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An Analysis of Technology Spillover from the Multinational Building Construction Firms to Local Artisans: Evidence from Lagos State, Nigeria

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Abstract

The study assessed technology spillover strategies among artisans that are employed by the multinational building construction firms that operate in the building construction sector of Lagos State, Nigeria. Multi-stage sampling technique was employed to sample three hundred and fifteen (315) artisans through the use of validated structured questionnaire, out of which three hundred and three (303) copies were properly completed and found analyzable, thus representing 96.2% return rate. Data obtained were analyzed using simple percentages, mean with standard deviation as well as factor analysis using principal component. The results show factor 1 which was named 'policy related' factor, accounting for 26.9% variation; factor 2 named 'institutional related' factor accounted for 15.9%; factor 3 which was labeled 'technical related' factor, accounted for 12.9% variation, factors 4 which was named 'organizational related factor' accounted for about 10.1% variation, and factor 5 which was labeled 'presence of foreign companies' accounted for about 8.4% variance in the use of the identified factor for technology spillover in the study area. The study concludes that government must ensure that multinational building construction firms operating in Nigeria are made to put in place established skills and knowledge transfer strategies that could ensure that appropriate knowledge and skills are transferred to the locals, which could be verified regularly. It was further recommended that educational institutions that are established for the purpose of manpower development in the construction industry are equipped with necessary input resources for knowledge and skills acquisition.

Keywords: Technology, Spillover, Building, Construction

INTRODUCTION

The construction industry is the bedrock of all economies as it contributes significantly to every nation's economy through the provision of infrastructural facilities and housing as well as indirectly supporting other sectors; especially manufacturing and agriculture (Chigara, Moyo and Mudzengerere, 2013). The sector plays a major role in the growth and development of all countries in the world, as it contributes to the socio-economic wellbeing of people (Ofori and Chan, 2001; Hilebrandt, 2000; Lopes, 2011). It is one of most important industries, that enhance people's living conditions as it contributes highly to nations' gross domestic product (GDP) and brings about multiplier effects on other important sectors of the economy, especially in agriculture, mining and service industry (Mohammad, Yaman, Hassan and Ismail, 2016). One of the most important sectors of the construction industry is the building construction sector.

The building construction sector offers three basic benefits: contributes directly to the nation's housing stock, provides employment, and indirectly facilitates the growth of other sectors such as agriculture and manufacturing, by providing services through the provision of physical facilities that are required for production and distribution of goods and services (Isa, Jimoh and Achuenu, 2013). The development and expansion of a country's building construction sector is therefore a key component to its early industrialization experience (Zhang and Gutman, 2015). With its many linkages to other sectors in the value chain management, the building construction sector is described as the cornerstone of structural change in the development of all emerging nations (Ofori, 2000; World Bank, 2009).

In view of the importance attached to the building construction sector, this area of research endeavor has attracted a number of scholars' attention. For instance, Blalock and Simon (2009); Buckley *et al*. (2002); Keller and Yeaple (2003); Liu and Wang (2003); Liu, Wang and Wei (2009) and Marin and Bell (2006) have identified foreign direct investment (FDI) and international trade as the main vehicles for technology spillover and knowledge transfer in the building construction sector of many developed nations of the world. However, information about the technology spillover from the multinational building construction companies in the developing countries is still scanty. Therefore, there is the need for a study in the sector to be undertaken in the Sub-Sahara African nations, such as Nigeria, especially in Lagos State, Nigeria where several building collapse has been reported in the recent years. Promoting technology spillover and knowledge from developed countries to developing ones is a crucial strategy for fostering economic growth, innovation and sustainable development globally (UNCTAD, 2019). This is usually achieved through foreign direct investment (FDI), trade and global value chains management (GVCMs), technology transfer agreements (TTA), capacity building and education (CBE), research and development collaboration (R&DC), capacity building and education (CBE), open access to knowledge (OAK), government policies and incentive (GPI) (World Bank, 2018). Technology spillover is therefore crucial for innovation and development in the building construction sector (Kang, Arefi, Goh and Song, 2015). This, according to them, involves the diffusion of technology and technical knowledge from one organization, or country to another, leading to advancements in construction practices, materials usage and methodologies. Also, Khamaksorn, Kurul and Tah (2016) averred that implementing technology adoption programmes through technology spillover can facilitate the transfer of knowledge and best practices within the construction industry. Essentially, these programmes often involve training sessions, workshops and demonstrations to educate stakeholders about new technologies and their potential benefits. They added that by showcasing successful case studies and providing hands-on experiences through practical adoption of technological programmes that encourage wider acceptance and utilization of innovative construction methods and emerging technologies, learning processes are easily deployed and exploited.

Interestingly, in the globalized economy, technology spillovers have taken place through human mobility efforts, as highly skilled labour has become more mobile and more easily able to cross national borders through the multinational industries. In addition to this, African countries,

especially Nigeria, have intensified efforts at acquiring technical skills in their building construction sector, from developed world, and this has manifested in several ways (Velasquez, 2010). More so, the Nigerian development strategies have been built around the concept of international technology transfer which comes in various forms, such as, foreign direct investment, licensing for production, contractual supply of management-related technology, sale and installation of 'turnkey' plants, design and construction of infrastructure and buildings, engineering and feasibility studies, consultancy, technical assistance and advice, training of personnel in the area of technology at home and abroad (Ogbimi, 2007).

Furthermore, Ayodeji and Adebayo (2015) noted that the Nigerian government in its drive to improve local productivity and to enhance the technical knowledge of its teeming youths in the construction and manufacturing industries formulated policy and programmes known as import substitution. This policy, according to them was operational in the 1970s and 1980s. Unfortunately, Nigeria just like other developing countries, has failed to take full advantage of achieving full technology spillover in its manufacturing and building construction sectors as well as ensuring full transfer of the desired technology to its teeming population Ogbimi, 2007). Therefore, this calls for an empirical documentation on the analysis of technology spillover and knowledge transfer from the multinational building construction companies in Lagos State, Nigeria with a view to identifying the avenues of technology spillover and knowledge transfer in the sector. Specifically, the study identified channels of technology spillover and knowledge transfer and examined factors influencing technology transfer among artisans in the building construction sector in the study area.

METHODOLOGY

The study was carried out in Lagos State, Nigeria. The decision to choose Lagos State for this study was informed by the fact that the state, since its creation in 1967, has continued to witness high rate of emigration in spite of the movement of Nigeria's capital to Abuja, since early 1990s and has remained to be the nation's economic hub. According to United States of America Census Bureau (2006), Lagos State is the Nigerian commercial-nerve centre and it is one the largest cities in Africa. Also, Ajanlekoko (2001) affirms that Lagos State accounts for about 60% of prospective clients that patronize building construction experts in Nigeria. The building construction sector comprises of both local and international companies with head offices in Lagos State. Artisans employed by multinational building construction companies form the population of this study. Therefore, the scope of this study is limited to the artisans that are employed in the building construction sector, including bricklayers, electricians, painters, plumbers, carpenters, ceramic-tilers and iron-benders that are engaged by the multinational building companies operating in the Nigerian building construction sector in Lagos State.

In terms of sample selection, multi-stage sampling technique was utilized. The first stage involved a purposive selection of at least one (1) multinational construction company (MNCC) operating in each of the Local Government Areas where they are operating in the state, as presented in Table 1. Thus, seven (7) MNCCs were selected based on the number of employees' population. At the second stage, stratified sampling technique was adopted to segregate the artisans into different categories in each of the seven (7) purposively selected construction firms. Thereafter, a list of artisans in each of the seven (7) selected MNCCs was generated, out of which the respondents were proportionately selected as contained in Table 1. That is, from Julius Berger Nigeria PLC, Elalan Construction Company Limited, G Cappa PLC, Adold Engineering Company Limited, Costain West Africa PLC, Brunelli Construction Company Nigeria Limited and Arbico Nigeria PLC. Thereafter, the Krejcie and Morgan (1970) sample size formula was applied to select a scientifically representative sample size for the study. Based on the preliminary findings, there were 3990 employees in the building construction units of the selected Multinational Construction Companies that were selected. This forms the sample frame for the study. The Krejcie and Morgan (1970) sample size formula, as presented below was applied to sample the statistically representative of the 3990 employees as given below:

$$S = \chi^2 NP(1-P) / d^2(N-1) + \chi^2 P(1-P) \quad \text{_____} \quad (1)$$

Where:

S = Required sample

χ^2 = The table value of Chi square for 1 degree of freedom at the desired confidence level 3.841.

N = Population size

P = The population proportion (assured to be 50% since this would provide the maximum sample size

d = The degree of accuracy expressed as a proportion (0.05).

To apply Krejcie and Morgan (1970) sample size formula with 10% proportion as given above,

$S = (3.841)^2 \times 3990 \times 0.1(1-0.1) / (0.05)^2 (3990 - 1) + (3.841)^2 \times 0.1(1 - 0.1)$.

$= 5297.90 / 9.9725 + 1.3277$

$= 5297.90 / 11.30$

$468.8 \cong 470$.

However, 315 artisans were identified from this figure using stratified sampling technique. The third stage involved simple random sampling of artisans in the selected building construction companies. At this stage, three hundred and fifteen (315) artisans were sampled from the sample frame of four hundred and seventy (470) in the selected multinational construction companies (MNCCs). Thus, 315 artisans were used for this study. However, three hundred and three (303) copies of the questionnaire were found to have been properly completed, thus representing 96.2% questionnaire response rate.

Table 1: List of Multinational Building Construction Companies with the estimated population to be selected for the Study

N/S	Name	Address	LGA	Estimated Number of Employees
1.	Julius Berger Nigeria PLC	15, Ijora Causeway, Ijora-Olopa, Ijora, Lagos	Apapa	450
2.	Elalan Construction Company Limited	9, Macgregor Road, Ikoyi, Lagos	Eti-Osa	486
3.	G Cappa PLC	8, Taylor Road, Iddo, Ebute Metta, Lagos	Mainland	675
4.	Adold Engineering Company Limited	6, Efunleye Street, Ikeja, Lagos	Ikeja	529
5.	Costain West Africa PLC	72, Campbell Street, Lagos Island, Lagos	Lagos Island	813
6.	Brunelli Construction Company Nigeria Limited	KM 3, Lagos/Badagary Expressway, Orile-Igamu, Lagos	Surulere	572
7.	Arbico Nigeria PLC	Plot D, Block 7, Industrial Crescent, Ilupeju Industrial Estate, Lagos	Mushin	465
TOTAL				**3990**

Source: Lagos State Ministry of Employment and Wealth Creation (2021)

Data collected with the use of structured questionnaire were analyzed with frequency counts, percentages, means and charts and factor analysis using principal component.

RESULTS AND DISCUSSION

Demographic characteristics of artisans

Results in Table 2 show that the mean age of artisans was 27.6 years. The implication of this finding is that artisans in the study area were still in their prime ages with the ability and potential to carry out the tedious activities associated with building construction works. By this result, it means they could still have the required physical energy to carry out strenuous activities that are needed to undertake activities in the building construction sector. This result is in tandem with the findings of Ayeniyo, Oluwale and Olanipekun (2020) that posited that over 60% of artisans in building construction sector in Nigeria are aged between 20 and 50 years. The fact that building construction activities are energy-sapping; that requires enormous physical energy to undertake building construction tasks, explains the relationship between building construction works

with age of artisans in the building construction sector.

In terms of gender participation, the study reveals that majority (96.7%) of the artisans were males while 3.3% were females. This falls within the a priori expectations where males are known to dominate most of the categories of artisans within the building construction sector worldwide. It is obvious that significant gender differentials exist among workers of building construction sector in Nigeria, just as it is in various parts of the world. Essentially, a number of factors, including cultural belief may be responsible for the poor number of female-artisans participation in building construction activities. The finding is in consonant with the study of Orekan and Okanlawon (2020), which stated that male constituted 73% of artisans in building construction sector in Ogun State, Nigeria and that only 27% were females. Furthermore, the finding closely fits with the results obtained by Jimoh, Oyewobi, Adamu and Badeje (2016) which argued that activities in building construction sector are usually male-dominated all over the world, with very minimal participation of female gender in the scheme of things in the sector.

On the methods of training, it was revealed that, majority (58.7%) were trained through the apprenticeship scheme, while 16.8%, 9.9% and 14.5% indicated that they were trained in the technical institutes, vocational centres and polytechnics, respectively. The findings show that the prominent avenue through which artisans received trainings in the building construction sector in the study area was through apprenticeship scheme. This supports the findings of (Ogbeifun, 2011) and Abdullahi, Anum, Adole and Williams, 2015), which stated that building construction activities are learnt mostly through informal trainings in Nigeria. The non-functional nature of the technical schools and vocational centres in Nigeria might be responsible for majority of artisans being trained through informal sector.

In terms of level of educational attainment of the respondents, the findings show that 40.9% of the sampled respondents had senior secondary school education (WASC/GCE), 27.7% had national diploma/national certificate of education/higher secondary school certificate, 26.1% were with junior secondary school certificates, while a very few and insignificant proportion (0.3%) were holders of higher national diploma. The finding implies that a significant proportion of the artisans had senior secondary/national diploma/national certificate of education/higher secondary school certificate. With this level of educational attainment of the respondents, the artisans might be able to read and write and this might also enable them to understand documented instructions as basic education is one of the essential requirements for the implementation of modern building construction tasks. This finding was in line with the result of the study undertaken by Zaidi and Davie (2011) that was focused on the Malaysian building construction sector, which discovered that acquisition of basic education was a necessary condition for knowledge transfer in the building construction sector, as activities in construction works are based on creating knowledge chain that is built on four basic frameworks of control, innovation, appraisal and audit.

As indicated in Table 2, 85.5% of the artisans were Nigerians, while the remaining 14.5% were of other nationalities. The implication of the finding is that a sizeable proportion of the respondents were non-Nigerians; in a country that is heavily challenged by high rate of unemployment. As a matter of fact, the construction industry is considered as one of the veritable vehicles; especially in developing countries, for the mobilization of human and material resources for the production of housing and infrastructural facilities, geared towards employment creation and improved economic prosperity of nations (Anaman and Osei-Amponsah, 2007). However, in the Nigerian building construction sector, a sizable number of professionals and artisans are non-Nigerians (Ukwu, Obi and Ukeje, 2003). The result also conforms with the work of Olanipekun and Nunayon (2017) who discovered that property developers in Nigerian built environment preferred the services of artisans from other West African countries to their Nigerian counterparts, because of their high quality service delivery and a reasonable level of honesty when compared to Nigerian artisans.

Table 2 also provides information on the various categories of artisans that were examined in this study. From the finding, 17.8% were bricklayers, 20.5% were electricians and 11.2% were plumbers. Others include; 9.6%, 18.2%, 11.6% and 11.2%

which were carpenters, painters, iron-benders and ceramic-tilers, respectively. The result shows that the distribution of respondents in this study was almost even along the various trades examined in the study area. To be specific, the various categories of artisans examined in the study have different roles to play in the delivery of building projects from the commencement stage to completion, maintenance and even destruction, when the need arises. Therefore, the involvement of artisans in building project implementation cannot be overemphasized. Bokini (2005) reported that artisans that are engaged in building construction activities in Nigeria are known to have possessed some technical skills that cannot be underrated as they are usually made to execute complex building tasks to the admiration of the sponsors of such projects, regardless of their level of education; especially when properly supervised by competent professionals. Also, Ayeniyo, *et al*. (2020) discovered that artisans in the building construction sector in Lagos State had capabilities to effectively make use of building materials, being able to deliver aesthetics in constructed buildings and had ability to determine the optimum lot size of building materials.

On the length of time spent to train the artisans, most (56.4%) of the artisans indicated that they spent between 3-4 years. Also, 26.1% reported that they spent between 1-2 years to be trained and the remaining 17.5% pointed out that they spent between 5-6 years to be trained. The implication of this is that it takes an average of 3-4 years to train artisans in the building construction sector in Nigeria. This finding is consonance with the study of Ogbeifun (2011), which describes the training in building construction sector to be highly technical, especially in the informal sector in which a combination of strategies are usually adopted, including off-the-site and on-the-site trainings. According to the study, artisans are offered highly technical training depending on mode, intensity and duration, which usually varies from country to country.

As regards the form of training received by the artisans, 25.4% indicated that they received training from formal skill acquisition centres, 50.8% from informal sector and the remaining 23.8% of the respondents were trained through mentorship arrangement. From this finding, it is obvious that larger percentage of the artisans were trained in the informal sector of the Nigerian economy. This finding conforms to the study of Fitchett (2009) which reported that the training of artisans in the South African building construction sector was dominated by the informal training arrangement, just it is in most African countries.

Avenue for Knowledge Transfer

Results in Table 3 show that 90.1% of the respondents indicated that training was the major avenue for knowledge transfer, with the mean duration of training put at 3.77. This implies that it takes between 18 and 24 months to be trained as an artisan in order to acquire appropriate knowledge, and skills in building construction activities. In terms of technical workshops, 25.4% of respondents provided information that their attendance at technical workshop was a veritable source of knowledge transfer, with a mean period of workshop attendance put at 2.49. This implies that it takes between 13-18 months to be trained in technical workshops, in order to be adequately knowledgeable about the technicalities of building construction tasks. Similarly, 12.9% of respondents reported that routine control in form of supervisory actions over their activities by foremen or professionals in the appropriate fields of building construction was an important factor influencing knowledge transfer with a mean of 1.24. The implication of this result is that it takes between 6-12months to be properly supervised by superior officers, in order to be adjudged adequately knowledgeable about building construction activities.

For the tracking of suppliers' performance, 4.0% of the respondents averred that it was an important venue for knowledge transfer in the building construction sector with a mean of 1.05. This implies that it takes between 6-12 months to track the suppliers' performance; to be adequately knowledgeable about the tasks that are involved in such building construction activities. Also, direct intervention of suppliers of imported building materials attracted the attention of 16.8% the respondents with a mean value of 2.17. By implication, it takes between 13-18 months to be properly trained, through the direct intervention of suppliers of imported building materials.

Table 2: Demographic Characteristics of the Artisans

Age (years)	**Frequency**	**Percentage**	**Mean**	**Standard Deviation**
<= 20	124	40.9	27.6	6.76
21 – 32	142	46.9		
33 – 44	29	9.6		
45+	8	2.6		
Sex				
Male	293	96.7		
Female	10	3.3		
Method of training				
Apprenticeship	178	58.7		
Technical Institute	51	16.8		
Vocational Centre	30	9.9		
Polytechnic	44	14.5		
Highest academic qualification obtained				
Primary School Leaving Certificate	15	5		
Junior Secondary School (JSS) Certificate	79	26.1		
WASC/GCE	124	40.9		
ND/NCE/HSC	84	27.7		
HND	1	0.3		
Nationality				
Nigerian	259	85.5		
Non-Nigerian	44	14.5		
Categories of artisans				
Bricklaying	54	17.8		
Electrical installation	62	20.5		
Plumbing	34	11.2		
Carpentry	29	9.6		
Painting	55	18.2		
Iron bending	35	11.6		
Ceramic tiling	34	11.2		
Years spent to be trained				
1-2 years	79	26.1		
3-4 years	171	56.4		
5-6 years	53	17.5		
Where did you obtain your training from?				
Formal skill acquisition centre	77	25.4		
Informal skill acquisition centre	154	50,8		
Mentoring	72	23.8		

Source: Computed from the Field Survey, 2023.

In the same vein, 24.4% of the respondents agreed that direct intervention of manufacturers of locally produced building materials was an important avenue for knowledge transfer in the sector, with a mean value of 2.25. The implication of this finding is that it takes between 13-18 months to be appropriately trained, using direct intervention of the manufacturers of locally produced building

materials. For the joint product development efforts between the manufacturers of building material products and the multinational building construction firms, 10.6% of the respondents indicated that this is a good avenue for knowledge transfer with a mean value of 1.12. It therefore means that it takes between 6-12 months to be adequately trained, using joint product development strategy, between the manufacturers of building material products and multinational building construction companies.

Also found to be an important avenue for knowledge transfer in the building construction sector was the direct financial support to the local suppliers of building construction inputs/materials, with 21.1% of the respondents agreeing to it, being an avenue for knowledge transfer, with a mean value of 2.32. It then means that it takes between 13-18 months, to be adequately trained, using direct financial support of multinational building construction companies to the local suppliers of building materials. Also, the study revealed that 13.9% of the respondents agreed that encouraging building materials to be supplied jointly by appointed suppliers was an important avenue for knowledge transfer in the sector, with a mean value of 1.17. This therefore means that it takes between 6-12months to train artisans who are expected to use such materials, to be so supplied.

Furthermore, making long-term agreement with the suppliers of building materials as regards offering trainings on the best ways of utilizing their products, attracted the responses of 10.9% of the respondents, with a mean value of 1.42. This implies that training artisans through this arrangement would require between 6-12 months. Essentially, building construction requires a wide range of activities, especially in its major distinct areas of carpentry, plumbing, electrical works, painting, masonry, among others, which are dynamic in nature and requires continuous trainings, in order to meet the ever-dynamic nature of the sector. The required training in the sector is usually provided by trade schools, vocational institutes and through apprenticeship scheme (Construction Industry Institute: Education and Training, 2023).

The finding was consistent with the assertion of Khan and Ali (2019), which argue that technical workshops offer practical learning environment, where participants can engage in activities such as demonstration, simulations and case studies. With technical workshops, hands-on learning approach is usually adopted, to enable trainees to apply theoretical concepts to real-life scenarios, thereby enhancing their understanding and retention of knowledge and skills, so acquired in the process (Sommerville and Gurocak, 2016). Also, technical workshops bring together professionals, researchers and learners from various backgrounds, thereby fostering networking opportunities and by extension, ensuring knowledge and skills exchange among participants (Schippers and West, 2015).

Routine control, otherwise known as quality control, is an important aspect of knowledge transfer, especially in the building construction sector, as it involves implementing systematically, processes that have been set out to be followed, while executing building construction projects. Through this strategy, set of measures are usually ensured, and the appropriate knowledge and skills are effectively transferred, thereby leading to improved constructional practices and outcomes. Therefore, this result is in line with the position of Love, Edwards, and Irani (2014) which revealed that routine control is a veritable avenue for the transfer of knowledge in the construction industry, which is usually undertaken through regular workshops attendance, seminars and on-the-job training sessions, in order to improve the knowledge and skills of workforce in the ever-changing building construction sector.

Also, engagement of local suppliers as a form of knowledge transfer has been documented as an important avenue for knowledge transfer in the construction industry. For instance, Sheng, Xia and Luo (2017) asserted that direct intervention of local suppliers of construction materials is capable of ensuring effective transfer of emerging knowledge and skills, thereby improving constructional processes, saves cost and enhances early project completion.

Equally, in terms of providing direct financial support to local suppliers, this result was in consonance with the findings of several scholars such as (Ofori, 2018; Soetanto and Roshani 2019; Maphunye and Ramuedzisi, 2017) who reasoned that such strategy is bound to enhance knowledge

transfer ability of workforce in the building construction sector, as building materials suppliers are noted to have had in-depth knowledge of local market and materials as well as valuable expertise that can be shared, and by so doing, appropriate skills and knowledge about building materials can be shared. This arrangement usually improves constructional skills and knowledge of operatives in the construction industry and by extension, increases the innovative capabilities of both artisans and professionals in the sector.

Table 3: Avenue for Knowledge Transfer in the Building Construction Sector among the Artisans

Avenues	Duration of Training			
	Frequency	Percentage	Mean	Standard Deviation
Trainings	273	90.1	3.77	0.28
Technical workshops	77	25.4	2.49	0.16
Routine controls	39	12.9	1.24	0.11
Tracking the suppliers' performance	12	4.0	1.05	0.32
Direct intervention of suppliers of imported building materials	51	16.8	2.17	0.15
Direct intervention of local suppliers of building materials	74	24.4	2.25	0.21
Joint product development	32	10.6	1.12	0.15
Direct financial support to local suppliers	64	21.1	2.32	0.14
Joint supply of input needs by local suppliers	42	13.9	1.17	0.16
Making long-term agreements with suppliers of building materials as regards offering trainings on the best way of utilizing their products.	33	10.9	1.42	0.13

Source: Field Survey, 2023.

Mean of 0- 1= < (6 months); Mean of 1.01 – 2.0 = (6 -12); Mean of 2.01 – 3.0= (13 – 18); Mean of 3.01 – 4.0 = (19-24)
Mean of 4.01 – 5.0 = (25 months and above)

Factors Influencing Knowledge Transfer among Artisans in Building Construction

In order to identify factors associated with technology spillover and knowledge transfer in the building construction sector, relevant variables were inter-correlated and ran with Varimax factor rotation pattern and results of Varimax rotation of the variables included in the factor analysis and the principal components subsequently extracted were reported as follows: The results show that the inter-correlation between the independent variables yielded five (5) factors which accounted for a total of 75.4% variation in knowledge transfer, with the remaining 25.6% of the variation accounted for by unknown factors, which may be part of the intervening variables in this study. The Kaiser-Meyer-Olkin (KMO) of 22 (df = 302) with Bartlett's Test of Sphericity Chi-Square of 6463.387; $p \leq 0.01$, which is an indication that the measures of sampling adequacy were significant. This shows that the sample collected for the study was adequate for factor analysis. The extracted factors were named as shown in Table 4. Factor 1 was named 'policy related' factor, and accounted for 26.9% variation; factor 2 'institutional related' factor with variance of 15.9%; factor 3 was labeled as 'technical related' factor, which accounted for 12.9% variation, factors 4 was named 'organizational related factor' and this accounted for about 10.1% variation, while factor 5 was labeled as 'presence of foreign companies' and this accounted for about 8.4% variance in the use of the identified technologies.

CONCLUSION AND RECOMMENDATIONS

The study established that artisans in the building construction sector in Lagos State were identified as young and agile youth with the potentials of carrying out the strenuous activities associated with the construction activities. The most avenue for training building construction workers in the study area is through apprenticeship scheme. Male artisans dominated the building construction sector in Lagos State, and that the highest qualification acquired by most of the artisans was secondary school leaving certificate, which is equivalent to a

Table 4: Variables Contributive to each of the Identified Factors Influencing Technology Spillover and Knowledge Transfer

Variables	Loading (L)	L^2	$\sum L^2$
Government Policy related factor			
Effectiveness of skills acquisition strategies of stakeholders	0.713	0.508	
Quality of government policies and incentives	0.759	0.576	1.561
Remuneration of artisans and local professionals	0.691	0.477	
Institutional related Factor			
Regularity of workshops attendance	**0.819**	0.671	1.484
Supervision of building construction work activities	**0.780**	0.608	
Research and development capability	0.453	0.205	
Technical related factor			
Job security in the building construction industry	**0.905**	0.819	
Building project delivery in the most cost effective manner	0.426	0.181	2.00
Expertness in CAD, CABMTM and CAE	**0.736**	0.542	
Quality control capability	0.479	0.229	
Testing and analytical capability	0.479	0.229	
Organizational Standard related factor			
Relevance and quality of local education	**0.514**	0.264	
Research and development capability	**0.683**	0.466	1.814
Quality control capability	**0.713**	0.508	
Testing and analytical capability	**0.759**	0.576	
Presence of foreign construction companies			
Transfer of quality of technology and knowledge	**0.574**	0.329	
Congestion or concentration of foreign construction firms	**0.718**	0.516	1.287
Government incentives policies for knowledge and skills	**0.665**	0.442	

Source: Field Survey Data, 2023

high school status in developed countries. It was observed that training was the most significant avenue for knowledge transfer among the artisans and that five significant factors, to include; 'policy related' factor, 'institutional related' factor 'technical related' factor, 'organizational related factor' and 'presence of foreign companies' factor with the Eigen values of above 1 at different percentage variations were identified to have significant influenced on the knowledge transfer levels among artisans in the building construction sector.

The study concludes that government must ensure that multinational building construction firms operating in Nigeria are made to put in place established skills and knowledge transfer strategies that could ensure that appropriate knowledge and skills are transferred to the locals which can be verified regularly. It was further recommended that educational institutions that are established for the purpose of manpower training and development in the construction industry are equipped with necessary input resources for knowledge and skills acquisition.

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