# ASSESSMENT OF SUSTAINABLE BUILDING TECHNIQUES FOR CREATIVE HUBS IN ILORIN KWARA STATE

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# ABSTRACT

Creative hubs are start-up incubation centres that enhance soft skills and promote local innovations start-ups. The greater need of Nigerian youth for a stable and conducive economy together with the effect of climate change necessitates the need for hubs which incorporates sustainable design techniques. Sustainability is a wide topic, therefore; the scope of this paper will be on energy efficiency. The study aims at exploring the various energy efficient techniques that can be used to enhance sustainability of hubs. Descriptive research design approach was used for the research. The study was conducted via review of existing literature on the subject matter, then; a set of questionnaire was tailored to observe experts’ opinions in the building industry on the crucial energy efficient techniques to be incorporated in creative hubs within the study area. A physical observation survey was also used for this research. Four creative hubs were purposively selected within Ilorin as case studies. The questionnaires were randomly distributed to the respondents; 377 questionnaires were analysed for experts’ opinions. The reports from the survey revealed that; there was low-level of energy efficiency in the existing hubs and the impact of these techniques does not reflect in the energy requirement of the creative hubs. One of the hub managers stated the high cost of installation deterred them from opting for solar alternative, but the hub relies on generator run by gas. This shows the awareness these hub managers have for the importance of energy efficiency and with time; energy efficiency will be embraced. The study recommends BIM as an integral part of architectural education in the country to enhance building sustainability via energy efficiency as seen with BEM aspect of BIM. It also recommended that policies which encourage the incorporation of sustainable techniques in building projects should be made within the country.

**Keywords**: Sustainability, energy efficiency, building techniques, creative hubs, Kwara State

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## INTRODUCTION

### Background of the Study

It has been clearly recognized and accepted that in the absence of global control, man’s so called peaceful constructive activity is turning into global aggression against the very foundation of life on earth (Bryan & Ejumudo, 2015). This gave rise to sustainability which ensures environmental protection for the later generation and survival of the present generation. The need to incorporate sustainability into every aspect of modern life has also led to a re-evaluation of creative processes and their effects on the environment. The emergence of innovative hubs as catalysts for innovation and cultural boom has received attention globally. The greater need of Nigerian youth for a stable and conducive economy together with the effect of climate change necessitates the need for hubs which incorporates sustainable design techniques. With the goal of illuminating how the act of making and creating can be in harmony with ecological management(Choi *et al*., 2022); creative hubs assumed a prominent role as incubators of invention and artistic expression. These hubs act as dynamic ecosystems that encourage innovation, teamwork, and cultural change. This research sets out to investigate the relationship between creative hubs and sustainable practices. Construction is one of the largest end users of environmental resources and one of the largest polluters of man-made and natural environments (Ding, 2007). The concept of sustainability entails construction while using environmentally responsible processes and resource efficient methods (Chen, 2017). This technique, in broader terms; involves a building, which is designed, built, operated, maintained or reused with objectives to protect occupant health, improve employee productivity, use wisely natural resources and reduce the environmental impact (Singh, 2018). In other words; this building process incorporates environmental considerations into every stage of the building construction

A creative hub is a physical co-location of activities involved in the creative industries (Pratt, 2021), which not only form communities, but also develop a structured serendipity that enables people to connect in ways they hadn’t before; inspiring new cross disciplinary collaborations, working mode and community engagements (Merkel, 2017). The common characteristic being a large space subdivided into individual studios or workshops for micro-enterprises. The premises are often managed on a flexible lease system which may allow ‘easy in, easy out’ transitions, as well as sub-letting of space (Pratt, 2021). Hubs are sector specific, some are a physical space only, some give development and guidance, and some go all out and get involved in the businesses they are working with (Kalitova *et al*., 2019). They promote making that is; full expression of an individual’s creativity, helping individuals to create self-fulfilment in everyday life and develop creativity (Choi *et al*., 2022).

### Statement of the Research problem

The exponential growth of Nigeria’s population makes harnessing youth potential possible via utilising the right measure which if otherwise; could exacerbate (Tankabou, 2023). This pressure together with the rate of development in the advanced country being influenced through the development of creative industries suggests the need for creative hubs within Nigeria which cannot be over emphasized due to the rise in un-employment rate within the country. Job creation hubs are shared infrastructures used by similar businesses to offer cost-effective services to different clients to reduce start-up costs, ease business challenges, and offers networking opportunities for growth and success (Nnanna, 2022).

Therefore establishing and maintaining environmentally conscious practices within creative hubs in Nigeria; Harmonising innovation with energy efficiency and other sustainable methods poses a difficult issue. Addressing these issues is imperative for ensuring the longevity and ecological responsibility of architectural structures within the country’s creative landscape.

### Aim

The main aim of the study is to explore the various energy efficient techniques that can be used to enhance sustainability of creative hubs within Ilorin Kwara State with the view to reduce the building’s carbon footprint.

### Literature Review

### Understanding Creative Hubs and Their Role in Fostering Innovation and Creativity

The rise of business incubators started in 1972 as ‘shared spaces’ with services and management (Pratt, 2021) with the first official mention in 1998 in Great Britain when the first map of creative industries was drawn (Dmukauskaite and Jureniene, 2022). The space, which can either be physical or virtual, that sustainably supports creative entrepreneurs and people to come together, collaborate and thrive (Innes *et al*., 2018) and allow individuals play creatively with a high level of self-organized activities with an open process (Choi *et al*., 2022) are termed creative hubs.

There are various terms used to denote these hubs in different literature based on the diversity of the terms and forms in which they operate, they are maker spaces (Choi *et al*., 2022), third spaces (Abdul-Kadir *et al*., 2022), honeypots (Merrell *et al*., 2022), creative hubs (Pratt, 2021), tech-hubs , co-working spaces (Innes *et al*., 2018), information hub (Rundel & Salemink, 2022), innovation laboratories, or cultural centres. Hubs are spaces where knowledge exchange can happen through formal knowledge transfer activities (Edipson *et al*., 2018) which are principally known by great internal and external networking and knowledge sharing capabilities.

They can be open workshops with different tools and equipment; where people can go independently to make; providing opportunities to generate new ideas through new ways of thinking and problem solving, resulting in the betterment of innovation, (Choi etal., 2022). Innovation on the other hand is the capacity of people to exploit a new idea or method successfully and thereby realize a desired material and social effect(Smith *et al*., 2017). This shows that hubs provide innovators and creative access to crucial resources like specialized tools, financing possibilities, and mentoring programs which enables them to test and successfully implement their ideas.

### Definition and significance of sustainability in creative hub design

Construction has been accused of causing environmental problems ranging from excessive consumption of global resources both in terms of construction and building operation to the pollution of the surrounding environment, (Ding, 2007). The concern on improving these practices to reduce their detrimental effects on the natural environment led to sustainability with major decisions made during the project planning and design stages.

Sustainability means meeting the present needs without compromising the ability of future generations to meet their own needs (Association, 2015). It is a means of responsibly utilizing available resources efficiently; balancing environmental, societal and economic impacts to meet the design intents of today while considering future effects (Association, 2015). Such techniques produce resilient buildings able to withstand the effects of nature with minimal damage (Chen *et al*., 2017).

Energy efficiency is one of the core techniques used in incorporating sustainability in buildings (Akadiri *et al*., 2012) which ensures social inclusion, enhances use of creative spaces as well as the design’s economic viability. It places focus on integrating environmentally friendly materials, ensures energy-saving technology, and community involvement to create hubs that not only encourage creativity and innovation but also have a good impact on the community and environment (Zabihi *et al*., 2012)

### Incorporation of Energy-efficient technologies, energy saving techniques, and Renewable energy sources

In earlier times, the demand for environmental suitability, safety and responsibility of buildings were enhanced (Akram *et al*., 2022) via rapid growth of the economic sector in China just as being witnessed in Nigeria in recent times. This led China to be the biggest energy consumer and producing GHG emissions in the world(Akram *et al*., 2022) and such; might also push Nigeria to the fore if care is not taken. Improvement of energy efficiency should be realized in the building sector, which contributes to the highest energy use.

Reducing energy consumption in buildings is one of main priorities in the construction industry to help reduce carbon footprints (Ibraheem and A., 2019). This aspect involves all techniques to ensure maximum output from the energy source. It can include use of energy-efficient designs on building window to relieve the pressure caused by growing building energy consumption (Huang *et al*., 2014). An example of this is the use of integrated façade system (IFS) that is gaining momentum in modern construction. Double Skin Façade (DSF) can also be explored in this light. Solar gains through windows generate efficient energy to serve the building load. Renewable energy sources like solar, wind, hydro, and geothermal energy presents viable alternatives to traditional fossil fuels which is depleting fast (Akram *et al*., 2022). Leveraging these abundant and eco-friendly resources makes it possible to produce power with little carbon emissions while improving energy security. It paves way for a shift to a low-carbon economy supporting initiatives to fight climate change and lessen environmental deterioration (Akadiri *et al*., 2012).

Thoughtful and efficient site design and development practices help lessen environmental impact and improve the energy performance of new Constructions (Singh, 2018). This include building site planning, orientation of buildings on site, location of windows on the building, and presence of vegetation on site. The use of renewable energy backup as on-site renewable energies are also used to generate electricity which partly covers the expected building energy load and is partly fed into the grid (Akram *et al*., 2022). The use of solar backup in the day, wind turbines at night can mitigate the buildings energy cost, then; combining two or more renewable sources will enhance such performance via optimal design method for building multi-energy systems (Xu *et al*., 2019). Increase building performance by including predictive energy models and system controls, such as occupancy and daylight sensors, CO2 sensors and other air quality alarms (Singh, 2018); a smart building solution to saving buildings energy consumption. Energy saving fittings is another means of improving the building efficiency for example the use of D.C bulbs, Fans, Fridges and Irons can drastically cut down residential building energy’s need.

### Building Information Modelling (BIM)

BIM offers an extensible medium for parametric information storage, and its implementation in design development offers the capability to include BEM parameter-integrated construction information. This can be conducted via modelling soft wares such as Autodesk Revit (Gerrish *et al*., 2017) or advanced methods via use of laser scanning or photogrammetry (Szelag, 2019, Yeoh, 2018), and ground penetration radar. Adoption of building information modelling (BIM) from design stage provides a platform on which improvement on operational energy performance consumed during its use (Gerrish *et al*., 2017). This can be conducted via Building energy modelling (BEM). It is the analysis of building energy performance through its simulation using predefined criteria describing building composition and utilization (Gerrish *et al*., 2017). They relate how information transfer between BEM tools and BIM authoring tools can facilitate the design of more sustainable buildings stating increased efficiency in modelling processes (re-use of information from a common data environment (CDE)) enables more time for performance analysis and design optimization. Efforts to integrate BEM within BIM (or using BIM data) have been attempted demonstrating success in the use of BIM for compliance checking and basic sustainability analysis, but performance analysis integration is still undeveloped and the information from the BIM must be extracted or copied, then evaluated separately (Gerrish *et al*., 2017)

## **Research Methodology**

A descriptive research design approach and analysis was used in conducting the research via a mixed method using qualitative and quantitative data collection methods. Two data sources were used for conducting this research; primary via the use of structured questionnaires to professionals within the built environment, oral interview was conducted with hub managers and an observational check-list was used to check the presence/absence of some sustainable technique within such hubs and secondary sources gotten from review of existing literature including journals, articles and thesis that highlights and discusses different sustainable techniques. To enhance the research process and gather insights; OpenAI's tools were used for guided exploration, alongside other sources including Google scholar, connected papers, semantic scholar, research gate and Core. This is in line with the view of (Rahi, 2017) as the approach helps to determine underlying reasons, rationales, and opinions through investigating each issue, event, or phenomenon of interest in its context thoroughly (Choi *et al*., 2022).

A total of four creative hubs were purposively chosen for the study. The studied hubs are; Malhub, Probity Hub, Founders' hub, and Kuagy Resources all located in Ilorin. They will be termed M-hub, P-hub, F-hub and KR during this research. The elements observed include; the building orientation, the size and building opening location, availability of alternative passive energy source, use of energy efficient fittings. The interview was manually recorded, the checklist was also observed by the researcher during field work to the case studies site.

A random sampling method was used in the distribution of questionnaire to the professionals within the built environment in Nigeria. This is to get a robust data set and views of professionals within the same macro-climate as the study area. There are about 20,000 professionals practising within the country and according to Morgan Table of Sample, a sample size of 377 is required. The questionnaire was made in form of Google forms which were collected electronically; this was coupled with printed copies which were distributed by the researcher during the field survey. Statistical programme for social sciences (SPSS) was used to analyse the data and the results were presented in tables to show frequency and percentages. The responses were further analysed for Pearson correlation coefficient on the SPSS tool to ensure validity of the result.

There was a very low response rate on the Google form as the questionnaire were sent to more than 20 groups with a minimum of 50 participants and the responses gotten via this means was less than a 100 which equates about 10% response rate. The electronic response that got the highest response rate was via a fellow of the National institute of builders more due to the familiarity with the individual in which the questionnaire came from. Then, architects later came through via different accesses by individuals encouraging professionals within their cycle to fill the forms. About 80 additional printed copies were required to meet the target number.

# Results and Discussions

Table 1 below represents a check-list used to check aspect of energy saving techniques used in the existing hubs. All the hubs are rented and they have no idea of incorporation of BIM. The researcher opines that since all the buildings are old; above 20years, even if BIM is used; it will be limited to AutoCAD 2d drawings as that was the first adoption by firms within Kwara state, the study area. None of the hubs has a renewable energy back-up although they all have back-up general run by gas or fuel. There was no energy saving/efficient fitting such as solar fan or bulbs and no smart energy technology was used in such hubs. Three of the buildings are oriented in East-west direction while only F-hub was oriented in North-South direction which maximises day-lighting.

**Table 1 showing sustainable techniques utilised within the hubs**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Hub character | BIM use  | Use of smart building solution  | Presence of Renewable back-up energy | Use of energy efficient lightings and fittings | Building Orientation on site | Energy efficient techniques | Presence of Window openings |
| F-Hub | No idea |  |  |  | East-west direction | Use of balconies and windows in all spaces |  |
| M-Hub | No idea |  |  |  | North-South direction | Back-up gen run with gas |  |
| P-Hub | No idea |  |  |  | East-west direction | Back-up gen run with gas |  |
| KR | No idea |  |  |  | East-west direction | Back-up gen run with gas  |  |

Source: Author (2023)

Table 2 shows the study’s respondents’ demographic information. It showed that there were 281 male respondents (74.5%) and 96 females (25.5%). 158 of whom were architects, 132 builders, 18 land surveyor, 32 planners with solar engineers, 18 land surveyors and geo informatics, 14 estate managers 12 quantity surveyors and 11 structural engineer. 28.9% of the respondents have less than 5 years’ experience , 14.9% have between 6-10 years’ experience, 13% have within 11-15 years’ experience, 9.8% have experience between 16-20 years and 33.4% have above 20 years of experience. This shows a greater percentage of the respondents have above 10 years of experience in the construction industry.

**Table 2: Respondents’ Demography**

|  |  |  |
| --- | --- | --- |
| Variable | Frequency | Percentage (%) |
| Sex |  |  |
| Male  | 281 | 74.5 |
| Female  |  96  | 25.5 |
| Profession |  |  |
| Architecture  | 158 | 41.9 |
| Structural Engineer  | 11 | 2.9 |
| Quantity surveyor | 12 | 3.2 |
| Builder  | 132 | 35.0 |
| Estate manager  | 14 | 3.7 |
| Land surveyor and geo-informatics | 18 | 4.8 |
| Others (town planner, solar technician, solar engineer) | 32 | 8.5 |
| Qualification  |  |  |
| ND/NCE | 6 | 1.6 |
| HND/B.Sc. | 153 | 40.6 |
| M.Sc. | 177 | 46.9 |
| Ph.D. | 41 | 10.9 |
| Year of experience |  |  |
| Less than 5 years  | 109 | 28.9 |
| 6-10 years | 56 | 14.9 |
| 11-15 years | 49 | 13.0 |
| 16-20 years | 37 | 9.8 |
| Above 20 years | 126 | 33.4 |

**Source: Author (2023)**

**Table 3: Respondents view on energy efficient techniques for hubs’ sustainability**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Highly unnecessaryF (%) | Not necessaryF (%) | Barely necessaryF (%) | Quite necessaryF (%) | Highly necessaryF (%) |
| Building orientation  | 49 (13.0) | 30 (8.0) | 25 (6.6) | 66 (17.5) | 207 (54.9) |
| Presence of courtyards/atrium | 45 (11.9) | 33 (8.8) | 37 (9.8) | 106 (28.1) | 156 (41.4) |
| sizes of openings and location | 42 (11.1) | 25 (6.6) | 30 (8.0) | 124 (32.9) | 156 (41.4) |
| Back up energy source-presence of renewable | 45 (11.9) | 27 (7.2) | 17 (4.5) | 106 (28.1) | 182 (48.3) |
| Use of energy efficient appliances | 38 (10.1) | 29 (7.7) | 9 (2.4) | 93 (24.7) | 208 (55.2) |

### Source: (Author’s field work, 2023)

The table above shows the respondents view on the need, use and practicability of energy efficiency techniques to ensure sustainability in creative hubs. All the techniques proposed were suggested to be of high importance within Nigeria. Building orientation had a response rate of 54.9% as being highly important, this is more than half of the respondents view, 17.5% of the remaining respondents said it is quite important and about a quarter of the respondents share the view of it being barely or not an important factor for sustainability. The same can be said of the need for use of energy efficient appliances with a response rate of 55.2% (208 respondents) also above average of the total population size responding about it being highly important, about 93 of the remaining said it is quite important, 9 responded that this is barely important, 29 said it is un-important and the remaining 38 opined that it is highly un-important. 182 of the respondents agree on the great need for alternative renewable source and 156 said maximum openings and use of courtyard is highly important. Less than 15% of the whole population negate the need for energy efficient techniques suggested.

# Conclusion and Recommendations

The integration of sustainable design techniques can be an effective way of reducing the carbon footprint of creative hubs. These techniques when implemented help in achieving maximum comfort for the buildings’ end users of these buildings and promote productivity. This is done by ensuring provision adequate natural lighting and ventilation. It also entails ensuring availability of water and reduction of waste generated by such hubs. The provision of alternative renewable energy source such as solar, wind, and biomass as back-up also improves such hubs efficiency especially within our environment where there is more to desire in their provision.

The study concludes that across the four case studies within the study area; there was low-level of integration of sustainable building techniques in the buildings and the impact of these techniques do not reflect in the energy requirement of the creative hubs. All the hubs rely on back-up generator either run by fuel or gas and none had a renewable energy back-up though one of the founders responded that the initial cost for solar was too expensive and the money would rather be directed to building the hub at its start-up. The researcher also observed that sustainability is known and practiced in one way/the other by the building professionals within Nigeria as most of the respondents who were builders and architects responded to use of sustainable methods in different forms ranging from use of sustainable materials, incorporation of smart technologies and the use of BIM for design.

## Recommendations

1. The research recommends BIM should be incorporated into architectural education within the country and BIM experts are to be made available within the institution for students’ tutelage.
2. The research recommends that there is the need for more sensitization of the professionals within the built environment on the benefits of adopting energy efficient techniques from design till the end the buildings life cycle whether new project, renovation, demolition or recycling.
3. The study recommends the need for the government to enact policies that will encourage the adoption of energy efficient design strategies in creative hubs relative with what is obtainable in developed countries.

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