Renewable Energy Sources and Technologies in Commercial Buildings - Understanding the Nigerian Experience

Abstract

Purpose – This study seeks to explore the perceptions and experiences of building practitioners in the adoption of renewable energy (RE) in commercial buildings in Nigeria.
Design/methodology/approach - A qualitative methodology was used guided by the principles of the Grounded Theory Method (GTM). Data was collected using in-depth semi-structured interviews with a purposive sample of five industry practitioners.
Findings - Five distinct factors emerged namely, being compliant, change in mindset, normalizing, being autonomous and identity. The research revealed the significance of contextual (cultural) peculiarities and the role identity plays in informing RE adoption. The findings substantiate the significance of RE adoption in the future practice of building practitioners and in ensuring environmental stability within the Sub-Saharan Africa (SSA) context.
Research limitations/implications – The study focuses on commercial office buildings and attempts to provide contextual grounding to inform theory generation as part of a wider study.
Originality/value – This research contributes methodologically and empirically by providing grounded insight into the adoption of RE in commercial buildings. Thereby, enabling a much greater understanding of the issues associated with enhanced promotion and adoption by professionals and stakeholders, which can inform policy interventions. Furthermore, it will benefit further research within the SSA context and provide valuable lessons associated with adopting GTM in construction research.

Keywords Renewable Energy, Commercial Building, Nigeria, Grounded Theory Method, Sustainable Buildings, Sub-Saharan Africa
Paper type Research Paper

1. Introduction

It is widely acknowledged that energy is central to both the world's opportunities and challenges (Keho, 2016). This has placed significant emphasis on the need to utilise renewable energy sources (RES) in response to global climate change (Intergovernmental Panel on Climate Change (IPCC), 2014). According to the IPCC (2014), the building industry plays a dual role as the problem and solution. Firstly, it is one of the highest contributors to greenhouse gas (GHG) emissions, and secondly, it has the greatest potential to reduce GHG emissions in a cost-effective way. As such, global climate concerns have increased awareness of the need for sustainability practices in the construction industry. Consequently, this has led to the development of measures to manage resources and mitigate against the environmental impact of building projects in the entire building process (Dalibi *et al.*, 2017). This has resulted in the development of the Green Building Councils (GBC'S) and other environmental standards worldwide (Painuly, 2001). Green buildings (GB) have been viewed as being capable of achieving sustainable development (Chan *et al*., 2016), by enabling holistic, optimized and integrated building solutions through the use of RE technologies and sustainable practices (Lockwood, 2006).

The International Renewable Energy Agency (IRENA) (2016) notes that, whereas most developed countries have prioritized GB standards, most notably, the UK with the Building Research Establishment's Environmental Assessment Method (BREEAM) and the US with Leadership in Energy and Environmental Design (LEED), this is not the case in most developing countries within the SSA region. In fact, South Africa is the only country within the SSA region, with a fully established GBC and environmental rating system, Green Star SA (WGBC, n.d.). Other countries such as Kenya and Ghana, while in the process of establishing such councils and rating systems (WGBC, n.d.), have adopted the Green Star SA. Other

countries such as Nigeria, have unofficially adopted LEED as a rating system (Usman and Mohd, 2012) on an ad hoc basis.

According to the International Energy Agency (IEA) (2016), Africa's GHG contribution is considered insignificant, at circa 4%, in comparison to China's 28%, which is the highest in the world. The IEA (IEA, 2016) however, recognises Africa's increase in GHG emissions as its countries industrialize, with Lotfabadi (2015) attributing the problem of future GHG emissions to developing countries. With respect to the SSA region, it has been identified as one of the most concentrated energy deficit areas in the world (The World Bank, 2017), with 62.5% of the region's population without electricity access (IEA, 2017). In addition, developing countries are predicted to account for 90% of the world's population growth by 2025 (Blowers, 2013). Thus, the significance of managing SSA's GHG emissions to enable preparedness and effective environmental management cannot be overstated. This study, whilst presenting selected energy data on SSA, focuses on the Nigerian context.

2. Background

Access to stable, reliable and affordable electricity has become an esoteric idea to most in Nigeria (Africa Progress Panel, 2015). The country has the 2nd largest energy deficit in the world after India (The World Bank, 2017). This has resulted in a number of unsustainable practices, such as, the widespread use of fossil-fuelled backup power generators (IEA, 2017). Existing empirical studies highlight the country's energy crisis and its implication to businesses and individuals (see Oseni, 2016; The World Bank, 2014). According to Awofeso (2011), 90% of businesses and 30% of residences in Nigeria have their own power generating sets. The country is currently the largest generator importer in Africa (IEA, 2014) and the 2nd largest GHG contributor in Africa, after South Africa (Ritchie and Roser, 2019). The Nigerian government acknowledged the severity of the energy crisis, in its 2015 power baseline report (Federal Government of Nigeria, 2015). Table 1 presents a country-comparative energy and GHG emanations analysis.

The Nigerian government also note a 75% loss of generated energy due to inefficiencies. For example, it has an installed energy generating capacity of circa 12,522MW, but produces a distributed capacity of only 3,115MW. In addition, self-power generation costs are about twice that of grid-based power. Consequently, Nigeria is beginning to take strides to diversify its energy mix and improve energy security by increasing its RE share. This is being achieved through several initiatives and policies, such as the Renewable Energy Master Plan (REMP) (Nachmany, 2015). However, it is recognised that these initiatives are not focused on power for the built environment (Waniko, n.d.). It is also acknowledged that the country has an abundant RE resource, which is able to meet its domestic needs (Africa Progress Panel, 2015) and consequently change its social, economic and environmental landscape. However, hydropower, is the only RE source contributing to the on-grid electricity system, accounting for 20-30% (Federal Government of Nigeria, 2015). Biomass (fuelwood), is the energy source that is used the most throughout Nigeria, contributing to an off-grid system, accounting to 82% of energy use. However, it is primarily used traditionally in rural areas (Ley et al., 2014). Other energy sources, such as wind and solar energy are currently being exploited (Ohunakin *et al*., 2014).

Traditionally, solar use has been limited in the country, with existing literature revealing its use, primarily on small scale and isolated applications in rural areas for residential and community use (Sambo, 2010), as well as, one-off independent use by private individuals and government (Oseni, 2016). However, its level of adoption in commercial buildings is not known (Onyekuru and Marchant, 2012; Arup Nigeria, 2016). This is of importance, as

commercial buildings have been identified worldwide as high-energy users, as well as, viable platforms for RE integration (Heinstein *et al.*, 2013). In addition, as commercial buildings in Nigeria are designed to be independent of utility services, due to the country's infrastructural poverty, providing services such as, water, sanitation and other related services (The World Bank, 2014), places an additional burden on energy requirements. As such, electricity provision is over-designed for, with redundancies to minimise disruption to business operations (Leishman *et al.*, 2012), resulting in the need for prolonged generator operations. This had led to commercial office buildings having up to 4 fossil-fuelled power generators depending on the criticality of work performed. RE's have the potential to be integrated into commercial buildings and thereby reduce the dependence on unsustainable energy generating practices. Therefore, the study seeks to explore the perceptions and experiences of building practitioners in the adoption of RE in commercial buildings in Nigeria.

3. Renewable energy adoption in buildings

Renewable energy, also referred to as clean energy resources, are described as natural and unlimited resources derived from the sun (indirectly or directly) or from natural movements of the environment such as wind, hydropower, photo-electric and tidal (Ellabban et al., 2014). RE is widely recognised as being capable of meeting the world energy demands if optimally utilised (Lotfabadi, 2015). Their use promote sustainable practices and environmentally responsive buildings (IPCC, 2007) and thereby, mitigate against the adverse effects associated with construction activities (Dalibi *et al.*, 2017). RE adoption has also been noted as enhancing market options, thereby creating competition, which in turn, leads to reduced cost of technologies, as well as, creating employment opportunities (IEA, 2015). According to Reddy and Painuly (2004), the move to RE from non-RE should be given priority, due to its benefits. However, despite this, there exist extensive adoption issues (Dalibi *et al.*, 2017), with RE only contributing circa 13% of total world energy supply (Sen and Ganguly, 2017).

RE, like all aspects of sustainability, face challenges to its adoption and/or building integration. According to Amaratunga *et al.* (2002) sustainability in the context of the built environment is multifaceted and complex, as such, its understanding and the significance attributed to it varies both at country and stakeholder levels. Thus, perceptions play a key role in determining adoption, which Chandra and Loosemore (2010) note, have positive or negative impacts on a project. This is reflective of the studies amongst others, which identify barriers and drivers as the two overriding themes in RE adoption, based on perceptions of stakeholder such as, architects, engineers, and facility managers. Thus, there is a need to understand the perceptions of stakeholders (Chinyio and Olomolaiye, 2009), which Painuly (2001) opines functions as the gap finders.

Prevalent in literature, is research on stakeholder perceptions on RE adoption in developed countries, in both residential (Balcombe *et al*., 2013; Leggett, 2014; Yamamoto, 2015) and office buildings (Jones, 2002; Warren, 2010; Zhang *et al*., 2012). However, research on its adoption in the SSA region is limited (du Plessis, 2007; Katikiro, 2016; Darko *et al*., 2017). In particular, there is limited empirical studies that have focused on RE in commercial buildings in SSA. This is of importance, as only when the issues associated with RE are recognised, can its full potential through adoption be realised (Painuly and Fenhann, 2002).

Available research in the SSA context focuses on residential buildings (Oliver *et al*., 2010; Barry *et al*., 2011; Ahlborg and Hammar, 2014; Ugulu, 2016) but it is however important to note, that empirical studies on RE in residential buildings in SSA have primarily adopted predefined frameworks for selection of influencing factors informed by literature aligned to developed countries (Painuly, 2001; Katikiro, 2016). For example, the studies by Ahlborg and

Hammar (2014) in Tanazania and Mozambique and Oliver *et al*. (2010) in South Africa both initially identified barriers through a review of literature which then informed further study for validation. The use of pre-formed processes imposed restrictions on the understanding of context-based barriers. There is need to recognise that one size does not fit all, especially in relation to sustainability (OECD, 2001). This raises questions of the suitability of the use of pre-formed list of barriers when researching sustainability issues in developing countries, which is predominantly the case (Katikiro, 2016; du Plessis, 2007). According to Katikiro (2016), studies in developed countries are based on models of decision-making process informed by information, regulations, and economics in quantitative methods, and typifies construction research.

However, this is not the same in developing countries, due to the lack of data and records (Onyekuru and Marchant, 2012), as well as, social and economic differences (Hansen et al., 2018). This suggests that studies that adopt predefined frameworks are limited by the assumption that barriers and drivers will be similar regardless of context. However, there is evidence to the contrary, as reflected by comparative studies in natural and social science fields, including studies in the built environment (see Painuly and Fenhann, 2002; Rupf *et al*., 2015).

The imposition of predefined frameworks will have implications on how concepts and methods are promoted and implemented in developing countries. According to du Plessis (2007), there is an urgency for broadening the scope of research in developing countries to enable a better understanding of inherent situations, in order to ensure accurate and valid empirical findings and knowledge, which will ultimately influence strategies for sustainable development. This is echoed by (Long *et al*., 2004; Laryea and Leiringer, 2011; Murtagh *et al.*, 2016; Darko et al., 2017). Long *et al*., (2004) advocate for comprehensive research in developing countries, due to their contextual and unique issues as opposed to adopting generalised problems associated with developed countries. Thus, factors influencing adoption (positively or negatively) identified in one country, would not simply be applied to another country (Trevarthen, 2011), especially in the context of developed and developing countries.

According to Murtagh *et al.* (2016), Ugulu (2016), Hansen et al. (2018), there are a number of issues and concepts representative of developing countries, that are unknown to and/or not experienced by developed countries such as, co-production, limited or lack of access of electricity, self-help and external dependencies. As such, the aforementioned issues and concepts can be taken for granted in developed countries and consequently, not taken cognisance of in research. In addition, Murtagh *et al.* (2016) and Traverthen (2011) note that much of the research in the construction industry has focused on technological and economic aspects of sustainability, as well as, adopting quantitative approaches, failing to give in-depth insight (Dainty, 1998; Katikiro, 2016)

This study took a similar approach to the studies, which presents a strong argument for research in the SSA region and wider African context. It adopted GTM as a strategy to the enquiry, due to the dearth of empirical research and literature on RE adoption in commercial (office) buildings in SSA. Thereby, facilitating grounded in-depth insight from building practitioners' perspectives, which are invaluable to understand the issues in context.

4. Method

GTM is an interpretive research approach, described in the literature as a naturalistic, flexible and a systematic process grounded in data, leading to theory generation (Charmaz, 2014). Literature presents varied approaches to GTM namely; classical, structured qualitative analysis and constructivist (Charmaz, 2014). However, the approaches have similarities with the main features being coding and constant comparative analysis, immediate analysis of data, memo

writing, theoretical sampling (Engward, 2013). The choice of using GTM was informed by the initial research question posed and the nature and field of the study. In this case, the research was interpretivist and sought to gain an in-depth understanding of building practitioners' perceptions and experiences within the context of sustainability in the built environment. According to Braun and Clarke (2013), GTM is best suited to inquiries about influencing factors and understanding the underpinning processes of a situation, which was central to the study. As such, the study was guided by the participants, allowing for a natural process without constraints. In addition, GTM is also applicable in the context of SSA, as it enables in-depth data grounded in that particular context and not pre-defined by any existing frameworks (Hussein *et al*., 2014). The study was guided by the fundamental principles of GTM, and not any approach, so as not to stifle flexibility, creativity, and emergence. However, GTM offers the opportunity to refine, modify and evolve the methodology to enable any potential limitations to be overcome.

4.1 Setting, sampling and recruitment

The study was conducted in Lagos, Nigeria adopting a purposive sampling strategy to guide the selection of the participants. The rationale for this was to select participants best suited to provide insight (Larsson and Poel, 2002), as well as being the initial stage of sampling in GTM (Glaser, 1978). Thus, building practitioners being the decision-makers in the building (design) process, offering differing perspectives were chosen. A sample size of 5 participants was used, which was considered suitable, as the study focused on achieving quality and robustness in the analysis as a foundation for further research as opposed to generalised representation (see Baker and Edwards, 2012). The sample was recruited from a personal network of contacts and consisted of: an architect with 36 years' experience (AR.36); a mechanical engineer with 35 years' experience and a PhD candidate (ME.35); an electrical engineer with 25 years' experience and Bachelor's degree (EE.25); a facilities manager with 13 years' experience and a PhD (FM.13), and a structural engineer with 25 years' experience and an Master's degree (SE.25). All participants were registered members of their relevant statutory and professional bodies.

Ethical approval was obtained for the research and all participants gave written consent for use and dissemination of information and for the interviews to be recorded. Voluntary participation and withdrawal were ensured, and confidentiality was protected.

4.2 Data collection

All interviews were conducted face to face and lasted on average 60 minutes. Semi-structured interviews with open-ended questions were used in the study and were considered appropriate based on the study aim (Patton, 1990). Questions designed to elicit participants opinions about RE's were asked, with broad initial questions, leading to more specific questions to gain deep insight and rich information. For example, some of the questions included; "***Can you please tell me about your profession?"***, ***"How would you describe the design process in Nigeria?"*** and ***"Tell me about what comes to mind when you think about the term sustainability?"*** An interview guide was developed and vetted for clarity and to limit interviewer bias (Charmaz, 2014). This, however, evolved during the process, taking into consideration new areas of inquiry, due to participant responses and the differing participant disciplines. Thus, the interview guide progressed in line with the analytical process. All interviews were digitally recorded, and transcribed by the researcher, with memos written throughout the data collection process.

4.3 Data analysis

Coding and constant comparative analysis

Described as the core process in GTM, data analysis is undertaken through constant comparison of data sets from codes to categories to concepts for theoretical development (Evans, 2013). This process allows the researcher to maintain a close connection with the data and was achieved through coding of interview transcripts and memo's (Charmaz, 2014). Data analysis was undertaken manually, using diagrams and computer software such as Excel and Microsoft Word, and started after the first interview, continuing with subsequent interviews, comparing interview data with one another. All interviews were transcribed and coded using gerunds, which are verbal nouns (ending in 'ing') and enable the analysis to focus on participant actions (Charmaz, 2014). Coding was conducted in stages, commencing with open coding; using line-by-line coding process, which identified codes and meaning from the transcribed text. This process was repeated for each participants response developing into focused coding. Table 2 illustrates an example of the coding process.

According to Charmaz (2014), gerunds emphasize processes and actions and the initial interviews identified several processes and generated many codes. For example, this included codes that captured how building practitioners reacted and/or responded to sustainability adoption, sought out information on RE and their practices associated with generators. Based on the processes which appeared significant/central to the practice of building practitioners, in relation to the adoption of sustainability (practices and renewable energies) in commercial buildings. As well as, its regular presence in the discussion across the varied disciplines, "being knowledgeable about sustainability issues", emerged as a focused code. Using this constant comparative method with the aid of analytical memos the categorisation of focused codes was distinguished, which enabled the emergence of the category "being compliant".

Memo writing

Memos are highly recommended in GTM, as they offer a key process in facilitating further data collection and analysis (Corbin and Strauss, 2015). Three types of memos were written throughout the research, namely, a reflective memo (personal journal), key point's summary (case-based memo), written after each the interview and analytical (conceptual) memo. The memo's served to articulate non-verbal aspects during interviews, ensure reflexivity; articulating the researchers thought process, any changes, and implications, as well as, development form initial codes to categories (aiding theory generation). It was also prudent not to rely solely on audio recordings. The emerging ideas where fit into categories, which involved the use of all the memos produced during the study. The memo's helped to formulate the storyline by relating categories, validating relationships and identifying gaps requiring further development. Interviews were also re-analysed, which helped to ensure the analysis process was grounded in the data (Glaser and Strauss, 1967).

5. Findings and Discussion

Five initial categories representing the perceptions and experiences of building practitioners to the adoption of RE in commercial buildings in Nigeria, were revealed as shown in Table 2 and discussed below.

Being compliant

This was identified as becoming a standard, the norm for participants, primarily working with international clients, who identified sustainability as a major concern. International clients (developers and businesses) were identified as driving RE adoption, by enforcing compliance through consultant appointment agreements. Participant ME.35 noted consideration of sustainability as a prerequisite for an appointment with, an international client, saying: *"We*

also work with a lot of the internationals we have to consider it, I mean we see clauses…if you are working with an international of which the issue of sustainability and climate change is an issue, you have to include it, you have to consider it.". Thus, illustrating that international clients as the building commissioners were exercising their power and directing the process to suit their requirements. Also, Nigerian standards were seen by participants as less stringent than international standards, with international standards often referred to in Nigerian building documentation. As such, international standards were generally followed. Participants also noted that most international clients had a sustainability policy, which also informed their drive for adoption of RE and sustainable practices. This was noted by Participant AR.36: "*They actually have a green bank philosophy or something… So, this project is one of the first major ones they would do for their own use, they agreed to put their philosophy to work."* However, Participant ME.35 suggested RE adoption primarily sought to gain sustainability certification, saying: *"…the client was emphatic on sustainability and other aspects…the intent was to achieve LEED certification…so it had to be included for a statement."* Both participants present varying perspectives, with Participant AR.36, relating the client's decision based on advocacy for sustainability, with Participant ME.35 being sceptic about the client's intention, implying it was more for recognition. The duelling perspectives are reflective of both Herazo and Lizarralde (2016) and Laufer's (2003) opinions. According to Herazo and Lizarralde (2016), there is a link between stakeholders attempt to evidence their contribution to sustainable development goals (SDG) and ethical stance as their reason for advocating sustainability. Whilst Laufer (2003) notes the function of advocacy as primarily a business tool. The excerpts point to the function of compliance as both external and internal drivers, informed by aspects, such as international collaboration/globalisation of business, social responsibility, and reputation/prestige. It highlights the drive towards sustainability either willingly or through forced compliance.

Change in mindset

This category highlights the acknowledgement of a problem and more importantly seeks a solution. Participant's emphasized efficiency as a key consideration in the design, with a focus on the reduction and conservation of resources in achieving both the client's requirements and reduced human and environmental impact. Participant AR.36 described efficiency as the *"big E"*, comprising of functional, construction and energy aspects, whilst Participant FM.13 identified efficiency as informing decisions to enable the reduced environmental impact of buildings. With Participant FM.13 further noting questions such as, "*…how does it impact my ability to say I am operating a clean environment?"* and *"should I have alternatives?"*, which were intended to act as checks for such decisions. This speaks to the appreciation of global issues and suggests that participants move towards taking ownership, making a link between their role and the impact on the environment, as well as, considering the utilisation of alternative sources as a more environmentally friendly option. In addition, Participant FM.13 noted: *"Today most grade A buildings in Lagos are not selling space any longer, they are selling the value space brings not only to the occupants, to the company…that mindset will also make them start thinking about alternatives sources of power."* Sustainability is perceived as adding value beyond environmental, but also social and economic value. It speaks to a transition towards more sustainable practices. The above discussion and excerpts infer a concern and desire for change due to increased awareness of global climate change and the role participants play in contributing positively or negatively to it and the need to take ownership. In addition, there is also tangible value for the clients, leading to exploitation of sustainability as a market mechanism tool for commercial value. This is consistent with the study by Olaleye *et al*. (2015), which aligned willingness to pay a premium for green buildings.

Being autonomous

This category highlights the users' motivation and self-initiative for the adoption of sustainable practices from perceived personalised economic benefit, as well as, overall environmental benefits. Some participants reported a move towards decentralised power generation using alternative power sources, primarily solar, either paring sources or adopting a shared power approach. Participant AR.36 explained: *"One of the things that we've been advocating is that you have solar source to run low energy consumers…at least it reduces the size of your mechanical fossil burning, fossil burning onsite power generating plant.",* whilst Participant FM.13 suggested that designing for sustainability will influence design, ensuring that the minimum power required can be generated. Despite its limited adoption, both participants acknowledge the benefit of solar in reducing generator pollution as well as, enabling the provision of minimum power requirements through considering solar in design. In addition, most participants indicated the increasing use of gas-powered generators due to its reduced pollution levels as opposed to diesel. According to Participant ME.35: *"…rather than burning diesel, we would rather burn gas."* This speaks to the appreciation of the environmental impact of fossil fuels and the need to mitigate against it. In general, participants recognised the need for decentralised power which presents less environmental impacts and reduced/shared cost. With decentralised power generation as the current power approach, and utility power unavailable, this appears to be the next logical step.

Normalising

This category highlights the dependence of fossil fuels as a perceived indispensable element entrenched in everyday life, as well as, a comfort with what is known. As noted by Participant AR.36: *"Well you know, they have been around, and we have been dependent on them for so long, that there is a lot of know-how and management skills [laughs] …*". Participants reported the primary use of fossil-fuelled generators replacing grid power due to its epileptic supply. All participants referred to fossil-fuelled generators as a first principle consideration for power to buildings. Participant EE.25 noted, saying: *"Generators are not efficient but necessary at whatever cost, you need to have it. Generators have to be part of the vernacular architecture because there is no other way."* Illustrating the acceptance of things as they are and a somewhat defeatist attitude. Participants also noted the unsupportive role of government with Participant AR.36 describing the situation as follows, *"If I have to produce my electricity then I am going to look for the most efficient way of producing it…I can just go down the road and buy a generator or have one fabricated for me."* The challenge identified by the participants highlights the acceptance of the burden of self-power generation as the natural process; the norm, understanding its ins and outs which offers assurance. As well as, the somewhat ease and comfort in acquiring generators, regardless of cost. In general, it points to the stability that fossil-fuelled generators provide, which has seen its entrenchment in everyday life, and as such, it has become institutionalised and accepted as the norm.

Identity

This category highlights the hereditary/entrenched systems and belief of the unsuitability of sustainability in the country and a lack of systems to support adoption. All participants reported a lack of an enabling environment, such as inadequate financial banking and previous unsuccessful projects as a challenge, with all participants attributing responsibility to government for either abdicating responsibility or acquiescence of foreign control. Participants AR.36 and FM.13 referred to the unsuccessful inaugural projects as the turning point, with Participant A noting *"…there has always been the question of reliability and robustness of this alternative power sources…that is because some of the early projects, that many state governments embarked upon were not properly done… The government always ran politics".* This highlights the influence that government can have in creating awareness and influencing

the type of discussion around issues. It speaks to the government's self-interest by creating the appearance of activity, interest, and commitment for political gain over public interest and the resultant promulgation of a negative image of alternative sources and sewing deep concern. In addition, Participant SE.25 refers to a lack of interest and appreciation for environmental issues as a challenge, saying: *"…they have not seen the imminent need and they are not threatened by such problems at the moment…there is very little sustainability".* This suggests two things, firstly a lack of awareness either by willingly or otherwise and as such not being well informed to act. Alternatively, having an awareness but deciding not to act. Also, having a sense of detachment to climate change as it is not directly felt, and as such, is not something of concern. Participants ME.35 stating: *"Nigeria has been burning wood for a very long time".* Thus, implying that the activity has been long-standing, with no consequences. The above comments highlight issues represented by Participant SE.25 and points to somewhat deep-rooted beliefs and practices. Adding to this, Participant FM.13 alludes to the lack of empirical evidence of environmental impacts as an issue, as people are not convinced. However, although this may be the case, Participant AR.36 presents a contracting view describing Nigerians as faddish and willing to copy trends, *"… this is an environment where people are very fashionable and faddish…you always need the trendsetters [laughs]. And until you find a trendsetter, a trendsetting client, you may have difficulty starting a trend, but the moment it becomes a trend, you get a lot of offtakes."* This speaks to the way of life and the culture of people as wanting to belong. In general, the excerpts reveal on one hand, entrenched beliefs and distrust of foreign influence because of government acquiescence as a challenge. On the other hand, the desire to follow western trends as a motivator.

The categories revealed the significance of contextual (cultural) peculiarities in understanding building practitioner's perceptions and experiences with investors/clients, the public and peers. Salient points, such as, institutionalised mentality, sense of detachment and faddish nature, substantiate the significant role that identity plays in RE adoption and the need to understand its dynamics within the Nigerian context.

6. Conclusion and recommendations

The built environment will continue to have adverse impacts on the natural environment and inhabitants as long as construction continues, and although the adverse impacts may not be fully stopped, they can be mitigated against. This is of importance in the context of developing countries, such as Nigeria, that are going through rapid urbanisation and infrastructural development (du Plessis, 2007). Consequently, it is important to ensure that sustainable practices and RE adoption become indispensable. The purpose of the study was to explore the perceptions and experiences of building practitioners in the adoption of RE in commercial buildings in Nigeria. Thereby laying the foundation and useful basis for further/continued research for theory generation.

The findings revealed the significance of contextual (cultural) peculiarities and the role that identity plays in informing RE adoption, which has been missing in previous studies, as the Nigerian perspective has not been holistically embraced. It also further reveals the human experience and relationship between building practitioners and the environment. Overall, the findings showed a gradual move towards RE adoption, particularly solar photovoltaics (PV), as well as, sustainability certification. Thus, highlighting a level of willingness towards achieving sustainability for decentralised power generation, taking into consideration that the current approach to RE adoption is independent of government incentives. This implies the improved adoption of RE's with a more enabling environment, which can be facilitated by enhanced collaboration between government, building professional and professional regulatory agencies, such as, setting up joint commissions and advisory boards at both local and national

levels with representation from the all relevant parties. This will promote awareness and adoption by reframing the sustainability discuss to one which resonates to the public, professional and corporate entities, effectively inform policy and its implementation and enable improved government support through initiatives and incentives.

Also, setting minimum standards for energy and sustainability requirements both in design, through the National Building Code and appointment agreements will provide the necessary impetus. The latter as exemplified by the regulatory financial body in Nigeria, with the implementation of sustainable banking principles (Deloitte, 2017), which has seen the integration of RE's in bank buildings, as well as, pursuance of sustainability certification. Aiding this can be the establishment of a research body and/or knowledge repository, as well as, funding from government agencies which will encourage research and development. The findings from the paper have provided a greater understanding of the issues associated with enhanced promotion and adoption, as well as, useful information, which will help in sensitising building stakeholders (public, client/investor, practitioners) and policymakers on the value of RE adoption. It will also aid in informing policy interventions suited to the context.

6.1 Contribution to method

The adoption of GTM has enabled the move beyond the standard descriptive statistics traditionally aligned with construction research (Dainty, 1998; Knight and Ruddock, 2008). The use of descriptive statistics provides a limited perspective of issues, however, the use of GMT provided a platform for in-depth and specific insight for the understanding of social processes in relation to RE adoption in commercial (office) buildings.

From the outset of the study quality was assured, providing an audit trail as it remained aligned with the fundamental procedures and principles of GTM, which innately imposes checks through its systematic and robust integrated approach Glaser and Strauss (1967), from data collection, analysis, and management to mitigate against inaccuracies and encourage rigour and validity. The following were crucial to the study to achieve quality during data collection and analysis; review of transcripts of interviews against digitally recorded interview, which ensured closeness with data and guided against inaccuracies and researcher bias; analysis of interviews immediately after the interviews, facilitating the process for further sampling (theoretical) to occur; copiously writing memos during the entire process, which allowed the researcher to capture ideas, make comparisons, generate codes, guide further data collection and enabling the creation of detailed records (audit trail) to explain processes; using constant comparative method to enable the explanation of social processes; review and discussion of analysis with research team and experts. In addition, detailed quotes are presented in the findings, to enable the readers to make their own inferences.

GTM facilitated the process of discovery of information, taking cognisance of its inherent elements and enabling direct access to participants (and areas) to better understand the situation in context, thus, reflecting the context of Nigeria in the inquiry, which might have otherwise been missing, thereby enabling the potential for benefits to be realised and the opportunity for lessons learned.

6.2. Implications of findings

RE adoption and sustainability in the broader context is influenced by external and internal factors, which both contribute positively and negatively to its adoption in commercial buildings. Consequently, having an enabling environment will not only encourage adoption, leading to positive environmental effects but a social and economic one as well, as they are intrinsically linked. As the alternative will be continued environmental degradation, as well as, implications for the construction industry, especially with rapid population growth and

urbanisation in the country, which will mean increased energy demand. In addition to the speed in technological advances around the world, which will leave the industry lagging further and struggling to play catch-up.

Given the inadequacies of legislation and obsolete building codes, which has resulted in the ad-hoc design process and reliance on foreign standards. This pose as potential implications for building practitioners and future practice. The danger is that Nigeria is not only importing products but also practices and processes, which are not well suited and are being applied without consideration of the local context. Although it may appear to meet its needs, the end in this situation does not justify the means.

6.3 Limitations and recommendations for further studies

As these findings were unique to the participating practitioners, further qualitative research adopting a GTM approach could be conducted that considers similar areas of inquiry with a diverse sample of building practitioners, including other building stakeholders. In addition, the findings provided an insight into the need for an in-depth understanding of some issues. As such further research could be considered into issues such as the suitability of the adoption of foreign certification within the Nigerian context, as well as utilising the professional conditions of engagement as a special purpose vehicle (SPV) for sustainability adoption.

8. Reference

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