



## Assessment of Factors that cause Rework in Building Projects in Abuja, Nigeria

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**Abstract:** Nigeria Construction Industry has been persistently faced with the problem of reworks in building projects. The aim of this paper is to investigate the causes of reworks in building projects and mitigating measures to reduce reworks in building projects. A total of 150 numbers of questionnaires were distributed to Engineers, Quantity surveyors, Project Managers, Construction Managers, Contractors, Consultant and Clients in the construction industry in Abuja. The descriptive analysis was used to analyze the data obtained from the responses of the respondents. The result obtained from the descriptive analysis show the followings as main causes of reworks in building projects. These are: poor leadership, lack of supervision, poor selection of sub-contractor, working overtime, design change, poor communication between parties and insufficient skill manpower. In addition, the followings were established as mitigating measure to reduce reworks in building projects: inadequate information and communication channels, uses of appropriate construction method, effective site management and supervision and quick decision making, systematic control mechanism, uses of experienced sub-contractor and suppliers, proper project planning and scheduling and delegation of authority. The paper recommended that the client should ensure that there is adequate supervision and communication between the parties during the course of building projects.

### 1. INTRODUCTION

The high cost of building projects in all aspect as a result of project leadership, design changes, lack of supervision as well as reworks are problems which is becoming obvious especially in Nigeria. Moreover, Love *et al.*, (2016) expressed that rework is a pervasive problem within the construction industry, but many firms are reluctant to openly acknowledge it as an issue because it can potentially damage their reputations. Love and Li (2000) described construction rework as unnecessary effort of re-doing a process or activity that was incorrectly implemented at the first time. Construction rework can cause project costs to be higher than calculated at the start of the project (Josephson *et al.*, 2002). Nzekwe *et al* (2015) asserted that the failure of projects due to excess rework from a cost perspective is a worrisome trend in the construction industry in Nigeria. Whereas in many cases, project cost variation is inevitable because of inflation and other unforeseen events, more often than not, poor project conception and design by themselves make it impossible to make credible estimates of the costs of materials and of the project itself (Nzekwe *et al.*, 2015). This trend has become a handy excuse for corrupt contractors and administrators who resort to varying the cost of ongoing projects in order to make money from the situation. The ultimate cost of the project after all the variations is several magnitudes higher than the projected cost at the

start. The inability to complete projects within stipulated time and cost, always led to total project abandonment, cost overrun, and claims (Ogunlana, 2008).

Even though, rework may occur as many concepts in a construction project at both the design and construction stages and it could be in the form of variation, design variation or design error or omission which may be direct or indirect (Nixon *et al.*, 2012). Reworks occur in the building projects due to poor supervision, lack of coordination, poor communication, mistake during construction and poor contractor due to poor leadership (Love and Edward, 2004). Therefore, the effects of reworks in building projects are the motivating factors for this paper in order to identify the key factors that cause reworks and establish the mitigating measures to overcome the challenges of reworks in building projects.

### 2. REWORK

Rework is a terminology in construction dictionary. It literally mean to remove and correct any work that is not in conformity with the design. Rework can be referred to an activity in the field which had already been completed but need to be carried for a second time as a result of impending correction that is necessary to be carried out (Ibrahim, 2016). Fayek, *et al.* (2008) described rework as a process of effecting a change in order not due to change of scope of work by client.

work was also revealed to be a significant factor that contributes to schedule time and cost overruns in project (Palaneeswaran *et al.*, 2007a). Burati *et al.* (1992) and Li and Li (2000) further described rework as a necessary effort of redoing a process or activity that is non-conformance or quality deviation from the planned. Li and Taylor (2008) explained that rework occurred during the development process and a project can experience poor cost schedule performance. It is deduced from previous studies that rework is needed as process of correcting the errors, mistakes and re-inventing the wheel to meet the client satisfaction.

#### Classification of Rework

Palaneeswaran (2006) revealed the classification of rework in an undertaken study of construction projects categorized as designed and constructed. The studies included the types of the rework, the factors causing the rework and their descriptions. Love *et al.* (2009) explained types of rework in construction projects as aggravated by error made in the design process and only manifested during the procurement process. The longer the error goes unnoticed, the greater impact will be on the cost and schedule of the project (Love *et al.* 2009; Ogunlana 2008 and Jarad 2008). The manifestation of error in most cases become evident during the incorporation stage (Palaneeswaran *et al.* 2007b) thereby prolonging the extent of rework to be done. Similarly, omission contributes greatly to rework in a project, and this may be as a result of the practice of the organization not incorporating a client project management procedure during the initiation of the project. A study conducted by Love *et al.* (2009) investigated the impact of omission in construction and resource engineering projects. It was concluded that a major factor contributing to omission is design error when discussing the design related rework.

#### Factors causes rework in Building Projects

Smith and Jirik, (2006) highlighted that there are various factors that causes reworks in construction projects and group the causes into two such as direct causes of reworks and indirect causes of rework. The direct causes of reworks are: lack of quality supervision, lack of supervision knowledge, lack of quality work, standard materials and repetitive from contract drawing. The indirect causes of reworks are: poor selection of sub-contractors, poor team coordination, poor work sequencing and poor work protection. Love and Edward (2004) stressed that some of the factors that causes reworks are: poor communication, poor leadership, design change, variation, conflict between parties, poor financial control, insufficient skill power, mistake during the construction and lack of division. Mastenbroek (2010) added that factors that causes reworks in building projects are: leadership & communications; construction planning & scheduling; human resource capability; material & equipment supply and engineering & reviews. These mentioned were explained below:

(1) Leadership and Communication: there are four factors causes rework under leadership and

communication. These include lack of vertical communication between consultant or project manager, contractor/sub-contractor, foreman and the operatives/labour, poor management of the project team, lack of safety, quality assurance and quality control commitment (Love *et al.* 1997).

(2) Construction Planning And Scheduling: the factors that cause rework under this include, unrealistic schedule, late input by the client, untimely deliveries and insufficient commissioning and start up resourcing (Riemer, 1976 & Yang *et al.* 2011).

(3) Human Resources Capabilities: the factors that cause rework under this include fatigue, low level of skill operative, vague specifications, poor professionalism, incompetent supervision and poor planning or scheduling (Toole 2005).

(4) Materials and Equipment Supply: the factors that cause rework under this include poor consideration to work specification premature delivery, poor assemblage of project components, delivery of materials to different location than where it is needed (Josephson *et al.*, 2003).

(5) Engineering and Review: the factors that causes rework under this include insufficient design advancement, scope and design changes, lack of document control errors or variation (Love *et al.* 1997).

#### 2.3. Mitigating Measure to Overcome Occurrence of Rework

Oyewobi *et al.* (2003) identified the following ways of reducing occurrence of rework in construction project. These are: supervision of the design process, a construction company must participate in the design process to avoid the problems related to design errors, and also providing its experience in design solutions. Mahamid (2016) added the followings means of reducing reworks in construction projects: coordination of the different construction specialist through a logic sequence of information transfer, avoiding incorrect assumptions, and giving a priority level for changes to avoid lack of coordination and improve the design compatibility. Wasfy (2010) listed out the possible means of mitigating reworks. These are standardization of design information, avoid the omissions, errors and continuous changes, these affect the normal development of the projects and control of the flow of information. Li and Taylor (2009) and Hwang *et al.* (2009) outlined the followings means of reducing reworks: delegation of authority, systematic control mechanism, information and communication strategy and uses of experience professionals.

### 3. RESEARCH METHOD

This study adopted a questionnaire survey approach to study the sample of individuals from a population with a view towards making statistical inference about the population using the sample. It was also used to pull out public opinion, such as beliefs, perception, ideas, views and thought about factors that causes reworks and mitigating measures to overcome the challenges of reworks in the building projects. In order to obtain the require population for this study, the stratified random

sampling technique was adopted for the selection of the construction companies that participated in this study. This selection was in line with concept of Creswell and Tashakkori (2007) that respondents are arranged in strata for the convenience in questionnaire distribution and assessment. In addition, the simple random sampling was adopted in each of the construction companies for the selection of construction players from the strata.

The questionnaire that was used to record the responses of each respondent contained mainly closed ended questions using a five-point Likert scale ranged from none=1, low=2, moderate=3, high=4 and very high=5. The scores of the respondents were computed based on the variables used in the questionnaire. However, the questionnaires were distributed to professionals in the construction industry that are actively involved in construction projects in Abuja with the years of experiences. These are Quantity Surveyors, Architects, Engineers, Project Manager, Construction Manager, Contractors, Consultants and Clients. 150 questionnaires were distributed and only 112 questionnaires were filled correctly and returned, which represent 74.67% of the Questionnaires used for the analysis.

### 3.1. Descriptive analysis

The descriptive analysis was adopted to summarise the sample, rather than use the data to learn about the population and sample. It was also used for a brief descriptive summarising transactions contained data set, which can either represent the entire population or sample (Creswell and Tashakkori, 2007). This method was used to describe the data set in terms of measuring the central tendency and dispersion or variance. The measurement of central tendency included the middle, and the average, while volatility measures include standard deviation (or difference), and the minimum and maximum variables. The descriptive analysis encompasses the mean, standard deviation, variance and standard error means. In this study descriptive analysis was used to present means and standard deviation values as well as frequency counts on the data. The mean value was used to ranked the respondents' opinions or responses obtained.

## 4. FINDINGS AND DISCUSSION OF RESULTS

The class range adopted in five point Likert scale was used to explain the outcome of result as shown in Table 1.

Table 1: Class range of Average Index (Kasimu (2016))

Mean Range	Likert Scale
$0.00 \leq \text{Mean Value} < 1.49$	None
$1.5 \leq \text{Mean Value} < 2.49$	Low
$2.5 \leq \text{Mean Value} < 3.49$	Moderate
$3.5 \leq \text{Mean Value} < 4.49$	High
$4.5 \leq \text{Mean Value} < 5.0$	Very high

### 4.1. Demographic Survey of the Respondents

Figure 1 the distribution of respondents' organization 34% of respondents belong to client organization while 33% each belongs to consultants and contracting organizations.

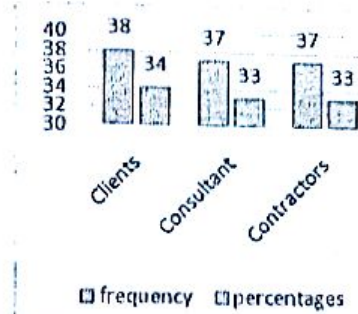


Figure 1: Nature of Respondents. Source: Researcher's Field Work (2017)

Figure 2 the profession of respondents revealed composition of Quantity surveyors, Architects, Builders, Civil engineers, Electrical and Mechanical engineers representing 40%, 22%, 18%, 13% and 7% respectively.

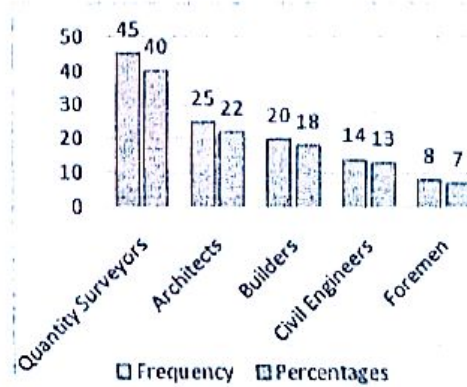


Figure 2: Respondents Profession. Source: Researcher's field works, (2017)

Figure 3 shows the respondents years of working experience in the construction industry. 9% of respondents have 1-5 years working experience; 18% of the respondents have 6-10 years of working experience; 40% of the respondents have 11-15 years of working experience; 40% of the respondents have 16-20 years working experience and 20% of the respondents have 21 & above years of working experience. This reveals that the majority of the respondents have the required years of working experience in the construction industry.

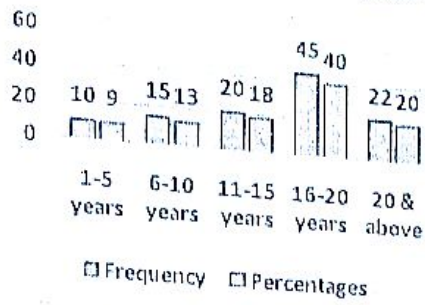


Figure 3: Respondents years of working experience. Researcher fieldwork, (2017)

TABLE 2: FACTORS THAT CAUSES OF REWORK IN BUILDING PROJECT.

Factors that causes reworks	Mean	SD	Rank
Poor leadership	4.86	.341	1
Lack of supervision	4.76	.424	2
Poor selection of sub-contractor	4.66	.515	3
Working overtime	4.61	.735	4
Design changes	4.42	.713	5
Poor communication between parties	4.17	.440	6
Insufficient skill manpower	4.10	.679	7
Lack of professional knowledge by project manager	4.08	.273	8
Lack of participation of client in the design process	4.05	.228	9
Conflict between parties	3.83	.890	10
Early delivery of materials	3.77	.634	11
Mistakes during the construction	3.71	1.41	12
Poor management of site	3.61	.622	13
Poor contractor selection	3.59	.524	14
Change of government	3.38	1.35	15
Variation	2.97	1.412	16
Inflation	2.64	.315	17
Absent of construction Data	2.54	.955	18
Design error	2.53	1.168	19
Poor financial control	2.52	.961	20
Economic recession	2.52	.905	21
Inexperience of project team	1.84	1.370	22

SOURCE: RESEARCHER'S FIELD WORK (2017)

Table 2 shows the factors that causes reworks in building projects. The top ranked factors are: poor leadership, lack of supervision, poor selection of sub-contractor and working overtime. These factors were ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, & 4<sup>th</sup> with the mean scores of 4.86, 4.76, 4.66 & 4.61 respectively. This implies that the

above mentioned factors are main factors that causes reworks in the building projects. In addition, the followings were considered as second major essential factors that courses rework in building projects. These are: design changes, poor communication between parties, insufficient skill manpower, lack of professional knowledge by project managers and lack of participation of client in the design process, conflict between parties, early delivery of materials, mistakes during the construction, poor management of site and poor contractor selection. These factors were ranked 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup>, 12<sup>th</sup>, 13<sup>th</sup>, & 14<sup>th</sup>. With the mean scores of 4.42, 4.17, 4.10, 4.08, 4.05, 3.83, 3.77, 3.71, 3.61, & 3.59 respectively. This show that the above listed factors are also leading factors that causes reworks in building projects in Nigeria.

Similarly, the followings were considered as least factors that causes reworks in building projects. These are: design error, poor financial control and economic recession. These factors were ranked 19<sup>th</sup>, 20<sup>th</sup>, 21<sup>st</sup>, & 22<sup>nd</sup> with the scores of 2.53, 2.52, & 1.84 respectively. This reflect that these factors ranked low have little effective on the causes of reworks in building projects. This results were in line with Love *et al.*, (2016) that highlighted the followings as causes of reworks in construction projects: variation, poor leadership, poor management of site, lack of supervision and poor financial control. Similarly, Hwang *et al.*, (2007) agreed with findings that causes of rework depend on the management roles in supervision, monitoring, and coordination of construction activities to accomplish the targeted. Oyewobi *et al.*, (2011) argued that the causes of reworks are poor workmanship, lack of details working drawing and method of construction projects adopted. In addition, Olawale and Sun (2010) agreed with findings that the causes of rework are: delay, cost overrun and reworks are poor leadership, poor contractor selection, mistakes during construction, design change and lack of supervision of construction works. Therefore, the paper deduced the followings factors that causes rework: These are: lack of supervision, poor selection of sub-contractor, working overtime, design changes, poor communication between parties, insufficient skill manpower, lack of professional knowledge by project managers and lack of participation of client in the design process.

Table 3 shows the mitigating measures to overcome the challenges of reworks in building projects. The main mitigating measures are: proper information and communication channels, uses of appropriate construction method, effective site management and supervision, quick decision making and systematic control mechanism. These mitigating measures were ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, & 5<sup>th</sup> with mean scores of 4.30, 3.43, 2.95, 2.78 & 2.51 respectively. This indicates that the above mention factors are the most imperative mitigating measure to overcome the challenges of reworks in the building projects.

Similarly, the followings mitigating measures were ranked lowest. These are: meeting with the stakeholders, adequate knowledge of construction, avoid working overtime and prompt materials and equipment. These

mitigating measures were ranked 16<sup>th</sup>, 17<sup>th</sup>, 18<sup>th</sup>, & 19<sup>th</sup> with mean scores of 1.41, 1.22, 1.14 respectively. This shows that the above listed mitigated measures have little significant influence in reducing the causes of rework in the building projects. Moreover, Palanesswaram (2006) conducted a study and outlined the followings as mitigating measure to reduce reworks in construction projects such as effective strategic planning, working strictly with working drawing, proper information and communication and meeting with stakeholders. However, Love and Edward (2004) agreed with findings that the followings are the measures to reduce reworks in building projects. These are: effective site management and supervision, frequent progress meeting, availability of skilled labours and materials, use of appropriate construction method, uses of experienced sub-contractor and suppliers and adequate knowledge of construction projects. Therefore, the paper deduced the followings as mitigating measures to overcome the challenges of reworks in building projects in Nigeria. These are: proper information and communication channels, uses of appropriate construction method, effective site management and supervision, quick decision making and systematic control mechanism.

TABLE 3. FACTORS THAT MITIGATE THE CAUSES OF REWORK IN BUILDING PROJECT

Reworks Mitigating Measures	Mean	SD	Ranked
Proper information and communication channels	4.30	1.173	1
Uses of appropriate construction method	3.43	.728	2
Effective site management and supervision	2.95	1.104	3
Quick decision making	2.78	.584	4
Systematic control mechanism	2.51	.692	5
Uses of experienced subcontractor and supplier	2.32	.709	6
Proper project planning & scheduling	2.30	1.469	7
Delegation of authority	2.14	.751	8
Use of standard construction materials	2.08	.363	9
Proper financial control on site	2.05	.329	10
Effective strategic planning	2.00	.882	11
Frequent progress meeting	1.97	.552	12
Working strictly with design	1.76	1.158	13
Prompt payment of labourers	1.57	.667	14
Availability of skilled labour and construction materials	1.57	.502	15
Meeting with the stakeholders	1.41	1.117	16
Adequate knowledge of construction	1.41	.498	17
Avoid working overtime	1.22	.417	18
Prompt materials and equipment	1.14	.391	19

RESEARCHER'S FIELD WORK (2017)

5. CONCLUSION

Rework is one of the essential difficulties that affect the performance of building projects in Nigeria. Therefore, the paper concluded by established Nine (9)

main causes of reworks in building projects: These are: (1) poor leadership, (2) lack of supervision, (3) poor selection of sub-contractor and (4) working overtime. Others include: (5) design change, (6) poor communication between parties, (7) insufficient skill manpower, (8) lack of professional knowledge by project managers and (9) lack of participation of client in the design process. In addition, the followings were established as mitigating measure to reduce reworks in building projects. These are: (1) proper information and communication channels, (2) uses of appropriate construction method, (3) effective site management & supervision; (4) quick decision making and (5) systematic control mechanism. Therefore, the paper recommended that the client should ensure there is adequate supervision and communication between the parties during the course of building projects. The contractors should engage experienced and qualified professional for effective site management and supervision and also encourage the use of appropriate construction method to achieve quality project delivery. The consultant should ensure quick decision making to avoid mistakes that will resulted into reworks and also develop a systematic control mechanism that would reduce the shoddy work. There is need for further empirical research on the elements that causes reworks frequently and the cost implication of reworks during the construction projects.

REFERENCES

Creswell, J. W. (2003). A framework for design, in Research design: qualitative, quantitative and mixed methods. Sage Publications, Thousand Oaks, CA.

Creswell, J. W. and Tashakkori, A. (2007). developing publishable mixed methods Journal of Mixed Methods Research. 1(2), 107-111.

Fayek RA, Dissanayake M, Campero O (2003). Measuring and classifying construction field rework: a pilot study. Department of Civil and Environmental Engineering, University of Alberta. Presented to the Construction Field Rework Committee, Construction Owners Association of Alberta, pp. 1-4.

Hafner, A. (1998). Descriptive statistics techniques for librarians. American Library Association Chicago: London.

Hwang, B.-G., Thomas, S. R., Haas, C. T., & Caldas, C. H. (2009, March) Measuring the Impact of Rework on Construction Cost Performance. Journal of Construction Engineering and Management, 187.

Josephson, P.-E., Larsson, B., & Li, H. (2002). Illustrative Benchmarking Rework and Rework Costs in Swedish Construction Industry. Journal of Management in Engineering, VOL.1 (No. 2), 76-83. 99

Kusim A.M (2016) Challenges of cost Management of infrastructural Development Science and Environmental Safety. 6, (1) 1-12.

Li Y and Taylor T, (2009). The Impact of Design Rework on Construction Project Performance. Journal of Construction Engineering and Management, 134(6), 421-431

Love, P. E., & Li, H. (2000). Quantifying the Causes and Costs of Rework in Construction. Construction Management and Economics, 479-490.

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- Love, P. E., & Sohal, A. S. (2003). Capturing Rework Costs in Projects. *Managerial Auditing Journal*, VOL. 18 (No. 4), 329-339.
- Love, P. E., Mohamed, S., & Wyatt, A. (1997). Understanding rework in construction. *Construction Process Re Engineering* (pp. 269-278). Gold Coast, Australia: Griffith University.
- Love, P., & Edwards, D. (2004). Determinants of Rework in Building Construction Projects. *Journal of Engineering, Construction and Architectural Management*, 11(4), 259-274
- Love, P. E. D. (2003). Influence of project type and procurement methods on rework costs in Building construction projects. *Journal of Construction and Engineering Management*. 128(1), 18-29.
- Love P., Mandal, P., Smith, J., & Georgiou J. (2005). DECOEM: A Design and Construction Rework Minimization Model. 1st International Conference on Systems Thinking in Management.
- Love, P., (2005). Auditing the Indirect Consequences of Rework in Construction: a case based Approach. *Managerial Auditing Journal* 17 (3), 138 - 146.
- Love O.E.D; Ackermann F; Carey B; Morrison J; Ward M; and Park A (2016) Praxis of Rework Mitigation in Construction. *Journal of Management in Engineering*, © ASCE, ISSN 0742 597X.
- Mastenbrock, Y. (2010). Reducing rework costs in construction projects. Bachelor Thesis. Twente, Netherlands: University of Twente.
- Morenikeji, W. (2006). Research and Analytical Methods (for Social Scientists, Planners and Environmentalists). Jos: Jos University Press Limited
- Nzekwe, J.U, Oladejo, E.L and Emoth, F. I. (2015) Project failure as a Procuing Issue in developing countries *International Journal of Energy and Environmental Research* vol. 3 No 3 pp 1-20.
- Olawale, Y.A and Sun, M (2010), cost and time control of construction projects: inhibiting factors and Miligating measures in practice construction management economy 28.509 - 526.
- Oyewobi, L. O., Ibranke, O. T., Ganiyu, B. O., & Ola-Awo, A. W. (2011). Evaluating rework cost- A study of selected building projects. *Journal of Geography and Regional Planning*. 4(3), 147-151
- Palaneeswaran E, Ramanathan M and Tam C (2007) Rework in Projects: Learning from Errors. *Surveying and Built Environment* Vol 18 (2), 47-58, ISSN 1816-9554
- Palaneeswaran, E. (2006) "Reducing rework to enhance project performance levels", *Proceedings of the One Day Seminar on Recent Developments in Project Management in Hong Kong*, Centre for Infrastructure and Construction Industry Development, Hong Kong, 5.1-5.10.
- Palaneeswaran, E., Ramanathan, M., and Tam, C.M. (2007) "Reducing design rework in construction projects", *Proceedings of the 4th World Project Management Week on Project Management: "Driving Growth, Creating Equality"* Conference, Singapore, CDROM, 11 pages.
- Riemer, J.W. (1976) "Mistakes at work - the social organization of error in building work", *Social Problems*, 23(3), 255-267.
- Rounce, G. (1998) "Quality, waste, and cost consideration in architectural building design management", *International Journal of Project Management*, 16(2), 123-127
- Smith, G. R., & Jirik, T. (2006). RR 203-11 Making Zero Rework A Reality. A Comparison of Zero Accident Methodology to Zero Rework and Quality Management. Construction Industry Institute. Austin: CII
- Toor S. Uand Ofor G (2009) authenticity and its influence on psychological wellbeing and contingent self-esteem of leaders in Singapore construction sector. *Construction Management and Economics*, 27, 299-313