Survey dataset on architect’s awareness and adoption of building envelope technologies for energy efficient housing in Lagos State

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ABSTRACT

Low energy houses are forms of housing that use less energy from the design, technologies and building products from any source than a traditional or average contemporary house. The survey dataset examines architect’s awareness and adoption of building envelope technologies (BET) for energy efficient housing in Lagos State, Nigeria. The dataset was based on seventy-four (74) returned questionnaires of both registered and non-registered Architects. A multistage sampling that involved cluster sampling and random sampling of architects in Lagos State was adopted. Descriptive statistical tools were used to present the dataset. The dataset contains the intent of promoting energy sustainability by architect while designing their building envelopes, the awareness of the building envelope strategies to adopt, factors influencing their adoption of these strategies, strategies that can be adopted to improve adoption of building envelope technologies for energy efficiency in housing units. The dataset can be used for evolving housing energy policy by decision makers.

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In most developing countries, there are few empirical evidence on the adoption of building envelope technologies which can be used by manufacturers in order to produce better energy efficient technologies for housing and to develop housing energy codes. Due to issues of climate change, sustainability and environmental pollution there is need for decision makers, researchers and construction professionals to enact and implement energy efficiency policies which would be convenient to occupants and positively impact the environment. A lot of energy is being generated for housing consumption, there is need to create sustainable solutions through designs which can be attained through innovative building envelopes that takes cognizance of low energy consumption and produce effective thermal comfort. Prospective and current architects involved in housing designs can benefit from the dataset through the variables that indicate building envelope technologies that can help attain energy efficient housing units. The dataset can be beneficial to developing countries that have problems in power generation by ensuring that buildings are habitable in spite of the non-availability of energy at any time of the day especially in hot dry regions. Based on the human behavioural studies on perception of architects, the dataset can be replicated in other developing countries to understand the designers’ take on the use of building envelope technologies and how it can be attained through different design strategies.

1. Data

A properly designed and constructed building envelope can greatly increase a building’s energy savings, comfort, and indoor air quality. Building envelope technologies can reduce uncontrolled air and moisture exchange, decrease thermal losses and gains, and improve occupant comfort [1–4]. The development of responsive/dynamic building envelope strategies and technologies, adapting to transient external and internal boundary conditions, is considered a crucial step towards the achievement of the energy efficient buildings. However, very little data exist on the awareness of the persons that are supposed to incorporate these strategies in the design of buildings. The survey dataset contains the intent of promoting energy sustainability by architect while designing their building envelopes, the awareness of the building envelope strategies to adopt, factors influencing their adoption of these strategies, strategies that can be adopted to improve adoption. The dataset in this survey was obtained using questionnaires administered to both registered and non-registered architects in public housing organizations involved in the design, construction and management of selected housing estates in Lagos state. The questionnaire employed to determine the architect’s perception on awareness and adoption of building envelope technologies (BET) for energy efficient housing (EEH) was based on a five-point Likert scale of variables selected from literature. The dataset
include data from the seventy four (74) questionnaires that were returned out of the one hundred (100) questionnaires administered. Descriptive statistical tools of charts and tables were used to present the dataset. In Fig. 1, the breakdown of the registration status of architects showed that 29.4% of the architects were registered professionals with the regulatory council while 70.6% were unregistered architects. The industry working experience of the architects shown in Fig. 2 showed that the architects with less than 5 years working experience were only 59% of the respondents, while architects with 6 to 10 years were 13%, architects with 11 to 15 years were 10%, architects with 16 to 20 years were 10% and architects with over 20 years working experience in the construction industry were 8% of the total respondents. The dataset presented the knowledge based of the architects on the subject of building envelope technologies. In Fig. 3, the chart showed that 12% of the architects were highly knowledgeable on the use of building envelope technologies while 62% were knowledgeable, 16% were not sure on the use, 6% of the architects had a fair knowledge and 4% of the architects had no knowledge on the use of building envelope technologies. Fig. 4 revealed how often architects design with the intention to promote use of building envelope technologies in achieving energy efficient buildings. In Fig. 4, 7.8% always considered the use, while 25.5% often considered it, 35.3% sometimes considered it, 15.7% rarely considered it and 15.7% never considered the use of building envelope technologies in promoting energy efficient housing units. Fig. 5 showed the perception of the architects on the use of building envelope technologies will help reduce energy consumption in housing units in Lagos State. In Fig. 5, 43.1% of the architects believe it will always reduce the energy consumption, while 23.5% believe it sometimes will and 3.9% believe it rarely will help curtail the energy consumption in housing units in Lagos State. Table 1 showed the extent of architect’s knowledge of using building envelope technologies in achieving energy efficient buildings. In Table 1,
**Fig. 3.** Knowledge of building envelope technologies.

**Fig. 4.** Intention to promote building envelope technologies in energy efficient housing units.

**Fig. 5.** Reduction of energy consumption using building envelope technologies.
the building envelope strategies such as the use of Smart windows, Double-gazed windows, Advanced Insulations, Energy efficient HVAC, Photovoltaic for floors, Horizontal reflecting surfaces, Photovoltaic doors, External overhangs, Vacuum insulated wall panels, Photovoltaic windows, Energy efficient using LED lightning, Window attachments, Photovoltaic walls, Aerogel sealant for Air leakage, Photovoltaic foam for walls, Vegetation roofing and Photovoltaic roof were identified and ranked. Even though, the architects were aware about most of the building envelope technologies, the use of the system was different as shown in Table 2. Table 2 presented extent to which architects use building envelope technologies for energy efficient housing. In Table 2, Energy efficient using LED lightning, Window attachments, External overhangs and Photovoltaic roof were the most used strategies of building envelope technologies for energy efficient housing units. Table 3 showed the factors that influence the use of building envelope technologies for energy efficient housing. Factors such as Inadequate Knowledge, High aesthetics value, Good thermal comfort, Lack of established standard,
Unwillingness to accept risks by architects, Low operating cost of building envelope technologies, Low impact on environment, Unwillingness to accept risks by clients, Concerns about privacy, Development control standards, Low aesthetics values, Time consuming to design with, Concerns about durability, Lack of material availability, Negative perception held by clients, Absence of construction guides and tools, Concerns about security, Lack of technical know-how, Site constraints, Low capital cost of building envelope technologies and Low energy consumption were identified and ranked.

Table 3
Factors influencing the use of building envelope technologies for energy efficient housing units.

| Factors                                              | To a large extent | To some extent | Undecided | A little extent | Not at all | SMV | INDEX | RANK |
|------------------------------------------------------|-------------------|----------------|-----------|----------------|------------|-----|-------|------|
| Inadequate Knowledge                                 | 41                | 22             | 0         | 6              | 5          | 310 | 4.2   | 1st  |
| High aesthetics value                                | 41                | 18             | 5         | 1              | 9          | 303 | 4.1   | 2nd  |
| Good thermal comfort                                 | 19                | 43             | 4         | 2              | 19         | 302 | 4.1   | 2nd  |
| Lack of established standard                         | 29                | 29             | 8         | 3              | 5          | 300 | 4.1   | 2nd  |
| Unwillingness to accept risks by architects          | 33                | 27             | 4         | 7              | 3          | 302 | 4.1   | 2nd  |
| Low operating cost of building envelope technologies | 19                | 25             | 15        | 10             | 5          | 265 | 3.8   | 6th  |
| Low impact on environment                            | 16                | 29             | 14        | 10             | 5          | 263 | 3.6   | 7th  |
| Unwillingness to accept risks by clients             | 20                | 28             | 8         | 8              | 10         | 262 | 3.5   | 8th  |
| Concerns about privacy                               | 16                | 28             | 10        | 15             | 5          | 257 | 3.5   | 8th  |
| Development control standards                        | 15                | 29             | 9         | 17             | 4          | 256 | 3.5   | 8th  |
| Low aesthetics values                                | 15                | 28             | 13        | 6              | 12         | 250 | 3.4   | 11th |
| Time consuming to design with                        | 12                | 30             | 14        | 11             | 7          | 251 | 3.4   | 11th |
| Concerns about durability                            | 13                | 26             | 14        | 11             | 10         | 246 | 3.3   | 13th |
| Lack of material availability                        | 6                 | 39             | 9         | 13             | 7          | 246 | 3.3   | 13th |
| Negative perception held by clients                  | 11                | 30             | 13        | 11             | 9          | 245 | 3.3   | 13th |
| Absence of construction guides and tools             | 8                 | 28             | 16        | 12             | 10         | 234 | 3.2   | 16th |
| Concerns about security                              | 12                | 20             | 19        | 15             | 8          | 235 | 3.2   | 16th |
| Lack of technical know-how                           | 9                 | 26             | 19        | 9              | 11         | 235 | 3.2   | 16th |
| Site constraints                                     | 7                 | 19             | 14        | 18             | 16         | 205 | 2.8   | 19th |
| Low capital cost of building envelope technologies   | 3                 | 16             | 25        | 20             | 10         | 204 | 2.8   | 19th |
| Low energy consumption                               | 8                 | 7              | 15        | 36             | 8          | 193 | 2.6   | 21st |

Table 4
Strategies to increase use of building envelope technologies for energy efficient housing.

| Strategies                                                                 | Very important | Important | Neutral | Not important | Not very important | SMV | INDEX | RANK |
|---------------------------------------------------------------------------|----------------|-----------|---------|---------------|--------------------|-----|-------|------|
| Obtaining more information on design policies and material performance     | 43             | 22        | 1       | 2             | 6                  | 316 | 4.3   | 1st  |
| Inclusion of training programs on designing with building envelope technologies for energy efficient housing | 44             | 21        | 0       | 1             | 8                  | 314 | 4.2   | 2nd  |
| Educating clients on the positives of being environmentally conscious     | 41             | 23        | 0       | 4             | 6                  | 311 | 4.2   | 2nd  |
| Reduction in technology costs                                             | 36             | 28        | 2       | 2             | 6                  | 308 | 4.2   | 2nd  |
| Seminars and lectures on the different types of building envelope technologies for energy efficient housing available | 42             | 21        | 1       | 1             | 9                  | 308 | 4.2   | 2nd  |
| Reduction in material costs                                               | 41             | 18        | 5       | 1             | 9                  | 303 | 4.1   | 6th  |
Table 4 highlighted suggested strategies to help increase the use of building envelope technologies for energy efficient housing. Table 4 ranked the strategies such as Obtaining more information on design policies and material performance, Inclusion of training programs on designing with building envelope technologies for energy efficient housing, Educating clients on the positives of being environmentally conscious, Reduction in technology costs and Seminars and lectures on the different types of building envelope technologies for energy efficient housing available. The dataset is useful in developing countries where there is limitation in the power generation, transmission and distribution leading to limited power supply to housing units. It is pertinent for designers to consider the use of sustainable designs that engender energy efficiency through building designs and building materials specified. Designers should be less focused on aesthetics in housing schemes and more focused on providing environment friendly designs that meets the needs of the occupant and the environment.

2. Experimental design, materials and methods

Energy efficient housing is a type of building that implements solar architecture with modern technologies and energy efficient building materials to ensure that maximum comfort is attained with reduced energy cost without harm to the environment/climate [5]. The dataset was obtained using a cross-sectional survey method. The sampling method adopted for the study of the architects was multistage sampling technique. The procedure involved purposive selection of a city where architects are most concentrated leading to the choice of Lagos, and then random selection of architects within Lagos. Similar methods and contributions can be seen in [6–15]. A total of seventy-four (74) registered and unregistered architects participated in the dataset. The dataset was collected in Lagos State. Lagos State was selected in this dataset due to its high population of over 20 million people with high need for housing units. Nigeria; a developing country at present generates a little above 5000 MW which is insufficient for its teeming population of over 200 million people in meeting its energy needs, therefore, the need for this dataset. A questionnaire instrument was used to obtain the dataset. The questionnaire was divided into five (5) sections. Using a 5-point Likert scale rating system for Section 2-4, adding all ratings for each isolate results in 15 points for overall user perception.

Thus; \[ Q = \frac{\sum fx}{N} \]

Where, \( Q = \) Mean, \( \sum = \) Summation, \( Fx = \) Frequency of \( x \) and \( N = \) Number of occurrences. In order to obtain the perception aggregate index (I) of each service, a weight value of 5,4,3,2 and 1 was assigned to the ratings of the 5-point Likert scale. The summation of weight value (SWV) for each variable was obtained from the addition of the product of weight value of each rating and the number of responses of each rating. The perception aggregate index (I) for each variable was obtained from the division of each summation of value (SWV) by the total number of respondents which is represented as “\( N \)”.

Thus, \( \text{Index}(I) = \frac{\text{SWV}}{N} \)

By summing the nominal values and dividing by the total number of scaling variables, the cut-off point is determined. Dividing the total ratings of each variable gives a mean of 3. Thus, any mean above 3 indicates positive respondent’s perception and below 3 indicates negative respondent’s perception while a mean of exactly 3 shows neutral (undecided) on user perception by a respondent.

Acknowledgements

The researchers acknowledge the effort given by Covenant University through the Covenant University Centre for Research, Innovation and Development (CUCRID) to furthering of this research work.
Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.06.093.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.06.093.

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