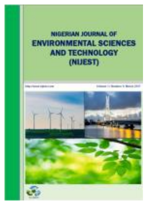
Nigerian Journal of Environmental Sciences and Technology (NIJEST)
www.nijest.com
ISSN (Print): 2616-051X | ISSN (electronic): 2616-0501
Vol 4, No. 1 March 2020, pp 127 - 137



Perception of Stakeholders on Factors Responsible for Sports Facilities Defects in Selected Universities in South Western Nigeria

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https://doi.org/10.36263/nijest.2020.01.0187

ABSTRACT

The study assessed the perceptions of stakeholders on factors causing sports facilities defects in selected universities established between 1957 and 1962 in South-West Nigeria by examining the strength of the identified factors responsible for sports facilities' defects in the selected universities. Data were collected using a structured questionnaire which was administered on sports men and women and maintenance personnel. The study incorporated all the fifteen sports featured at the Nigeria University Games Association (NUGA) competitions. Three federal universities were purposively selected because these have facilities for all the fifteen sports and have hosted national and international sporting events. Data obtained were analyzed using frequency distribution, percentages, mean response analysis and factor analysis. Using the mean response analysis, the result showed that the most severe factors responsible for sports facilities' defects were design deficiencies (3.67), intensity of use (3.53), level of exposure to climatic condition (3.41), inadequate maintenance funding (3.19), vandalism (3.18), moisture (3.17) and inadequate cash flow analysis (3.16). The study recommends that users of the facilities should be carried along at the designs stage to minimize design errors and also adequate fund should be provided to maintenance unit to guarantee adequate maintenance of sports facilities for optimal performance.

Keywords: Defects, Factors, Facilities, Sports, Stakeholders, Universities

1.0. Introduction

"Sports for all'' is a stated goal of both governments and sports organizations the world over (Tangen, 2004; Spaaijj *et al*., 2018). Large grants and huge investments are used for the construction, maintenance and rehabilitation of different forms of sports facilities (Tangen, 2004). It is generally accepted that participation in sports provides an extensive range of benefits to individuals and the community as a whole. Engagement in sports is advised because it provides a variety of physiological, psychological and social benefits (World Health Organization (WHO) 2010; World Health Organization (WHO) 2014; Department of Health South Africa (DOHSA) 2015; Mthethwa, 2017). Involvement in physical activities has been revealed to decrease the risks of lifestyle related diseases such as cardiovascular diseases, obesity, hypertension, cancer and diabetes mellitus (WHO, 2010; McGuirk and Prentice, 2012).

Acknowledging the value of physical activities, tertiary institutions have invested massively in sports facilities and recreation resources (Webber and Mearman, 2005; Soleymani *et al*., 2012; Desrochers, 2013; University of the Western Cape (UWC), 2014; Mthethwa, 2017). Therefore, in order to achieve a balanced upkeep of these sports facilities including the structures, Robert (1995) emphasized the need for the crew to comprise personnel with appropriate technical knowledge and skills. The inference here is that for a bi- dimensional setting as this, the experts should have both the technical (engineering) and sports administration background (Adeniran and Ikpo, 2001). This may demand the incorporation of sports administrators into the engineering-based maintenance organization or conversely, contracting some workload requiring specialist attention if the organization is primarily managed by sports experts.

Perhaps the greatest concern to the management of public utilities such as sports facilities is security of the facilities. Studies have shown that these facilities are prone to vandalism, graffiti, and theft, management inability to forecast in scientific terms the fund required periodically for maintenance (Seeley, 1987; Anderson, 1999; Akinpelu, 2002), probably because of the non-availability of facilities condition assessments data. Intensity of use of sports facilities could be a major source of defect, since usage of the sports facilities cannot practically be limited by management and this generate increasing failure rate of composite items such as closets, including septic tank, concrete and timber finishing surfaces where applicable, and the second aspect relates to trespassers who not only add to the design target but also use the area for other non-conforming purposes (Adeniran and Ikpo, 2001; Oseghale *et al*., 2019). Also, physical aggression and abrasion on the sports surfaces from athletes and vibrations induces on the sports building structures as a result of their trainings are other sources of deterioration on the sports facilities (Fischer *et al*., 2020). Corrosion of steel reinforcement especially from combine effects of chemicals such as chlorides, sulphate, acids are other sources of deterioration of sports facilities (Rossi *et al.*, 2019).

The personality of an estate is marked by physical appearance. Most sports structures suffer severe exposure, which tells quickly on the finishing materials. The two most common materials (reinforced or plain concrete and timber) become unsightly when exposed to moisture and solar radiation. For concrete finishes, moss, lichens, moulds, plant growth and so on, mar appearance. Timber members rot due to fungi attacks and plant life, such as ivy and are completely destroyed by insects especially termites (Ikpo, 1990; Oseghale and Ikpo, 2014).

According to Adeniran and Ikpo (2001), client's brief for a new sporting facility often determines the long-term maintenance needs of the facility. The brief should indicate performance requirements and possible changes in use, as well as the future policy for operating, clearing and maintaining the facility. The effects of deterioration can be reduced by serious commitment towards maintenance by the users of the facility. The problem of deterioration can also be increased due to delay in responding to the problem by indifferent users. When maintenance is ignored (delayed or not executed at all) the effect is to aggravate it or increase the rate of sports facilities deterioration from year to year (Al-Sultan, 1996; Olubodun, 1996; Brumaru, 2002; Oseghale, 2016).

Neglecting maintenance of sport facilities imply increase in cost of operating facilities and a waste of related natural and financial resources (Jackson, 1989). This view was backed by Banful (2004) who noted that the financial effects of not attending to maintenance are often not only seen in terms of decreased asset life and premature replacement but also in increased cost of maintenance, operation and waste of related natural and financial resources. Most developing countries neglect maintenance and have no policy in dealing with deteriorating facilities (Oyenuga *et al*., 2012).

Maintenance organizations have always been complaining of inadequate funding. The implication of this is that the limited resources of the maintenance department have to be judiciously managed. Inadequate funding of maintenance activities all over the world made prioritization of maintenance demand a critical issue (Berger *et al.*, 1991; Oladapo, 2004; Wing *et al.*, 2016; Iversen, 2018; Parnell, *et al.*, 2018; Lovett *et al*., 2020). Though the expenditure on maintenance is inadequate, poor management of the resource and maintenance services are also contributing greatly to spots facilities defects, poor service delivery, the spate of maintenance backlogs and poor user satisfaction (Olarewaju, 2011).

Defects in sports facilities can occur as a result of extreme environmental conditions such as solar radiation, moisture, wing, driving rains, high velocity water, soil erosion, frost, soil condition and lack of maintenance (Lavy and Bilbo, 2009; Oseghale, 2012). US Department of Education (2003a), noted that most of the facility problems are not only as a result of geographic or social-economic factors; but they are identified with maintenance staffing level, training and management practices.

Deficiencies in the design, poor detailing of working drawings, poor specification of construction materials, construction faults and maintainability issues if not attended to will result in more damages and costly repair works of sport facilities (Ikpo, 2006; Oseghale, 2012, Suffian, 2013; Oseghale and Ikpo, 2014). Also, the problem of poor workmanship, poor material specifications and design deficiency leads to distress in spalling bricked wall and causes vapour infraltration in buildings

(Anderson, 1999; Muhamad, 2019; Yacob *et al*., 2019 and Ahmed, 2019). While, Atkinson (2003), Tayeh *et al*. (2019) and Ibitayo *et al*. (2020) noted that managerial errors accounted for more than 82% of all errors committed during construction of buildings.

It has been observed that in most organization, maintenance is perceived as merely about the mechanical and electrical system repairs and replacements in the facilities without much consideration given to civil and structural elements of the building. The implication of this is that the other elements and components in the facilities (e.g. building) unattended to deteriorate at a faster rate and more costly to maintain at a later date when it has completely failed or cease to perform the design function. Previous studies focused on deterioration of facilities and various maintenance practices in other sectors. Studies that have examined the deterioration and maintenance of sports facilities especially in tertiary institution are scanty. Also studies on the relationship between sport facilities defects and their maintenance are limited, hence this study. This paper therefore examines the strength of identified factors responsible for sports facilities defects in selected universities in South-West, Nigeria.

2.0. Methodology

The study population includes sportsmen and women and staff of maintenance department in the selected universities in South-West, Nigeria. The sampling frame covered all the universities in Southwestern Nigeria accredited by the National University Commission (NUC). Based on information provided on the Web of NUC (32) universities were identified in South Western Nigeria which includes; Seven Federal universities, nine State universities and sixteen private universities. 15 games featured by the Nigeria University Games Association (NUGA) namely: badminton, basketball, chess, cricket, football, handball, hockey, judo, squash racket, swimming, table tennis, taekwondo, tennis, track and field and volleyball were also included in the sampling frame.

The sample size includes; all NUGA sports and the attendant facilities, however, purposive sampling was used in the selection of the institutions. The choice of Universities selected for this study was dependent on the Universities having facilities for all the 15 NUGA sports, have participated in all the games and have hosted National and International sporting events.

A pilot survey conducted for this study revealed that only three federal universities [Obafemi Awolowo University, Ile-Ife; University of Ibadan and University of Lagos] had all the facilities for the 15 different sports and had hosted National and International sporting events. The respondents include: four members of NUGA technical committee, two coaches from each of the fifteen games in each university, the Director of Sports, two other members of the Sports Council, and two grounds-men from each University. From each selected University the Director of Works, four maintenance supervisors, two administrative staff, and eighteen maintenance operatives were selected from the Maintenance Units. From the user’s perspective, six sports men and women (4 male, 2 female) were selected from each of the fifteen games in the selected Universities. The total sample size for the respondents was four hundred and fifty-four.

3.0. Results and Discussion

The respondents were asked to indicate their perception in a 5-point scale ranging from 1 – very low, 2 – low, 3 – moderate, 4 – high and 5 – very high on the strength of factors responsible for sports facilities defects. The result of the frequency of occurrence of the factors is evaluated in Table 1.

Table 1: Factors responsible for sports facilities defects as perceived by respondents

Factors	Mean	Standard deviation	Ranking
Design deficiencies	3.6667	4.5935	1
Intensity of use	3.5256	1.2031	2
Level of exposure to climate condition	3.4125	1.2895	3
Inadequacy of maintenance funding	3.1923	1.2899	4
Vandalism	3.1818	1.3546	5
Moisture	3.1728	1.3397	6
Inadequate cash flow analysis	3.1605	1.3082	7
Chang of use of facilities	3.1519	1.2618	8
Plant growth	3.1235	1.3075	9
Maintainability issues	3..0988	1.4018	10
Construction faults	2.9877	1.2698	11
Driving rain	2.9877	1.2196	11
Solar radiation	2.9750	1.1360	13
Wind	2.9750	1.2425	13
Attack by insect	2.9750	1.3310	13
Lack of maintenance	2.9383	1.4521	16
Corrosion	2.9375	1.2049	17
Vibration	2.9103	1.2399	18
Soil condition	2.8642	1.2425	19
Attack by Rodents	2.8642	1.2723	19
Poor specification of materials	2.8312	1.2503	21
Termite attack	2.8101	1.2411	22
Dusting	2.7375	1.2091	23
Physical aggression	2.7284	1.2749	24
Chemical agencies	2.7250	1.2726	25
Attack by algae, mosses	2.7051	1,2495	26
Damage cause by high velocity water	2.6914	1.2614	27
Abrasion	2.6456	1.3111	28
Inadequate detailing of working drawing	2.6250	1.2157	29
Attack by fungi	2.6173	1.2406	30
Sulphate attack	2.5750	1.1883	31
Erosion	2.5556	1.2247	32
Crystallization of salts	2.5443	1.2890	33
Frost	2.4375	1.2411	34
Acid attack	2.3250	1.2890	35

The analysis revealed that the highest rated factors were found to be design deficiencies (3.67), intensity of use (3.53), level of exposure to climatic condition (3.41), lack of maintenance funding (3.19), vandalism (3.18), moisture (3.17), inadequate cash Flow analysis (3.16), change of use (3.15), plant growth (3.12), maintainability issues (3.10), driving rain (2.99), construction faults (2.99), wind (2.98), attack by insect (2.98) and lack of maintenance (2.94).

The study explored factor analysis to reduce the factors to principal components. The value of Kaiser – Meyer – Olkin (RMD, 0.710) measure of sampling adequacy test carried out (Table 2) showed that the data collected were adequate for the analysis and the Barlett's test of sphericity (0.000) was highly significant. Thus, the data upon which the analysis was carried out were reliable. The total variance explained by the factors (35 factors) is shown in Table 2. In all (7) components were extracted via principal component analysis with Eigen values greater than 1.000. The extracted seven (7) components explain approximately 69% variability in the original thirty five (35) variables. The rotation sums of squared loadings revealed percentage of variables accounted for by extracted components as listed in a uniformly distributed manner of 37.87%, 6.97%, 6.33%, 5.67%, 4.72%, 4.02% and 3.82% respectively (Table 3).

Table 2: Factor analysis - KMO index

Kaiser-Meyer-Olkin and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.710
Bartlett's Test of Sphericity	Approx. Chi-Square	1538.319
	Df	595
	Sig.	.000

Table 3: Factor analysis - total variance explained

Factor	Total	Percentage of Variance	Cumulative percentage
Biological Agencies	13.256	37.874	37.874
Human error related factors	2.441	6.974	44.847
Chemical and Physical Agencies	2.215	6.327	51.175
Physical Agencies	1.984	5.670	56.844
Climatic Agencies	1.650	4.715	61.560
Chemical Agencies	1.406	4.016	65.576
Maintenance factors	1.338	3.824	69.399

By considering a cut-off point for the score loading with absolute value greater than 0.500, the components and the corresponding critical factors loading are presented in Table 4.

Table 4: Factor analysis - rotated component matrix

	Components						
Factors	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Termite attack	.853						
Attack by insect	.818						
Attack by Algae and Mosses	.752						
Attack by Rodents	.731						
Attack by fungi	.563						
Inadequate detailing of working drawings		.724					
Poor specification of materials		.704					
Inadequate cash flow analysis		.642					
Lack of Maintenance		.604					
Construction faults		.593					
Vibration		.551					
Vandalism		.532					
Abrasion			.832				
Physical Aggression			.823				
Acid attack			.806				
Crystallization of salts			.678				
Damage caused by high velocity water				.808			
Erosion				.806			
Dusting				.744			
Plant growth				.534			
Wind					.762		
Moisture					.653		
Soil Condition					.635		
Solar Radiation					.593		
Driving Rain					.513		
Chemical agencies						.685	
Corrosion						.611	
Intensity of Use							.787
Maintainability issues							.511

The first component in the analysis is mostly correlated with attack of the sports facilities by biological agencies. This component has Eigen value of 13.26 and percentage variance of 37.87% with factors including termite attack (0.853), attack by insect (0.818), attack by algae and mosses (0.752) attack by rodents (0.731) and attack by fungi (0.563). The outcome of the study reveals that the material used for the construction of the floors of indoor sports hall, roof truss, skirting boards, office furniture and doors were majorly timber. There are over 2000 known species of termites in the tropics and they are broadly classified as dry wood and subterranean termites. Dry wood termites confine themselves entirely within the timber and need no contact with the ground, while the subterranean are more wide spread and need to maintain contact with the soil. They both infested and cause destruction of timber by constructing tubes in the internal structure of timber. These reasons underscored the higher scoring of termites as a factor responsible for sports facilities defects.

Insect attack is generally confined to timber, but some other materials derived from organic fibers may be infected. Beetles of one kind or another infest timber because the organic nature of the material is favourable to the grub’s life cycle of hatching, growing and emerging. The effect is to reduce the cross-sectional area of the timber and also reduce its strength and therefore shorten the durability of the material. Algae growth resembles dirt deposit on external paint surface and porous concrete. Plant life in the form of moss if allow to develop will cause deterioration of material for the construction of sports buildings. The damage is done by the penetration of roots into the crevices as they grow to extract moisture from the damp materials. Rodents may cause considerable damage to timber and other organic materials. Fungi are parasitic and attached themselves to the surfaces which supplies nutrients. Fungi attack occurs only in the presence of sufficient persistent moisture, oxygen, and cellulose in the timber, and they are the chief causes of decay of timber. Findings agreed with Ikpo (1990) & (2006), Adeniran and Ikpo (2001), Oseghale (2014) and Oseghale and Ikpo (2014).

The second component is highly correlated with man-oriented decay. This component has Eigen value of 2.44 and percentage variance of 6.97% with inadequate detailing of working drawings (0.724), poor specification of materials (0.704), inadequate cash flow (0.642), and lack of maintenance (0.604), construction faults (0.593), vibration (0.551) and vandalism (0.532). The constructional details of working drawings dictate to the builder what to build. Examples are non – adherence to the recommended minimum eaves projection of 600mm that expose external walls to significant moisture resulting from driving rain. Depths and widths of footings, specific foundation types, and degree of inclination of elements such as roofs are details commonly observed to be missing in working drawings. These inadequacies in detailing of working drawings lower the quality of the final product. Poor specification of composite building materials may produce devastating results. The findings agree with Watt (1999), Calder (1997) and Ikpo (2006) who opined that inappropriate materials applied to building and poor expert decision making caused building defects and lower construction quality. Inadequate cash flow agreed with Ikpo, (2006) who opined that cash constraints lead to project delays and in extreme cases abandonment. Neglecting maintenance of sports facilities and delay in attending to the problem of indifferent users as in the case of sports facilities could heighten the problem of deterioration. This finding is in agreement with Al-Sultan (1996), Olubodun (1996) and Brumaru (2002) who opined that the effects of ignoring maintenance is to aggravate or increase the rate of facilities deterioration from year to year. Fault construction from site personnel can promote the deterioration of sports facilities through bad workmanship, inadequate supervision and the substitution of poor materials. This finding agreed with Atkinson (2003), Tayeh *et al*. (2019) and Ibitayo *et al*. (2020) who found that managerial errors accounted for more than 82% of all errors committed during construction of buildings. The finding also agreed with Anderson (1999), Muhamad (2019), Yacob *et al*. (2019) and Ahmed (2019) who found that distress on the spalling brick wall that caused vapour infiltration in building was due to deficiencies in workmanship, material and design.

The third component is most highly correlated with chemical and physical agencies that cause decay of sports facilities. The component has Eigen value of 2.22 and percentage variance of 6.33%. It is clustered around with abrasion (0.832), physical aggression (0.823), acid attack (0.806) and crystallization of salts (0.678). Abrasion caused by either athletes, pedestrians or equipment continuously passing over timber and concrete floor particularly in play surfaces, are subject to wear. Physical force imposes by the athletes continuous sliding on the concrete and timber finished surface during training and competition accelerate the process of deterioration of these materials. This underscores the high rating of physical aggression as a factor responsible for sports facilities defects which agreed with the findings of Fischer *et al*. (2020). Atmospheric gases such as sulphur dioxide, carbon dioxide in the presence of moisture contribute to the formation of acid that attack certain materials such as metals which are used in the fencing of outdoor courts and concrete for hard courts areas. Crystallization of salts may be present initially in certain building materials or may be conveyed into them by movement of moisture from the ground. When crystallization of salt occurs within the pores of the surface layer it may cause gradual erosion or flaking of the finished materials such as paints and surface disfiguration, but when it takes place below the surface it can cause more serious problem. This agrees with the findings of Rossi *et al*. (2019) who opined that deterioration of sports facilities as a result of the corrosion of steel reinforcement were from the combine effects of chemicals such as chlorides, sulphate and acids attacks.

The fourth component is highly correlated with environmental factors. This component has Eigen value of 1.98, percentage variance of 5.67% and had factor loading of damage by high velocity water (flooding) (0.808), erosion (0.806), dusting (0.744) and plant growth (0.534). In places where drainages and water channels are not properly constructed or not constructed at all flooding and erosion have serious consequences and damaging effects on the fields and concrete courts. Dusting is most encountered on floors where traffic and abrasion are heavy such as basketball, handball, tennis and volleyball courts. Also increased water at the surface of the courts after rainfall raised the water cement ratio and reduced the strength of that portion of concrete and subsequently subjected to abrasion. Trees also grow around buildings and outdoor hard court areas, and at times have their roots shooting gradually along horizontal plane. The effects on the building and hard courts areas are that the foundation walls within the areas suffer severe damage and manifest in the form of cracks. These underscore the very high rating of these factors as responsible for sports facilities defects.

The fifth component is most highly correlated with climatic factors with Eigen value of 1.65, and percentage variance of 4.72%. This component has wind (0.762), moisture (0.653), soil condition (0.635), solar radiation (0.593) and driving rain (0.513). Wind causes direct physical damage by the removal of parts of the roof or the whole roof of sports buildings and covered pavilions. This finding agreed with Ikpo, (2006) who opined that wind cause serious damage on poorly secured roof structures. Moisture is the principal agent of deterioration and probably also the agent with the greatest influence on the properties of materials. The finding is in agreement with Son and Yuen (1990); Ikpo (1990); Obiegbu (2003); 1kpo (2006); Oseghale (2014); and Oseghale and Ikpo (2014). Soil movement which may result from geological processes such as folds, faults, compression of layers of peats, swelling and shrinkage of clay soils adversely affects the foundations of sport buildings and hard courts areas. Solar radiation causes thermal expansion which in buildings manifests as thermal expansion cracks in brickwork, blockwork and concrete if ends were restrained. The effect of driving rain is that the vertical surface facing the received rainwater at an angle. The resultant stresses set up may lead to disintegration of the surface layer.

The sixth component which mostly correlated with chemical agencies has Eigen value of 1.41 and accounted for 4.02% of the total variance. This component has the factor loadings of chemical agencies (0.685) and corrosion of metals (0.611). Metal poles and wire gauze were predominately used in the fencing of outdoor courts in the study areas. When metals are exposed to moisture in the presence of oxygen corrosion takes place. This is in agreement with Rossi *et al*. 2019.

The seventh component in the analysis is most highly correlated with maintainability issues and intensity of use. This component has Eigen value of 1.34 and percentage variance of 3.82% with intensity of use (0.787) and maintainability issues (0.511). Intensity of use of sports facilities could be a major source of defects. The high scoring of intensity of use is justified because sports facilities like any other hospitality facilities are such that provide services (round the clock) all the time. The findings agreed with Ikpo (1990), Adeniran and Ikpo (2001), Ikpo (2009) and Oseghale (2016). Indoor sports buildings are usually design with a high head room to enable athletes have their games. Some of the maintainability issues commonly observed were failure to provide accessibility to ceiling space for the purposed of maintenance.

4.0. Conclusions

The study assessed the strength of each of the identified factor responsible for sports facilities defect. The finding revealed that the most severe factors responsible for sport facilities defects were: design deficiencies, intensity of use, and level of exposure to climatic condition, vandalism, moisture and inadequate cash flow analysis. The study found that attack of sport facilities by biological agencies were the first components correlated in the analysis, while the second component was highly correlated with man-oriented decay. And the third component was most highly correlated with chemical and physical agencies that cause decay of sports facilities. Physical force imposes by the athletes continuous sliding on the concrete and timber sports finished surface during training and competition accelerate the process of deterioration of these materials. The study found design defects, high intensity of use, high level of sports facilities exposure to climatic and environmental condition and poor maintenance funding as the most influencing factors responsible for sports facilities defects. The study, therefore, recommends that the users of sports facilities (athletes and members of sports council) be carried along in the design of sports facilities to improve their designs and adequate fund be made available by the government to enable maintenance units to stockpile the materials that fail frequently as a result of the high intensity of use of these facilities to minimize maintenance downtime and improve their reliability.

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Cite this article as:

Oseghale G. E. and Ikpo J. I., 2020. Perception of Stakeholders on Factors Responsible for Sports Facilities Defects in Selected Universities in South Western Nigeria. *Nigerian Journal of Environmental Sciences and Technology*, 4(1), pp. 127-137. https://doi.org/10.36263/nijest.2020.01.0187