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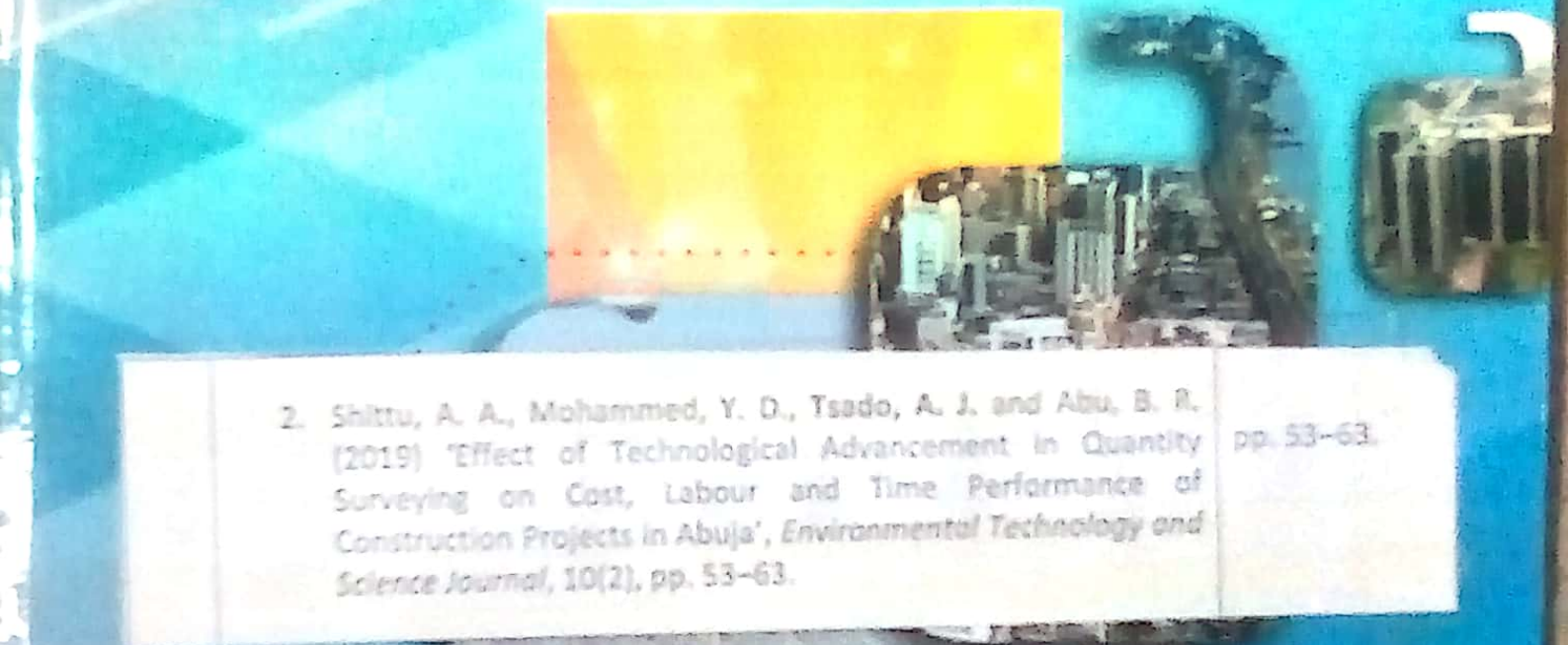

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Effect of Technological Advancement in Quantity Surveying on Cost, Labour and Time Performance of Construction Projects in Abuja

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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advancement in the field of QS range between Inadequate training (MIS = 4.329) and Rate at which software becomes outdated and requires updating (MIS = 3.586).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.

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.

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

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 Moremikeji (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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Introduction

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Determination of the critical success factors for attaining quality performance in partnering projects in Lagos and Abuja, Nigeria

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Quality is one of the factors leading to high cost and is the most prominent source of dissatisfaction in construction projects. This paper aimed at determining the critical factors leading to quality performance in partnering projects as a means of improving the construction industry performance. The goals pursued are: identifying critical success factors (CSFs) leading to partnering quality performance, test if there is an agreement in the ranking and identify which of these identified factors has a significant influence on the quality outcome. The study was quantitatively conducted using questionnaires survey to extract information from practitioners. The questionnaire was analysed using statistical tools such as descriptive, Kruskal-Wallis, and ordinal logistic regression. The study discovered that acting inconsistent with the objectives, effective monitoring and evaluation, commitment and support of management, and joint conflict resolution technique are vital to quality performance. This paper findings would assist the practitioners in decision making and would ensure a better quality outcome in future partnering projects. This paper used the empirical study to reveal critical factors for achieving a quality outcome in partnering projects. Practitioners should focus on those factors for quality performance improvement in partnering projects.

Keywords: Construction practitioners, Critical Success Factors, Ordinal logistic regression, Partnering project and Quality performance.

Introduction

Quality is considered as the fulfillment of expectations of project stakeholders, it is also a means of assessing success of any construction project (Sanvido *et al.*, 1992). A nation level of development is assessed through the quality of the construction projects or infrastructures. Achieving quality in a construction project is a global issue (Lee & Arditi, 2006), but so serious in developing countries such as Nigeria. Quality is the most prominent source of dissatisfaction to the stakeholders (clients especially) and is one of the factors leading to high cost and unachieved schedule of construction project globally, due to rework and cost of rectification of defect (Xiao & Proverbs, 2002; Femina *et al.*, 2016). Client's satisfaction on a construction project depends on quality performance because a project is expected to offer performance, appearance, and reliability expected for a given price (Femina *et al.*, 2016). A project may be considered as a failure without achieving the specified quality even when the completion time and budget are met. When a project is completed, quality continues to remain in the minds of everyone, even when price is forgotten.

Apart from quality effects on the actual contract, quality also affects future of the construction practitioner stays in business, because winning future contract nowadays depends on previous record. Research on quality is of great importance especially in developing countries such as Nigeria, where a lot of resources and human- life's are being wasted annually due to poor quality of the construction projects. Hardy, find a state without a case of reported collapse

building. Therefore, identification of the critical factors for enhancing the quality performance of construction project is necessary. But since the construction industry project delivery system is heterogeneous in nature, there is a need to study critical factors for achieving quality for alternative procurement options such as partnering (Adnan *et al.*, 2014).

The need for performance improvement in the construction industry led to the adoption of partnering as an alternative procurement system globally without exception of Nigeria. Partnering implementation is full of benefits such as timely completion, completion on a budget, quality, and dispute free as reported in the literature (Cheng *et al.*, 2001). Unfortunately, these benefits could not be fully reaped in Nigeria due to quality challenges associated with partnering projects and this is a great concern. Lack of understanding of the best practices (critical factors) on the part of construction practitioners on attainment of the quality performance is the major cause (Awodele & Ogunsemi, 2010). Jakum *et al.* (2004) affirmed that failure in determining the critical factors influencing each project's objectives is one of the challenges in managing a construction project.

The motif of this paper is to determine the critical factors leading to the quality performance of partnering projects. The aim is achieved through the following objectives: (i) to identify CSFs leading to partnering quality performance and their relative importance, and (ii) to identify which of these factors has a significant influence on the quality outcome of the project. Determining the factors affecting quality performance in partnering construction project is a step towards the quality improvement. This study findings would provide the stakeholders with information that would assist them to use their limited resources judiciously to accomplish better quality project. The findings would also provide construction practitioners and the decision makers with necessary information that would assist in quality improvement through better project management and decision-making process. This study will minimise the rate of partnering projects failure in Nigeria.

Literature Review

Concept of quality and factors influencing quality in construction projects in general

The concept of quality varies from individual to individual. [illegible] and [illegible] (2006); [illegible] and [illegible] (2006) defined the quality of a project as meeting the customer's expectation or compliance with customer's satisfaction. In a general term, construction project quality is meeting the requirements of each party in the construction team as well as the general agreement (Arditi & Gunaydin, 1997). The end result of the service rendered at work from the technical and workmanship aspects is referred to as quality (Long *et al.*, 2004). [illegible] and [illegible] (2006) in their study of the quality performance in construction projects, they found that project manager's [illegible] competence, interaction among project participants, top management's support, and project participants' monitoring and feedback are factors affecting quality. Leonard (2010) affirms that quality culture is vital for successful quality attainment most especially partnering project.

Quality has a great influence on the project performance, durability, and appearance of a structure. The absence of quality in a construction project results into high cost of construction in the long run. Most of the owner wanted the product at a cheap price, while contractors wanted to remain in the business through gain acquired from the contract and remain competitive (Ogunsemi, 2015). Therefore, quality performance satisfaction has been a major problem to construction practitioners in Nigeria. Building failure has remained a major concern for all the stakeholders and the built environment in the Nigeria construction industry ([illegible], 2014; Olusola, 2015). [illegible] (2015) reported that within five years thirty four cases of building collapse were reported in one state in Nigeria, this is so alarming. These failed structures did not exclude any procurement system. The

poor-quality performance had been noted as a factor responsible considered as project failure.

Chan and Tan (2000) assessed the Hong Kong construction industry to identify factors influencing the quality of building projects. They found out that construction team leader effectiveness, the emphasis of the client's on time, the emphasis of the client's on quality, and management actions of the project team are the factors impacting on the quality of building projects.

In addition, the construction activity is sensitive to change in economic condition; in times of general economic growth, it flourishes and verse vice during economic downturns. Economic affects the quality of construction project. Oyedele *et al.* (2015) researched the critical factor influencing poor construction quality. They found that poor quality of materials, poor inspection and testing, poor site installation procedure, lack of quality assurance, low level of skill, and labours's experience are the causes of poor quality construction output in Nigeria. Similarly, Oyedele *et al.* (2003) reveal that non-involvement of all key players at the design stage, design changes, insufficient and unrealistic project cost constraints, design professionals low level of commitment to quality improvement, and emphasise on cost at design decisions rather than the value of work were the factors negatively impacted on quality. Jha and Iyer (2006) and Arditi and Gunaydin (1997) discovered that non-involvement of the project participant in quality planning and practice is one factor affecting the quality of construction project. Construction projects quality may be affected by the lack of project definition while clear goal definition is vital to project success (Oyedele *et al.*, 2015).

Jha and Iyer (2006) identified inefficient communication between parties involved in construction projects as one of the critical factors affecting project quality. Teena (2014) investigated the quality of construction projects and the impact of design related factors. The findings reveal that ineffective communication, conformance to codes and standards, designers selection, the cooperation of parties, management factors, contractor selection, top management support, contract documents labour, execution, material, equipment, financial issues, and quality and safety systems are the factors influencing design quality. In addition, inadequate information in the contract documents may lead to a low quality constructed project (Arditi & Gunaydin, 1997). Jha and Iyer (2006) asserted that project quality performances are affected by factors such as hostile socio-economic environment; aggressive competition during tendering, conflict among project participants; harsh climatic condition; faulty project conceptualization; and project managerlack of knowledge or ignorance.

Yung and Yip, (2010;) revealed that lack of consideration for the adequate resources such as financial, material, human resource, technical, and so on are responsible for poor project quality. El-Maaty *et al.* (2016) affirmed that factors affecting the quality of project are the availability of experience project teams; clarity of responsibilities and roles; and efficiency of the project monitoring and inspection team. Oke and Abiola-Falemu (2009) noted that poor materials and workmanship and inefficient supervision of workmen are the causes of poor quality work in the Nigeria building industry. Superior quality in construction projects could be achieved if more attention is pay to implementing and improving quality management in the construction (Heravitorbati *et al.*, 2011).

Critical success factors for achieving quality in partnering project

The concept of CSFs came into limelight in 1979 when Rockart applied it in the field of information technology, but since then it has spread to other sectors such as construction. CSFs are the few areas in which if there are satisfactory results it will ensure successful competitive performance for the project or organization. Toor and Ogunlana, (2009) affirmed that the implementations and implications of previous researchers' findings are limited to the countries where

the research was conducted. CSFs are influenced by the specific characteristics of the industry where was carried out and change based on the industry environment (Yong & Mustaffa, 2013). CSFs are context specific; it depends on the operating environment. Therefore, varied from country to country and change as the policy and the industry's environment changes.

In the construction industry, there are various procurement system such as design and build, partnering, and so on, each has key factors that drive their success. The Construction Industry Institute (CII, 1991) defined partnering as "a long-term commitment between two or more organizations for achieving specific business objectives by maximising the effectiveness of each participant resources." Partnering is acknowledged as a management technique that allows design and construction teams to work as a team to achieve overall project objectives (Larson, 1997). Chan *et al.* (2004) investigated critical factors for accomplishing partnering projects objectives in Hong Kong through the perception of stakeholders. Chan *et al.* (2004) found that establishment and communication of strategy of resolving conflict, willingness to share resources among the project participants (sharing culture), clear definition of responsibilities, and regular monitoring are factor critical to successful partnering project.

In the present competitive market, for the practitioners to remain relevant in the construction industry, quality performance strategy needs to be improved. Similarly, Larson (1997) noted that partnering project CSFs are: support from top management for teamwork, fair profit assumptions, conflict identification, team building session, previous work experience, provisions for continuous improvement, and the establishment of the problem-solving process. Cheng *et al.* (2000) identified factors vital to the success of partnering construction project. Among the identified factors are conflict resolution, effective communication, adequate resources, long-term commitment, management support, coordination, mutual trust, and creativity. Cheng and Li (2001) discovered that open communication, mutual trust, top management support, and effective coordination are factors affecting partnering project successful completion. Hansen-Addy and Nunoo (2014) researched partnering in the UK; they discovered that effective communication, mutual trust, competence, and sufficient information flow, openness and integrity of communication are factors critical for running successful partnering construction projects. Dikmen *et al.* (2008) empirical studied critical factors leading to successful partnering projects, among the factors, among the identified factors are clearly defined roles and responsibilities, partner selection, cooperation among partners, dispute resolution, mutual decision-making, effective communication, coordination, and trust among partners. All these studies considered project success in totality without isolating quality.

Partnering project quality is affected by a vast number of issues; eradicating these problems required overcoming these issues. All the key stakeholders in a partnering project need to understand the requirements for quality to be achieved. Quality is achieved when there is a harmonious working relationship between parties (Matthews *et al.*, 2000). Mathew *et al.* (2000) ascertained that partnering provides an avenue to improve productivity and quality attainment through construction design process, communication and buildability provided. Partnering working relationships encourages technology transfer within an organisation at an affordable cost because partnering provides the opportunity to obtain quality management expert skills from their partners. This technology transfer improves quality performance.

In the construction projects such as partnering, effective communication cannot be over emphasized. Therefore, for a construction project to be successful all the professionals on the contract must communicate effectively (Tipili *et al.*,

2014). All key stakeholders need to possess communication skills. With these skills, project difficulties can be resolved, exchange of ideas, and visions are facilitated. Good communication is a key aspect of partnering relationship. It helps in understanding partners' need and building mutual trust. A good communication system mitigates risks and increases reputation of all concerned parties. Keeping a good communication system would avoid ambiguous situations and discrepancies occurring at all times (Wong *et al.*, 2008). Absence of effective communication creates fear of betrayal and exploitation, which may lead to avoidance of commitment to the team. Project mission in which clear project objectives and directions are made known to the project team is guarantee through some form of communication. Through open communication, project issues can be solved immediately in the early stages before it goes out of hand (Cheng *et al.*, 2000). Albanese (1994) concluded that partnering enables the parties not only to communicate more effectively regarding quality issues, but also helps to develop a quality consciousness amongst all concerned. Communication leads to the earlier recognition of potential problems.

In addition, top management support toward the project is imperative and is crucial towards attainment of project success such as quality. In construction or any other businesses, decision making is crucial in achieving results, and top management plays an important role in this process. The success of any key decision make in the process is depend commitment and support of top management (Zakuan *et al.*, 2012). Quality attainment is an importance issue that no management can afford to assign it to ordinary people. Therefore, the top management needs to play a crucial role by making available all the necessary resources, establish quality policy as well as communicating it to all stakeholders, establishing a quality management structure and managing the entire process through close monitoring and evaluation. Moreover, participants' commitment plays a vital role in ensuring success or failure of construction projects. Success of a project is influence by commitment of the participants. If there is active involvement of all key project parties, there is more likelihood for the project to be completed within budget, on time, and with the least number of work defects (CII, 1991).

Availability of competence project team is crucial for quality attainment. A competence partner delivers the project in a quality manner. The level to which business transactions meet performance expectations is referred to as competency. Tang *et al.* (2009) identified past experience, selecting the right partner, improved collaborative culture, long term relationship commitment, leadership capabilities, adequate resources, effective coordination, early project planning and motivation, availability of the required technology and training, a clear project mission, early involvement of all key project parties, and problem solving ability as factors leading to successful quality performance in partnering project. The key factors of quality improvement in partnering relationship development is continuous improvement and partnering tools. While Albanese (1994) pointed out that good relationship quality influence quality of work undertakes in any partnering project. Kubal (1994) also highlighted that acting consistent objectives, top management support, and effective communication play vital roles in achieving successful partnering in term of quality.

In partnering project, teamwork is a critical factor for attaining project quality. For the relationship between contractor and client to be successful, there should be attitudinal and behavior change and a commitment in the concept of teamwork (Abudayyeh, 1994). Abudayyeh, (1994) identified six factors involve in accomplish quality partnering project, namely mutual agreement on aesthetic standard, timely send of the revised plans to appropriate person, provision of quality material, timely project inspection, early problem identification, and use of competent craftsmen and communication.

Research Methodology

This study was conducted using quantitative research approach via a structured questionnaire survey, since it allows access to a large number of respondents. Literature was comprehensively reviewed at the commencement stage of the study to identify critical factors leading to partnering project quality performance and four experts were interviewed as pilot study to ascertain the relevant of factors identified through literature review to the study area. They were selected from the list gotten from the Bureau of Public Procurement (BPP) office for interview because of their handful experience on partnering projects. The experts are senior management staff in their various organization and have partook in those partnering projects, in-charge of quality management, and more than ten years partnering experience. Based on their comments and observations the list of critical factors were refined. Finally, thirty–two critical factors influencing partnering project success in term of quality in Nigeria context were derived.

The questionnaire is split into three sections. The first section presents demographic characteristics of respondents. The second part of the questionnaire contained 32 items of partnering project critical factors influencing the success of partnering projects in which respondents requested to assess their level of agreement on five points Likert's scale. The third part is about quality performance outcome, in which the respondents were asked to assess the quality performance of the nominated completed partnering projects and assess them on a five-point scale. The respondents were asked to indicate their level of agreement with of each CSFs on a five-point Likert's scale as influencing the quality performance of partnering project. The respondents were asked to rate the successful completion of their projects (in terms of quality) on a 5 point Likert's scale ranging from1 = strongly disagree to 5 = strongly agree. The questionnaire was designed to establish the relationships between quality performance and partnering CSFs. Idoro, (2010) asserts that the quality of a construction project can be assessed in two categories namely: objective and subjective. This study was conducted using subjective assessment due to nonavailability of hard data on quality in the study area, similar approach was employed in Jha & Iyer (2006).

The list of partnering projects executed since 2003 were sourced from the authorized desk official Federal and State Bureau of Public Procurement (BPP) offices in Abuja and Lagos, Nigeria. BPP is the authority coordinating contract documentation and awards in the study areas. From this list, 88 partnering projects executed (consist of building and civil engineering projects), from which the names and addresses of stakeholders' organisations were extracted. The assistance of senior management staff in their various organization were then sought by the researcher to distribute the questionnaire to those professionals that have partnering experience and participated on partnering projects development before and understand key factors to achieve quality performance in project execution. Since limited number of projects has been executed through partnering since its inception in 2003, therefore, there is no year limitation in this research.

These two study areas (Lagos and Abuja) were purposively selected based on the volume of partnering projects there and for convenience purposes. The questionnaire was administered to the construction professionals such engineers, architects, builders, and quantity surveyors that participated on those projects. 155 questionnaires were administered to the professionals in Abuja and Lagos, 113 questionnaires were returned, and 102 were analysed, eleven dropped for incomplete information.

The respondents were grouped into consultants, clients or contractors, being the three recognised organisations in the study area. The mean of each factor was computed and ranked. The statistical tools employed are descriptive, Kruskal-Wallis, and Ordinal logistic regression with the aids of SPSS

software, being nonparametric data (ordinal data).

The respondents background information and each factor mean score were determined using descriptive analysis. Kruskal- Wallis at 5% significant level was employed to test the agreement in the ranking of the CSFs by the three organizations. This method of analysis was used in previous study by Babatunde *et al.* (2015). In determining factors influencing the quality performance, ordinal logistic regression was adopted because the outcome variables are ordinal data on the Likert scale of five point's ranges from strongly disagree and strongly agree. Ordinal regression statistical may be used to establish the relationship between the independent variables (that is CSFs) and the dependent variable (quality). Ordinal regression does not require the assumptions of the normality and homogeneity of variance for the ordered categorical outcome, but the assumption of parallel lines is required across all level of the categorical outcome ((Field, 2013). This approach has been used in a similar study in management research (Alzahrani & Emsley, 2013; Elamir and Sadeq, 2010).

Decision rules used in the ordinal logistic regression are: the parallel line test result should not be significant; the likelihood ratio (-2LL) should be significant; the deviance chi-square in the goodness of fit should not be significant, and pseudo-R-square values give the proportion of variance explains.

Data Analysis and Discussion

The respondent's demographic information reveals that the clients 24 (23.8%), contractors 34 (33.7%) and consultants 43 (42.5%). The respondents working experience reveals that 13.9% of the respondents were less than five years, 19.8% respondents had 5-9 years of experience, 26.7% respondents had 10-14 years of working experience, 25.2% respondents have 15-19 years of experience, and 14.4% respondents have more than 20 years of experience. The respondents are Architects, Quantity Surveyors, Builders, and Engineers.

Thirty-two identified factors influencing the quality of partnering projects and their means scores computed as shown in Table 1. The five most ranked factors influencing quality in descending order are effective communication among the project team, adequate briefing, top management commitment to quality, effective coordination, and competent project team. Those factors having p-value greater than 0.05 indicate there were agreement on them. In testing the agreement in ranking the factors only four out of the thirty-two have their p-values less than 0.05, they are experience, design decisions based on the value of work rather than cost, early involvement of all key players, and learning climate and creativity. The researcher is not surprised about the disagreement on these items since the respondents belong to different organisations with different roles and responsibilities, different partnering projects, and also individual with a different perception.

Table 1: Critical factors influencing partnering project quality performance with their mean, Chi-square and Kruskal-Wallis Values

Critical Success Factors	Overall (MS)		Chi-square	Kruskal-Wallis sig.
	Mean	rank		
Effective communication among the project team	4.31	1	2.234	0.340
Adequate project briefing and clear mission	4.22	2	2.143	0.331
Top management commitment	4.22	3	2.959	0.228
Effective coordination	4.20	4	2.758	0.263
Competent project team	4.18	5	0.087	0.958
Adequate technical knowledge (team with adequate technical skills)	4.16	6	2.715	0.257
Adequate resources	4.15	7	1.299	0.522
External influence (Conducive environment)	4.11	8	4.206	0.125
Improve collaborative culture	4.09	9	0.655	0.721
Problem solving ability	4.09	9	3.521	0.172
Acting consistent with objectives	4.08	11	0.215	0.898
Early identification of problem & cooperation	4.05	12	1.796	0.407
Adherence to specifications	4.04	13	4.018	0.134
Mutual agreement quality	4.02	14	0.942	0.624
Effective project planning, monitoring, & evaluation	4.00	15	0.73	0.694
Procurement system to get best quality material and suppliers	3.99	16	4.499	0.105
Past experience	3.98	17	6.17	0.046*
Design decisions based on the value of work rather than cost & continuous improvement	3.96	17	11.937	0.003*
Timely responsiveness	3.95	19	1.998	0.368
Good relationship quality	3.95	19	0.86	0.650
Availability of the required technology & Training	3.94	21	1.421	0.492
Early implementation of partnering and motivation	3.94	21	5.592	0.061
Harmonious working relationships among the project team	3.92	23	5.088	0.079
Leadership capabilities/ qualities of project manager	3.89	24	2.152	0.146
Selecting right partner	3.88	25	4.511	0.105
Early involvement of all key players	3.87	26	10.589	0.005*
Timely project inspection & regular meeting	3.81	27	5.377	0.068
Participants level of commitment to quality	3.78	28	1.797	0.407
Partnering tools	3.73	29	0.290	0.865
Team building (team work)	3.69	30	2.115	0.347
Long term relationship commitment	3.68	31	1.127	0.569
Creativity and potential for innovation	3.56	32	5.857	0.049*

N.B: * implies no agreement.

The factors identified (independent variables) were run through ordinal regression using SPSS software. Therefore, complementary log-log link function was adopted in line with Ekanem and Sadiq (2010), since they fall in upper categories. The outputs reveal that four out of the thirty-two factors have a significant influence on the project quality. They are acting consistently with objectives, commitment and support of management, effective monitoring and evaluation, and conflict resolution techniques, since their $p<0.05$ as shown in Table 2. This implies they are contributors to the project success in terms of quality performance.

The model fits information test outputs show that log Likelihood ratio (-2LL) =441.117, chi-squared=78.218, and significant at 0.001 ($p<0.05$), indicating a significant improvement over the one without predictor variable (intercept only) as shown in Table 1. Similarly, the deviance

chi-squared goodness of fit had a non-significant value ($\rho>0.05$), indicating a well-fitting model. Furthermore, the pseudo-R-square test, revealed that Cox and Snell R-squared value =0.750 while Nagelkerke R-squared value =0.773, these imply that they explained 75.0% and 77.3% of the variation in the dependent variable respectively. The test of parallel line revealed a non- significant value of 0.075, implies that the slopes of the independent variables were the same for each level of the outcome variable.

Acting consistently with the objectives is critical to the quality performance in partnering project since $\rho<0.05$. This study finding is in line with Chen and Chen (2007) finding in a study conducted in Taiwan. For a partnering project to be successful, it requires a joint effort from all contract parties, and they should act consistently with the objectives. If the project participants act in line with the project objective, the project will not run off the track set regarding quality delivery. Commitment and support of management is statistically significant to quality performance outcome ($\rho<0.05$), therefore is a vital ingredient for a successful partnering project quality. The degree of top management commitment determines the quality management implementation to adopt. If the top management is committed to quality, quality will receive a higher attention over other criteria such as schedule and cost, and this will lead to cost and delivery performance in the long run. This study finding is in line with previous studies by Omran and Druica (2011). Ghaffari (2015) affirmed that the full support and commitment of management at the point of initiating partnering arrangement is vital for the success of partnering relationship. In addition, human resources development and selection of the project team are under the control of top management which can be used to improve quality of delivery.

Effective monitoring and evaluation are another factor having a significant influence on partnering quality performance $\rho<0.05$. This finding is in line with Chan *et al.* (2004), which asserted that regular monitoring of partnering process would lead to the partnering success since this action will prevent projects from slip out of focus. If there is proper monitoring, all the needed corrections would be noticed and rectified. Lastly, conflict resolution strategy adopted influenced the quality of partnering project. The conflict resolution strategy is a statistically significant predictor of partnering project success in term of quality. Through partnering workshops progress of work and conflict of interest are jointly evaluated and discussed, this improves the quality of the work.

Table 2: Ordinal Logistic Regression Statistics Outputs for Quality Performance

Predictor	B	SE	Wald	Df	Sig	95% confidence interval	
						lower	upper
Acting consistent with objectives	0.530	0.255	4.324	1	0.038*	0.030	1.029
Commitment & support of Management	0.630	0.240	6.885	1	0.009*	0.159	1.100
Effective monitoring & evaluation	0.500	0.250	3.986	1	0.046*	0.009	0.991
Conflict resolution techniques	0.455	0.212	4.405	1	0.036*	0.029	0.861
Model Fit information:							
-2log Likelihood = 441.137							
Chi-square = 58.218							
Sig. = .003							
Goodness-of-fit:							
Deviance chi-squared = 439.751							
Sig. = 1.000 (sig >0.05, so the model fit well)							
Pseudo- R- square:							
Cox & snell = 0.750							
Nagelkerke = 0.773							

* Significant at $p<0.05$

Conclusion

This paper set out to establish identified critical factors having a great impact on the partnering projects quality objective from the perception construction practitioners in Nigeria. The five most ranked factors critical to quality performance in partnering projects in Nigeria are effective communication among the project team, adequate briefing and clearly set project mission, top management commitment, effective coordination, and competent project team. The factors were established tthrough the literature review and quantitative approach via a questionnaire administered to the construction professionals. Analysis was carried out on collected data using descriptive, Kruskal-Wallis, and ordinal regression. Further analysis shows factors affecting the quality of partnering projects in Nigeria context are commitment and top management support, acting consistently with the objectives, conflict resolution techniques, and effective project planning, monitoring, and evaluation. The findings are expected to make significant contributions to the Nigerian construction sector through improvement in the quality of construction project most especially partnering. The findings would provide feedback to the stakeholders in order to ensure effective management and quality partnering projects. For any construction practitioner who has quality as a priority should be acting consistent with the objectives, the management should be committed to partnering implementation, effective monitoring, and evaluation of the project, and joint conflicts resolution techniques should be adopted. Based on the findings the following recommendations are proposed:

All the participants in the construction project should embrace a cultural and behavioural change from adversarial to collaborative culture most especially top management for the quality performance to be improved. Qualified personnel should be engaged in all aspects of the project, and they should be properly monitored and control to accomplish specified quality project outcome.

There should be regular meeting to discuss the pressing project issues and maintain cordial relationship between the project team for conflict avoidance. The key stakeholders should be incorporated into planning and practice from the inception stage; it would assist in solving substantial amount of quality challenges. Through top management commitment, all the necessary quality policies would be put in place and project under management control would not be starved. Training of human resources would not be handled with levity, and the competent team would be arranged for the project.

The findings would be of great benefit to the construction industry, the practitioners, and decision makers and it would encourage the construction practitioners to implement partnering in future projects since the findings would create a better understanding of partnering implementation, through a better understanding of the best practices leading to successful partnering implementation on an aspect of quality.

The limitation of this study is that partnering performance measures were based on respondents' perception due to lack of hard data. The second limitation is that the sampling of research is confined to cities other cities may have different results due to different environment condition. Future study can adopt an in-depth case study approach of investigating the factors influencing quality.

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