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APPLICATION OF ARCHITECTURAL DESIGN QUALITY INDICATORS (DQI) ON TETFUND BUILDINGS INKADUNA STATE UNIVERSITY FOR QUALITY DETERMINACY

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ABSTRACT

Tertiary Education Trust Fund's (TETFund) intervention in constructing higher education institutions has had a significant impact, enhancing the academic environment and thereby influencing the quality of education provided. Despite this, there is currently no established format for measuring the quality of TETFund buildings. Consequently, the study applied the United Kingdom Construction Industry Council (UK-CIC) Design Quality Indicators to selected academic-oriented buildings in the North West zone of Nigeria, with a focus on a case study at Kaduna State University's main campus. The research utilized a combination of visual surveys, participant observations, interviews, and the administration of questionnaires to collect data. Both quantitative and qualitative methods were employed for analysis, utilizing the Statistical Package for Social Sciences (SPSS) version 19.0 and Microsoft Excel. Key findings highlighted that adequate funding from committed sources correlated with a higher level of commitment from designers and contractors, resulting in maximum benefits for the quality of design and construction. TETFund earned a positive reputation for delivering projects on time, within budget, and of high quality. The analysis of variance coefficient, being less than 0.05, indicated a substantial use of Design Quality Indicators (DQI) in TETFund projects. Consequently, the study recommends incorporating DQI in the assessment of quality from the design stage to the maintenance stage of TETFund buildings.

Keywords: Quality Indicators, Design Quality, Building Quality, TETFund Buildings, Quality Determinacy

1. INTRODUCTION

The tertiary education landscape in Nigeria has grappled with a significant challenge – the acquisition and deployment of sufficient financial resources to keep pace with its growth. The previous intervention agency, Education Trust Fund (ETF), found itself overwhelmed, providing only temporary relief to public educational institutions. To address financial constraints and enhance efficiency, the government introduced the Tertiary Education Trust Fund (TETFund), aiming to collaborate with the private sector in facilitating the development of structural facilities within tertiary institutions. This strategic partnership is geared towards, infrastructure delivery, development, and fostering economic growth, ultimately striving for good governance and quality service delivery, particularly in developing nations. However, the success of TETFund intervention programs has not been universal. Since its establishment in 2011 for delivering major building projects in Nigerian tertiary institutions, concerns have arisen about the quality of many intervention buildings. Initially raised by the architectural community (Azeanita&Safuan, 2015; Asuquo, 2011), doubts about building quality have extended to user groups (Oweh, 2015). While Jawando

(2015) commends the impact of TETFund intervention structures, the Nigerian Senate expresses reservations, asserting that numerous intervention buildings lack functionality and appeal, often appearing shabby, dilapidated, and rundown (www.nassnig.org, 2015). Furthermore, there have been reported cases of TETFund intervention building collapses in various institutions, raising concerns about construction standards (Baffa, 2016).Despite numerous designs, constructions, and commissions, there is a scarcity of information on the evaluation of design quality in TETFund building projects. As Asuquo (2011) notes, little attention has been given to determining whether the quality expectations of stakeholders have been met. Consequently, this study aims to address this gap by identifying Architectural Quality Measurement Tools and applying Architectural Design Quality Indicators (DQI) as tools to assess the quality of TETFund intervention buildings specifically within Kaduna State University (KASU).

2.0 LITERATURE REVIEW

2.1 Architectural Design Quality

Architectural Design Quality transcends mere style or appearance; it encompasses the essential architectural requirements of stakeholders and end-users. Harputlugil, Gultekin, Prins, and Topcu (2014) characterize Architectural Design Quality as the weighted sum of qualitative and quantitative preferences of stakeholders. Nelson (2017) defines it as the extent to which a design meets the needs and expectations of stakeholders. This concept plays a pivotal role in achieving excellence in construction and ensuring value for money. The design stage presents a prime opportunity to optimize a facility's value to end-users, as good design fully considers stakeholders' expectations.

The significance of Architectural Design Quality extends beyond tangible outcomes; it comprises both objective and subjective components. Some design indicators lend themselves to objective measurement, while others contribute to intangible assets, influenced by the subjective views, experiences, and preferences of respondents. Evaluating the impact of Architectural Design Quality offers the potential to enhance the management and quality of building products and programs, (Barry and David (2015).

2.2 Architectural Quality Measurement Tools

Various contemporary tools dedicated to assessing design quality have been developed and are currently in use. Notable methodologies include the Housing Quality Indicator (HQI), Post Occupancy Review of Buildings and their Engineering (PROBE), Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), and Building Quality Assessment (BQA). These tools primarily focus on evaluating the construction of new buildings and the renovation of existing structures (Giddings et al., 2016; DQI, 2009).In particular, the Architectural Design Quality Indicators (DQI) stand out as a comprehensive tool for measuring Architectural Design Quality. Developed by the United Kingdom Construction Industry Council (UK-CIC) in collaboration with the Department for Trade and Industry (DTI), Office of Government Commerce (OGC), and Commission for Architecture and the Built Environment (CABE), the DQI represents a significant contribution to the field (Construction Industry Council [UK-CIC], 2021).

2.3 Architectural Design Quality Indicators (DQI) as aTool

The DQI comprises three major variables: functionality, impact, and built quality (Commission for Architecture and the Built Environment [CABE], 2005). These variables collectively form a comprehensive framework for evaluating and measuring Architectural Design Quality, providing a structured approach to assess the effectiveness and success of a design in meeting the needs and expectations of stakeholders.

Functionality: This assesses how effectively a facility fulfills its intended purpose, with a specific emphasis on its sub-variables, namely use, access, and space. This dimension is centered around the arrangement, quality, and interrelationship of spaces within the facility, examining how well the design contributes to the overall utility of the space and its accessibility. In essence, functionality evaluates how well the facility is designed to be useful to all stakeholders involved.

Impact: The impact component of the DQI delves into how effectively a facility establishes a distinct sense of place. This is assessed through sub-variables including character and innovation, form and materials, internal environment, as well as urban and social integration. Impact evaluates how well the design contributes to the overall identity and uniqueness of the facility, considering factors such as architectural character, innovative elements, the physical form and materials used, the internal ambiance, and the integration of the facility into its urban and social context. Essentially, impact examines the lasting impression and influence that the facility has on its surroundings and the people who interact with it.

Built Quality: The sub-variables under the built quality category within the DQI are pivotal elements that address the engineering and overall performance of a facility. These considerations span construction aspects, encompassing structural stability, integration of health and safety measures, and the durability of systems, finishes, and fittings throughout the entire project lifecycle (UK-CIC, 2021).

The United Kingdom Design Quality Indicator (UK-DQI) for Education, commissioned by the Department for Education in 2005, has been widely utilized, particularly in the "Schools of the Future" program. This specialized version of the DQI has been applied to over 800 educational facilities in the UK, with a focus on spaces within schools, such as school grounds, teaching areas, dining areas, staff spaces, halls, and the relationship between the community and the school.

For the current research, The DQI model, crafted by the Construction Industry Council (CIC) in the UK, has proven its efficacy since its inception in 2002 and will be embraced for this study. Notably versatile, the DQI isn't confined to Post Occupancy Evaluation (POE) alone; it extends its utility to the design stages. Over its operational history, the DQI has left its mark on more than 1,400 projects, covering 55% new constructions, 10% refurbishments, and 35% mixed projects, engaging a vast network of over 7,000 stakeholders (Design Quality Indicators [DQI], 2016). This very tool found application in Azeanita and Safuan's (2015) study, attesting to its flexibility for use in the context of the Malaysian construction industry.

2.4 TETFund Public Intervention Programme

The Federal Government employs TETFund intervention programs to address inadequate funding for infrastructural development in Nigerian tertiary institutions. Aligned with the Nigeria Infrastructure Concession Regulatory Commission (ICRC), the government's involvement in TETFund initiatives is motivated by the need to bridge funding gaps, enhance educational standards, promote research and innovation, improve access to quality education, support economic growth, ensure global competitiveness, facilitate public-private partnerships, and address societal needs. These interventions aim to create a conducive environment for effective teaching, learning, and research while contributing to the overall development of the country.

(i) Enhancing the efficient use of available resources for optimal utilization.
(ii) Improving organizational plans and policies to foster transparency and fairness.
(iii) Attracting skilled personnel with a

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focus on efficient performance.

(iv) Reforming sectors by reallocating roles, providing incentives, and enhancing accountability.

Against this backdrop, the concept of TETFund as an intervention agent aims to involve the public sector in fostering infrastructure development, thereby enhancing both the quality and quantity of investments.

3.0 RESEARCH METHODOLOGY

This study utilized a participatory opinion survey and field assessment, incorporating interview, observation techniques, and questionnaire administration. The participatory opinion survey involved all stakeholder groups in the assessment, while the field assessment relied on an objective evaluation of architectural drawings and researchers' environmental perceptions of existing buildings in use. Quality assessment methods, including statistical analysis, visual inspection, and feedback/questioning, followed the recommendations of Okoye, Okolie, and Agu (2019).

4.0 FINDINGS AND DISCUSSIONS

4.1 Findings

4.1.1 Findings from Questionnaire Survey

A. Respondents Demographics

Information about all categories of respondents across all the institutions location that participated in the questionnaire survey.

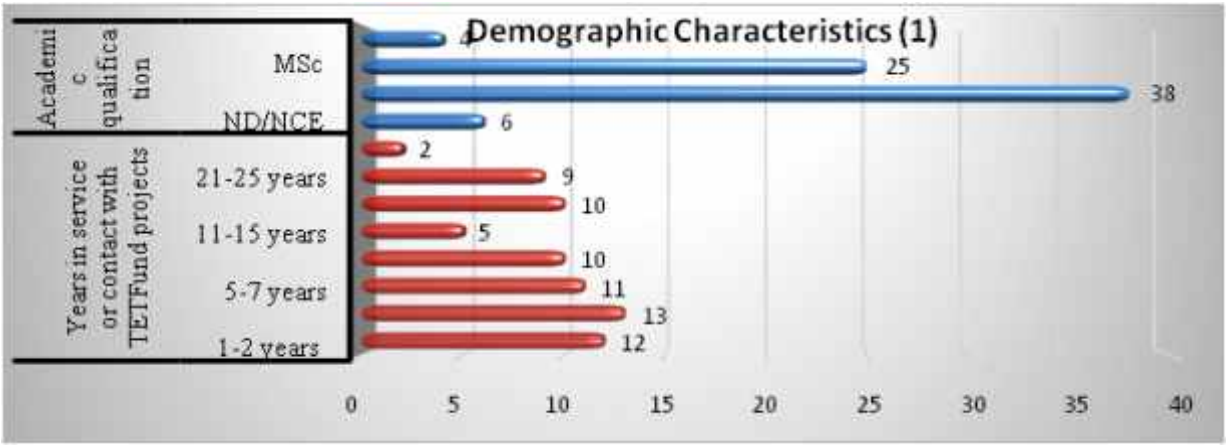

Figure 1: Demographic Characteristics (1)

Figure 1, shows sixty-four percent of the respondents have either less than 10 year work experience or less than 10 years' familiarity with the environment on which the building is sited and up to half the respondents possess either HND/BSc with about 39% having higher academic qualifications.

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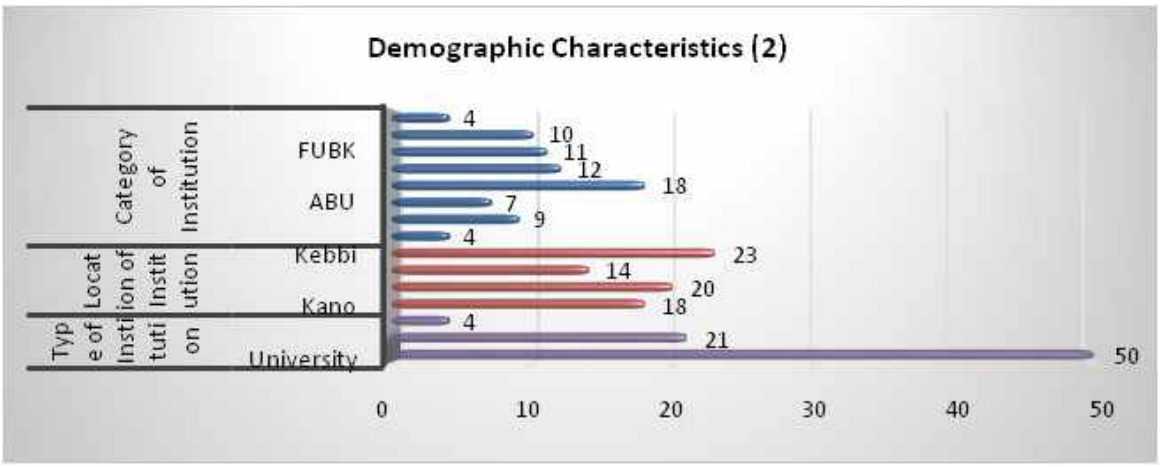

Figure 2: Demographic Characteristics (2)

Figure 2, shows 67% of the buildings for which information were provided are in Universities, 28% in Polytechnics while 5% are within Colleges of Education. It also presents that 24% of these buildings are located in Kano State, 27% in Kaduna State, 18% in Zamfara State while 31% are located in Kebbi State.

B. Design Quality Indicators (DQI) influence on Quality of TETFund Building.

This second section of the questionnaire sought data from respondents on their satisfaction with architectural design quality of specific buildings based on the DQI instrument adapted for the survey. The results of the analysis are presented in Table 1.

Table 1: Percentage responses of Functionality of Buildings

Functionality descriptors in terms of Use, Access and Space.	Very Low extent	Low extent	Average	High extent	Very high extent
Layout easily understood	0 . 0	1 . 4	9 . 5	45.9	43.2
Building is attractive	0 . 0	5 . 4	24.3	44.6	25.7
Building provides good and safe access	0 . 0	4 . 1	28.4	47.3	20.3
Spaces are right size	0 . 0	12.2	35.1	41.9	10.8
Lighting is efficient	2 . 7	0 . 0	35.1	40.5	21.6
Building provides essential services	0 . 0	10.8	16.2	40.5	32.4
Windows/doors suitable for natural lighting	2 . 7	6 . 8	24.3	45.9	20.3
Windows/doors suitable for natural ventilation	2 . 7	2 . 7	21.9	49.3	23.3
Mean Percentage Response	**1 . 0**	**5.4**	**24.4**	**44.5**	**24.7**
Aggregate Mean Percentage Response	**30.8**			**69.2**	

Source: Researchers' fieldwork (2022)

Table 1, reveals that most of respondents (approximately 70% and above) rated various buildings as possessing architectural design features of good quality.

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4.1.2 Findings from Fieldwork Visual Assessment of Kaduna State University (KASU)

This study delved into the assessment of two buildings situated within Kaduna State University (KASU), aiming to explore the influence of Design Quality Indicators (DQI) on the design of TETFund intervention buildings. The primary focus of the evaluation centered around the essential variables of functionality, impact, and built quality. Despite KASU being a modern university currently operating from its temporary main campus in Kaduna, the discernible imprint of TETFund intervention activities is evident. The plethora of TETFund-sponsored buildings afforded researchers a rich array of options, enabling the selection of two distinctive structures from among many for this specific study.

A. Information Technology (IT) Park: Despite its smaller size among TETFund intervention buildings, the IT Park's uniqueness and importance led to its selection for the study. It adopts a concept reminiscent of a central community hut found in Eastern Nigerian villages.

B. Faculty of Sciences Building: As the largest TETFund intervention project on campus, the Faculty of Sciences Building boasts well-planned location, integrated pedestrian walkways, ample car parking, and a seamless connection to a coal-tar road network. Its structural design and materials harmonize with both social and urban environments.

Table 2: Summary of Fieldwork Visual Assessment based on DQI Variables of Information Technology (IT) Park and Faculty of Sciences Building at the Kaduna State University, Kaduna

S/N	Quality Indicators	Observers/Findings	
		Information Technology (IT) Park	**Faculty of Science Building**
A	**Functional Quality**		
II	Use	Numerous students from various departments and faculties convene, ostensibly for research purposes, utilizing the provided IT facilities.	Functional spaces within the facility include lecture halls, laboratories, offices, and more.
II	Access	The IT Park enjoys a central location, and access into the building is unimpeded, featuring an open structure without doors.	The placement and external surroundings of the faculty building were carefully designed and well-planned.
III	Space (Size)	The IT Park is smaller compared to other TETFund buildings, and the roof over this large "hut" remains uncovered, eliminating the need for a ceiling due to the design concept.	The Faculty of Sciences Building is arguably the largest among all TETFund building projects on the campus. Each lecture hall was designed to accommodate 50 students.

B	**Built Quality**		
I	Performance	User activities face significant hindrance during rainy conditions.	A feeling of security permeates throughout the building.
II	Engineering	There are no side walling, and the distinctive roof structure is upheld by X-crossed concrete beams.	Challenges arise in ensuring sufficient natural lighting andventilation.
III	Construction	The openness on all sides of the structure provides a natural advantage, allowing for and uninterrupted airflow and abundant lighting.	The numerous lecture halls suggest that the accommodation is likely sufficient. The construction of the complex isrobust and sound.
C	**Impact Quality**		
I	Character and Innovation	Its uniqueness and significance led to its selection for this study.	The layout consists of two large buildings that share a similar design, employing the double-loaded corridor concept.
II	Form and Materials	The structure is designed to resemble a large central community hut.	The structural form and materials of the building were seamlessly integrated.
III	Internal and Environment	The noise level in this environment is understandably high.	The internal corridor is sufficiently wide to accommodate the mass movement of users.
IV	Urban and Social Integration	The facility leans more towards being a social center.	The pedestrian walkway and ample car parking spaces are effectively linked with the road network. The surrounding environment is well landscaped, producing a visually pleasing effect.

Source: Researchers' fieldwork (2022)

Pictorial illustrations of Information Technology (IT) Park and Faculty of Sciences Building at the Kaduna State University, Kaduna (KASU)

Information Technology (IT) Park

Plate I: A glimpse of KASU IT Park, designed with the concept of a giant hut.

Plate II: The IT-Park facility functions more as a social center.

Faculty of Sciences Building

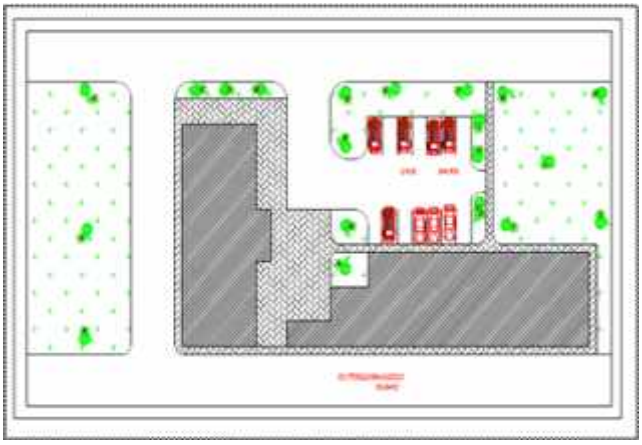

Figure 3: The typical layout plans of the two large buildings are similar in design.

Plate III: The one-story building is a fully equipped department, encompassing all the necessary facilities required for its operations.

4.2 Discussion of Findings and the Implications

This presents the key findings and discussions of the study, highlighting their relevance to the existing body of knowledge. The focus is on major parameters that impact architectural design quality and, subsequently, building quality.

4.2.1 Attributes of Quality Architectural Design for Quality Building

Interview and questionnaire responses gathered from the study's location unanimously emphasize that the perception of quality is closely tied to values, with stakeholders prioritizing the essential focus on the building's use. Additionally, respondents view quality design positively, aligning with user approval. The consensus is that evaluating and understanding a building's performance is most effectively achieved by obtaining feedback from occupants, echoing the sentiments of Gohary et al. (2006).

4.2.2 Effects of DQI on Quality of TETFund Intervention Buildings.

The development of infrastructure stands out as a crucial factor for qualitative academic progress, creating a conducive environment for teaching and learning. Simultaneously, the primary objective of DQI is to enhance the enjoyment and functionality of architecture. The study suggests that the UK-CIC developed DQI is universally applicable with minor adjustments, particularly regarding considerations such as opening sizes for lighting and ventilation and cultural nuances. Survey results from the questionnaire indicate that the studied TETFund buildings exhibit architectural design features of good quality. This reinforces the significance of employing DQI for ensuring the quality of TETFund building projects, as noted by Jawondo (2015). In conclusion, stakeholders demonstrate an awareness of the distinctions between TETFund buildings and others, emphasizing the importance of quality assessment in infrastructure development.

4.2.3 Innovative Application of DQI on TETFund Intervention Buildings.

The interview results indicate that adequate funding from committed sources significantly enhances the commitment of designers, contractors, and other professionals in the building industry. This heightened commitment results in increased innovative input for the quality design and construction of building structures. This finding aligns with the assertion of Egan (2002), as cited in Alzahrani

and Emsley (2013), emphasizing the growing concern among architects and design professionals, affiliated with the Construction Industry Council, about user satisfaction with quality design and construction.

Moreover, the study highlights that the TETFund Intervention Program goes beyond creating physical assets and services; it also addresses broader environmental and social goals. This innovative approach to design is exemplified in the socially friendly Kaduna State University Information Technology (IT) Park.

5.0 CONCLUSION AND RECOMMENDATIONS

The findings underscore the incorporation of the TETFund Intervention program within the administrative framework of the beneficiary institution's project team. This structural alignment enables the strategic use of participant observation techniques during design and management processes, incorporating elements like competitive dialogue and user consultation. This strategic approach resonates with Giddings *et al*. (2016), who advocate for these attributes in fostering workable building design that aligns with the functional and quality needs of users. Furthermore, the study highlights TETFund's commendable track record in project delivery—consistently meeting deadlines, budgetary constraints, and maintaining high-quality standards. This aligns with the conclusions drawn by Hayford (2013). However, the research reveals instances of controversial disappointments, potentially contributing to TETFund intervention building collapses in specific locations (Baffa, 2016). The results underscore the pivotal role of Design Quality Indicators (DQI) in assessing the quality of TETFund buildings. The positive impact of DQI application is affirmed, as visual assessments and interviews reveal that most respondents perceive the buildings as having architectural design features of good quality. In light of these findings, the study strongly recommends that TETFund enforce the systematic application of DQI across all their building projects. This insistence is crucial to ensuring and affirming quality throughout the entire life cycle of construction, operation, and maintenance processes.

REFERENCES

Asuquo, I. N. (2011). *Effect of sustainability reporting on corporate performance of selected NSE quoted brewery firms in Nigeria*. An unpublished Ph.D. Thesis.University of Uyo.Uyo

Alzahrani, J.I. and Emsley, M.W., (2013). The impact of contractors' attributes on construction project success: A post construction evaluation.*International Journal of Project Management*,31(2); 313-322. https://doi.org/10.1016/j.ijproman.2012.06.006.

Azeanita, S.andSafuan, J., (2015). Indicators to measure design quality of buildings.First International Conference on Science, Engineering & Environment, Tsu City, Mie, Japan, Nov.19-21, 2015, ISBN: 978-4-9905958-5-2 C3051

Azeanita, S., Chee-Ming, C. and Safuan, J., (2016).Indicators for measuring satisfaction towards design quality of buildings. *International Journal of GEOMATE, 11(24); 2348-2355*, 2349

Baffa, A., (2016). TETFUND: FG set to spend N3b on high impact research. https//www.vanguardngr.com

Barry, D. and David, A., (2015). Gardening Design.www.aacorn.net Reviewed 15th November 2021

Bell, P.A., Greene, T.C., Fisher, J.D. and Baum, A..(1996). Environmental Psychology.(4th Ed.)Forth Worth; Harcourt Brace College Publishers.

Commission for Architecture and the Built Environment [CABE], (2005).*Design Quality and the Private Finance Initiative, London*.The Commission for Architecture and the Built Environment.

Construction Industry Council [UK-CIC],(2021). Design quality indicator.

Online, *www.dqi.org.uk*, accessed on 6th December 2021

Design Quality Indicators [DQI], (2016). DQI for education: guidance. Online, Retrieved August 12, 2018 From www.dqi.org.uk

Egan, J., (2002) *Rethinking Construction*, Department of the Environment, Transport and the Regions, London

Giddings, B. (2016). An evaluation tool as a means of improving architectural design quality: the results.*http://www.homesandcommunities.co.uk/architecture-design-quality-evaluation-tool*.Retrieved May 2021

Gohary (El-Gohary), N.M., Osman, H.and El-Diraby, T.E., (2006).Stakeholder Management for Public Private Partnerships.*International Journal of Project Management*, 24; 595-604.

Harputlugil, T., Gültekin, A. T., (2014).A*conceptual framework to assess architectural design quality by analytic hierarchy process (AHP) and to building contracts.FifthInternationalConference on Construction in the 21st Century (CITC-V) Collaboration and Integration in Engineering, Management and Technology*, İstanbul.267-74.

Harrison, J., (2005). Construction quality assurance.*Perfval White Papers*.Retrieved on 11/03/2021.http://perfval.com/white-papers/QA.pdf

Hayford, F., (2013). *Tools and Techniques for Project Risk Management: Perspective of Micro to Small Scale Construction Firms in Ghana*. Control Handbook. New York:McGraw-Hill.

Jawando, T., (2015)."TETFund and Nigeria's tertiary institutions".*Time Nigeria Magazine*. October 16th, 2015.

Nelson, C., (2017). *Managing quality in architecture*: integrating BIM, risk and design process.2nd Edition. London: Taylor& Francis. ISBN 9781138280175 Pub.,

Okoye, N.O., Okolie, K.C. andAgu,N. N., (2019).*Evaluation of Quality Assessment System for Building Contractors in Lagos, Nigeria.**PM World Journal,*** VIII(VIII).

Oweh, I., (2015). Nigeria: *impact of TETFund'sintervention in the rating of nigeria tertiary institutions*.Daily Independent (Lagos) 15 July; 2015.

Tertiary Education Trust Fund **[**TETFund], (2011/2014).History of TETFund. Retrieved on November 8, 2014 from *http www.tetfund.gov.ng/index.php/abouttetfund/history*

www.nassnig.org (2015). Retrieved on 11th March, 2018.