	Available Public Stadia	Capacity	Year of Commissioning
1	Abia	None		
2	Anambra	None		
3	Akwa Ibom	Godswill Akpabio International Stadium Uyo	30,000	2014
4	Bayelsa	None		
5	Cross River	U.J. Esuene Stadium, Calabar	30,000	1977
6	Delta	None		
7	Ebonyi	None		

8	Edo	Samuel Ogbemudia Stadium, Benin City	30,000	1983
9	Enugu	Nnamdi Azikiwe International Stadium, Enugu	22,000	1959
10	Imo	Dan Anyiam Stadium Owerri	10,000	1998
11	River	❖ Adokiye Amasiemaka Stadium, Port-Harcourt ❖ Yakubu Gowon Stadium (formerly Liberation Stadium), Port Harcourt	38,000 25,000	2015 2001

Source: *(Nwanguma, 2020)*

Results and Discussion

As stated, the objectives of the study were to: investigate the extent to which physical conditions of the stadia impact on user safety in public stadia in the study area; investigate the extent socio-economic characteristics of users in public stadia impact on user safety within the study area; to investigate the relative contributions of physical, natural, human trigger and safety infrastructure variables to stadia user safety in the study area. Data were therefore gathered on the variables in focus, and the analyses of the data showed the following:

Ease of finding parking space in stadium *EPSS* (variable 1)

The data collected under variable 1 showed that for Nnamdi - Azikiwe stadium 24.6% of respondents indicated *"least easy"*, while 75.4% *"easy"*; Data gathered from God'swill Akpabio stadium showed that 23.4% of respondents indicated *"least easy"*, while 76.6% indicated *"easy"*. Data gathered from Yakubu Gowon stadium showed that 43.4% indicated *"least easy"*, 47.2% - *easy*, while 9.4% indicated *neither*. The data collected from Dan Anyiam stadium showed that 26.7% of respondents indicated *"least easy"*, while 73.3% indicated *"easy"*. This is depicted in Figure 1.

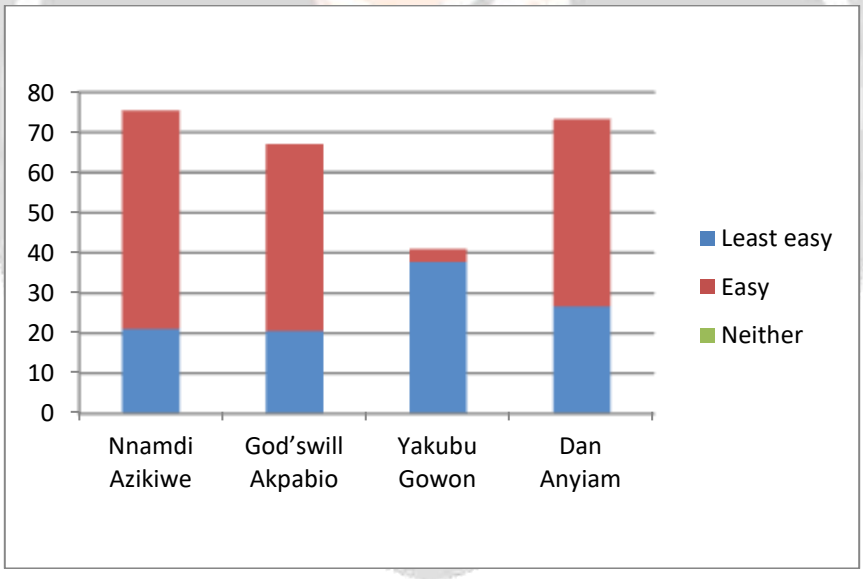

Figure 1: Ease of finding parking space in stadium

Source: Fieldwork (2019)

Satisfaction with directional signs in stadium *SOSS* (Variable 2)

Data for variable 2 showed that for Nnamdi Azikiwe stadium, 65.5% indicated *"least satisfied"* while 34.5% indicated "*satisfied"*. The data collected from God'swill Akpabio stadium showed that 31.2% indicated *"least satisfied"*, while 68.8% indicated *"satisfied"*. Data gathered from Yakubu Gowon stadium showed that 58.5% indicated *"least satisfied"*, while 36.1% indicated *"satisfied"*. The data collected from Dan Anyiam stadium showed 30.0% *"least satisfied"* while 70.0% were satisfied with directional signs in the stadium. This is delineated in Table 3.

Table 3 Area-wise data on V2 - Satisfaction with directional signs in stadium

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Least satisfied	65.5	100.0	31.2	100.0	58.5	100.0	30.0	100.0
Satisfied	34.5		68.8		41.5		70.0	
Neither								
More Satisfied								
Most Satisfied								
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Users use short-cuts to access stadium *SUSS* (Variable 3)

The data collected showed that 7.9% of the respondents from Nnamdi Azikiwe stadium indicated *"Yes"*, while 92.10% indicated *(No).* Data gathered from God'swill Akpabio stadium showed that 7.1% of the respondents indicated *"Yes"*, while 92.9% indicated *(No).* Data collected from Yakubu Gowon stadium showed that 2.6% indicated *"Yes"*, while 97.4% indicated *(No).* The data collected from Dan Anyiam Stadium showed that 64.9% of respondents indicated *"Yes"*, while 35.1% indicated *(No).* This is delineated in Figure 2.

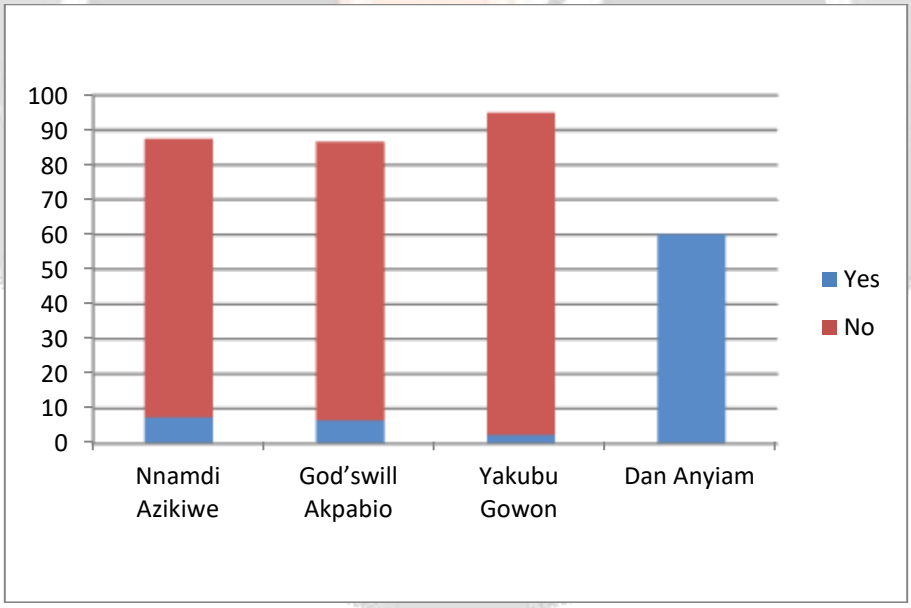

Figure 2: Seen users use short-cuts to access stadium

Source: Fieldwork (2019)

Supply of electricity *SE* (Variable 4)

The data gathered showed that 81.6% of the respondents from Nnamdi Azikiwe stadium indicated *(least regular)*, while 18.4% indicated *(regular).* Data gathered from God'swill Akpabio stadium showed that 92.9% of the respondents indicated *(least regular)*, while 7.1% indicated *(regular).* Data gathered from Yakubu Gowon stadium showed that 82.1% of the respondents indicated *(least regular)*, while 17.9% indicated *(regular).* The data collected from Dan Anyiam stadium showed that 86.5% of the respondents indicated *(least regular)*, while 13.5% indicated *(regular).* This is depicted in Figure 3.

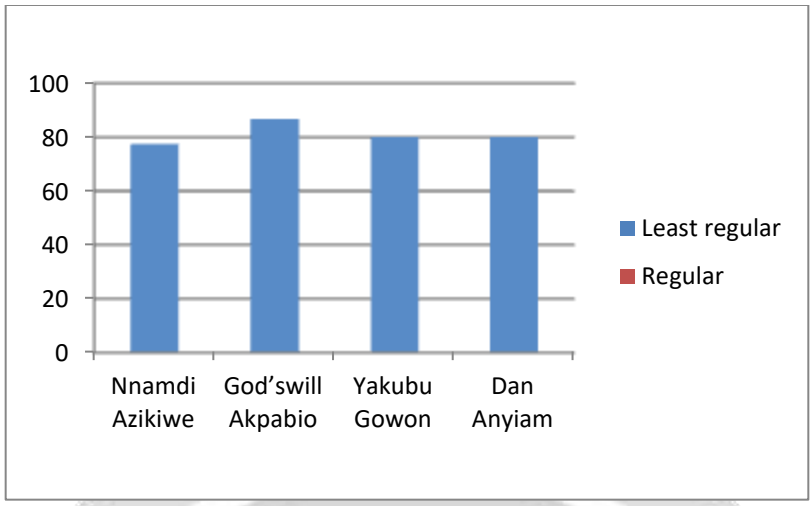

Figure 3: Supply of electricity

Source: Fieldwork (2019)

Alternative sources of power *ASPS* (Variable5)

The data showed that 68.4% of the respondents from Nnamdi Azikiwe stadium indicated *(Yes)*, while 31.6% indicated *(No)*. Data gathered from God'swill Akpabio stadium showed that 66.7% of the respondents indicated *(Yes)* while 33.3% indicated *(No)*. Data gathered from Yakubu Gowon stadium showed that 74.4% of the respondents indicated *(Yes)*, while 25.6% indicated *(No)*. The data collected from Dan Anyiam Stadium showed that 73.0% of the respondents indicated *(Yes)*, while 27.0% indicated *(No)*. This is delineated in Figure 4.

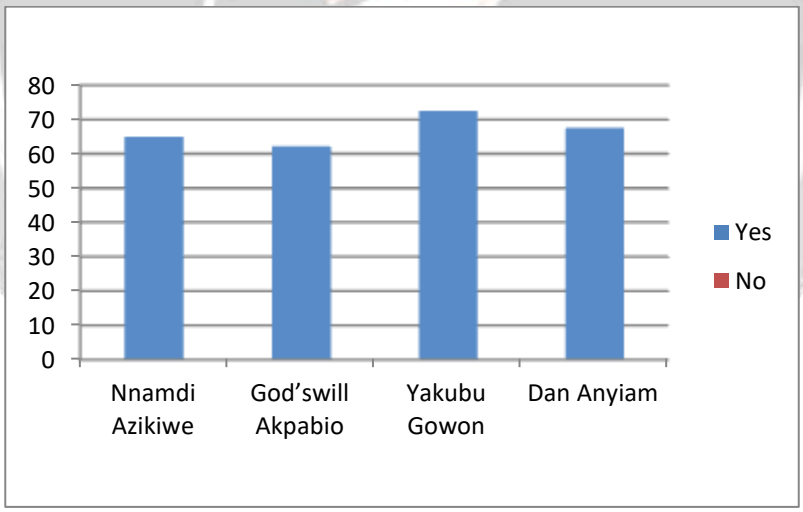

Figure 4: Alternative source of power

Source: Fieldwork (2019)

Type of alternative power source *TAPS* (Variable 6)

The data gathered showed that 71.1% of the respondents from Nnamdi Azikiwe stadium indicated *(generator set)*, 15.8% *(inverter)*, 10.5% *(solar system)*, while 2.6% indicated *(others)*. Data gathered from God'swill Akpabio stadium showed that 52.4% of the respondents indicated *(generator set)*, 26.29% *(inverter)*, 11.9% *(solar system)*, while 9.5% indicated *(others)*. Data gathered from Yakubu Gowon stadium showed that 53.8% of the respondents indicated *(generator set)*, 10.3% *(inverter)*, 30.8% *(solar system)*, while 5.1% indicated *(others)*. The data collected

from Dan Anyiam stadium showed that 45.9% of the respondents indicated *(generator set),* 13.5% *(inverter),* 32.4% *(solar system),* while 8.1% indicated *(others).* This is depicted in Table 4.

Table 4: Area-wise data on V8 Type of alternative power source

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Generator set	71.1	100.0	52.4	100.0	53.8	100.0	45.9	100.0
Inverter	15.8		26.2		10.3		13.5	
Solar system	10.5		11.9		30.8		32.4	
Others	2.6		9.5		5.1		8.1	
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Warning signs clearly show exits and entrances *WSEE* (Variable 7)

The data gathered showed that 70.9% of the respondents from Nnamdi Azikiwe stadium indicated *(least shown),* while 29.1% *indicated (shown).* Data gathered from God'swill Akpabio stadium showed that 68.8% of the respondents indicated *(least shown),* while 31.3% indicated *(shown).* Data gathered from Yakubu Gowon stadium showed that 77.4% of the respondents indicated *(least shown),* while 22.6% indicated *(shown).* The data collected from Dan Anyiam stadium showed that 70.0% of the respondents indicated *(least shown),* while 30.0% indicated *(shown).* This is depicted in Table 5.

Table 5: Area-wise data on V8 - Warning signs clearly show exits and entrances

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Least shown	70.9	100.0	68.8	100.0	77.4	100.0	70.0	100.0
shown	29.1		31.3		22.6		30.0	
Neither								
More shown								
Most shown								
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Attended night event in stadium *ANES* (Variable 9)

The data showed that 34.5% of the respondents from Nnamdi Azikiwe stadium indicated *(Yes),* while 65.5% indicated *(No).* Data gathered from God'swill Akpabio stadium showed that 39.1% of the respondents indicated *(Yes),* while 60.9% indicated *(No).* Data gathered from Yakubu Gowon stadium showed that 41.5% of the respondents indicated *(Yes),* while 58.5% indicated *(No).* The data collected from Dan Anyiam Stadium showed that 23.3% of the respondents indicated *(Yes),* while 76.7% indicated *(No).* This is depicted in Figure 5.

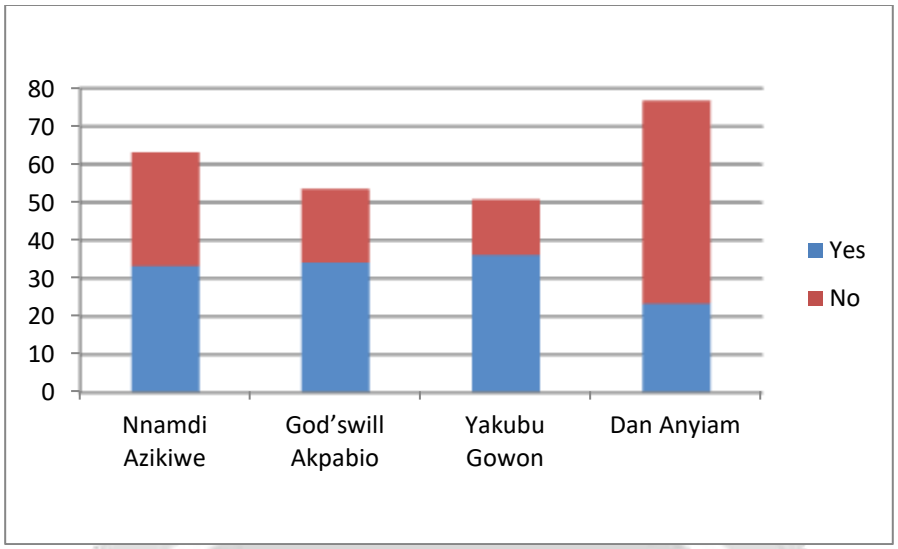

Figure 5: Attended night event in stadium

Source: Fieldwork, 2019

Difficulty in finding your way in the stadium at night *DFSN* (Variable 10)

The data showed that 72.7% of the respondents from Nnamdi Azikiwe stadium indicated *(least difficult),* while 27.3% indicated *(difficult).* Data gathered from God'swill Akpabio stadium showed that 76.6% of the respondents indicated *(least difficult),* while 23.4% indicated *(difficult).* Data gathered from Yakubu Gowon stadium showed that 77.4% of the respondents indicated *(least difficult),* while 22.6% indicated *(difficult).* The data collected from Dan Anyiam stadium showed that 90.0% of the respondents indicated *(least difficult),* while 10.0% indicated *(difficult).* This is depicted in Table 6.

Table 6: Area-wise data on V10- Difficulty in finding your way in the stadium at night

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Least difficult	72.7	100.0	76.6	100.0	77.4	100.0	90.0	100.0
Difficult	27.3		23.4		22.6		10.0	
Neither								
More difficult								
Most difficult								
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Frustrated in stadium for difficulty in reaching important destinations *FDRD* (Variable 12)

The data showed that 36.4% of the respondents from Nnamdi Azikiwe stadium indicated *(least frustrated),* 52.7% *(frustrated),* while 10.9% indicated *(more frustrated).* Data gathered from God'swill Akpabio stadium showed that 28.1% of the respondents indicated *(least frustrated),* 51.6% *(frustrated),* while 20.3% indicated *(more frustrated).* Data gathered from Yakubu Gowon stadium showed that 17.0% of the respondents indicated *(least frustrated),* 56.6% *(frustrated),* while 26.4% indicated *(more frustrated).* The data collected from Dan Anyiam stadium showed that 16.7% of the respondents indicated *(least frustrated),* 53.3% *(frustrated),* while 30.0% indicated *(more frustrated).* This is depicted in Table 7.

Table 7:Area-wise data on V12- Frustrated in stadium for difficulty in reaching important destinations

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Least frustrated	36.4	100.0	28.1	100.0	17.0	100.0	16.7	100.0
frustrated	52.7		51.6		56.6		53.3	
Neither								
More frustrated	10.9		20.3		26.4		30.0	
Most frustrated								
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Stadium staff helpful in showing exits in emergency evacuation *SSEE* (Variable 13)

The data showed that 23.6% of the respondents from Nnamdi Azikiwe stadium indicated *(least often),* 43.6% *(often),* while 32.7% indicated *(more often).* Data collected from God'swill Akpabio stadium showed that 31.3% of the respondents indicated *(least often),* 53.1% *(often),* while 15.6% indicated *(most often).* Data gathered from Yakubu Gowon stadium showed that 18.9% of the respondents indicated *(least often),* 39.6% *(often),* while 41.5% indicated *(more often).* The data collected from Dan Anyiam stadium showed that 53.3% indicated *(least often),* while 36.7% indicated *(more often).* This is delineated in Table 8.

Table 8: Area-wise data on V13- Stadium staff helpful in showing exits in emergency evacuation

Value Label	Nnamdi Azikiwe Stadium		God'swill Akpabio Stadium		Yakubu Gowon Stadium		Dan Anyiam Stadium	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Least often	23.6	100.0	31.3	100.0	18.9	100.0	10.0	100.0
often	43.6		53.1		39.6		53.3	
Neither								
More often	32		15.6		41.5		36.7	
Most often								
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork (2019)

Test of Hypotheses

Having investigated the variables in focus, the hypotheses were statistically tested to investigate significant relationship. The variables in focus were ordinal variables, hence, Pearson's product moment correlation analysis tool was used to examine the significance of the relationships.

The relationship between SSEE and SE

Hypotheses Ho1 concerns objective 1 which was "*to investigate the extent to which physical conditions impact on user safety in public stadia in South-East and South-South geo-political zones of Nigeria"*. The variables - *"stadium staff helpful in showing exits in emergency evacuation" (SSEE)* and "*supply of electricity" (SE)* were chosen as representative of physical conditions and user safety infrastructure of the stadia. The two variables in focus were ordinal variables, hence Pearson Product Moment correlation analysis tool was used to test the significance of the relationship. The result of the analysis showed a correlation coefficient value of 0.443 with a probability value (p-value) of 0.87. The magnitude of relationship is high and significant. The null hypothesis was therefore rejected and alternate hypothesis accepted. That is "*there is a significant relationship between physical conditions and user safety in public stadia in South-East and South-South geo-political zones of Nigeria"*. The results are shown in Table 9.

Table 9: Pearson Product Moment correlation analysis result of relationship between *SSEE* and *SE*

		Stadium Staff helpful in showing exits in emergency evacuation	Supply of electricity
Stadium Staff helpful in showing exits in emergency evacuation	Pearson Correlation	1	0.87
	Sig. (2-tailed)		.443
	N	202	202
supply of electricity	Pearson Correlation	0.87	1
	Sig. (2-tailed)	.443	
	N	202	202

Source: Fieldwork (2019)

The relationship between *UASS* and *WSEE*

Hypothesis Ho2 concerns objective 2 which was "*to investigate the extent users' socio-economic characteristics in public stadia impact on user safety in the study area*". Two representatives variables of user safety and socio-economic characteristics chosen were "*users aggressive to stadium staff " (UASS)* and *"warning signs clearly show exits and entrances" (WSEE)* The two variables in focus were ordinal variables, hence Pearson Product Moment correlation test analysis tool was used to examine the significance of the relationship.

(i) The results of the analysis showed a correlation coefficient of 0.779 with probability value (P-value) of 0.221. This implies a positive relationship exists. The magnitude of relationship is high and significant. We therefore reject the null hypothesis, and the alternative accepted. This alternative hypothesis states that *"there is significant relationship between socio-economic characteristics of users* and *user safety in public stadia in South-East and South-South geopolitical zones of Nigeria*. The results are shown in Table 10.

Table 10: Pearson Product Moment correlation analysis of relationship between *UASS* and *WSEE*

		Users aggressive to stadium staff	Warning signs clearly show exits and entrances
Users aggressive to stadium staff	Pearson Correlation	1	.779
	Sig. (2-tailed)		.221
	N	202	202
Warning signs clearly show exits and entrances	Pearson Correlation	.779	1
	Sig. (2-tailed)	.221	
	N	202	202

Source: Fieldwork (2019)

Difference between *SSE, DFSN, EJQ* and *EHCD*

Ho 3: Hypothesis Ho 3 evolved from objective 3 which was *"physical, natural, human trigger, and safety infrastructure variables do not significantly contribute to user safety in stadia situated in the study area"*. The variables in focus were *"stadium staff helpful in showing exits in emergency evacution" SSEE; "difficulty in finding your way in the stadium at night" DFSN; "ever jumped queue to gain quick access into arena" EJQ; excessive heat causes discomfort" EHCD.* Table 11 is the one-way ANOVA analysis test results showing the difference *SSEE, DFSN, EJQ,* and *EHCD.*

Table 11 One-way ANOVA analysis test results showing the difference between *SSEE, DFSN, EJQ* and *EHCD*

		Sum of Squares	df	Mean Square	F	Sig.
Stadium Staff helpful in showing exits in emergency evacuation (*SSEE)*	Between Groups	20.196	3	6.732	17.117	.000
	Within Groups	59.778	152	.393		
	Total	79.974	155			
Difficulty in finding your way in the Stadium at night *(DFSN)*	Between Groups	3.894	3	1.298	6.620	.000
	Within Groups	29.799	152	.196		
	Total	33.692	155			
Ever jumped queue to gain quick access into arena *(EJQ)*	Between Groups	2.752	3	.917	6.312	.000
	Within Groups	22.088	152	.145		
	Total	24.840	155			
Excessive heat causes discomfort *(EHCD)*	Between Groups	17.707	3	5.902	10.519	.000
	Within Groups	85.287	152	.561		
	Total	102.994	155			

Source: Fieldwork (2019)

The results showed a probability value (p-value) of .000, for all the tests. The magnitude of significance is high, implying that there is a highly significant difference between the variables in focus. Therefore null hypothesis was rejected, and the alternative accepted; which states that physical, natural, human trigger, and safety infrastructure variables significantly contribute to user safety in the stadia situated in the study area.

Findings

This research identified 13 critical wayfinding variables in public stadia situated in South-East and South-South zones of Nigeria. Pearson Product Moment Correlation analysis was used to investigate the significant relationships among the variables. The ordinal variables *"stadium staff helpful in showing exits in emergency evacuation" (SSEE)* and *"Supply of electricity" (SE)* were chosen as representatives of physical conditions and user safety infrastructure of the stadia. The result of the analysis showed a correlation coefficient value of 0.443 with a probability value (P-value) of 0.87. the magnitude of relationship is high and significant. The null hypothesis was therefore rejected and alternate hypothesis accepted which states that there is a significant relationship between physical conditions and user safety in public stadia situated in the study area.

The ordinal variables, *"users aggressive to stadium staff" (UASS)* and *"warning signs clearly show exits and entrances" (WSEE)* were chosen and tasted as representatives of user safety and socio-economic characteristics. The results of the analysis showed a correlation coefficient of 0.779 with probability value (P-value of 0.221). The magnitude of relationship is high and significant. The null hypothesis was therefore rejected, and the alternate chosen which states that there is a significant relationship between socio-economic characteristics and user safety.

Four ordinal variables, *stadium staff helpful in showing exits in emergency evacuation" (SSEE)*; *"difficulty in finding your way in the stadium at night" (DFSN); ever jumped queue to gain quick access into arena" (EJQ); excessive heat causes discomfort" (EHCD)* were chosen and tested to investigate if there is a significant difference among them in contributing to user safety in public stadia situated in the study area. The ANOVA analysis test results showed a probability value (P-value) of .000, for all the tests. The magnitude of significance is high, implying that there is high significant difference among the variables in focus. The null hypothesis was this rejected and the alternate accepted was thus rejected and the alternate accepted which states that "physical, natural, human trigger, and safety infrastructure significantly contribute to user safety in the public stadia situated in the study area".

Recommendations

The study has established statistically that wayfinding variables play critical roles in user safety in public stadia situated in South-East and South-South zones of Nigeria. Professionals and operators of public stadia should

therefore consider the incorporation of effective wayfinding systems and materials in the design and management of stadia facilities to mitigate potential dangers, and overwhelming navigational challenges to users. Maintenance staff in the public stadia should be retrained and sensitized to the fact that signage materials are vulnerable and fragile, and must be handled with diligence and caution. Realizing that adverse architectural design impedes wayfinding in complex public facilities such as the stadium, design professionals must endeavour to expunge irrationality of wayfinding settings in their floor plan configuration.

Conclusion

The interaction of the three sub-systems in prescribed values would produce the expected results of user safety in the public stadia. A breakdown of the interaction of elements of the sub-system would lower the rating of the stadia in terms of user safety. After statistical tools of analyses were applied at 95% confidence level, the null hypotheses were rejected, and the alternates chosen. It was found statistically that physical, socio-economic and safety infrastructural variables. significantly contribute to user safety in public stadia situated in South-East, and South-South zones of Nigeria.

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