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FACTORS INFLUENCING TECHNICAL CAPABILITIES OF ARTISANS IN THE BUILDING CONSTRUCTION INDUSTRY IN LAGOS STATE, NIGERIA

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ABSTRACT

The successful delivery of any building project involves many resources and the most critical is the artisan. To this end, this study examines factors influencing technical capabilities of artisans with a view to unveiling strategies that could make them more effective and efficient. Data was collected with the use of a set of structured questionnaire. Multi-stage sampling technique was used to select 210 and 150 artisans and house sponsors respectively as respondents in Lagos State, Nigeria. Data collected were described with frequency counts and percentages while multinomial logistic regression was used to isolate critical factors that influenced technical capabilities of the artisans. Results affirmed that the need to effectively utilise building materials, improve aesthetic appearance of constructed buildings and enhance the ability to determine the optimum lot size of building materials used were the significant determinants of technical capability of the artisans. The study established that the above identified factors are critical to improving the technical capabilities of artisans in the building construction industry. It is therefore recommended that these factors are important criteria to assess the competence of artisans in building construction industry. The factors could serve as the basis for the evaluation of artisans and useful parameters for policy aiming to improving the quality of workmanship of artisans in the building construction industry.

Keywords: Artisans, Building, Technical and Capabilities

1.0. INTRODUCTION

The building construction industry is one of the five sectors used in measuring the National Gross Capital Formation (NGCF) and the Gross Domestic Product (GDP) of any country and its effect on every other sector makes it a significant front for sustainable development (Mosaku *et al.,* 2006). The successful delivery of any building project involves many input resources and one of them is the artisan. Artisans are noted to hold a very important position in the building construction sector (Olanipekun and Nunayon, 2017). This set of workers is needed on all building construction sites (Kazaz and Ulubeyi, 2017). Artisans' involvement in building construction activities in developing countries such as Nigeria is much more pronounced, unlike in the developed economies such as the United Kingdom, United States of America and Germany where most operations on construction sites are highly automated (Bilua *et al.*, 2015). Thus, artisans are needed in various stages of the building construction process (Ajagbe and Ismail, 2014). According to Hickson and Ellis (2014), the outcome of every building construction effort largely depends on the inputs of artisans. Essentially, artisans play a very important role in the growth and development of the building construction sector of any nation.

This is because of their invaluable contributions towards the successful completion of building construction works (Medugu *et al.,* 2011; Rafeel, 2012; Bilau *et al.,* 2015).

Essentially, a number of studies have been undertaken to examine the importance of artisans in the building construction industry both in developed and developing countries of the world. For instance, Jennings (2012) and Molloy and Chetty (2015) examined the challenges of the building construction industry in the United Kingdom and South Africa and discovered that the recurring poor performance in the sector was directly linked to the quality of artisans. Equally, low productivity and reduced investment in the sector have directly been attributed to the abysmal performance of the industry (Thomas *et al.,* 2002; Lu *et al.,* 2015). Studies have also shown that the dwindling productivity in the industry was directly associated with ageing and reduced number of artisans in the sector (Thomas and Horman, 2006; Hasan *et al.,* 2018). Equally, the Construction Industry Development Board (2017) reported that the reduced level of contractors' profitability experienced in the past few years was due to the depleting availability of artisans in the industry. As good as these studies might look to be, none was specifically dedicated to examine factors influencing artisans' performance despite the fact that they have been described as indispensable in the building construction process. Hickson and Ellis (2014) noted that this set of stakeholders in the building construction industry is very important in project delivery as they significantly determine the outcome of any construction work. Therefore, factors influencing artisans' technical capabilities in the building construction industry especially in developing countries such as Nigeria is largely unknown in literature. Investigation into this gap in literature is important considering the low technological advancement in most developing countries' construction industry, unlike in advanced countries where there is improved technical know-how in the building construction processes. Therefore, this study was conducted to analyse factors influencing artisans' technical capabilities in the building construction industry in Lagos State, Nigeria.

2.0. Literature Review

Technical capability is the knowledge and skills that an individual possesses to carry out tasks that require technological knowledge; especially how to make use of a machine or how a particular kind of job is undertaken (Lall, 1992; Kim, 1999 and Sobanke, 2013). It is the ability to have special or practical knowledge to undertake a particular task. Technical capability is the ability to effectively make use of technological know-how which is a major determinant of industrial performance (Lall, 1992). According to Lall (1992), it means the skills and knowledge needed to effectively absorb, master and improve on existing knowledge and to create new ones. Hoffman *et al.* (1998) and Wignaraja (1998) define technical capability as the scientific knowledge and skills obtained by an individual through experience and acquisition of new skills. Essentially, those knowledge and skills are usually obtained through interaction among professionals as well as operatives of a particular trade or profession.

Therefore, technical capability in the building construction industry is the process of assembling or accumulating necessary skills among artisans in the building construction industry. This process is very important in providing high quality buildings not only for economic growth but also for the aesthetic beauty and functionality. Technical capability in any industry brings about product leadership and offers competitive advantage for individuals, firms and even nations. To this end, technical capability is meant to grow like crops, and it is seen like a manufactured product in the building construction industry (Marcelle, 2003). Technical Capability (TC) is a potential that naturally exists in individuals awaiting

manifestation which can only be made possible through inclination, training and exposure. This naturally enables individuals to be versatile in the application of technology (Tandon, *et al.*, 2012). TC is usually acquired within an institution or organization. The institution or organization according to Enos (1991) is described as a body with appropriate resources needed to bring out the potentials in individuals with diversified skills and talents.

According to Braverman (1994), an artisan is an individual who has the creative capability to effectively manage available material resources and tools of his craft or trade. This is because an artisan is expected to have some skills, such as individual thinking capabilities and be knowledgeable about his craft and trade; and more importantly, the physical act of production which should normally manifest in the creation or production of physical objects (Rameezdeen *et al.*, 2000).

The United Nations (1959) noted that technical capability of artisans is usually acquired as a mixture of tacit and codified knowledge, physical and mental skills, contextual awareness, personal creative autonomy and innovation. While assessing the importance of artisans to the Sri-Lankan building construction industry, Rameezdeen *et al.* (2002) argue that the features of artisans in the country's building construction industry include clear division of labour, high creativity and increased for the environment.

In Nigeria, the industry has been described as ironic by Bilau *et al.* (2015). The authors affirmed that the building construction industry happens to be the largest employer of labour after agriculture but faces challenges such as shortage of technical skilled craftsmen, low level of capability which usually results in poor quality of workmanship, materials wastage, high life cycle of maintenance, resulting from shoddy jobs leading to rework and low quality of project delivery. Equally, Hanson *et al.* (2003) investigated causes of clients' dissatisfaction in the South African building construction sector and found that conflict among artisans, poor workmanship and incompetence are the major indicators that have negatively impacted building project performance. According to Siyanbola *et al.* (2012) one of the major challenges facing developing nations in their attempt to advance technologically especially in key sectors of the economy is the technical know-how of delivering high quality buildings that is globally acceptable. Also, Okejiri (2011) conducted a study on constraints of housing delivery in Nigeria and discovered that technical capability is not limited to scientific technical knowledge and engineering alone, but also includes behavioural patterns of other stakeholders such as workers, suppliers and customers. Based on this study it was noted that knowledge and skills can be acquired through interaction, learning and practice within and between firms as well as with suppliers and customers. Oluwale *et al. (*2013) described technical capability as the required competence in the use of knowledge, skills, and technological know-how to improve existing practices in the industry. Kuroshi (2015) also noted that craftsmen in the Nigerian building construction sector are bereft of necessary skills, experience and knowledge to execute assigned tasks effectively.

Factors influencing technical capability of artisans in the building construction industry are normally categorized into two, namely; internal and external (United Nations Centre for Human Settlement, 1997; Kerzner, 2001; Harvey, 2002; Jenkins, 2006; Harrin, 2007; and Hill, 2011). In the opinion of these scholars, the internal factors include; inherent desire for acquisition of new skills and information, on-the job training, work experience, linkages with well-established building construction firms, interaction with in-migrant artisans, availability

of micro-level learning support mechanisms and learning as well as intelligence gathering. Conversely, the external factors involve competition policy in the industry, nation's trade orientation, technological change, government support policy towards science and engineering education, available skills in the building construction industry, access to technological infrastructure, access to appropriate technology information, licensing, size of economy and growth rate and fiscal policies of government. Equally, Lema (1996) in his study on Tanzanian artisans identified factors such as leadership, level of skill, wages, level of mechanisation of operations and monetary incentives. Also, Motwani *et al.* (1995) who conducted his survey in the United States of America identified four problems that are capable of influencing artisans negatively in the construction process to include poor sequencing of tasks, conflict/lack of information, searching for tools and materials, and poor weather.

Meanwhile, Ahadzie, Proverbs and Olomolaiye (2008) have accentuated some of the important consequences of technical capability of artisans in the building construction industry to include customer satisfaction, cost effectiveness, time reduction of project and improved quality assurance. Furthermore, Belout and Gauvreau (2004) agree that the essence of improved technical capability of artisans in the building construction industry is to guarantee high level of clients' satisfaction and improved project performance.

3.0. Methodology

The scope of this study was limited to common artisans such as bricklayers, electricians, painters, plumbers, carpenters, ceramic tilers and iron benders that were registered by the Lagos State Ministry of Employment and Wealth Creation as well as selected building project sponsors in Lagos State. The choice of Lagos State was informed by the fact it is one of the fastest growing cities in sub-Sahara Africa and about eighty percent (80%) of the Nigerian building construction contractors that are registered with the Federal Registration Board of Nigeria have their headquarters in Lagos, Abuja and Port-Harcourt (Fagbenle, Adeyemi and Adesanya, 2004 and Olaleye, 2008). For the purpose of selecting respondents for this study, multi-stage sampling technique was employed. The first stage involved stratification of all the twenty (20) Local Government Areas (LGAs) in Lagos State into low, medium and high-density residential zones for fair sampling representativeness (Nwana, 2005). The choice of Lagos State is also due to the high occurrence of building collapse and high population density according to CLEEN Foundation (2005) and Oyetola and Babatunde (2008). For the purpose of this study, one local government area was selected from each of the identified residential density zones, using simple random sampling. This is in line with the work of Mosi (2001) that carried out a similar study in the Philippines. In the third stage, systematic sampling technique of every 10^{th} artisan in the compendium of artisans was selected. The fourth stage involved the selection of house owners using the artisans as leads in the three (3) selected local government areas across the three residential zones. This technique was continually used until the required respondents for the study (both artisans and house sponsors) were obtained. About 210 and 150 copies of questionnaire were used for artisans and house sponsors, respectively. However, about 179 copies of the questionnaire administered were properly completed and retrieved from the artisans and 128 from house sponsors. This represents about 85.2% and 85.3% response rate for artisans and house sponsors, respectively. Data collected were described with the use of frequency counts, percentages and means, while multinomial logistic regression was used to isolate factors that influenced technical capabilities of artisans. Technical capability was the dependent variables and the variable was categorized into high which was as coded 3, moderate coded 2 and low coded 1. Multinomial logistic regression was used because the technical

capabilities scores were categorized into high, moderate and low using equal interval approach as used by Ajayi (2008). The range of the technical capabilities scores was obtained as 66-26 = 40. The obtained range was divided by 3 since three (3) categories were to be obtained and the result was 13.3. Therefore, 13.3 added to the minimum technical capability score 26 to obtain 39.3. Hence, respondents that scored between 26 and 39.3 were categorized as having low technical capabilities, those having between 39.3 and 52.6 were regarded as respondents with moderate technical capabilities while respondents having between 52.6 and 66 were regarded as those with high technical capabilities. The high, moderate and low technical capabilities were coded 3, 2 and 1 as dependent variable for the multinomial logistic regression model.

4.0. Results and Discussion

4.1.1. Distribution of artisans

Table 1 provides information on the different categories of artisans surveyed in this study. As indicated in the table, 25.7% were house painters, while plumbers were about 22.3%. Others are electrical technicians (16.2%) closely followed by both the bricklayers and carpenters that recorded 15.6% each, while iron-benders constituted 4.5%. These findings show that various artisans were found in the building construction industry in the study area and each of them has specific roles to play in building construction process; starting from land excavations to the completion of the building. This result is in consonance with the work of Adenuga *et al.* (2007) who worked on the selected safety measures of construction companies in Lagos State, Nigeria. The authors documented that numerous artisans are found in the building construction industry with specific roles, although some of them may possess more than one skill with high competency. Adewale *et al.*, (2014) reported high level of competence among artisans in the Nigerian building construction industry, but recorded increasing reduction in the number of apprentices and low enrolment of students in building-related skills at the technical colleges and vocational centres. Equally, Bokinni (2005) discovered that the artisans found in the building construction sector in Nigeria possessed some special skills that enable them undertake complex building construction activities that meet the needs of house sponsors. These suggest that artisans in the building construction industry in Nigeria cannot be under-rated in terms of technical capability.

Table 1: Distribution of Artisan in the Building Construction Industry

Categories of Artisans	Frequency	Percentage (%)
Bricklayers	28	15.6
Electricians	29	16.2
Plumbers	30	16.7
Carpenters	28	15.6
Painters	37	20.6
Iron Benders	9	5.0
Ceramic Tilers	18	10.0
Total	**179**	**100.0**

4.1.2. Determinants of Technical Capability among the Artisans

Table 2 presents the results of Multinomial Logistic Regression showing the determinants of technical capability of the artisans. The dependent variable in this study was the technical capability which was categorized into three: low, moderate and high. In the output, the 'moderate' category was used as a baseline equation. Based on the results, it was observed that effective use of building materials ($\beta = 3.17$); aesthetic appearance of constructed buildings ($\beta = 5.11$) and ability of the artisans to determine the optimum lot size of building materials used

(β = 4.26) were the attributes that significantly influenced high technical capability of the artisans. The F-test value of 19.51 indicates the fitness of the logistic regression at 1% level of significance. The findings show that the ability of artisans to skilfully master the use of basic building construction tools positively influenced their level of technical capability in the study area. It could be deduced from the findings that technical capability of an artisan is influenced by ability to skilfully make use of basic tools. Based on these findings, an individual who is noted to have the capability to skilfully make use of tools is likely to have higher level of technical capability than his counterpart who was noted not to have had such tacit knowledge required in handling working tools. This implies that artisans found in the study area were dominated by highly skilful individuals who have tendency to have high level of technical capability. In addition, being able to deliver aesthetically appealing building projects was found to significantly determine level of technical capability. This implies that artisans with ability to construct buildings that are attractive to the general public in view of their high quality of decorative attributes may be adjudged to be technically competent.

In the same vein, effective use of building materials was also significant in determining the level of technical capability of the artisans. The implication of this is that artisans with the ability to effectively make use of building materials are bound to deliver building project at the most reasonable cost possible. Therefore, this is an indication of high level of operational technical capability. Lastly, ability to determine the optimum lot size of building materials required at any point in time was found to be significantly related to high level of operational technical capability. This means that artisans who are knowledgeable in determining the lot size of building materials required are likely to reduce the average cost of building projects. Such artisans must have been involved in regular engagements in building construction activities and are bound to be exposed to contemporary developments in their various areas of specialization. The-2 Log likelihood value of 167.530 and Nagelkerke value of 0.776 implies that the variables chosen for the models were appropriate as they were found to have generated values that were large enough. This is in line with the opinion of Kolibáčová (2014) who stated that the causal relationship between employee competence and employee performance is a linear relationship. Also, the findings were consistent with the work of Kashiwagi and Massner (2000) who posited that artisans' skill acquisitions process in building construction industry is influenced by their regular engagement in building construction activities. Similarly, Saha (2003) reported that engagement in other occupations and regular training programmes are major factors influencing operational technical capability among artisans in building construction projects. This high level of competence according to him implies regular involvement in training programmes, as this is bound to increase skills and knowledge stocks of individuals.

Fagbenle and Oluwunmi (2010) and Adebayo (2000) also emphasized the importance of operational technical capability in the building construction industry. These scholars however, reported low level of technical competence among artisans in the Nigerian building construction industry and also noted that the incessant building collapse in Nigeria may be as a result of the direct impact of low level of technical competence among the major stakeholders in the industry. Therefore, the above identified determinants of technical capability are very crucial in ensuring that artisans' competence is enhanced.

4.1.3. House Owners' Level of Satisfaction with Quality of Workmanship of Artisans

Table 3 shows the level of house owners' satisfaction with the quality of workmanship of the artisans. The highest mean score was obtained on the aesthetic appearance of building projects delivered ($\bar{X}$= 4.25; SD= 0.41). This was followed with the ability to determine the optimum lot size of building materials used ($\bar{X}$=3.92; SD= 0.27). Next to this in terms of ranking, was the capability of the artisans to translate building plans to built-up structures ($\bar{X}$=3.63; SD= 0.32). Further analysis using Equal Interval Approach to categorize respondents' level of satisfaction into very satisfied, averagely satisfied and not satisfied as presented in the table shows that 25.8% of the house owners were not satisfied with the artisans' workmanship, 30.5% were averagely satisfied, while 43.8% were highly satisfied with the workmanship of the artisans in the study area. The findings show on the aggregate, that house owners were satisfied with the artisans' workmanship. This result is in agreement with earlier findings which, affirmed that the technical capability of the artisans was high in the areas of operation and innovation. This high level of technical capability is an indication that the artisans in the building construction industry in Lagos State were technically competent in as much as they can deliver good quality building projects to the owners.

The technical report of International Labour Organization (2001) on the image, employment prospects and skill requirements of artisans in the construction industry reported that artisans are bound to be competent because of their regular involvement in construction activities, although, the report noted that location may influence competence in the building construction sector. In addition, Omran *et al.* (2012) who assessed building project performance in the Sudan construction industry reported that most house sponsors in the study area were satisfied with the artisans in terms of reduced cost of projects, high quality of workmanship and timely delivery of building projects. Equally, Curtis (2016) examined how new house owners rated builders in New-Zealand's building construction industry and reported that they were satisfied with the builders' performance. The results show that the building construction industry in the country has continued to improve averagely at a rate of 0.9% annually and that the house owners rated the artisans highly in their ability to deliver quality homes with a good standard of finish. In Nigeria, Ubenyi (1999) posited that workers in the construction industry were noted to deliver building projects that satisfy house sponsors more in urban centres than in the rural areas. This was attributed to the nature of complex buildings and structures constructed in urban areas while compared to those of the rural areas. This means that artisans that are technically competent may be more concentrated in the cities than in the rural areas.

5.0. Conclusion

The study showed that effective use of building materials, aesthetic appearance of constructed buildings and ability to determine the optimum lot size of building materials used were the determinants of high technical capability of the artisans. Based on this study, artisans' technical capability could be explicitly described with resources utilization and management as well as aesthetic design and appearance of buildings. These factors must be put into consideration during evaluation of the technical capability of artisans in building construction industry. Therefore, technical capability of artisans must have been high due to the high-level satisfaction with which the house sponsors derived from the quality of workmanship of the identified artisans in the building construction industry in the study area.

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Table 2: Results of Multinomial Logistic Regression Showing the Determinants of Technical Capability among the Artisans

Variable	B	Low Std. Dev	Wald	Sig	Exp (B)	B	High Std. Dev	Wald	Sig.	Exp (B)
Effective use of materials	3.88**	1.98	1.96	0.01	1.9	3.17**	1.15	2.76	0.01	2.91
Translation of plans to structures	2.26	1.72	1.32	0.17	0.85	1.40	1.9	0.74	0.31	0.4
Aesthetic appearance	1.39*	0.88	1.57	0.05	2.35	5.11**	1.58	3.23	0.01	2.24
Timely completion	-2.33	2.27	1.03	0.17	0.72	1.32	1.01	1.31	0.71	0.47
Determine the optimum lot size	-2.58**	0.69	2.58	0.01	3.98	4.26**	1.85	2.30	0.01	1.69

-2 Log Likelihood = 167.530; Nagelkerke = 0.776
***Significant at 5%**
****Significant at 1%**
F= 19.51≤ 0.010

Table 3: House Sponsors' Level of Satisfaction with Artsans' Workmanship

Table 4.13: House Owners'	Mean	Std. Dev
Effective use of materials	2.17	0.19
Translation of building plans to built-up structures	3.63*	0.32
Aesthetic appearance of building project delivered	4.25*	0.41
Timely completion of building projects	2.11	0.67
Ability to determine the optimum lot size of building materials used	3.92*	0.27

Mean ≥3.0 = Satisfied
Insert

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