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INNOVATIVENESS OF QUANTITY SURVEYING FIRMS IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Quantity surveying firms (QSFs) are faced with countless challenges and fierce competitions in the construction industry that would require the continuous embrace of technological Innovations (TI) in their services and operations. Therefore, this research examines the technological innovations in QSFs with a view to establishing their innovativeness in combating the challenges and attaining competitive advantage. Census sampling was adopted to sample QSFs in Lagos and Ondo States. Questionnaires were distributed to top management of these firms and relevant descriptive and inferential statistical analysis were conducted on the data gathered. The findings from the analysis revealed that QSFs are slightly innovative because the adoption of new software and involvement in innovative services is moderately high though their level of awareness is high. Also, the diversification of services of QSFs to other industries like mining, automobile, shipping and aeronautical is slightly low. Hence, the implication is that QSFs should adopt technological innovations in their service delivery to survive the changing demands of clients and diversify their services to other industries to be able to meet the changes in the construction industry.

Keywords: Diversification. Nigeria. Quantity surveying firms. Quantity surveying services. Innovations.

1. INTRODUCTION

In most part of the world, the construction industry has not been able to keep up with technology adoption and so remain behind other industries in the adoption of technology (Construction Industry Institute, 2008: Noktehdan *et al.*, 2015). Globally, the construction sector in recent time is observing a rapid growth of demand for the exploitation of technological ideas (Shibeika and Harty, 2015). This is so because technological innovation has been observed to be of great importance to the long-term success of firms and enterprises in any industry and economy (Smith and Estibals, 2011). According to Sepasgozar, Loosemore, Davis (2016), Technological Innovation (TI) is vital to the construction sector as it greatly improves productivity and quality. When a firm introduces and uses creative ideas into its products or processes (either goods or services) so as to bring about a worthwhile change, then the firm is said to have been innovative. In other words, innovation is technological when it involves new or improved ideas in products and/or processes. Therefore, technological innovation can be referred to as the processes by which firms master, implement and/or commercialize the design and production of goods or services that are new to the firm irrespective of whether those goods or services are new to the competitors or to the customers or to the world at large (Naude and Szirmai, 2013; Nurulhasanah et al., 2015).

In the construction industry, QSFs are service-based firms that are expected to continuously develop new niches, new knowledge and be innovative in its services in order to enhance competitiveness and meet the demands and standards of client (Harun and Torrance, 2006; Masidah and Khairuddin, 2005; Page, Pryke and Pearson, 2004). There is a strong and unpredictable competition in the construction industry which has threatened the survival of many firms within the industry and QSFs are not exempted from this threat (Jonas and Donald, 2015; Yu, 2007). This led Owusu-Manu et al. (2017) to assert that QSFs need to constantly develop their strength to challenge existing practices and implement innovative practices. They also need to expand their horizon beyond the traditional scope of cost management and develop new ideas, new knowledge and break into new grounds in order to meet the changing demand of the client. Notwithstanding, the QSFs on their own are witnessing series of significant changes and improvements, compared to when it first came into existence, which is as a result of increased standards and demands of the client. On the other hand, Quantity Surveyor (QS) working in these QSF's also need to be more knowledgeable and skillful in information technology (IT), especially in the use of computer software which is a prominent feature of technological innovation (Harun and Torrance, 2006; Hasnanywati, Ismail and Azlan, 2007).

In view of this, this research is aimed at studying technological innovations in QSFs with a view to ascertaining the improvement quantity surveying practice and development of QSFs in relations to other firms in the construction industry in Nigeria. To achieve this goal, the study assessed the awareness, involvement and use of innovative services and products by QSFs.

2. LITERATURE REVIEW

2.1 Quantity Surveying Firms in Nigeria

The QSF is a professional service organization in the construction industry and it provides consultancy services as well as manages financial related issues for their clients (Abidin et al., 2011; Page et al., 2004). QSF also employs the services of QS and other resources to carry out quantity surveying activities. They depend on the skill, expert knowledge of the QS to meet the client's needs (Aluthwela and Perera, 2017). The growth of QSFs depends on the number of the project handled by them and the time of securing new projects before the one in hand ends. QSFs generate revenue from remuneration for projects handled by the firm (Abidin et al., 2011).

QSFs are faced with a lot of challenges such as international and local competition, fee-cutting and bidding amongst other firms, professional indemnity insurance cases, conservatism and inability to change, encroachment, poor marketing, automation, lack of personnel money and time (Aluthwela and Perera, 2017; Olanipekun et al., 2014). Some of the professional services rendered by the QSF might be unnecessary and unwanted by the client and the only way the quantity surveying profession can be attractive is to meet the expected standards of the client. As a result of this, the QSF has to develop the stamina to challenge the existing unnecessary and unwanted or outdated practices and implement innovative practices (Olatunji, Sher, and Gu, 2010). In the same vein, the QSF should also strive to keep abreast of the latest technology for future survival and growth (Aluthwela and Perera, 2017).

2.2 Technological Innovations in Quantity Surveying Firms

From the review of related literature, it is obvious that QSFs innovate in a number of ways, both in the services rendered and the process of achieving the service. In support of this, Ibironke et al. (2011) noted that the quantity surveying profession in Nigeria has experienced significant changes in terms of the scope and type of services provided within the

construction industry. As observed by Hardie et al. (2005) quantity surveyors tend to innovate in the fields of data collection, management and monitoring processes which are perhaps not as visible to other members of the team as design innovations. According to Smith (2005), the following are quantity surveying services; taxation advice, insurance valuation, cost-benefit analysis, due diligence report, premises audit, facility management and post-occupancy services, quantity measurement, value management, project management, risk management, expert witness, arbitration and mediation, construction planning, life cost analysis and feasibility studies. In a more recent study, Yeshwanth (2017) observed that quantity surveyors now offer modern services which include asset advisory, facilities consultancy, building surveying, litigation support, risk mitigation and due diligence, property taxation and value management. Aiyetan (2015) identified the software used by quantity surveyors which include; Autodesk Quantity Take-off; WinQS; Vector; CostX; Develop; Feasibility Estimate; Cut and Fill; Digico; Ripac; QSPlus; Qs Cad; Masterbill; Building Information Model software and Microsoft Excel. Smith (2005) also identified the following as innovation in the way quantity surveying practice is carried out; access to online services such as Email or internet facilities and website, possession of CAD facilities such as use of CAD for measurement, use of Digitizers and use of quantity surveying specialized software such as CostX, Eclipse and Buildsoft Take Off system (BTOS), electronic document transfer such as information and knowledge sharing amongst staff members.

As suggested by Hiew and Ng (2007) in a study carried out on how the QS can create value in the procurement of construction works in Hong Kong, the QS must continue to invent, re-invent and improve on the services provided in the traditional role of a QS in order to reassert value and satisfy clients. Hiew and Ng (2007) further added that the QS is found to be innovative in the provision of service to new industries and offering of a wider spread of services to a wider spread of clients. Also as noted by many researchers, QSF has generally expanded in the nature and scope of services they now provide (Abidin et al., 2011; Ibironke et al., 2011; Olanrewaju and Anahveb, 2015).

2.3 Diversification of Quantity Surveying Services to Other Industries

According to Hassan et al. (2007), the growth of QSF can be identified in three dimensions, one of which is an increase in the number of diversified clients. Likewise, Abidin et al. (2011) stated that the role and scope of services of QSFs are continuously expanding. Sequel to this, Smith (2005) observed that QSFs in Australia has taken on the challenge of diversification to better meet and serve the industry demand. The profession has made significant inroads in providing cost management services to other industries such as petrochemical, manufacturing, mining, aeronautical, shipping, transport and civil sectors which is as a result of the profession adapting to meet changes in industry requirement. Olanrewaju and Anahveb (2015) noted that quantity surveyors are diversifying in the services they offer into various industries including petrochemical, manufacturing, automobile, mining, telecommunication, shipping, transport, and agriculture.

3. RESEARCH METHODOLOGY

This research is designed to examine the various types of technological innovations in QSFs in South-western, Nigeria. A quantitative approach was adopted where a structured questionnaire was used to obtained primary data from QSFs in Lagos and Ondo States, which are registered with the Nigerian Institute of Quantity Surveyors (NIQS). Census method was adopted to sample all the seventy-six (76) QSFs due to the manageable size of the population. The principal partners or senior quantity surveyors in each of the practicing QSFs were contacted to obtain information about technological innovations in the firms. This is so because top management or organizations' representatives are in a better

position to provide relevant information about the firm. Mean item score (MIS) was used to analyze the level of awareness, level of use and level of involvement of the types of technological innovations in QSFs; factor analysis was used to analyze and explore the relationship among innovative quantity surveying services, paired sample t-test was used to determine the difference between the opinion of QSFs on awareness and used/involvement of innovative technologies and services while Cronbach alpha coefficient was used to check the reliability of the scale in the research instrument. The reliability test showed that the research instrument is reliable with alpha values of 0.872, 0.881 and 0.901 for innovation in QS software, innovative services and diversification of QS services respectively. This is because according to Moser & Kalton (1999), the more an alpha value tends to 1.0, the more reliable the instrument. To discuss and interpret the result from MIS, the maximum possible mean score was divided by 2, and the score below the average was regarded as relatively low, while the score above the average was regarded as relatively high. The principal components from the factor analysis were reduced based on the >0.4 significant factor as adopted by Yap (2013).

Out of the 76 questionnaires that were administered to the top management of each quantity surveying firm in Lagos and Ondo States, 40 were retrieved and found suitable for analysis representing a response rate of 52.63%. According to Baruch (as cited in Owusu-Manu et al. (2017), a response rate of approximately 35 per cent is satisfactory for most academic studies targeting top management or organizations' representatives.

4. RESULT AND DISCUSSION OF FINDINGS

4.1 Background Information of Respondents

The result from the analysis of the background information of the respondents shows that 46% of the respondents are principal partners while 54% are senior quantity surveyors. Furthermore, 10% of the respondents are PhD holders, 46% of the respondents are Master's degree holders, 32% are Bachelor degree holders while 12% of the respondents are HND/PGD holders. 5% of the respondents are Fellows of the Nigerian Institute of Quantity Surveyors (NIQS), 63% are corporate members while 32% are probationer members. The respondents have an average of 13 years of experience and implied that the selected respondents have sufficient experience to respond to the questionnaires.

4.2 Technological Innovations (TI) in QSFs

This section describes the current TI in QSFs and the TI covers innovations in the process (use of software), innovation in services and product diversification.

4.2.1 Innovation in Quantity Surveying Software

The different software being commercialized and developed for quantity surveying services are compiled from literature and respondents were asked to rate the software based on their level of awareness and level of use. The results in Table 1 showed the ranking of the quantity surveying software according to the mean values and significant values from the paired sample t-test. From Table 1, QSFs are aware of all the software though Excel Spreadsheet was ranked highest with a score of 4.88. Also, Excel Spreadsheet is the software mostly used by QSFs while WorkMate, BIM software, MasterBill, QsCAD, Win Qs and Blue beam software are moderately being used by QSFs since they are found slightly above the mean score. However, the use of Don Mex-QS and Building Energy Modelling (BEM) that are newly introduced software into quantity surveying practice in Nigeria is low by QSFs. This finding corroborates the finding of Odeyinka and Doherty (2008) that Excel Spreadsheet is the general Microsoft Office software adopted in QSFs and it is of great value in achieving measurement and estimation of constructions by QSFs.

This indicates that most QSFs seem not to adopt innovative technology as expected based on the level of use of the new software. This is in contrast to the findings of studies undertaken in other developing countries that QSFs are innovative in the use of software and the provision of services to new industries and to a wider range of clients (Hiew and Ng, 2007; Smith, 2005; Yeshwanth, 2015).

Table 1. Paired Samples T-Test for Awareness and Use of QS Software

QS Software	Awareness Mean	SD	Use Mean	SD	Mean Diff	t	Sig. (2-tailed)
Excel	4.88	0.33	4.66	0.57	0.22	2.08	0.04
WorkMate	4.27	1.03	2.93	1.15	1.34	6.17	0.00
BIM	4.46	0.98	2.93	1.33	1.53	7.22	0.00
MasterBill	4.59	0.71	2.90	0.94	1.69	9.64	0.00
QsCAD	4.41	0.77	2.88	1.12	1.53	8.19	0.00
WinQs	4.29	1.01	2.80	1.03	1.49	5.85	0.00
Bluebeam	3.95	1.30	2.51	1.23	1.44	7.78	0.00
Don Mex-QS (DMX)	3.76	1.28	2.29	1.17	1.47	6.25	0.00
BEM	3.61	1.26	2.27	1.00	1.34	5.97	0.00

Paired samples t-test was carried to determine if there is a significant difference between the perceptions of the respondents on the level of awareness and use of innovative software in QS. The result of the paired sample t-test in Table 1 showed that there is a significant difference between the level of awareness and level of use of the QS software. This confirms that the majority of QSFs do not make use of innovative software in Quantity surveying though they are aware of them as evident in the mean scores derived.

4.3 Technological Innovation in Quantity Surveying Services

QSFs have generally expanded on the nature and scope of their services. They now offer services that are beyond the traditional scope of quantity surveying profession and these services are known as the modern quantity surveying services (Abidin et al., 2011; Ibironke et al., 2011; Olanrewaju and Anahveb, 2015). To know whether the firms have adopted services that are more innovative and beyond the traditional scope of services rendered by a QSFs such as Estimating, Taking off, Bill preparation etc, respondents were asked to rate their level of awareness and level of involvement in the services related to QS services that are identified from the literature. The analysis was carried out using MIS and T-test to determine the difference between the 2 assessments.

From Table 2, the majority of the QSFs are aware and involved in all the innovative services rendered since they are found above the mean value. This is due to the premise that QSFs have expanded their scope of service beyond the traditional scope. This corroborates the finding of Smith (2005) that the quantity surveying profession is now innovative in the services they provide. Nevertheless, the finding of this study is in contrast to the finding of Alutwela and Perera (2017) that QSFs are narrowed in the scope of their services.

Paired samples t-test was done to determine if there is a significant difference between the level of awareness and involvement of innovative services by QSFs. The result of the paired sample T-test in Table 2 showed that there is a significant difference between the level of awareness and involvement of QSFs of the innovative services except for the provision of value management and value engineering services with a significant value greater than 0.05. This implied that QSFs are more aware of innovative service though moderately involved in them and hence are considered slightly innovative in the services offered.

Table 2. Awareness and Involvement of Innovative Services by QSFs

Innovative Services	Awareness Mean	SD	Involve. Mean	SD	Mean Diff	t	Sig. (2-tailed)
Involvement in design and upstream activities	4.00	0.89	3.44	1.05	0.56	2.33	0.025
Application of Whole life costing and life cycle cost analysis	3.95	0.80	3.22	0.94	0.73	4.21	0.000
Provision of value management and value engineering services	3.93	0.91	3.49	1.05	0.44	1.60	0.117
Provision of Arbitration/ adjudication services	3.80	0.84	3.22	1.15	0.58	2.57	0.014
Involvement in Private Finance Initiative (PFI)	3.78	0.79	3.17	1.12	0.61	3.24	0.002
Involvement in sustainable construction	3.73	1.00	3.15	1.22	0.58	3.24	0.002
Provision of facilities management services	3.68	0.91	2.95	1.21	0.73	4.22	0.000
Involvement in environmental impact assessment (EIA)	3.68	1.19	2.83	0.97	0.85	4.77	0.000
Provision of constructability analysis	3.58	0.96	2.93	1.14	0.65	3.54	0.001

A further analysis was carried out on the innovative services offered by QSFs using the Factor Analysis (FA). The Kaiser-Myer-Olkin (KMO) test and Bartlett's test were used to ascertain the suitability of the data for FA. Result of the KMO gave a value of 0.76 and significant value of 0.00 respectively, implying that the data sets are adequate and suitable for factor analysis since Pallant (2005) stated that KMO value is significant if found above 0.60 and Bartlett's test of sphericity should be significant when ($p<0.05$).

Table 3. KMO and Bartlett's Test for the innovative services offered by QSFs

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.761
Bartlett's Test of Sphericity	Approx. Chi-Square	292.589
	df	45
	Sig.	0.000

Principal components analysis (PCA) carried out on the innovative services in QSFs. This showed that the first two components had initial Eigenvalues greater than 1. According to Leech et al. (2005) when an Eigenvalue is less than 1 the factor would explain less information and so should be excluded. These two factors explained 72 per cent of the variance being 54.858 and 15.429 respectively with the scree plot also suggesting the same.

The component matrix is used to decide the loadings of the items on the factors. In order to allow for easy interpretation of these factors, the factors were rotated. There are different types of rotation but the Varimax is the most commonly used of the three as it minimises the number of variables that have high loadings on each factor resulting in a cleaner, easier interpreted result (Eadie, Perera and Heaney, 2011). The Result revealed the extraction of 2 components with eigenvalues greater than 1. Sobh (2008) asserted that in order to retain an item it must have a significant factor loading. A factor loadings of 0.4 is considered significant and factor greater than 0.5 are considered very significant. Factor loadings of less than 0.3 are considered low and therefore not significant (Child, 2006; Leech et al., 2005). The result in Table 4 depicts the summary and category of the relationship between the innovative services offered by QSFs and they were reduced to two principal services. The principal services are emerging sustainable services and whole life cycle services.

Table 4. Rotated Component Matrix for Innovative Services by QSFs

Services		Component	
		1	2
Emerging Sustainable Services	Involvement in sustainable construction	0.675	
	Involvement in environmental impact assessment (EIA)	0.658	
	Involvement in design and upstream activities	0.688	
	Involvement in Private Finance Initiative (PFI) consultancy	0.648	
	Provision of value management and value engineering services	0.674	
	Provision of Arbitration/ adjudication services	0.838	
Whole Life Cycle Services	Provision of facilities management services		0.905
	Provision of constructability analysis		0.886
	Application of Whole life costing and life cycle cost analysis		0.583

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

4.4. Diversification of QSF's to Other Industries

According to Hassan et al. (2007), growth in the number of diversified clients is one of the three dimensions of innovation in terms of firm's growth. To know if firms provide services to industries other than the construction industry and if the firms have been innovating or not, respondents were asked to rate their level of diversification to other industries as adapted from Smith (2005). The analysis was carried out and the industries were then ranked according to their mean values.

The findings revealed that the level of diversification of QSFs to other industries is moderately high because they are found slightly above the mean score. Though the diversification of QSFs in the shipping and aeronautical industries is low. This finding is in contrast to the findings of Smith (2005) that the quantity surveying profession in Australia diversified their cost management services to petrochemical, aeronautical, mining, shipping and other industries. This means that QSF's have not been providing services and contributing to these industries. This could have been as a result of the state of infrastructure development in Nigeria.

Table 5. Diversification of QSFs

Variables	Mean	Std. Deviation	Rank
Manufacturing Industry	3.17	0.95	1
Petrochemical Industry	3.10	1.04	2
Telecommunication Industry	2.88	1.05	3
Agricultural Industry	2.85	1.30	4
Mining Industry	2.73	1.14	5
Automobile Industry	2.56	0.71	6
Shipping Industry	2.05	0.92	7
Aeronautical Industry	1.93	0.88	8

5. CONCLUSIONS AND RECOMMENDATIONS

As a result of the quest by the different professions to meet the changing demands of the client, the study assesses the innovativeness of quantity surveying in the Nigerian construction industry. In view of this, the study focuses on QSFs in South-western, Nigeria and investigated the adoption of innovative services and software by these firms. The finding revealed that QSFs in Nigeria are aware of the innovative products and processes (in terms of services offered, software used and diversification) required of them to meet the changing demands of the construction industry. However, these QSFs relatively adopt them. This is evident in the disposition of QSFs to the moderate adoption of innovative software such as BIM, Don-Mex, BEM amongst others and the level of diversification of QSFs to other industry being low. The implication is that QSFs need to increase the level of adoption of technological innovations (TI) by making use of more innovative quantity surveying

software. QSFs also need to continually adapt TI by providing new services to other industries in order to gain more competitive advantage and increase their survival chances as a result of the changes within the construction industry.

The study was able to report the innovativeness of the quantity surveying profession in Nigeria though it was limited to the Southwestern region of the country. Further study can be undertaken to assess the level of adoption of innovative services and diversification of QSFs in other geographical regions of Nigeria. Also, the innovative services assessed in the study account for 70% of the total innovative services needed to improve the service delivery of QSFs in the country. This implies that there are other possible underlying variables that can help, which is not captured within this study. Hence, further study can be done through a qualitative approach to get first-hand information from QSFs in Nigeria.

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