The relevance of the internet of things to the real estate profession

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Abstract
This paper examines the relevance of the Internet of Things to the Real Estate profession. Questionnaires were distributed, and the interview was also conducted on the Estate Surveyors and Valuers in Akure metropolis. The paper adopts a quantitative method of data analysis. Descriptive techniques were adopted; it includes the tabular analysis of data using percentages and frequencies. A bar chart and Pie chart were also used. From table 4 and figure one (1) (bar chart), it was discovered that most of the respondents are aware of the existence of the Internet of Things as the majority of them indicated their awareness. Table 5 and figure 2 (Pie chart) also show that a high percentage of the respondents agreed that the Internet of Things is relevant to the Real Estate profession.

Keywords: Estate Surveyors and Valuers, Internet of Things, Quantitative method, Real Estate profession

1. Introduction
The real estate sector is gradually embracing the technology that is penetrating all aspects of the built environment as the fourth industrial revolution is fast approaching. We now have smart cities, smart buildings, smart homes, which is becoming an integral part of our daily life and will become smarter and will be connected to the world around us as time goes on. The real estate sector operation for all existing stakeholders (such as tenants and property owners) is being remodeled by the technological advances while bringing in new players who are technologically inclined and are fast modifying the order of the real estate activities [1].

Kevin Ashton formulated the Internet of Things (IoT) in 1999. He was the executive director and Cofounder of the MIT Auto-ID Center. At this period of IoT, there exists communication which is Machine to Machine (M2M); this means without human involvement, there is communication between two machines [2].

In [3] it was forecasted that by 2020 IoT will be made up of about 50 billion connected devices, and more than 10 trillion dollars industry will be the worth of the global IoT market. It was predicted based on the
findings of the globally leading research and advisory firm on information technology that by 2020, the world will have IoT devices of about 22 billion, which is an estimate that is conservative as compared to the prediction of other big multi-national companies.

Based on research carried out in 2003, the number of things connected to the internet is more than the number of people on earth. It also predicted that by 2020, 50 billion things would be available.

Common practical instances of the IoT applications are the traffic lights that change its colours based on the flow of traffic, the windows which can be automatically shut after turning on the A.C etc. Disabled persons also benefit from the idea of IoT (i.e., Google Eye).

There are four elements in the IoT System; it includes Sensors/ devices, user interface, connection, and information handling. The Sensors in IoT systems usually communicate by the Internet connection. With the device to device, IoT, by several tools, communication continues this connectivity. For the user to be able to control it when the data reaches the destination, the software will be processed.

Applications that are based on the Internet of Things are becoming parts of buildings. To modify how properties and its infrastructures are being operated and occupied, some IoT applications such as sensors are progressively being installed at the internal and external parts of the buildings to gather a huge range of data, which will be used in the analysis. This paper examines the Relevance of the Internet of Things (IoT) to the Real Estate Profession.

2. Review of Relevant Literature

In 2016, [4] one of the advisories and leading Research organizations estimated that by the end of 2017, there would be a connection of some IoT devices of about 8.3 billion, it increased in 2018 to 11.2 billion, then by 2020, it nearly doubling to 20.4 billion. The applications that have to do with the consumer takes approximately the highest percentages of these forecasted figures. Greater China, North America, and Western Europe are the world's highest-tech regions and the first known Internet of Things (IoT) drivers of where the combination of the three countries represents in 2017 above 67% of the concept execution.

What has made IoT a technology that is everywhere today is the speedy and continuous development in its popularity.

Internet of Things has some market opportunities; some of them are as follows:

i. Connected cars of 152 million in 2020- HIS. Automotive Mobile subscriptions of 9.5 billion in 2020- Ericsson mobility.

ii. Fifty billion connected devices in 2020- Cisco.

iii. Households of 42% will have Wi-Fi in 2020- Strategy Analytics.

According to an enterprise software strategist called Louis Columbus, the highest potential of the Internet of Things is to be customer-oriented, transform the business to digitally efficient one, and be more flexible. The research carried out in [5] expatiate on the IoT technologies motivations and users' experience, taking a smart home environment into cognizance. For the study, with 40 smart home users, a questionnaire type of survey was carried out. A research framework was proposed in which we have a technology acceptance framework and five potential user factors. It was discovered from the research that the highest predictor of users' intention to use the internet of things technologies is their attitude towards. Also, the cost and suitability will determine their intentions.

The study of [6] revealed that to maximize the systematic process of business, the internet of things technologies can be adopted. To have a better performance in the real estate industry project management, a model was made available to reduce the decision-making time. Finally, To solve any communication-related challenges inactive site situations, the modern IoT-based conditional-aware computer applications were found to be useful.
The idea of the internet of things incorporation and environment and data localization cloud-based building information modeling platform was introduced by [7]. They displayed the utilization of injury-free real estate construction management method and the internet of things technology. This study was targeted towards enhancing the process of safe value creation, on-time, and higher quality project delivery. Two distinct studies were carried out towards achieving the purpose of the study. In the first research, they run an IoT application test that was targeted towards a trailing series of real estate construction projects trades. In other research, they tested an IoT application that aims to quantify the work stations' brightness point. In conclusion, they revealed the potential of incorporating smart technologies in real estate management and the likelihood of gathering and visualizing real project data in real-time.

In order to enhance the construction site decision making, [8] planned to build a model applying the internet of things technology. They introduced by using IoT technology, a sensor-agnostic execution of operation-stage decision making. From their study, the developed model has the potential to enhance the real estate construction operation performance. Therefore, it was declared that the provided model can help in making decisions and can improve the construction project management control and planning approaches.

Through utilizing the cloud asset system, [9] developed an integrated cloud-based IoT system for real estate construction works that are pre-casted. This system was created in order for the medium and small businesses to use the internet of things technologies for their benefits easily. They used the cloud-based internet of things system application in Hong Kong pre-casted construction project. Finally, it is believed that purported cloud-based IoT applications may enhance the present mechanization and information level in the construction industry.

The authors of [10] executed an IoT-based platform to obstruct the job site's construction works in a hazardous situation. To find a solution to the problems of falling construction workers, this platform works in line with a deep learning platform and sensors. From the research, they believe that, at the real estate construction site, safety rules and regulations could be set out for workers using the internet of things technology.

In [11], the scholars focused on the identification of the potential utilization of the internet of things technologies for series of real estate projects and to expatiate on the potential of 5G integration in enhancing the proper functioning of the IoT system in terms of construction management matters. In line with this aim, a comparative study was conducted on the present IoT systems in the real estate sector and the analysis of the merits and demerits of IoT in real estate. Finally, they conclude that it is not easy to adopt IoT effectively in the real estate environment, and in order to achieve better and effective applications of IoT in the future, there is a need for uninterrupted advancement of IoT.

The real estate sector is being revolutionized by the Internet of Things; it also has the possibility of delivering true gains to everyday lives. However, just like some other sectors, people that risk being left behind are those people that didn't embrace and adapt advanced technology and therefore getting low income or not getting additional or new streams of income. For example, in the U.K., in order to certify and measure a building's connectivity, some businesses are now available (much like the certificate for rating energy performance). When choosing where to locate and how much rent to pay prospective tenants (are currently used to advance working ways), use technology and connectivity as the major determinants. Not embracing technological change can make some business never to enjoy the advantages of comfortable, adaptable, conducive workspaces and opportunities such as efficient space usage, greater productivity, costs minimization and employee retention that a workplace that is connected can offer.

Ateyero et al., in their work, investigated the readiness of Sub-Saharan African countries in adopting the Internet of Things (IoT) [12]. Other works on estate valuing are linked to [13-14].
3. Methodology

For the investigation of the relevance of the internet of things to the real estate profession, the study adopted the method of data collection through interviews and questionnaires from all the 15 estate surveying and valuation firms in Akure, Nigeria (NIESV firms' directory). Total enumeration was used for the Estate Surveying and Valuation firms to cover all these firms in Akure metropolis because of the small numbers (15) of firms we have in Akure. Thus, a total of 15 questionnaires were distributed, and the interview was also conducted on the respondents. The respondents were asked about their socioeconomic characteristics and their level of awareness of the Internet of Things. They were further asked to rate the level of their agreement with the relevance of the internet of things to the real estate profession using a Likert scale. For the data analysis, descriptive techniques were adopted; it includes the tabular analysis of data using percentages and frequencies. A bar chart and Pie chart was also adopted.

4. Data Analysis and Discussion

Fifteen (15) questionnaires were administered to estate surveying and valuation firms in Akure Metropolis. Thirteen (13) questionnaires were returned and found useful, which represents an 87% response rate, two questionnaires were not returned, which represents 13% of the response rate. Tables 1-3 below presented the socio-economic characteristics of respondents who are practicing Estate Surveyors and Valuers in Akure. In this section, they supplied the data needed for this survey in terms of; the position of respondent in the firm, academic qualification of the respondent in the firm, professional qualification of the respondent in the firm, etc. This was carried out in order to determine the reliability and validity of the collected data for the research and also for the researcher to familiarise himself with the respondents for the study.

| Position of Respondents in the Firms | Frequency | Percentage |
|--------------------------------------|-----------|------------|
| Branch Manager                       | 1         | 7.7        |
| Estate Officer                       | 1         | 7.7        |
| Estate Surveyors                     | 6         | 46.2       |
| Managing Partner                     | 2         | 15.4       |
| Principal Partner                    | 3         | 23.1       |
| **Total**                            | **13**    | **100.0**  |

Source: Authors' field survey, 2020

The analysis on the above table shows that the majority of the respondents, i.e. (46.2%) are positioned as estate surveyors in their various forms. 23.1% are principal partners, 15.4% are managing partners, 7.7% are branch managers, while the remaining 7.7% are estate officers. This showed that the majority of the study population is in the right position to respond adequately to the questionnaires. This also gives more credence to the reliability and validity of the data gathered.
Table 2: Academic Qualification of Respondents in Akure Estate Firms

| Academic Qualification | Frequency | Percentage |
|------------------------|-----------|------------|
| HND                    | 5         | 38.5       |
| B. Sc.                 | 3         | 23.1       |
| M. Sc.                 | 4         | 30.8       |
| Others                 | 1         | 7.7        |
| **Total**              | 13        | 100.0      |

Source: Authors' field survey, 2020

From the table above, it can be inferred that with respect to their academic qualification, 38.5% of the study population are HND holders, 30.8% are M. Sc. holders, and 23.1% are B. Sc. holders while the remaining 7.7% are holders of other certificates of education such as the OND. This indicated that most of the respondents are well educated and academically qualified to respond adequately to the questionnaires. This response indicated that the information gathered for this study could be relied upon as per the educational level of the respondents.

Table 3: Professional Qualification of Respondents in Akure Estate Firms

| Professional Qualification | Frequency | Percentage |
|----------------------------|-----------|------------|
| Graduate                   | 1         | 7.7        |
| Probationer                | 3         | 23.1       |
| Associate                  | 7         | 53.8       |
| Fellow                     | 2         | 15.4       |
| **Total**                  | 13        | 100.0      |

Source: Authors' field survey, 2020

Based on the analysis on the above table, it was discovered that in terms of professional qualification, only 7.7% are Graduate Members of the Nigerian Institution of Estate Surveyors and Valuers (NIESV), 23.1% are Probationers, 53.8% are Associate Members while the remaining 15.4% are Fellows of the institution. The majority of the respondents are, therefore, qualified professionals to respond to the questionnaire adequately. Thus, the respondents were found to be qualified professionals to provide credible, reliable, and valid data for this research. This is an indication that the respondents have the ability to understand the essence of the subject of matter.

Tables 4 and the chart below presented the level of awareness of Akure Estate Surveyors and Valuers of the Internet of Things.

Table 4: Level of awareness of Akure Estate Surveyors and Valuers of Internet of Things

| Level of awareness of IoT | Frequency | Percentage |
|---------------------------|-----------|------------|
| Very high                 | 3         | 23.1       |
| High                      | 5         | 38.5       |
| Average                   | 2         | 15.4       |
| Low                       | 2         | 15.4       |
Very Low | 1 | 7.7  
---|---|---
Total | 13 | 100.0

Source: Authors' field survey, 2020

Figure 1: Level of awareness of IoT

From the table and chart above, 7.7% of the respondents replied that their awareness about Internet of Things was 'very low', 15.4% of the respondents replied that their awareness about Internet of Things is 'low', 15.4% of the respondents are averagely aware of the IoT, 38.5% of the respondents are highly aware of the Internet of Things, and 23.1% are very highly aware of the IoT. Since most of the respondents are in the range of average to very high, we would conclude that their awareness level is high.

Tables 5 and the chart below presented the level of agreement of Estate Surveyors and Valuers in Akure with the relevance of the Internet of Things to the Real Estate profession.

| Relevance IoT to Real Estate | Frequency | Percentage |
|---|---|---|
| Very Relevant | 4 | 30.8 |
| Relevant | 7 | 53.8 |
| Not Relevant | 2 | 15.4 |
| Total | 13 | 100.0 |

Source: Authors' field survey, 2020
The above table and chart show the level of agreement of the respondents with the relevance of IoT to Real Estate profession, 15.4% of the respondents' said IoT is not relevant to Real Estate profession, 53.8% of the respondents' said IoT is relevant to Real Estate profession, and 30.8% of the respondents' said IoT is very relevant to Real Estate profession. This shows that most of the respondents agreed that the IoT is relevant to the real estate profession.

5. Conclusion
The paper has attempted to examine the relevance of the Internet of Things to the Real Estate profession. The Estate Surveyors and Valuers in the Akure area of Ondo State, Nigeria, have given their views on their awareness of the IoT and its importance to the Real Estate profession. Through personal interviews and questionnaires served on the Estate Surveyors and Valuers in this area, the researcher was able to deduce that most of them are aware of the existence of the IoT (as shown in table 4 and figure 1), and its usefulness in various aspect of real estate profession such as construction, property development, property management, property valuation and so on (as shown in table 5 and figure 2). However, from the empirical studies, it was discovered that due to the low level of development in Akure as compared to other parts of the country such as Lagos, Abuja, and Port Harcourt, Internet of Things is not widely known and some people have not even heard about it for once.

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