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An Analysis of The Benefits of Adopting Modular Construction: A Nigerian Construction Industry Context

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Abstract

Onsite and offsite are the main construction methods used in the construction industry with the former being majorly adopted. Offsite construction offers significant opportunity to improve project performance. However, there is little awareness of its benefits in the Nigerian construction industry. This study aims to assess the benefits of adopting modular integrated construction in Nigeria to improve the level of understanding, usage for stakeholders, and enhance productivity. Purposive and Snowballing technique were used to select the prefab construction experts. Professionals that were involved in the study are engineers, architects, and quantity surveyors in the study area. The most rated benefits are enhanced teamwork and collaboration, improved productivity, simplicity, and ease in the construction, enhances sustainable building, and improved quality of work. Five variables have significant difference between the professionals while others do not. The study concludes that modular construction is at its nascent stage and could be developed and be more implemented if the government takes the lead. It is therefore recommended that stakeholders must be ready and willing to use modern method for better collaboration and teamwork. Also, more awareness and training programs should be conducted to stakeholders' that could implement its usage in the Nigerian construction industry. The government should also provide financial support to encourage private clients and people that want to execute construction projects with prefab.

Keywords: Benefits, Modular construction, prefab, construction professionals, construction industry, off-site construction

1. Introduction

Since the late 19th century, onsite construction has been the common construction method and nowadays it accounts for a significant portion of the housing industry (Zenga & Javor, 2008). However, in light of the industrialization of the construction process, the construction industry has experienced different construction methods during the past few decades (Kamali & Hewage, 2015). The off-site construction process is significantly different than that of on-site. In the case of off-site construction, different elements and components of a building are first manufactured and preassembled, and then they are transported to the final project site and installed to form the building (Kamali & Hewage, 2015).

Modular construction is one of the significant and rapidly growing off-site construction methods that is mainly used in North America, and several European and Asian countries (Annan 2008; Li *et al.,* 2013). A module consists of a volume fitted with all structural elements, finishes, and process components which, regardless of system, function, or installing craft, are designed to occupy that space (Salman, Maulik, & Irtishad, 2013). Modules may contain prefabricated components or assemblies and are frequently constructed away from the Jobsite. Modular construction, on the other hand, is the technique of exporting a portion of site-based work to off-site, such as at fabrication and modular assembly shops or yards (Jin, Choi & Tae, 2017). When properly implemented, modular construction offers considerable opportunity to improve project performance by reducing capital costs, project duration, construction waste, accidents, and noise, and can improve labor productivity, product quality, and environmental performance (Haas *et al.* 2000; Song *et al.2005;* Modular Building Institute (MBI) 2010; McGraw Hill Construction 2011; O'Connor *et al.* 2013; Choi 2014).

Modular integrated construction (MiC) also called modular construction, industrialized building systems, offsite manufacturing, offsite production, modern methods of construction, and prefabricated prefinished volumetric construction (Nadim and Goulding, 2011; Yunus and Yang, 2014; Hwang Shan and Looi, 2018; Wuni *et al.,* 2019a; Wuni & Shen, 2019b). The modular construction technique is not a new concept nowadays and has been reasonably used in the United States, Japan, Sweden, and United Kingdom, whilst becoming popular in Australia, Germany, Netherlands, China, and Hong Kong (Annan *et al*. 2009; Larsson *et al.* 2012; Steinhardt *et al.* 2016). The modularization technique has been utilized by the industry for centuries; however, the building industry including the Engineering, Procurement, and Construction (EPC) sector and the Architectural, Engineering, and Construction (AEC) sector has been struggling to achieve high levels of modularization (Haas *et al*. 2000; O'Connor *et al.* 2013).

Previous researches have been conducted on the benefits of modular construction in Hong Kong (Choi, Chen and Kim, 2017), USA (Velamati, 2012; Lu, 2017), Malaysia (Musa, Yusof, Mohammad, Samsudin, 2016; Paliwal, 2019) and Australia (Ferdous, Bai, Ngo, Manalo and Mendis, 2019). In Nigeria, Kolo et al., (2014) opined that the usage of prefab construction will resolve deficit housing. Ogunde et al., (2016) assessed the challenges and prospects of prefabricated methods in Lagos state. It was shown that unawareness of the MiC, high cost, challenges in installation, unavailability of prefabrication companies locally, and technology are the major stumbling blocks. Adebayo and Dixon-Ogbechi (2017) evaluated prefabricated methodology for building in Nigeria but their study was from the client's perspective only. Alagbe and Aina-Badejo (2019) reviewed the literature on how the low and middle-income groups can use the prefabricated building for smart and fast housing delivery to meet up the high demand for housing. Sholanke *et. al* (2019) examined the level of awareness and adoption of prefabricated construction for affordable housing. This study was not holistic in view because it was from the architects' perspective.

There is no empirical study on the benefits from the perspective of all professionals in the built environment in Nigeria. This necessitates this research and therefore it is pertinent to examine the benefits so that there will be better awareness and adoption of offsite construction in Nigeria to enhance affordable and sustainable housing. This paper will only assess the awareness or knowledge of construction professionals on the benefits of modular, consideration wasn't given to barriers. The barriers of prefabrication have been examined in another paper. This study is important to professionals such as Architects, Clients, Quantity surveyors, Builders, Government, and others construction stakeholders. This paper explores the benefits of Modular Integrated construction in Nigeria towards facilitating its adoption and enhancing sustainable housing.

2. BENEFITS OF MODULAR INTEGRATED CONSTRUCTION

According to Bhattacharjee, Pishdad-Bozorgi, and Ganapathy (2016), the benefits of modular construction were categorized into three dimensions of sustainability which are social, economic, and environmental. Social sustainability includes productivity of labor, reduction in time of labor, the economic aspects deal with minimization of cost of construction and economic sustainability is reducing waste, rework, and pollution. There are some factors that make modular construction to be the most preferred choice over the conventional construction process which are construction in congested cities, a clustered building where noise needs to be minimized, a high degree of repetition of work, and so on (Jaillon, Poon and Chiang, 2009). Other benefits of prefabrication are discussed in detail below;

2.1 Improved productivity in construction: Pan and Hon (2018) revealed that offsite construction result to 30% increase in labor productivity compare to on-site projects. Similarly, FMI (2013), concluded that offsite construction reduces construction risks.

2.2 Speedy completion of construction work: Conventional method of construction is associated with issues such as material shortage, time and cost overruns, low quality, poor weather conditions and skills shortage (Omotayo and Keraminiyage, 2014; Femi and Khan, 2014). With the adoption of modern method of construction, there is fast completion of work because all components have been done offsite (Lawson, Ogden & Bergin, 2012). Completion can be done 30% to 50% sooner for modular projects when compared with the traditional construction because 60-90% is completed in the factory which reduces the risk of weather delay (MBI, 2013; Kolo et al., 2017). This will remove the delay been spent on the conventional process of construction. Faster and efficient factory processes is been replaced with slow, less productive, and ineffective site processes. A high level of fabrication will provide less interruption during the construction process (Chen, Okudan, & Riley, 2010). A $90 million project for the construction of Canyons lodge and cabins in Yellowstone National park in the US was fabricated by Guerdon Modular Buildings in Boise, Idaho facility. The proposed completion time for the five structures was 30 months, but by the use of modular construction, 10 months was used for its completion and was reported that it reduced construction waste by 85% (Canyons Lodge, Yellowstone National Park & Wyoming, 2018).

2.3 Reduction in life cycle cost: Despite there is high capital at the initial stage of offsite construction, there is reduced operation and maintenance cost at the long-run of the building. Reduction in the lifecycle cost is achievable when quality materials are used for initial construction. The cost used for operation and maintenance and disposal of modular construction are minimized at the course of the use of the building (Blismas, Pasquire & Gibb, 2006).

2.4 Improved quality of work: Modules produced in the factory are of a high quality due to strict quality assessment and control with inspection and testing protocol before it is transported to the site (Kolo et al., 2017; Killingsworth et al., 2020). This quality requirements are performance, whole life cost and durability. The quality of work is increased because skilled workers in the factory are more permanent than temporary workers on site. Modular components that are used for building are constructed in the same standards as the conventional process and according to architect specified materials (MBI, 2013).

2.5 Reduction in greenhouse gas emission: The US Geological Survey (2012) reported that 3.4 billion tons of cement produced contribute to 5% of global carbon dioxide emissions. These emissions can be minimized if MiC is adopted in the construction industry. Mao *et. al* (2013) noted that gas emission is reduced by 40-50% with the implementation of off-site construction. It was noted that there is a reduction of carbon emissions by when modular construction is implemented.

2.6 Lessens construction waste, possibility of re-use and resale of materials: These derived principles from lean and factory environment have enhanced control and reduction in waste (Kolo et al., 2017). In Nigerian construction projects, a large percentage of waste is being generated for conventional buildings. In Hong Kong, it was observed that construction wastes are reduced by 52% when modular integrated construction is used (Jallion *et al.,* 2009). Lachimpadi *et al.,* (2012) carried out research on industrialized buildings system (IBS) for the construction of high-rise buildings in Malaysia and proved that the waste generated from precast (or IBS) construction in comparison to the conventional in-situ casting is as low as 25%. Furthermore, fewer wastes are been produced in the factory for the production of modular products at every step of the way (Musa & Mohammed, 2015). Modular construction helps in reducing, reusing, and recycling waste because materials that are not used can be kept in the inventory which can be used in another project.

Also, modular construction helps in deconstructing a building and these materials can be relocated to another site and reconstructed for a new building (NRB, 2014). These materials can be sold to those that need modular components or elements. Most repetitive projects like hotels and so on reduce construction waste by 50% and waste produced in the off-site area is either reused or recycled (Mtech Consult Group, 2012).

2.7 Reduces pollution in the environment: Effective implementation of MiC reduces pollution in the construction, any form of noise nuisance, and disruption of work in the area. When the construction time is reduced, it also reduces the construction noise in the environment compared to the conventional process (Velamati, 2012). For example, sandwich exterior walls prefabrication aid in minimizing the construction dust emission by 30%. These help in reducing noise on-site because it will have been produced in the factory shop (Wilkinson, Xia, & Chen, 2016).

2.8 Enhances sustainable/Green building: Modular building promotes sustainability because there is less disturbance from suppliers, workers, and equipment. Most of the works are been done in the plant before it is transported to the construction site. Also, this can be dismantled and relocated to a new place or refurbished for new use. Thus, it reduces raw materials and minimizes energy costs to create a new building. This sustainability is also improved because there is less waste and improved safety on the construction site (Musa, Mohammed & Mahbub, 2014).

2.9 Reduce health and safety risks: MiC enhances the safety and security of construction workers on-site due to prefab products are brought to the site for fabrication and joining (Killingsworth, et al., 2020). Most of the work in Modular construction is done by plant and equipment like the lifting of modular components, fixing, and joining. In the conventional process, more labors are needed on-site which is prone to accidents and other risks. Safety in modular construction is higher, compare to the traditional or conventional process of construction because most work is done offsite (Nahmens & Ikuma, 2012).

2.10 Minimize defects in the building: Prefab components are not easily affected by adverse weather conditions compared to the traditional process like rain, sun, and relative humidity. Defects are been minimize in prefab building because of the level of standard and quality of modular components.

2.11 Certainty of project cost: Modular construction gives certainty of cost and this can lead to the possibility of a reduction in the cost of construction (Killingsworth et al., 2020). The kings' park accommodation in Queensland Australia was able to save 40% of the expected cost by using modular construction. Those modules were prefabricated within 50 days in China and were assembled on-site for a week (Paliwal, 2019). The reduction in construction time brings about the certainty of cost because fewer resources will be spent on the project which gives a glimpse of money that will be executed on a subsequent project.

2.12 Improved aesthetic view: Velamati (2012) noted that there is an improved aesthetic view of building compared to a conventional process. In the factory, strong expertise is used in the production of modules in high standard and quality but there is the possibility of using quack artisans in the conventional which diminishes the aesthetic of the building. Also, thermal and airtightness performance is enhanced for building fabric when modular construction is adopted due to tighter joints that can be achieved in the factory environment.

2.13 Minimization in labor, material demand, and cost: MiC reduces labor skills needed in construction because work is less complicated. Also, few and expert laborers are used for the work compare to the conventional process. Modular construction can reduce the labor and material cost but this cost saving is partially offset by the transportation cost. The transportation of modular units is also subject to the country's road department. Jallion *et. al.,* (2009) observed that when in-situ concrete was replaced with precast concrete, concrete quantities saved was 55%, Quantities of reinforcement saved was 40%, and 70% of timber formwork was replaced from different projects.

2.14 Lessen weather disruptions on-site: When there is fast completion of work, there is less disturbance of weather such as heavy rain and adverse heat on-site. In the conventional process of building, numerous delays affect the progress of building which makes shut down and stoppage of certain specific trade or delay in delivery of materials (Velamati, 2012). These delays are compensated when subcontractors are forced to work extra hours to meet the schedule. In modular method of construction, there is never a factory delay which makes time to be saved.

2.15 Safe and better site operations: The use of a factory for the production of the modular unit reduces the risks of accidents and various liabilities that can be experienced by workers on site. This improved safety is more in fabrication than onsite operations which is characterized with lack of space, skilled labor, and bad weather (Mohamad Bohari *et al,* 2015)

2.16 Simplicity and ease in the construction process: Modular building is easily constructed by connecting modular components. It is also movable and flexible when the components are not needed. The joints and connections are removed and moved to another place of use. There is also the possibility of executing construction in remote locations because projects that are not feasible using traditional construction are often feasible using modular construction.

2.17 Increased competition on foreign firms: The national research council of the US noted that the implementation of modular construction will enhance the efficiency and competitiveness of the construction industry. Therefore, there is a need for construction companies to be leaner to be competitive to win foreign and better contract (Mc Graw Hill construction, 2011)

2.2 HINDRANCES TO THE USAGE OF MODULAR CONSTRUCTION

There are various factors limiting the adoption of modular construction. These are explained in the subsections below;

Modular construction is very capital intensive this was noted by Pan and Sidwell (2011) and that it is cost saving in the whole life cycle. Hong, Shen, Li, Zhang & Zhang (2018); Sun et al., (2020) emphasized that the cost of prefab is higher than conventional buildings. Furthermore, lack of government support is one of the critical factors that affects the adoption of modular construction (Xu, Zayed and Niu, 2020; Ferdous, Bai, Ngo, Manalo & Mendis, 2019). When government promotes, encourages, enforce, provides incentive and subsidies for modular buildings, it will gain more wider adoption (Luo et al., 2015).

It was also observed that lack of qualified professionals hinders the adoption of MiC projects (Wuni and Shen, 2019a). Highly skilled and experience contractors, labourers can suggest modular buildings to clients who don't have an idea of prefab (Sun et al., 2020). Also, lack of advancement in technology is a problem in the use of modular building (Pan, Gibb and Dainty, 2007; Shahtaheri, Rausch, West, Haas & Nahangi, 2017). It requires interfacing of modules and a level of technological requirements is needed to avoid assembly errors, rectification of problem and reworks (Wuni and Shen, 2020). Lack of standard and codes for certifying modular construction which includes architecture, structure, services, safety, durability and sustainability. The limited availability of MiC design codes, technical guidance and standards contributes to low level of usage (Chang, Zuo, Wen and Zillante, 2018; Sun et al., 2020)

Kamali and Hewage (2016) revealed that logistics related issue such as transportation and limited storage space impede MiC adoption. In addition, the risk associated in transporting those modules can discourage owners and increase the amount budgeted (Meehleis, 2020). Other obstacles identified by various authors are client resistance to change and dissatisfaction of clients (Gan et al., 2018; Havinga & Schellen, 2020); Lack of manufacturer and suppliers of MiC products (Wuni and Shen, 2020); Limited contractors that are specialized in prefab (Polat, 2010); Complex procurement and contract system (Wuni and Shen, 2020); Lack of awareness by stakeholders and clients (Blismas 2005); Skilled labor with high wages (Wuni and Shen 2020); inflexibility of design changes (Jaillon and Poon, 2009); untimely supply of modular products (Luo, Mao, Shen and Li 2015); dominance of traditional process and practices (Nawi et al., 2009).

(Insert Table 1)

3.0 RESEARCH METHODOLOGY

The quantitative research approach was used in the study. This involves collecting data relating to the objective of the study through the distribution of questionnaires to the professionals that have handled Modular construction in the Lagos, Port Harcourt, Abuja. Some of the executed or ongoing modular projects in Nigeria are Nigeria Immigration Service, NCDC Abuja Testing

Laboratory Project, Spring Hall British School modular cabin classrooms, Skye Bank Experience Hub Project, Police transit camp project, Defense headquarter, amongst others. The questionnaire was designed to retrieve respondents' demographic information (academic qualification, number of prefab projects handled, years of experience, and profession of the respondents). This is a significant aspect of the research study before getting their views on the benefits of Modular construction. Five-point Likert Scale was used in the ranking where 1 represents Strongly Disagree, 2 represents Disagree, 3 represent Undecided, 4 was noted for Agree, and 5 represents Strongly Agree. The target populations for this study were professionals that have handled prefab construction in the study area.

A pilot study was conducted with experts in prefab construction regarding the research instruments, 3 participants/professionals were used in the pilot study. This pilot study was used to correct the ambiguity of words and errors in some statements for clarity and the correct rating for the survey. Those experts that constituted the study were the ones that directed to unknown professionals (experts). The data collection was collected from 15th May 2020 to 10th July 2020. The questionnaire was administered to experts in modular construction by hand. The purposive and snowballing techniques were used in identifying professionals in the study area. The purposive sampling was used to contact professionals for the pilot study. These professionals then connect us to other unknown professionals. Eighty-seven (87) professionals were identified in the study area and were given a questionnaire to fill. At the end of the whole data collection, seventy-five (75) were returned and sixty-four (64) questionnaires were suitable for further analysis. The other eleven (11) questionnaires were not included because it was partially filled. Despite the sample size was very small, statistical analyses can still be conducted due to the generally accepted rule. Hwang et al., (2015) noted that a sample size of 30 or above makes the central limit theorem to be true. Also, Modular construction or Prefab have not been generally utilized in the Nigerian construction industry which makes it difficult to get a large sample of experienced professionals.

After the data collection, percentile, frequency table, pie chart, and bar chart were used to analyze the demographic aspect of the respondents which is on a nominal scale. The other part in the ordinal scale was analyzed with Statistical Package for Social Sciences (SPSS 23). The reliability/Cronbach alpha (α) test was used to test how reliable is the research instrument and scale. The reliability test value for this study was 0.870, this value is reliable because it is above 0.70 (Doloi et al., 2011). The mean item score was used to find the average of the factors for the benefits of modular construction. The benefits were ranked from the highest to lowest in their values. Kruskal Wallis was also used for further analysis to know the difference in the views of professionals. This was conducted to see whether there are significant differences or not.

4.0 FINDINGS AND DISCUSSION

Table 2 shows the profession of the respondents, 15 were Quantity surveyors depicting 23.4% of the population. Builders represent 15.6% which were 10 and project managers connotes 10.9% where were 7 in numbers. 12 were Architects and 20 were Engineers which represent 18.8% and 31.3% respectively. The academic qualification of respondents engaged are HND, B.Sc/B. Tech and M.Sc/M.Tech. 12 were classified into the HND groups, 37 were grouped into B.Sc/B. Tech and 15 were classified into the M.Sc/M.Tech groups. This represents 18.8%, 57.8%, and 23.4% of the population respectively.

(Insert table 2)

Figure 1 depicts the types of organization where the respondents work. 33% of the respondents work in the consulting firm i.e., 21 professionals. 67% of the respondents work in the contracting firm which connotes 43 professionals. Regarding the years of experience of the respondents, those with 1-5 years of experience were just 12 respondents which represent 18.8% of the population. 6-10 years of experience were 30 respondents which depict 46.8% of the population. 20 respondents have 11-15 years of experience i.e., 31.3% of the whole respondents. 2 respondents have 16-20 years of experience which connotes 3.1%.

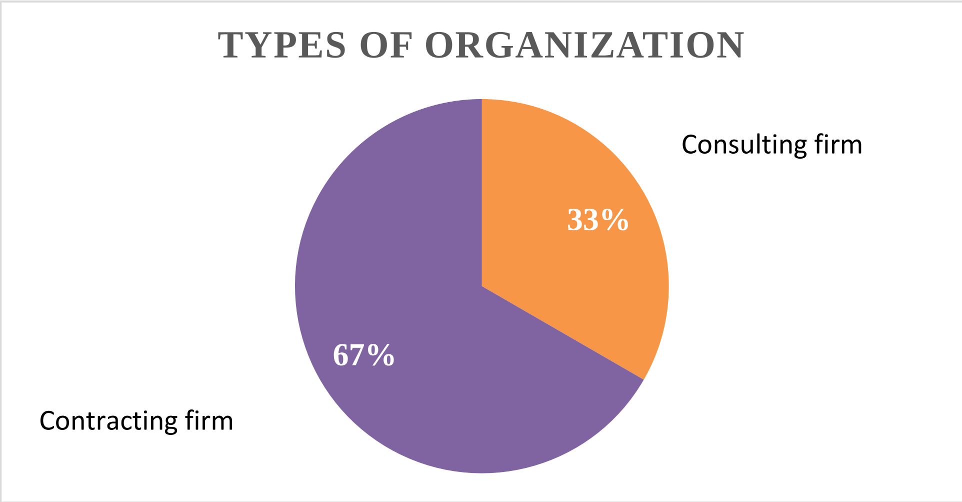

Figure 1: Types of organization

Figure 2 reveals the number of modular construction projects handled by professionals. 28 respondents have handled 1-5 Modular integrated construction (MiC) projects i.e., 43.8%. 18 professionals were engaged in 6-10 MiC projects i.e., 28.1%. Those with the range of 11-15 projects were 10 professionals which represent 15.6% of the population. 16-20 MiC project execution were 8 respondents which also represents 12.5% of the entire population. In the aspect of professional qualification, i.e., Nigerian Institute of Architects (NIA), Nigerian Institute of Quantity Surveyors (NIQS), Nigerian Society of Engineers (NSE). Professionals with fellow were 18 which represents 28.1% of the population. Those with membership in their professional bodies were 38 depicting 59.4% of the population. Those with associate membership in each professional body were 8 connoting 12.5%.

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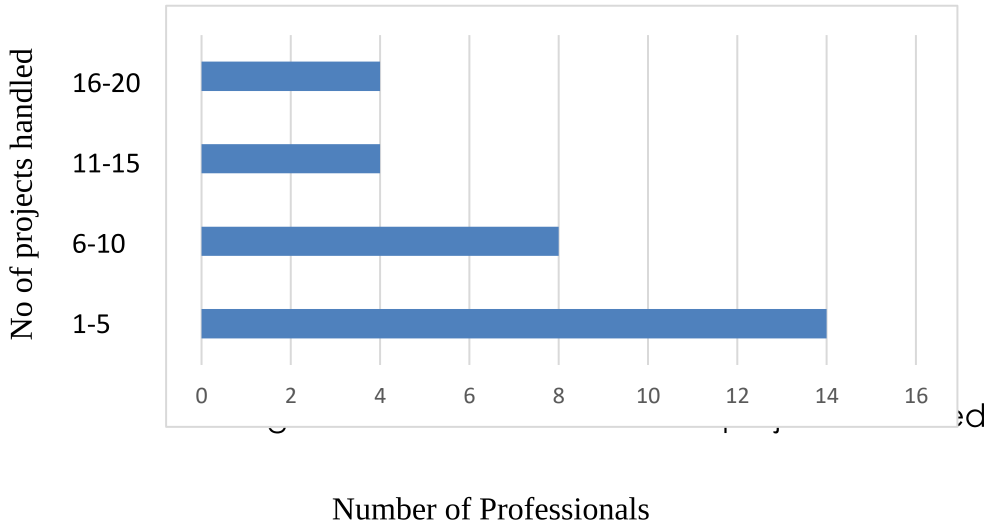

Figure 2: Number of projects handled by professionals

(Insert Table 3)

In table 1, it shows the variables and their codes which can be used to interpret the table 3. Enhance teamwork and collaboration was ranked first with a mean value of 4.86. Reduces pollution in the environment was ranked second with a mean value of 4.77. Improved productivity in construction and speedy completion of construction work were ranked third position having same mean value of 4.73 with the same standard deviation. Besides, improved quality of work was ranked fifth with a mean value of 4.72 and enhances Sustainable/Green building was ranked sixth with a 4.70 mean value. Simplicity and ease in the construction process was ranked seventh position having mean value of 4.60.

Safe and better site operations was ranked eighth position with mean value of 4.58. Theft reduction on-site, and reduction in life cycle cost were ranked ninth and tenth position respectively. These variables or factors have same mean value (4.56) but different standard deviations. The variables with larger standard deviation are ranked last and this was applied in the ranking of the variables in table 3 (Field, 2005). Reduction designs/construction rework and possibility of reuse and resale were both ranked eleventh position due to the fact they have same mean values and standard deviations. Also, reduction in greenhouse gas emission was ranked thirteenth with 4.55 mean value while lessen weather disruptions on-site was ranked fourteen. The fifteenth position was acoustic and installation benefits with a 4.48 mean value.

Improved aesthetic view, and airtightness and thermal performance of building fabric were ranked sixteenth and seventeenth position with mean of 4.47 and 4.44 respectively. The eighteenth ranked variable was minimizing defects in the building and nineteenth position was lessen construction waste having mean value of 4.43 and 4.41 respectively. Furthermore, minimization in labor demand was ranked twentieth position with mean value of 4.33 and increased competition for foreign firms was ranked twenty-first position with mean 4.25. The factor ranked in the penultimate position was certainty of the project cost having mean value of 4.11. The last ranked variable for benefits of MiC was reduce health and safety risk with a 3.95 mean value.

(Insert Table 4)

Table 4 shows the difference in the views of professionals which was conducted with the Kruskal Wallis test. Five (5) variables have significant difference in the opinions of respondents. These variables or factors are reducing construction waste, enhances sustainable/Green building, reduce health and safety risk, lessen weather disruption onsite, and safe better site operations. The other eighteen (18) variables or factors have *p-values* greater than and equal to 0.05 i.e., there is no significant difference in the views of respondents. This also means that these professionals have the same views and opinions on these variables.

The result gotten from the US and Hongkong is slightly similar to the result in Nigeria. Hong Kong and the US noted that the top five benefits are better site operations, better quality, improved schedule, lower cost and increased productivity (Choi et al., 2017; Edmonds, Golden and McKenna, 2018; Beecroft and Awobodu, 2018; Wuni and Shen, 2019c). Improved productivity, quality of works, improved quality of work and speedy completion of construction works are in line with studies in the US and Hongkong. This implies that off-site construction enhances the productivity of workers which in turn leads to a high quality of work (Modular unit). This modular unit when assembled eliminates unnecessary time that is been associated with the traditional method. Also, Velamati (2012) and Paliwal (2019) noted that prefab enhances improved schedule of the project by eliminating delays associated with the conventional method of construction such as weather condition

Enhance teamwork and collaboration, reduces pollution in the environment, and Enhances sustainable/green building were rated among the top benefits of this study. This study has been able to show that teamwork and collaboration, reduces pollution in the environment is one the greatest benefits of prefab construction in Nigeria. Zhai and Reed (2014) revealed that offsite construction reduces noise or pollution, onsite dust and local community disruptions which is in support of this finding. Sustainable building is consistent with Musa and Mohammed (2015); Wilkinson, Xia, and Chen, (2016); Musa et al., (2016) who opined that that off-site construction provides sustainability in the construction environment. This does not conform to the study of Zhai and Reed (2014) who noted that there are been sustainable challenges in China where stakeholders consider cast-in-situ method as effective approach making offsite adoption relatively low. This might be cast-in-situ is cost effective compare to precast and stakeholders are not willing to change to modern method of construction (Havinga & Schellen, 2020). This implies that despite offsite construction reduces waste, materials, pollution, and fewer disturbances in enhancing sustainability, some countries are yet to partake in this technology. Blismas et al., (2006) and the Construction industry council (2018) noted that modular construction reduces lifecycle cost and carbon emission which is partially in line with this finding which was rated tenth and thirteenth position respectively. This means that the professionals are yet to observe how prefab minimize the cost of operation and maintenance and carbon emission to the environment in Nigeria.

Certainty of the cost was rated among the least which does not corroborate with the findings of Edmonds, Golden, and McKenna (2018) and partly consistent with Sholanke et al., (2019) who noted that modular construction minimizes and guarantee cost. This implies that the cost of projects does exceed the budgeted cost which might be an error in costing or not following the specifications in the drawing for prefab components. Also, Kamali and Hewage (2016); Meehleis (2020) elaborated that the risk of transporting modules can cause an increase in the budgeted contract sum which is in tune with this finding. In the US and Hong Kong, it was noted that there is better site operation which is partially in line with this finding where it was rated eighth positions. This means that professionals could not perfectly fathom how better and safe site operations are provided by modular construction. Furthermore, the possibility of re-use and re-sale is partly in alignment with Modular construction (2011); Basu (2012) and NRB (2014) findings who said that modular units can be reused and relocated for those that need it in another place like mobile offices and complex units. Buildings can be moved to different locations for use without difficulty. Mobile offices that are gotten by companies can be reused in different sites compare to the conventional offices which cannot be moved. This means that there is little utilization of the aspect of re-use, re-sale, and relocation of modular units in the Nigerian construction industry which has impede the wider adoption.

In a construction site, the researcher expects that increase safety, less site disruption, safe and better site operations should be well achieved and appreciated. It was shown in this finding that safe site operations and safety have not fully realized or achieved these benefits. Musa et al., (2014); Musa and Mohammed (2015) noted that off-site construction provides less waste in the industry which partly corroborates with this finding but in support of Arif, Goulding and Rahimian (2012). This means despite the offsite has the potential to minimize waste, experts or professionals have not utilizes how modular construction can reduces waste in construction or see where wastes are been minimize compared to the conventional method. This will require operatives and professionals to be retrained and reskilled in order to harness the opportunity of waste reduction. Mao et al., (2013) noted that implementation of Modular construction reduces greenhouse emission which is partly in line with this study. This implies that this aspect of the reduction of green gas emission has not been maximized well in the Nigerian construction industry. Rahimian et al., (2017) emphasized those stakeholders should be well informed and trained in the aspect of green gas emission so that it can be fully maximized.

Also, government should be the frontier in the use of offsite construction which makes the benefits to be visible to private organizations and other stakeholders in the industry. This is in support of Xu, Zayed and Niu (2020) who said that the major hindrance to wider adoption of MiC is that government are not willing and ready to support, encourage and provides incentives for modular projects in developing countries such as Nigeria. When there is wider adoption of MiC more of its benefits will be glaring to stakeholders and clients

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the finding, it has been shown that modern method of construction has huge benefits compare to the conventional method. The most emphasized benefits were speedy completion of work which in turn can increase housing in Nigeria when governments and private organization have a lot of projects to construct. Presently, Nigeria has the issue of housing deficit to accommodate Nigerians with affordable housing. With modular construction, buildings and offices will be executed at the targeted cost, time, and at the best quality. This will reduce wastage that is associated with conventional methods. This study has revealed the benefits of off-site construction to the stakeholders, society, and the nation at large. The top five benefits rated by the experts engaged were enhanced teamwork and collaboration, reduces pollution in the environment, speedy completion of work, improved productivity, and improved quality of work. The least rated benefits include lessen construction waste, minimization in labor demand and cost, increased competition for foreign firms, certainty of project cost, reduces health and safety.

All factors or variables have no significant difference in the opinions of professionals except lessen construction waste, enhances sustainable/Green building, reduce health and safety risk, lessen weather disruption on site, safe and better site operations which have significant difference in the views of professionals. It is recommended that every stakeholder should be willing and ready to adopt these modern methods for better cooperation and effective team work. Government should take the lead in adopting it for public housing projects, it inspires private clients and people to act also. This will enhance more implementation and development. Also, more awareness and training program should be conducted to stakeholders' that could implement its usage in the Nigerians construction industry. The government should provide financial support to encourage private clients and people that want to execute construction projects with prefab. This study was limited to industrialized part of Lagos state in Nigeria. Additional study can be done in other states, developing countries and through qualitative means. Further studies can be conducted on the post-occupancy evaluation of modular buildings on users to know their perspective on the benefits in terms of energy-saving, cost, and satisfaction.

REFERENCES

Alagbe O. A., and Aina-Badejo T. F. (2019). Exploring Prefabricated Construction Principles for Smart and Fast Housing Delivery in Abuja, Nigeria. International Journal of Engineering Research & Technology (IJERT). 8(6), 917-924

Arif, M., Goulding, J., and Rahimian, F.P. (2012). Promoting offsite construction: Future challenges and Opportunities. Journal of Architectural Engineering, 18, 75-78.

Beecroft, J., & Awobodu, K. (2018). Why New Building Technics are not Prevalent in Nigeria. The Guardian.

Bhattacharjee, S., Pishdad-Bozorgi, P., and Ganapathy, R. (2016). Adoption of Pre-Fabrication in Construction to Achieve Sustainability Goals: An Empirical Study, *Construction Research Congress* ASCE, Reston, VA, 1050-1060

Blismas, N. G., Pendlebury, M., Gibb, A., & Pasquire, C. (2005). Constraints to the use of off-site production on construction projects. *Architectural Engineering and Design Management, 1*(3), 153-162.

Blismas, N. G., Pasquire, C., and Gibb, A.G. (2006). Benefit evaluation for offsite production in construction. Construction Management and Economics, 24(2), 121–130

Canyons Lodge, Yellowstone National Park, Wyoming. (2018). Retrieved from http://www. guerdon modularbuildings.com/our-work/canyon-lodge/

Chen, Y., Okudan, G. E., & Riley, D. R. (2010). Sustainable performance criteria for construction method selection in concrete buildings. Automation in Construction, 19(2), 235-244. https://doi.org/10.1016/j.autcon.2009.10.004

Choi, J.O., (2014). Links between modularization critical success factors and project performance [Ph.D. Dissertation]. Austin (TX): The University of Texas at Austin.

Choi, J.O., Chen, X.B., & Kim, T.W. (2017). Opportunities and challenges of modular methods in dense urban environments. *International Journal of Construction Management,* 1-13 http://dx.doi.org/10.1080/15623599.2017.1382093

Construction Industry Council (2018). About modular integrated construction. Hong Kong: Construction Industry Council. Retrieved from www.cic.hk/eng/main/mic/whatsmic/about mic/

Doloi, H., Iyer K.C., and Sawhney A. (2011). Structural equation model for assessing impacts of contractor's performance on project success. Int J Proj Manag. 29: 687–695.

Edmonds, C., Golden, N., & McKenna, C. (2018). Modular Construction for Multifamily Affordable Housing. United States of America: WSP Built Ecology.

Femi, A.B. and Khan, T.H. (2014). Bridging the Gap between Housing Demand and Housing Supply in Nigerian Urban Centres: A Review of Government Intervention So Far. British Journal of Arts and Social Sciences, 18(2), 94-107.

Ferdous, W., Bai, Y., Ngo, T.D., Manalo, A., and Mendis, P. (2019). New advancements, challenges, and opportunities of multi-storey modular buildings – A state-of-the-art review. 183 (2019) 883–893. https://doi.org/10.1016/j.engstruct.2019.01.061FMI (2013).

Gan, X., Chang, R., Zuo, J., Wen, T., & Zillante, G. (2018). Barriers to the transition towards off-site construction in China: An Interpretive structural modeling approach. *Journal of Cleaner Production, 197*, 8-18. doi:10.1016/j.jclepro.2018.06.184

Prefabrication and modularization in construction. Raleigh (NC): FMI Corporation.

Haas, C.T., O'Connor, J.T., Tucker, R.L., Eickmann, J.A., and Fagerlund, W.R. (2000). Prefabrication and preassembly trends and effects on the construction workforce. Austin (TX): Center for Construction Industry Studies, The University of Texas at Austin.

Havinga, L., & Schellen, H. (2018). Applying internal insulation in post-war prefab housing: Understanding and mitigating the hygrothermal risks. *Building and Environment, 144*, 631-647.

Hong, J., Shen, G. Q., Li, Z., Zhang, B., & Zhang, W. (2018). Barriers to promoting prefabricated construction in China: A cost–benefit analysis. *Journal of Cleaner Production, 172*, 649-660. doi:10.1016/j.jclepro.2017.10.171

Hwang, B.G., Zhao, X., See, Y.L., and Zhong, Y. (2015). Addressing risks in green retrofit projects: the case of Singapore. *Proj. Manag. J.,* 46 (4), 76-89.

Hwang, B.G., Shan, M., and Looi, K.Y. (2018). Knowledge-based decision support system for prefabricated prefinished volumetric construction. *Autom. Constr.*, *94*, 168–178. DOI:10.1016/j.autcon.2018.06.016.

Jaillon, L., Poon, C. S., and Chiang, Y. H. 2009. Quantifying the waste reduction potential of using prefabrication in building construction in Hong Kong. *Waste Management*, 29(1), 309–320

Kamali, M., & Hewage, K. (2015). A framework for comparative evaluation of the life cycle sustainability of modular and conventional buildings. Modular and Offsite Construction (MOC) Summit Proceedings.

Kamali, M., & Hewage, K. (2016). Life cycle performance of modular buildings: A critical review. *Renewable and Sustainable Energy Reviews, 62*, 1171-1183. doi:10.1016/j.rser.2016.05.031

Killingsworth, J. Mehany, M.H., and Ladhari, H. (2020). General contractors' experience using off-site structural framing systems. Journal of construction innovation, 1-25, DOI 10.1108/CI-05-2019-0038

Kolo, S.J., Rahimian, F.P., Goulding, J.S. (2014). Offsite manufacturing Construction: a big opportunity for housing delivery in Nigeria. Creative Construction Conferenece 2014, CC2014. Procedia Engineering, 85, 319-327

Lachimpadi, S. K., Pereira, J. J., Taha, M. R., & Mokhtar, M. (2012). Construction waste minimization comparing conventional and precast construction (Mixed System and IBS) methods in high-rise buildings: A Malaysia case study. *Resources, Conservation and Recycling,* 63, 96-103.

Lawson, R.M., Ogden, R.G., and Bergin, R. (2012). Application of Modular Construction in High-Rise Buildings. *Journal of architectural engineering*, 18 (2), 148-154.
Lu, N. (2007). *Investigation of the designers' and general contractors' perceptions of offsite construction techniques in the United States construction industry.* (Doctoral dissertation) Retrieved from http://tigerprints.clemson.edu/cgi/viewcontent.cgi?article=1081&context = all_dissertations (5-2007)
Luo, L.-z., Mao, C., Shen, L.-y., & Li, Z.-d. (2015). Risk factors affecting practitioners' attitudes toward the implementation of an industrialized building system. *Engineering, Construction and Architectural Management, 22*(6), 622-643. doi:10.1108/ecam-04-2014-0048
Mao, C., Shen, Q., Shen, L., and Tang, L. (2013). Comparative study of greenhouse gas emissions between off-site prefabrication and conventional construction methods: two case studies of residential projects. Energy Build. 66, 165-176. https://doi.org/10.1016/j. enbuild.2013.07.033.
McGraw Hill Construction (2011). Prefabrication and Modularization: Increasing Productivity in the Construction Industry. Bedford, MA.
Meehleis, M. W. (2020). Difficulties Posed and Overcoming Challenges in Modular Construction: A Case Study.
Modular construction - Steelconstruction.info. 2011. Retrieved January 2, 2014, from http://www.steel construction.info/Modular_construction_truncated.
Mohamad Bohari, A.A. (2015). The path towards greening the Malaysian construction industry. Renewable and sustainable energy reviews, 52, 1742–1748.
Mtech Consult Group (2012). Waste reduction potential of offsite manufactured pods, 1 10. Retrieved from www.wrap.org.uk
Musa M.F., and Mohammad M.F., (2015). Adopting Modular Construction through IBS Approach. LAP LAMBERT Academic Publishing

Musa M.F., Yusof, M.R., Mohammad M.F., and Mahbub R. (2014). Characteristics of Modular Construction: Meeting the Needs of Sustainability and Innovation. In Colloquium on Humanities, Science, and Engineering (CHUSER 2014). IEEE, Penang, Malaysia. 216- 221.

Musa, M. F., Yusof, M.R., Mohammad, M.F., and Samsudin N.S. (2016). Towards the adoption of modular construction and prefabrication in the construction environment: A case study in Malaysia. *ARPN Journal of engineering and applied sciences*. 11 (3), 8122-8131

Nadim, W., and Goulding, J.S. (2011). Offsite production: A model for building down barriers A European construction industry perspective. *Eng. Constr. Archit. Manage.*, *18*, 82–101. DOI:10.1108/ 09699981111098702.

Nahmens, I., and Ikuma, L.H. (2012). Effects of lean construction on the sustainability of modular Homebuilding. *J Archit Eng,* 18, 155–163.

Nawi, M. N. M., Kamar, K. A. M., Abdullah, M. R., Haron, A. T., Lee, A., & Arif, M. (2009). Enhancement of constructability concept: An experience in offsite Malaysia construction industry. *Proceeding in Changing Roles; New Roles, New Challenges*.

NRB (2014). 7 Sustainable Building Benefits of Off-Site Construction | NRB Blog. NRB, 1, 17-19. Retrieved from https://www.nrb-inc.com/modular-construction-blog/7- sustainable7-building-benefits-site-construction/

O'Connor J. T., O'Brien, W. J., and Choi, J.O. (2013). Industrial modularization: How to optimize; How to maximize. Austin (TX): The University of Texas at Austin, Construction Industry Institute

Ogunde, A., Selekere T. E., Joshua, O., Kukoyi, P. O., and Omuh, I. O. (2016). Prefabrication Method of Building Construction in Lagos State, Nigeria: Prospects and Challenges. International Journal of Engineering Technology and Computer Research (IJETCR), 4(1), 88-100

Omotayo, T., and Keraminiyage, K. (2014). The Widening Knowledge Gap in the Built Environment of Developed and Developing Nations: Lean and Offsite Construction in Nigeria and the UK, in International Conference on Construction in a Changing World. Heritance Kandalama, Sri Lanka.

Paliwal, S., (2019). Opportunities and Challenges of Modular Construction in a Hospitality Centric Environment. UNLV Theses, Dissertations, Professional Papers, and Capstones. 3658. https://digitalscholarship.unlv.edu/thesesdissertations/3658

Pan, W., Gibb, A. G., & Dainty, A. R. (2007). Perspectives of UK housebuilders on the use of offsite modern methods of construction. *Construction Management and Economics, 25*(2), 183-194.

Pan, W., & Sidwell, R. (2011). Demystifying the cost barriers to offsite construction in the UK. *Construction Management and Economics, 29*(11), 1081-1099.

Pan, W., Gibb, A.G.F., and Dainty, A.R.J. (2012). Strategies for integrating the use of off-site production technologies in house building. *J. Constr. Eng. Manag.* 138, 1331-1340. https://doi.org/10.1061/(ASCE)CO.

Pan, W., and Hon, C.K. (2018). Modular integrated construction for high-rise buildings. *Proc. Inst. Civ. Eng. Munic. Eng.* 1-12. https://doi.org/10.1680/jmuen.18.00028.

Polat, G. (2010). Precast concrete systems in developing vs. industrialized countries. *Journal of Civil Engineering and Management, 16*(1), 85-94.

Rahimian, F.P., Goulding, J., Akintoye, A., and Kolo, S. (2017). Review of Motivations, Success Factors, and barriers to the adoption of offsite manufacturing in Nigeria. Creative Construction Conference 2017, CCC 2017, 19-22 June 2017, Primosten, Croatia. Procedia Engineering 196, 512 – 519

Shahtaheri, Y., Rausch, C., West, J., Haas, C., & Nahangi, M. (2017). Managing risk in modular construction using dimensional and geometric tolerance strategies. *Automation in Construction, 83*, 303-315.

Sholanke, A. B., Opoko, A. P., Onakoya, A. O., and Adigun, T. F., (2019). Awareness Level and Adoption of Modular Construction for Affordable Housing in Nigeria: Architects' Perspective. *International Journal of Innovative Technology and Exploring Engineering (IJITEE),* 8(9), 251-257

Song. J., Fagerlund, W.R., Haas C.T., Tatum C.B., and Vanegas, J.A., (2005). Considering prework on industrial projects. *J Constr Eng Manage.* 131(6):723–733.

Sun, Y., Wang, J., Wu, J., Shi, W., Ji, D., Wang, X., & Zhao, X. (2020). Constraints Hindering the Development of High-Rise Modular Buildings. *Applied Sciences, 10*(20). doi:10.3390/app10207159

Tam, V. W., Tam, C. M., Zeng, S. X., & Ng, W. C. (2007). Towards the adoption of prefabrication in construction. Building and Environment, 42(10), 3642-3654.

Tatum, C.B., Vanegas, J.A., and Williams, J. (1987). Constructability improvement using prefabrication, preassembly, and modularization. Austin (TX): The University of Texas at Austin: Construction Industry Institute. (RR 83-3). p. 345.

U.S. Department of the Interior (2012). Mineral commodity summaries 2012. *U.S. Geological Survey,* 38-39.

Velamati, S. (2012). Feasibility, Benefits, and Challenges of modular construction in high rise development in the United States: A developer's perspective, Unknown (Unknown), 1 102.Retrieved from http://www.dt.co.kr/contents.html?article_no=201207130201053 1749001

Wilkinson, S. P., Xia, J., & Chen, B. (2016). Sustainable Buildings and Structures

Wuni, I. Y., & Shen, G. Q. (2019a). Critical success factors for modular integrated construction projects: a review. *Building Research & Information, 48*(7), 763-784. doi:10.1080/09613218.2019.1669009

Wuni, I. Y., & Shen, G. Q. (2020). Barriers to the adoption of modular integrated construction: Systematic review and meta-analysis, integrated conceptual framework, and strategies. *Journal of Cleaner Production, 249*. doi:10.1016/j.jclepro.2019.119347

Wuni, I. Y., Shen, G. Q., & Mahmud, A. T. (2019). Critical risk factors in the application of modular integrated construction: a systematic review. *International Journal of Construction Management*, 1-15.

Wuni, I.Y., and Shen, G.Q., (2019b). Towards a decision support for modular integrated Construction: An integrative review of the primary decision-making factors. Int. J. Constr. Manag. 1-20. https://doi.org/10.1080/15623599.2019.1668633.

Wuni, I.Y., and Shen, G.Q., (2019c). Holistic review and conceptual framework for the drivers of offsite Construction: a total interpretive structural modeling approach. Buildings 9, 1- 24. https://doi.org/10.3390/buildings9050117

Xu, Z., Zayed, T., & Niu, Y. (2020). Comparative analysis of modular construction practices in mainland China, Hong Kong and Singapore. *Journal of Cleaner Production, 245*. doi:10.1016/j.jclepro.2019.118861

Yunus, R., and Yang, J. (2014). Improving the ecological performance of industrialized building systems in Malaysia. *Constr. Manage. Econ.*, *32*, 183–195.doi:10.1080/01446193. 2013.825373.

Zenga, M., & Javor, A. (2008). Modular homes: The future has arrived. Cronos Books.

Zhai, X., and Reed, R. (2014). Addressing sustainable challenges in China: The contribution of off-site industrialization. Smart and Sustainable Built Environment. 3(3), 261-274. DOI 10.1108/SASBE-02-2014-0008

Table 1: Summary of variables and their codes

Benefits of modular construction	Code
Enhance teamwork and collaboration	BFT 1
Improved productivity in construction	BFT 2
Simplicity and ease in the construction process	BFT 3

Enhances sustainable/green building	BFT 4
Improved quality of work	BFT 5
Speedy completion of construction work	BFT 6
Reduces pollution in the environment	BFT 7
Theft reduction on site	BFT 8
Minimize defects in the building	BFT 9
Lessen weather disruptions on site	BFT 10
Acoustic insulation and installation benefit	BFT 11
Airtightness and thermal performance of building fabric	BFT 12
Reduction in greenhouse gas emission	BFT 13
Lessens construction waste	BFT 14
Safe and better site operations	BFT 15
Reduces design/construction rework	BFT 16
Minimization in labor demand and cost	BFT 17
Reduce health and safety risks	BFT 18
Reduction in life cycle cost	BFT 19
Improved aesthetic view	BFT 20
The possibility for re-use and re-sale	BFT 21
Increased competition for foreign firms	BFT 22
Certainty of project cost	BFT 23

Table 2: Profession of Respondent

Profession	Frequency	Percent %
Quantity Surveyors	15	23.4
Architects	12	18.8
Engineers	20	31.3
Builders	10	15.6
Project Managers	7	10.9

Total	**64**	**100.0**

Table 3: Benefits of Modular integrated construction

Benefits	QS	Rank	Engr.	Rank	Arch	Rank	Bldr.	Rank	PM	Rank	Overall rating	SD	Rank
BFT 1	4.93	1	4.95	2	4.67	7	4.90	3	4.71	9	4.86	0.350	1
BFT 7	4.60	6	4.90	5	4.67	6	4.90	2	4.71	6	4.77	0.427	2
BFT 2	4.80	2	4.75	6	4.58	8	4.80	4	4.71	2	4.73	0.445	3
BFT 6	4.47	8	4.75	7	4.92	1	4.90	1	4.71	3	4.73	0.445	3
BFT 5	4.60	7	4.90	3	4.58	9	4.70	8	4.71	5	4.72	0.548	5
BFT 4	4.73	4	4.95	1	4.42	16	4.70	9	4.43	11	4.70	0.460	6
BFT 3	4.80	3	4.55	14	4.58	10	4.60	14	4.43	14	4.61	0.492	7
BFT 15	4.33	15	4.40	19	4.83	2	4.70	11	5.00	1	4.58	0.586	8
BFT 8	4.47	10	4.70	10	4.50	14	4.60	15	4.43	15	4.56	0.500	9
BFT 19	4.20	19	4.70	12	4.58	12	4.70	7	4.71	4	4.56	0.639	10
BFT 16	4.33	16	4.50	17	4.83	3	4.80	6	4.43	16	4.56	0.753	11
BFT 21	4.20	20	4.65	13	4.58	11	4.80	5	4.71	8	4.56	0.753	11
BFT 13	4.60	5	4.90	4	4.00	21	4.70	12	4.14	21	4.55	0.958	13
BFT 10	4.47	9	4.25	20	4.75	4	4.60	13	4.71	7	4.50	0.504	14
BFT 11	4.07	23	4. 55	15	4.75	5	4.50	19	4.71	10	4.48	0.712	15

BFT 20	4.27	18	4.50	16	4.50	13	4.70	10	4.43	13	4.47	0.616	16
BFT 12	4.40	14	4.70	11	4.17	19	4.50	18	4.14	20	4.44	0.710	17
BFT 9	4.40	11	.4.40	18	4.42	15	4.50	16	4.43	12	4.43	0.498	18
BFT 14	4.13	21	4.75	8	4.17	18	4.50	17	4.29	17	4.41	0.684	19
BFT 17	4.40	13	4.70	9	3.83	22	4.40	21	3.86	22	4.33	0.960	20
BFT 22	4.27	17	4.25	21	4.17	17	4.40	20	4.14	18	4.25	0.713	21
BFT 23	4.13	22	4.10	22	4.00	20	4.20	22	4.14	19	4.11	0.620	22
BFT 18	4.40	12	3.95	23	3.67	23	3.90	23	3.57	23	3.95	0.677	23

Key: QS – Quantity surveyors; Arch – Architects; Engr. – Engineers; PM – Architects; Bldr. – Builders; SD – Standard Deviation

Table 4: Kruskal Wallis test of professionals for Benefits of Modular Construction

	Mean Item Score					Kruskal Wallis test	
Benefits	**QS**	**Engr.**	**Arch**	**Bldr.**	**PM**	**Chi-square**	**Asymp. Sig**
BFT 1	4.93	4.95	4.67	4.90	4.71	6.971	0.137
BFT 7	4.60	4.90	4.67	4.90	4.71	5.975	0.201
BFT 2	4.80	4.75	4.58	4.80	4.71	1.964	0.742
BFT 6	4.47	4.75	4.92	4.90	4.71	8.860	0.065
BFT 5	4.60	4.90	4.58	4.70	4.71	4.218	0.377

BFT 4	4.73	4.95	4.42	4.70	4.43	12.945	0.012*
BFT 3	4.80	4.55	4.58	4.60	4.43	3.529	0.473
BFT 15	4.33	4.40	4.83	4.70	5.00	11.038	0.026*
BFT 8	4.47	4.70	4.50	4.60	4.43	2.810	0.590
BFT 19	4.20	4.70	4.58	4.70	4.71	6.554	0.161
BFT 16	4.33	4.50	4.83	4.80	4.43	6.504	0.165
BFT 21	4.20	4.65	4.58	4.80	4.71	2.384	0.665
BFT 13	4.60	4.90	4.00	4.70	4.14	5.842	0.211
BFT 10	4.47	4.25	4.75	4.60	4.71	9.600	0.048*
BFT 11	4.07	4. 55	4.75	4.50	4.71	9.296	0.054
BFT 20	4.27	4.50	4.50	4.70	4.43	2.109	0.716
BFT 12	4.40	4.70	4.17	4.50	4.14	4.428	0.351
BFT 9	4.40	.4.40	4.42	4.50	4.43	0.317	0.989
BFT 14	4.13	4.75	4.17	4.50	4.29	10.449	0.034*
BFT 17	4.40	4.70	3.83	4.40	3.86	4.489	0.344
BFT 22	4.27	4.25	4.17	4.40	4.14	1.457	0.834
BFT 23	4.13	4.10	4.00	4.20	4.14	0.581	0.965
BFT 18	4.40	3.95	3.67	3.90	3.57	10.967	0.027*

Key: QS- *Quantity surveyors,* ***Engr-*** *Engineers,* ***Arch-*** *Architects,* ***Bldr. -*** *Builders,* ***PM-*** *Project Managers,* ***SD-*** *Standard Deviation*