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Effect of Technological Advancement in Quantity Surveying on Cost, Labour and Time Performance of Construction Projects in Abuja

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Studies have shown that technological advancement is capable of creating fundamental impact on the manner in which business processes are undertaken in the construction industry. The study was undertaken to address the problem of lack of effective utilisation of technological advancement (use of modern technology software) in the services of Quantity Surveying (QS) which results to poor cost, labour and time performance of construction projects in the Nigerian construction industry. The study evaluated the effect of technological advancement in QS on the cost, labour and time performance of construction projects with major emphasis on the use of QS and other built environment ICT software. Data was collected from 230 randomly selected registered Quantity Surveyors in Abuja using questionnaires. Analysis of data was done using Mean Item Score (MIS). The study found that all the core QS competence areas highly require the use of technological advancement (Average MIS = 4.338). It was also revealed that the factors limiting the use of technological advancement in the field of QS range between Inadequate training (MIS = 4.329) and Rate at which software becomes outdated and requires updating (MIS = 3.586). Relationship between use of ICT and Cost; Labour; and Time Performance was also found to be very significant (MIS ranges from 3.940 - 4.517). It was therefore concluded that the use of ICT in the field of QS has a significant effect on the overall performance of construction projects. Major recommendation from the study was that QS firms should strengthening the use of ICT more in the areas of BOQ preparation; Final account; Procurement technique exercise; valuation; and Estimating in order to improve Cost; Labour; and Time Performance of construction projects.

Keywords: Cost, Labour, Project Performance, Technological Advancement, Time.

Introduction

The construction industry generally contributes between 3% and 10% of the Gross Domestic Product (GDP) of most countries (National Bureau of Statistics [NBS], 2015; Olanrewaju & Anahwe, 2015). The issue of technological advancement which is largely attributed to the conversion of various manual tasks into computer software is of significant importance in the construction industry. This is because there will be savings in labour cost and time taken to complete a task. This will increase the contribution of the construction sector to the GDP of the nation. This is in line with the assertion that the construction industry significantly contributes to the economy of a nation (Giang & Pheng, 2010). Technological advancement is therefore capable of creating fundamental impact on the manner in which business processes are undertaken in the construction industry. In view of this, Pamulu & Buta (2004) reported that technological advancement can no longer be viewed as an enhancement of traditional business procedures but rather as an innovation agent that enables new and different alternatives to operation of business organisation.

According to Ibironke *et al.* (2011), technological advancement has made the construction industry to recently witness a paradigm shift from traditional paper-based method of service delivery to electronic information exchange using Information Technology (IT), at least in the western world like UK. It is therefore evident that the adoption of IT can enhance construction productivity and improve communications for effective decision-making and coordination among construction participants. In view of this, the QS profession which deals more with cost and economy of the construction process requires a shift from the traditional approach to the modern technological approach in order to enhance improved cost, labour and time performance of projects (Nnadi *et al.*, 2016). The construction activities being managed by the QS ranges from building; civil, industrial and other heavy engineering works. As a result of this, Oyediran and Odusami (2005) reported that QS appears to be one of the few professions that have not been profoundly transformed by the application of the technological advancement offered by digital revolution especially in a developing economy like Nigeria.

In addition, most of the Nigerian researches (Oyediran & Odusami, 2005; Oladapo, 2006; Ibironke *et al*., 2011; Zainon *et al*., 2016) majorly focused on the impact of technology in terms of QS software on project performance. The use of technological advancement with respect to software that will bring all built environment professionals together is still lax in the Nigerian literature. The efforts made in this direction are mostly from foreign researches. This leaves a gap that the study attempted to fill by evaluating the effect of technological advancement in Quantity Surveying on the cost, labour and time performance of construction projects in Abuja with major emphasis on the use of Quantity Surveying and other built environment ICT software. In order to achieve the aim, the study identified the areas requiring the use of technological advancement in the field of QS; examined the factors limiting the use of technological advancement in the field of QS; established the relationship between the use of technology in the field of QS and the cost, labour and time performance of construction projects; and identified measures for enhancing the application of technology in the field of QS.

Literature Review

This section gives a review of relevant literature to the theme of the study. In the context of this study, "Technological Advancement in the Field of Quantity Surveying" means the use of Information and Communication Technology (ICT) for core Quantity Surveying services in Nigeria.

Technology Advancement in the Construction Industry

The construction industry is so hierarchical and fragmented that some of the major participants do not consider themselves to be part of the same industry (Oladapo, 2006). There is therefore the need for close coordination among large number of specialised but independent organisations and individuals to achieve the cost, time and quality goals of a construction project. Hence, a major construction process demands heavy exchange of data and information between project participants on a daily basis. In view of this, Oladapo (2006) identified two vital roles information plays in all construction projects. These are the specialisation of the resulting product (design information) and the initiation control of the activities required for constructing the facilities (management information), acting as professional advisers to the client, are largely responsible for the production and dissemination of both the design and management information among the various participants. Therefore, from the Quantity Surveyors, a basic competency in data, information and information technology is required (Royal Institution of Chattered Surveyors [RICS], 1998), which with regards to engineers, the availability of computer facilities is a measure of technical capability (Ng & Chow, 2004). As for the Architects, the effective communication of

design information to contractors is a key performance criterion (Oyedele & Tham, 2004).

Technological Advancement in the Field of Quantity Surveying

The explosive growth of ICT has had unquantifiable impact on business systems and processes. The worldwide acceptability and widespread adoption of ICT has increased the dimensions of competition not only among organisations globally but among professions locally. The Quantity Surveyors' ability to avail themselves with the emerging opportunities provided by the advent of ICT depends on the adoption of new technologies (Castle, 2002).

Computer has proven to be a reliable tool in all spheres of human endeavour. There is quite a lot of development in all areas of computer application to the construction industry. Of note are the expert systems, artificial intelligence, knowledge-based systems (KBS), artificial neural networking (ANN), robotics, building information modeling (BIM) and computer aided design (CAD). Rivard *et al.* (2004) predicted that the evolution of IT will have a profound impact on how organisations in the architectural, engineering and construction (AEC) industry operate. Honey (1998) reported that a large proportion of Quantity Surveyors in the United Kingdom have been using computers. Oyediran & Odusami (2004) examined the state of the art of computing by Quantity Surveyors in Nigeria at the turn of the last century. Thus, an update on the state of the art of computing by the professionals is necessary. The critical roles being played by the Quantity Surveyors in the procurement chain require that the professionals must not lag behind in the adoption of tools that promise to improve on their service delivery (Oyediran & Odusami, 2005).

Quantity Surveying Competence Areas Requiring Technological Advancement in Relation to Other Fields in the Built Environment

The core competence areas of the Quantity Surveying Services over the last five decades have been highlighted by Nnadi *et al*. (2016). These are summarised in Table 1.

Factors Limiting the Use of Technology in Quantity Surveying Field

In the contributions of Oyediran & Odusami (2005) and Ibironke *et al.* (2011), several factors have been identified as causing serious limitations to the use of ICT in Quantity Surveying Field. These are: Rate of virus attack leading to loss of data and associated problems, High initial cost of acquisition, Fear of ICT making professionals redundant, Irregular power supply, Inadequate job order to encourage investment in computer, Security/Privacy fears, The cost of engaging computer literate staff is high/ training on use of software, Fear of personal abuse, and The rate at which software becomes outdated and requires updating.

Table 1: Highlight of Quantity Surveying Core Services

DATE	PRACTICE / SKILLS
Pre - 1960s	Approximate estimating; Bills of quantities; Final accounts
1960s	Elemental bills; Operational bills; Cut and shuffle; Cost planning; Cost limits and allowances; Value for money in building
1970s	Computer bills; Formula methods of price adjustment; Cash flow forecasting; Engineering and construction; Cost-in-use; Cost modeling; Contractor's estimating; Cost control
1980s	Project management; Post-contract cost control; Contractual procedures; Contractual claims; Design and build; Life-cycle costing; Accuracy in forecasting; Value engineering
1990s	Diversification; Development appraisal; Facilities management; Commercial revolution; Building sustainability; Value management; Risk analysis
2000s	Rethinking construction; Lean construction; Facilities management; IT in construction; Knowledge management; Whole-life costing

Source: Nnadi *et al.* (2016)

Oladapo (2006) identified three main effects of ICT on professional practice of the Quantity Surveyors. These are: Making jobs easier for the profession, Facilitating decision-making, and Savings in operating costs. Ibironke *et al.* (2011) also identified a number of benefits of ICT to the services of the QS profession. These include: ICT enhances productivity, ICT improves presentation, ICT makes a professional's job easier, ICT gives professionals competitive advantage, ICT upgrades social image of firm or organisation, ICT saves time in business, ICT saves money in business, and ICT helps in decision making.

In view of the above identified factors, Ibironke *et al.* (2011) asserted that the adoption of IT has high level of impact on QS roles as was also discovered by Nnadi *et al.* (2016). Therefore, it was shown that technology is considered to have a very high impact on bill preparation and a high impact on the other roles of a quantity surveyor such as final account preparation, valuation, tendering and even feasibility study, when it is adopted.

Measures for Enhancing the Application of Technology in QS Field

Oyediran and Odusami (2005) emphasised the need to include computer training in the formal Quantity Surveying education curriculum in order to enhancing the application of technology in the field of QS. The need for equipping the higher educational institutions so that they will be properly positioned to give the requisite industry relevant computer education to their students is also emphasised. This requires that the trainers be literate in computer also. This capacity at the construction industry level is yet to be explored. The training requirement should include understanding in database management, such as information storage, data mining, data retrieval and programming and in the use of QS packages. Nnadi *et al.* (2016) also stated that the use of "knowledge management" and "lean construction" as effective measures for enhancing the application of technology in the field of QS.

Research Methodology

The use of the quantitative research approach was employed in this study. A literature review related to the theme of the aim and objectives of the research was carried out (e.g. Oyediran & Odusami, 2004; Oyediran & Odusami, 2005; Ibironke *et al*., 2011; Nnadi *et al*., 2016). Data were collected from primary source using questionnaires. Descriptive statistics was used to present and analyse data. The population for the study is comprised of the number of registered Quantity Surveyors in Abuja which is 589 (NIQS, 2017). The sampling frame was the register of professional Quantity Surveyors in Abuja which was obtained from the Nigerian Institute of Quantity Surveyors (NIQS) Abuja Chapter. The sample size was therefore 230 based on Krejcie and Morgan's (1970) formula (Equation 1). The use of simple random sampling technique was adopted to select the sample size from the entire population.

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P) \ldots\ldots (1)$$

s = required sample size.
X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).
N = the population size.
P = the population proportion (assumed to be .50 since this would provide the maximum sample size).
d = the degree of accuracy expressed as a proportion (.05).

230 copies of questionnaire were therefore administered personally, by post and by email to the respondents, out of which 100 were retrieved, giving a response rate of 44%. This was done with the consent of respondents on which they prefer and in order to get a good response rate. Of the 100 questionnaires returned, 70 were found useful for analysis. The response rate in the study of Ankrah (2009) was 15.42% and it was reported in the study that the norm for the response rate for postal questionnaire surveys is 20 – 30%. Other studies are those of Kheni (2008) and Ikpe (2009) with response rates of 32.42% and 15.8% respectively. In addition, 15.72% was the response rate in the study of Agumba and Haupt (2014) were questionnaires were both self – administered and administered by

mail. This justifies that the response rate in this research is adequate.

The structured questionnaires employed to gather information for the study was designed using the five-point Likert's Scale format. MIS was employed to analyse the data collected in order to achieve the research objectives. The use of MIS for the analysis of data in this study is based on the formula depicted Equation 2.

The decision rule employed for the MIS analysis is summarised in Table 2.

Results and Discussion

4.1 Assessment of QS Competence Areas Requiring Use of Technological Advancement

This section presents and discusses the MIS results of the level at which 12 identified Quantity Surveying Core Competence Areas require the use of Technological Advancement. The MIS results are presented in Table 3.

It was revealed in Table 3 that the use of technological advancement in cost estimating is highly required (MIS = 4.514) while the use of technological advancement in other core QS competence areas is very required (MIS = 4.043 - 4.486). On the average, the use of technological advancement to all the core QS competence areas are highly required (Average MIS = 4.338). Therefore, MIS observed ranges from 4.043 – 4.514 with an average of 4.338. This implies that the core QS competence areas greatly require the use of technological advancement to an extent of 86.76% on a five-point scale. The finding of this analysis agrees with that of Oyediran & Odusami (2005) where it was reported that the critical roles being played by the Quantity Surveyors in the procurement chain require that the professionals must not lag behind in the adoption of tools that promise to improve on their service delivery. It was added that these ICT software in the Quantity Surveying profession needs to be integrated with software of other key professionals in the execution of construction projects (Oyediran & Odusami, 2005).

$$MIS = \frac{\sum f(x)}{\sum f} \quad \text{------- (3.2)}$$

Where;

f = Number of respondents for the attribute rated scale (1, 2, 3, 4 or 5)
x = Observed Value or rated scale (1, 2, 3, 4 or 5)
f(x) = Product of number of respondents for attribute rated scale and observed value
$\sum f(x)$ = Number of respondents for the attribute rated 3 on scale used
$\sum f$ = Total number of Respondents

Table 2: Decision Rule for MIS

SCALE	MEAN SCORE	DECISION/REMARK				
5	4.50 to 5.00	Very Effective	Strongly Agree	Most Significant	Most Severe	Highly Required
4	3.50 to 4.49	Effective	Agree	Very Significant	Very Severe	Very Required
3	2.50 to 3.49	Less Effective	Partially Agree	Significant	Severe	Less Required
2	1.50 to 2.49	Least Effective	Disagree	Less Significant	Less Severe	Least Required
1	0.00 to 1.49	Not Effective	Strongly Disagree	Not Significant	Not Severe	Not Required

Source: Adapted and modified from Morenikeji (2006)

Table 3: Level at which QS Competence Areas Require the use of Technological Advancement

S/No.	QS Competence Areas	Mean Item Score	Standard Deviation	Rank	Decision
1	Cost estimating	4.514	0.528	1st	Highly Required
2	Programme of works	4.486	0.579	2nd	Very Required
3	Final account	4.486	0.579	2nd	Very Required
4	Bill preparation	4.486	0.528	4th	Very Required
5	Valuation	4.429	0.575	5th	Very Required
6	Cost control	4.400	0.782	6th	Very Required
7	Tendering process	4.357	0.677	7th	Very Required
8	Cash flow forecasting	4.329	0.626	8th	Very Required
9	Feasibility Studies	4.229	0.721	9th	Very Required
10	Resource leveling	4.186	0.780	10th	Very Required
11	Variation	4.114	0.854	11th	Very Required
12	Material schedule	4.043	0.818	12th	Very Required
	Average	**4.338**			

Examination of Factors Limiting the Use of Technological Advancement in QS Field

This section presents and discusses the results of MIS ranking on the factors limiting the use of technological advancement in the field of Quantity Surveying in order of severity. The results of the MIS here are summarised in Table 4.

Table 4: Factors Limiting the Use of Technological Advancement in QS Field

S/No.	Innovative and Quality Management Skills	Mean Item Score	Standard Deviation	Rank	Decision
1	Inadequate training	4.329	0.769	1st	Very Severe
2	Inadequate/erratic electric power supply	4.157	0.936	2nd	Very Severe
3	Inadequate/erratic electric power supply	4.129	0.925	3rd	Very Severe
4	Lack of available funding and finance	4.100	0.848	4th	Very Severe
5	Rapid change in technology	4.071	1.019	5th	Very Severe
6	High initial cost of acquisition	4.029	0.985	6th	Very Severe
7	Poor management	3.886	0.993	7th	Very Severe
8	Poor team work	3.857	1.099	8th	Very Severe
9	Poor leadership	3.829	0.971	9th	Very Severe
10	The cost of engaging computer literate staff is high/ training on use of software	3.800	1.116	10th	Very Severe
11	Integration and compatibility problems	3.757	1.075	11th	Very Severe
12	High rate of obsolescence of hardware and software	3.757	1.006	12th	Very Severe
13	Security / Privacy fears	3.629	1.044	13th	Very Severe
14	Rate of virus attack leading to loss of data and associated problems	3.614	0.990	14th	Very Severe
15	Lack of awareness of availability of ICT	3.614	0.961	15th	Very Severe
16	The rate at which software becomes outdated and requires updating	3.586	1.021	16th	Very Severe
17	Inadequate job order to encourage investment in computer	3.386	1.199	17th	Less Severe
18	Fear of ICT making professionals redundant	3.357	1.196	18th	Less Severe
19	Fear of personal abuse	3.329	1.192	19th	Less Severe
	Average	***3.801***			

Table 4 revealed nineteen (19) factors limiting the use of technological advancement in the field of Quantity Surveying. Sixteen (16) of these factors are ranked to be very severe. These range between Inadequate training (MIS = 4.329) and Rate at which software becomes outdated and requires updating (MIS = 3.586). The last three factors were ranked to be less severe. These are Inadequate job order to encourage investment in computer, Fear of ICT making professionals redundant and Fear of personal abuse with MIS of 3.386, 3.357 and 3.329 respectively. On the average, the factors limiting the use of technological advancement in the field of Quantity Surveying are very severe with average MIS of 3.801. This implies that the level of severity is 76% on a five-point scale. This agrees with the findings of Pamulu & Bhuta (2004); Oladapo (2006); and Ibironke *et al.* (2011) where it was unanimously reported that these factors cause serious limitations to the use of ICT in QS Field.

Relationship between use of Technology in the field of QS Cost, Labour and Time Performance of Construction Projects

This section examines the relationship between the use of technology in the field of Quantity Surveying and the cost, labour and time performance of construction projects. To do this, the relationship between the use of ICT and cost; labour; and time performance respectively was ranked using MIS in order of significance. In addition, the effect of the use of ICT on overall project performance was also ranked using MIS in order of significance. Tables 5 – 7 give summaries of the results of the relationship between the use of ICT in the Field of QS and cost; labour; and time performance.

Table 5 revealed that the relationship between use of ICT in the Field of QS and Cost Performance is very significant in the areas of BOQ preparation; Final account; Procurement technique exercise; valuation; and Estimating. MIS ranges between 4.414 and 4.600. On the average, the use of ICT in the Field of QS has a significant effect on Cost Performance (average MIS = 4.517).

Table 6 also revealed that the relationship between use of ICT in the Field of QS and Labour Performance is very significant in the areas of BOQ preparation; Final account; Procurement technique exercise; valuation; and Estimating. MIS ranges between 4.186 and 4.357. On the average, the use of ICT in the Field of QS has a significant effect on Labour Performance (average MIS = 4.254).

Table 5: Relationship between use of ICT in the Field of QS and Cost Performance

S/No.	Core Quantity Surveying Services	Mean Item Score	Standard Deviation	Rank	Decision
1	BOQ Preparation	4.600	0.571	1st	Most Significant
2	Procurement/Tendering Exercise	4.543	0.805	2nd	Very Significant
3	Final Account	4.529	0.806	3rd	Very Significant
4	Valuation	4.500	0.770	4th	Very Significant
5	Estimating	4.414	0.802	5th	Very Significant
	Average	***4.517***			

Table 6: Relationship between use of ICT in the Field of QS and Labour Performance

S/No.	Core Quantity Surveying Services	Mean Item Score	Standard Deviation	Rank	Decision
1	BOQ Preparation	4.357	0.698	1st	Very Significant
2	Final Account	4.300	0.744	2nd	Very Significant
3	Procurement/Tendering Exercise	4.229	0.740	3rd	Very Significant
4	Valuation	4.200	0.748	4th	Very Significant
5	Estimating	4.186	0.833	5th	Very Significant
	Average	**4.254**			

Table 7: Relationship between use of ICT in the Field of QS and Time Performance

S/No.	Core Quantity Surveying Services	Mean Item Score	Standard Deviation	Rank	Decision
1	Final Account	4.043	0.948	1st	Very Significant
2	BOQ Preparation	4.014	0.902	2nd	Very Significant
3	Valuation	3.957	0.901	3rd	Very Significant
4	Procurement/Tendering Exercise	3.929	0.884	4th	Very Significant
5	Estimating	3.757	1.006	5th	Very Significant
	Average	**3.940**			

It was also shown in Table 7 that the relationship between use of ICT in the Field of QS and Time Performance is very significant in the areas of BOQ preparation; Final account; Procurement technique exercise; valuation; and Estimating. MIS ranges between 3.757 and 4.043. On the average, the use of ICT has a significant effect on Time Performance (average MIS = 3.940).

Tables 5–7 therefore revealed that the use of ICT in the Field of QS has a more significant effect on Cost Performance than on labour and time performance respectively. The results of the effect of the use of ICT in QS field on the overall performance of construction projects are summarised in Table 8.

Table 8 revealed that the use of ICT in the field of QS has a significant effect on the overall performance of projects (average MIS = 4.414). In view of this, eight (8) major positive effect of the use of ICT in QS field were identified and ranked to be very significant. These are Making jobs easier for the profession (MIS = 4.571), ICT improves presentation (MIS = 4.500), ICT saves time in business (MIS = 4.486), Facilitating decision-making (MIS = 4.457), Savings in operating costs (MIS = 4.386), ICT saves money in business (MIS = 4.343), ICT upgrades social image of firm or organisation (MIS = 4.343) and ICT gives professionals competitive (MIS = 4.229). The results of this section are in line with that of Ibironke *et al*. (2011) who asserted that the adoption of IT has high level of impact on QS roles. Therefore, technology is considered to have a very high impact on bill preparation and a high impact on the other roles of a quantity surveyor such as final account preparation, valuation, tendering and even feasibility study, when it is adopted.

Evaluation of Measures of Enhancing the Application of Technology in the Field of QS

The results of the MIS ranking of the measures of enhancing the application of technology in the field of QS is presented and discussed in this section. Table 9 presents a summary of the results of the identified measures of enhancing the application of technology in the field of QS.

Table 8: Effect of Use of ICT in QS Field on Overall Performance of Construction Projects

S/No.	Effect of the Use of ICT in QS Field on Project Performance	Mean Item Score	Standard Deviation	Rank	Decision
1	Making jobs easier for the profession	4.571	0.495	1st	Most Significant
2	ICT improves presentation	4.500	0.528	2nd	Most Significant
3	ICT saves time in business	4.486	0.554	3rd	Very Significant
4	Facilitating decision-making	4.457	0.602	4th	Very Significant
5	Savings in operating costs	4.386	0.682	5th	Very Significant
6	ICT saves money in business	4.343	0.674	6th	Very Significant
7	ICT upgrades social image of firm or organisation	4.343	0.558	7th	Very Significant
8	ICT gives professionals competitive	4.229	0.759	8th	Very Significant
	Average	***4.414***			

Table 9: Measures of Enhancing the Application of Technology in QS Field

S/No.	Measures of Enhancing the Application of ICT in the Field of QS	Mean Item Score	Standard Deviation	Rank	Decision
1	Maintain and Develop Professional Expertise in Core Competencies	4.529	0.499	1st	Very Effective
2	Continuing Professional Development	4.429	0.623	2nd	Effective
3	Multi-Skilled Team	4.400	0.641	3rd	Effective
4	Invest in Necessary Technology	4.314	0.766	4th	Effective
5	Introduction of computer training in the formal Quantity Surveying education curriculum	4.300	0.763	5th	Effective
6	Be Prepared to Share Information	4.286	0.759	6th	Effective
7	Learn, Utilise and Evolve with CAD	4.286	0.700	7th	Effective
8	Diversification/Specialisation of Services	4.286	0.589	8th	Effective
9	Understanding in database management in the use of Q S packages	4.214	0.773	9th	Effective
10	Equipping higher educational institutions to give the requisite industry relevant computer education to their students	4.186	0.703	10th	Effective
11	Form Strategic Alliances with Designers	4.071	0.976	11th	Effective
	Average	**4.300**			

From Table 9, eleven (11) effective measures have been identified as strategies for enhancing the application of technology in the field of Quantity Surveying. These strategies range from Maintaining and Develop Professional Expertise in Core Competencies (MIS = 4.529) which is very effective and Forming Strategic Alliances with Designers (MIS = 4.071) which is effective. On the average, the identified measures for enhancing the application of technology in the field of Quantity Surveying have MIS of 4.300 implying that the measures are effective and are capable of improving project performance by 86%. The finding of the study in this section is in agreement with the finding of Oyediran & Odusami (2005) where it was found that these measures enhance the application of technology in the field of Quantity Surveying especially for integrating QS profession with other profession for harmonious working condition among the built environment professionals.

Conclusion and Recommendations

In view of the findings from this research, it is concluded that the use of ICT in the field of QS has a significant effect on the overall performance of construction projects. Therefore, technological advancement in in the Field of QS improves the overall performance of construction projects. It is therefore recommended that QS firms should digitize all the core competence services areas in order to improve the performance of projects in terms of cost, labour and time efficiencies. QS firms should also strengthen the use of ICT more in the areas of BOQ preparation; Final account; Procurement technique exercise; valuation; and Estimating in order to improve Cost; Labour; and Time Performance of construction projects. This is because it was found that these are the core areas where the use of ICT is mostly required.

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