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Duties and responsibilities of quantity surveyors in the procurement of building services engineering

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Abstract

Quantity surveying is global and provides services across various industries. Quantity surveyors are involved in all phases of a facility's lifecycle such as feasibility, design, construction, extension, refurbishment, maintenance, and demolition. The competencies of quantity surveyors are aimed at producing constructions that meet the client's value system. Building engineering services are part of buildings, but quantity surveyors' involvements in procurement are limited. Therefore, this study examines the kinds of services that quantity surveyors play in the procurement of building services. Primary data is collected through a survey questionnaire. The results of the findings led to the conclusion that quantity surveyors were actively involved in the procurement of building services. Cost advice during construction is the most offered service while advice on the impact of building engineering services on environment is seldom offered. However, most of the services are still at the downstream side in the supply chain. The analytical method and detailed costing techniques were predominantly applied for estimating building engineering services. We argue that there is a need for quantity surveyors to move to the upstream in the supply chain for competitiveness. The results of the study are useful to quantity surveyors, service engineering consultants, academic institutions and other stakeholders in the construction industry.

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Keywords: Deskilling, competency, prime cost sum, value added services, client value system

1. Introduction

The construction industry comprises many stakeholders such as clients, design professional, construction professionals, and operational teams (example: in case of the PPP/PFI schemes). The major professionals in the

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industry in terms of their initial contact with the clientele and involvement with the design and construction stages of the construction projects includes engineers (notably civil, electrical and mechanical), building engineers, quantity surveyors and architects. The architects are specialists in the development of building concepts and design. During the construction phase, the architects progressively revise plans, drawings, and specifications to meet the client and statutory regulations. While civil engineers are concerned with public constructions (i.e. roads, dams, quays, shipyards, and bridges), building engineers are involved in calculating the strength and forces of the proposed construction. They also prepare structural drawings and specifications from architectural drawings and other relevant contract documents. Building engineers work to ensure that buildings can safely carry and withstand the loads they will encounter while in operation. The mechanical and electrical engineering are often termed together as services engineering and are an important aspect of modern constructions contributing up to 30% of the total contract sum for a standard building. Engineering services are executed by the nominated or domestic subcontractors.

Quantity surveying involves cost management, procurement and contractual issues in the supply chain and marketplace. They provide advice on cost implications of the clients' requirements and other stakeholders' decisions. They monitor and update initial estimates and contractual obligations as the construction progresses based on additional works and variations. Some practices still provide services that are focused on buildings (the architectural elements), and civil engineering now provides services that include heavy engineering, oil and gas, and building engineering services. Although the engineering services is part of buildings, it would be out of place to claim that all quantity surveyors have the required skills and knowledge to provide expert advice on building engineering services as they do for other aspects of construction. Most quantity surveying practices consider building engineering services a specialised duty [see 1, 2, 3]. However, building clients are increasingly becoming uncomfortable with the inability of quantity surveyors to provide conclusive and accurate estimates for their buildings arising from using lump sum approaches to price engineering services. Today, it is common to see or hear statements like 'M&E Quantity Surveyors' ostensibly to mean quantity surveyor that is 'qualified' to offer advice on building engineering services. Moreover, some universities now offer degree in building services quantity surveying. Such degrees aim to, "…provide students with a sound understanding of the principles and practices involved in the building services quantity surveying specialism, up to degree level standard, and to prepare them for progression to Masters level should they so wish" [4]. The question to ask is if such degrees are required considering the knowledge and skills expected of quantity surveyors in the measurement of building works. Quantity surveyors have background rich in the dynamics of costs of construction. Arguably, such degrees are not warranted. However, recent studies show that quantity surveyors have generally expanded on the nature and scope of services they now provide [2, 5, 6]. To illustrate this point, we evaluate the levels of involvement of quantity surveyors in the procurement of building services engineering. The study aims to provide fresh knowledge on the expertise of quantity surveyors with a focus on the procurement of building engineering services. This knowledge is valuable to academic institutions that offer quantity surveying programmes, practicing quantity surveyors and other players in the construction industry.

2. Theoretical frameworks

The construction industry is fundamental to the growth of a country irrespective of whether the country is undeveloped, developing or developed. This is because of the industry's micro-economic contribution to the Gross Domestic Product, Gross National Product and Gross Fixed Capital Formation. Its multiplier effects on other major economic sectors are profound. If the construction industry of a nation is inefficient, the country cannot witness any meaningful development. This is because industry is mostly concerned with development of roads, bridges, railways, buildings, etc. required to stimulate economic growth and increase standards of living. In most countries, the contributions of the construction industry to the GDP range from 3% to 10%. The construction industry comprises various activities such as new construction, maintenance, refurbishment, rehabilitation, conversion, extension and renovation. In 2012, the construction industry contributed ₦2, 188,718.59 million, 3.05% to the Nigerian GDP and employed 6,913,536 (3%) [7]. This figure is not static as it could increase or decrease due to the peculiar nature of the construction industry. The figure could increase if the labour force from the allied industries that produce, process and transport construction materials, components and services are added. The industry has

recorded an average growth rate of 18.08% between 2010 and 2012 [7]. It contributed ₦2,568,464.75 to the GDP in 2014 [8]. Its contribution to total real GDP stood at ₦697,366.62 million (4.34%) in the first quarter of 2015 [8].The Nigerian construction industry is largely British with some incursion from Europe and America, as such quantity surveying is offered in most universities and polytechnics.

2.1. Branding the quantity surveyors

Quantity surveying is universal. However, it is carried out under different names. In countries like the USA, quantity surveying is closely related to cost engineering, while they are also referred to as cost economists or cost consultants in other places. However, quantity surveying is more than any of those names or titles. Perhaps the phrase "quantity surveying" is a catch-up term that hides a multitude of meanings. The modern quantity surveyors perform various types of services that extend beyond the services traditional quantity surveyors provide and higher institutions offering quantity-surveying programs are responding accordingly by modifying and upgrading their course content. Quantity surveyors provide advice on the strategic planning of a project. For a construction work, this advice affect clients' decisions on whether to construct or not, and if the client decides to construct what effect does cost have on other criteria within the clients/users value systems including time and quality, function, satisfactions, comfort and aesthetics. As is usually the case, even under the traditional procurement system where the quantity surveyor is not usually the lead or prime consultant, all other members of the team, including the client relate with him and supply valuable information to the quantity surveyor (a converging point!) to enable him to prepare 'accurate estimates' to make meaningful contributions towards the successful completion of construction facilities [1, 6, 9]. Regardless of the procurement strategies adopted, the roles of quantity surveyors are prominent for the successful completion of projects. Modern procurement strategies like Private Public Partnership (PPP) have increase the potential and relevance of the quantity surveyors towards best service delivery.

'Modern' quantity surveyors are diversifying in the services they offer into various industries including petrochemical, manufacturing, automobile, mining, telecommunication, shipping, transport, and agriculture. The major impetuses for this diversification are the quantity surveyors' culture of elasticity and changing clients' requirements. There is also increasing awareness on accountability and transparency. However, for quantity surveyors to remain competitive, there is a need to embrace value added tools, skills, and expertise. The quantity surveyors need to be involved in both the downstream and upstream sides in the supply chain and construction market, to provide value added services. The current business model is 'pushing' the clients demand for construction to be completed on schedule, within budget, with maximum performance, reliability, safety, and meeting other criteria within their client value system.

2.2. Building engineering services and quantity surveying

Building engineering services are part of the building; in a bill of quantities, it is commonly considered a single element. Broadly, the element comprises two major components namely the mechanical and electrical (M&E) components. The components generally include, plumbing installation, electrical installation, air-conditioning, heating ventilation, lift installation, firefighting and communication installation. Usually, the engineering services are treated on the basis of outline drawings and specifications and ultimately priced as a lump sum contract or cost reimbursable contract. However, this is grossly irreconcilable with the values systems of modern clients and building users. Perhaps, previously, one could consider procuring construction works, or the engineering works specifically with the lump sum or cost reimbursable but current construction supply chain and markets have rendered this approach inadequate. A plausible explanation for this is the gradual increase in the cost of engineering services that is exceeding 30% of the total capital costs. In some buildings like hospitals, laboratories, mega shopping complexes and hotels, it could represents more than 60% of the capital costs. Added to this is the fact that the greater the increase in the size of engineering service in capital cost, the higher the operation cost and the maintenance of the building while in operation. Close to 80% of the operation costs of buildings are attributable to engineering services [2]. Decisions made on layout, design and specifications have cost implications on both the

capital costs and operation costs. Hence, there is a need for this scope of work to be rigorously measured like other construction elements.

Therefore, the skills and knowledge of quantity surveyors in this element is critical. Quantity surveyors who do not possess these required competencies could not provide the value added service expected of them. Currently, specialist quantity surveyors in engineering services are invited for large facilities distinct from standard quantity surveyors. For most quantity surveyors, involvement in the engineering services is unknown territory [2, 3]. Added to which is that by their very nature, engineering services tend to be very complex. For the quantity surveyors to provide value added services, they must have detailed knowledge and skills of the construction works, a failure of which will inhibit the delivery of the value added services to the clients and to other members of the design and construction teams [10]. The procurement of the engineering services with most of the procurement methods is further fragmenting the supply chain. This fragmentation makes it difficult for the quantity surveyors to provide expert advice at the upstream in the procurement of building services. In part, this would possibly explain why the contractors' quantity surveyors are more competent in offering cost management expertise advice on the engineering services as compared to those in consultancies. For instance, as the contractors' quantity surveyors prepare payment for claim, interim valuation, progress reports and final accounts, the interactions with the services engineers and subcontractor provide strong channels for knowledge and skills transfer and acquisition.

3. Outline of research design

Primary data is collected based on convenience sampling. In convenience sampling, a survey is administered on the respondents who are accessible, available or willing to participate. It is an appropriate method where sufficient information on population size is not available but like other nonprobability sampling, its findings may not be generalisable. However, if the respondents are carefully selected and with sufficient size, the findings could be representative [11]. Primarily data for this survey was collected through an online survey [https://docs.google.com/spreadsheets/d/1Cqer6ictAdWReGStoBbEBid0VmVg3O08FNFF36Yxf0Y/edit#gid=1963553787]. The survey commenced in November 2014 through to April 2015. The questionnaire was divided into two parts. The first part seeks to capture the respondent's profiles while the second part exploring the involvement of quantity surveyors in the procurement of building engineering services. While selecting and defining the categories of the scale, we decided to omit both "do not know" and "neutral" because we felt that both would influence the decision of the respondents. We are aware that both terms do not mean the same. For instance, it is not practicable for the respondent to be "neither often nor often" with any of the services. It is also considered inaccurate for the respondent to claim 'do not know' if any of the services is offered or not. The survey was mainly close ended, but empty spaces were provided for respondents to add additional services they considered significant. The survey was conducted by the co-author by sending the survey to all his professionals' colleagues, clients and vendors. When the need emerged to measure services delivery, the issue of 'extent' becomes important. Therefore, respondents were asked based on their current experience, to place a tick on the extent to which the quantity surveyors offer each of the services on a five continuum scale; where 5 denotes 'extremely often', and 1 denotes 'not often'. 2, 3 and 4 are located in between. The degrees at which the roles are performed are determined by Average Relative Index (ARI) (Equation 1).

$$ARI = \frac{\sum_{i=0}^{5} a_i x_i}{5\sum_{i=0}^{5} x_i}, (0 \leq ARI \leq 1) \quad (1)$$

Where a_i is the index of a group; constant expressing the weight given to the group; xi is the frequency of response; i = 1, 2, 3, 4, 5, x_1, x_2, x_3, x_4, x_5, are the frequencies of the response corresponding to a_1=1, a_2=2, a_3=3, a_4 =4, a_5 = 5, respectively. For interpretation, the lowest possible score is 0 (zero) and the highest possible score is 1 (one). Simply put, the closer to 1 the higher the extent at which the service is performed. The mode technique was used to analyze the demography of the respondents. Mode was also used to determine the distribution

of services with respect to the scales. The measurements of the services are displayed in frequencies but the rating of the roles is determined by 'average relative index'.

4. Results and Discussion

The findings are discussed briefly in the following sections because of space constraints.

4.1. Respondents' profiles

Sixty-nine (69) usable questionnaires were received and analysed. Though the response rate is small, it was nevertheless appropriate for this type of study. Li et al. reported a study in which 500 questionnaires were administered, but only 61 (12%) was returned [12]. The profiles of the respondents indicated that most (48%) of the respondents were quantity surveyors (Table 1), which could be explained by the research design. With the exception of respondents who did not indicate their academic qualifications, all the remaining 96% are degree holders with approximately 50% having obtained postgraduate qualifications (Table 2). More than 80% of the respondents have more than five years work experience in the construction industry and 42% with more than 10 years' work experience (Table 3). Some 60% of the surveyed respondents have completed more than 10 projects in the last ten years and about 20% have actually completed more than 30 projects each in the last ten years (Table 4). Table 5 contains the respondents' positions. More than 90% of the respondents held strategic positions in their organizations. The apparent interpretations of the information in Table 1 through to 5 are that the respondents have the required qualifications to provide valid and accurate information on the nature, scope and activities in the Nigerian built environment.

Table 1. Respondent's academic background

Professional	Quantity surveying	Engineering	Architecture	Estate management	Town planning	Others
Frequency	33 (48%)	17(25%)	10(15%)	4(6%)	1(1%)	4(6%)

Table 2. Respondent's highest academic qualification

Qualification	BSc/BTech.	Higher National Diploma	MSc/Pg.D,	Ph.D.	Others
Frequency	22 (32%)	14(20%)	20(44%)	1(1%)	2(3%)

Table 3. Respondent's working experience in years)

Working experience	< 5	5-10	10-15	15-20	20 and above
Frequency	12(17%)	27(39%)	15(22%)	8 (12%)	7(10%)

Table 4. Number of project completed by respondent's organisation which he/she was involved in the last 10 years

Working experience	< 10	10-20	20-30	30-40	40 and above
Frequency	25 (36%)	20(29%)	9(13%)	8(12%)	5(7%)

Table 5. Respondent's current position

Position	Managing director	Contract manager	Project managers	Principal partner	Partner	Others
Frequency	8 (12%)	4(6%)	18(26%)	7(10%)	9(13%)	32(46%)

4.2. Analysis of the duties of quantity surveyors and responsibilities surveyors in the services engineering works

For an overview on the quantity surveyors' in the procurement of building engineering, the initial question that suffices was to determine the levels, see Table 6 for the surveyed results.

Table 6. How often do you provide quantity surveying services on building engineering services?

How often	Extremely often	Very often	Often	Somewhat often	Not often	Not at all
Frequency	11(16%)	33(48%)	14(20%)	3(4%)	6(9%)	2(3%)

In general, from Table 6, it is surmised that the involvement quantity surveyors in the procurement of building services is impressive. On the face of it, this finding is not surprising. Traditionally, quantity surveyors are expected based on their expertise to possess knowledge in the measurement of the building engineering services like building elements. Added to this is the fact that some quantity surveyors are specialized in engineering services, due to the extensive knowledge and skills they acquired in practice. Table 7 presents the degree of involvement of the quantity surveyors at different phases of the procurement of the building engineering services. The Cronbach's Alpha reliability test produced a cumulative of 0.825 for all the services and ranges from 0.797 to 0.825 for each individual service. The average validity score (using extraction method) was 0.545. On these bases, the results are both valid and reliable. As may be seen, quantity surveyors play strategic roles in the procurement of the engineering services. 64% of the respondents offer the services exceptionally or very often. In addition, 22% often offer the services. Generally more than 84% offer expertise advice for the building engineering services.

Table 7. Types of services that the quantity surveyors offer in the procurement of building engineering services.

Services	Extremely often	Very often	Often	Somewhat often	Not often	Index
Offers advices in the development of the preliminary architectural development on the impact of the building envelope on services design	20	20	15	10	3	0.7294
Provide input into the project's cost plan through the establishment of a building services capital budget	33	21	11	1	2	0.8412
Provide services on whole life costs	27	23	11	6	2	0.7942
Provide an environmental impact assessment	9	5	23	22	9	0.5500
Examine the impact of contractual arrangement	20	26	19	4	0	0.7800
Provide cost control during the constructions	42	20	6	1	0	0.8986
Provide input into the establishment of the project brief	14	27	20	4	4	0.7246
Provide input into or conduct value management	20	22	17	9	0	0.7559
Provide input into the development of specification clauses	16	30	11	10	2	0.7390

Providing cost control on building engineering service is the most dominant on the list (at 90%), followed by the establishment of capital budget of the engineering through cost planning (at 84%), followed by considering the operational cost of the engineering services through whole cost analysis (at 79%). The least service is to conduct environment impact of the building engineering services. Irrespective of the methods of procurement, during construction the nature and scope of advice that quantity surveyors provide is numerous. For instance, quantity surveyors will prepare interim valuation reports, advice client on costs implications of variations, examine

contractor's claims and advice on other decisions by the client and design team that may affect the cost and value of the buildings. It is exciting to find that the quantity surveyors are actively involved in establishing the capital budget of the engineering services. The quantity surveyors advice on selecting method of contract to enter and participate actively in value management processes. However, while it may be concluded from Table 7 that quantity surveyors provide extensive advice on engineering services, their level of involvement is still blurred. Therefore, the methods of estimating engineering services are examined. Figure 1 displays the methods. Index for the guest estimating, single rate approximate estimating, multiple rate estimating, analytical method and detailed cost method is 43%, 62%, 62% 70% and 84% respectively. To interpret, the methods most quantity surveyors deployed for estimating engineering service are detailed cost estimating methods and the analytical method. The least used is the guess estimates/ preliminary estimate. Single rate approximate estimate is common. Guess estimates are normally used for preliminary estimates before any specification and drawings are produced. Similarly, single rate approximate estimates as well as the multiple rate approximate estimates are deployed at the upstream end of the supply chain. Therefore, the inferential interpretation of the results is that the quantity surveyors usually offer their service when major design decisions have been made. This conjecture can be confirmed based on the findings on the appointment of the quantity surveyors, where only 21% of the surveyed respondents measured that the quantity surveyors are appointed based on self-recognition, otherwise they are engaged based on advice of architects (39%), engineers (11%), projects managers (22%) or other (6%). However, if appointed at a later stage, quantity surveyors would be unable to provide strategic roles. For instance, it is possible for the quantity surveyors to participate in the value management workshop, but not during the value planning phase rather during value engineering phase to examine production drawings.

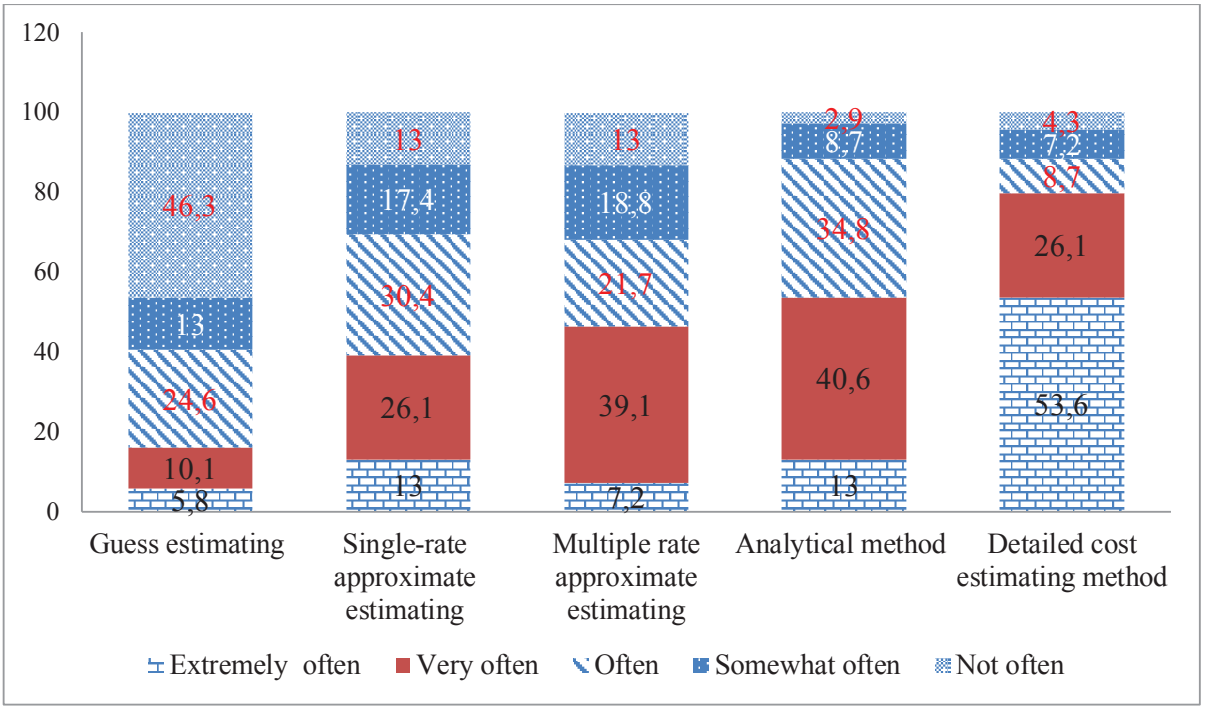

Figure 1.Method of estimating building engineering services by the quantity surveyors (%)

The more sophisticated the methods of estimating, the higher the expected accuracy and the higher the accuracy and sufficiency of the information in terms of drawings and specification provided to the quantity surveyors. For instance, the guest estimate can be used when sufficient information is not available for preparing preliminary estimates. Therefore, the inferential interpretation is the involvement of the quantity surveyors is more prominent

when drawings, specifications and other contract documents are provided by consultants like the architects and engineers. This is also applicable if the quantity surveyors do not have adequate knowledge of the elements. The obstacles to the involvement of the quantity surveyors in the procurement of building engineering services are mainly due to the educational gab and work culture. For instance, the contractors as well as many engineering consultants doubt the accuracy of the bill of quantities. Added to this, in the traditional procurement system where the service engineers are engaged in the later stage means that only outline drawings and specifications will be available at the tender stage. The implication of this is that this works can only be included as in the bill of quantities as prime cost sums. Although many or most big constrictors in Nigeria have a quantity surveying unit, there are a large number of middle and small contractors that are yet to employ quantity surveyors on a full time basis or have a dedicated unit for them. In comparison, the course contents of the quantity surveying program emphasizes too much on architecture and structure as compared to building engineering service. Hence, quantity surveyors face some restriction by engineers (the civil engineers included), with only few a quantity surveyors expanding their service to include building service engineering, with most still restricting themselves to the main architectural elements. One of the major factors responsible for this is the inability of the services consultants to understand the expertise of the quantity surveyors in this scope and most of the engineering subcontractors and suppliers consider the tendering with bill of quantities as counterproductive. The second reason is that the university courses on engineering in the quantity surveying programme are broad, which makes it impossible for the quantity surveyors to engage in the building engineering services.

5. Conclusion and general observations

This paper examines the services that quantity surveyors offer to create awareness on the extent to which quantity surveyors are involved in the total procurement and management of built assets. Managing a construction from the design through to the operation stage requires knowledge on all aspects of the constructed facilities. Throughout the life of a project, the quantity surveyors are required to advise all stakeholders on financial probity, procurement and achieving the stakeholders' value systems. What we found is that some quantity surveyors are involved both in downstream and upstream aspects of engineering service procurement, but the majority remain restricted to the downstream. The general training of quantity surveying pays less attention to the building services engineering. The quantity surveyors interested with building services engineering tend to acquire their skills and knowledge from post graduate studies, apprenticeships or on the job training. This does not means that on the job training or apprenticeships are bad per se, but there is a need for their formal education to account for this basic knowledge in order to prepare them for what they must accept as their primary function. Graduate degrees in building services for quantity surveyors do not make up the variability in their basic education. Therefore, students who in their future professional careers must attend to their own education holistically should make use of all surveyors. Their current job scopes demand they provide holistic services, even beyond the construction industry.

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