

FACTORS INFLUENCING REWORK OCCURRENCE IN SOME SELECTED ONGOING BUILDING PROJECT, ABUJA

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Rework is the act of carrying out a work for the second time due to defect. It remains a chronic problem in the construction industry because of human imperfection. It is a menace in the Nigerian construction industry as it contributes to cost and overruns in projects. It leads to clients' and contractors' dissatisfaction. The aim of this research is to study factors causing rework occurrence in ongoing building project and elements that can be influenced by it. It is a criterion-based research. The targeted population comprised 25 ongoing building projects, precisely commercial buildings. Data collection was carried out with the use of structured questionnaire and checklist for archival data. Data presentation was done using frequency table and bar charts while data were analyzed using relative importance index and T-test. The result of the analysis showed that the level of occurrence of rework in building elements varies. It was discovered that the main factors causing rework are poor workmanship, defective materials and incompetent supervision and elements mostly affected are Blockwork, Roof and plastering. Conclusively, the level of rework is one of the key determinants to project performance. Construction team all have crucial roles to play in the success of any project. Construction organizations should re-examine the way they conduct their operations, become technically oriented and become prevention-focused to help strive for better organizational management.

Keywords: Construction, Cost Overrun, Ongoing Project, Rework.

INTRODUCTION

Construction is one of the largest and most dependable industries that has contributed immensely to our economy and about 10% of the Gross National Product (GNP) according to (Navon, 2005). The construction industry has been in existence since ancient times as nature itself because it involves a general project that affects all people. Many construction projects report poor performance due to evidences in specific causes as changes in designs, lack of project leadership skills leading to rework (UNRWA, 2006). It is complex in nature as it is made up of different sections, for instance, the clients, contractors, consultants, etc. (Dlakwa and Culpin, 2010) reports that the Nigerian Construction Investment is over 60% of the Gross fixed capital formation (GFCF). Building industry is a subset of the most important sectors in the Nigerian economy, (Adedeji, 2008) and one of the threats to the building industry is "Rework".

It is defined as the act of correcting, rebuilding or redoing defects that has been done in the initial. It is also the unnecessary effort of redoing a process or activity that is incorrectly implemented the first time (Oyewobi, 2011). According to Navigant Construction Forum (2012), American society of civil Engineers and Love (2010), reworks has a considerable impact on the industry as a whole because it leads to lower productivity, less trust and profit, increased workforce.

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It is prolific in the construction industry. It is even a popular terminology in construction industry. A project, irrespective of completion time or cost fitting is indeed a failed one if it is not a quality one and cannot perform its function, it is called a white elephant project. In a study Baker, Fisher and Murphy, (2010) to gauge the value of customer satisfaction as a measure of project success, analysis of responses from project managers caused the researchers to conclude that that project success means much more than merely meeting cost schedules and performance specifications. This research states the problem of the factors causing reworks in selected ongoing building project and the elements that can be influenced by it to help improve quality project, cost and time overrun. The aim of this research is to examine the factors influencing reworks of selected ongoing building projects while its objectives are, (1) To identify factors causing reworks in selected ongoing building project. (2) To determine rework's level of occurrence in selected superstructure elements. (3) To determine the difference between final cost of rework and initial cost of rework in superstructure elements. This research examines factors influencing reworks of selected ongoing building projects as different researchers have proven that rework is the major cause of cost and schedule overrun (Oyewobi *et al.*, 2010) and (Wasfy, 2010) said that it leads to client's dissatisfaction which threatens the construction industry.

Rework in Construction Project

The construction industry has the iniquitous reputation of being fragmented, lacking coordination and communication between parties, creating adversarial contractual relationships and lacking customer focus (Love, Edwards and Smith 2005). Besides, there is generally an absence of systems within projects to monitor and control rework (Hwang, Thomas, Haas and Caddas, 2009). This combination of problems has meant that rework has become an insidious problem and consequently, the costs of rework have been found to be considerable (Love *et al.*, 2005). Love, Holt, Shen, Li, and Irani (2002) stated that both the internal and external environments of construction projects are dynamic and relatively unstable. Tasks performed in construction projects are typically divided between professional disciplines (architect, structural engineer, project manager) and trade disciplines (the contractors' and sub-contractors' carpenters, bricklayers, plumbers), which frequently operate independently of one another. Oyewobi and Ogunsemi (2010) reported that the genesis of the problems experienced by the construction industry and clients lie in the division of the responsibilities between the design and the construction aspect. A direct criticism of the organizational structure of the construction industry by many researchers is that the construction industry is different in the sense that the design process is separated from construction process. Adejimi (2005) argued that construction is not well-connected or integrated until at the terminal end of each other rather than overlapping and mutually benefiting throughout the process. Adejimi (2005) further opined that if the design process is to be enhanced, the participants within the industry, including the architects, planners, engineers, contractors and the initiator of the process, need to come together in well-coordinated effort, especially if rework-free construction is to be attained. The occurrence of rework can be attributed to changes during the design and construction stage. Love (2002) affirmed that a degree of change can be, and to a certain extent should be expected in construction, as it is difficult for clients to visualize the end product that they procure. Othman, Jaafar, Harun, and Ibrahim (2016) identified that building defects can be categorized into two which are patent and latent defects. Patent defects are visual defects while latent defects are not but becomes apparent at a later date. Constructability is a problem in Nigerian construction industry according to Ibrahim *et al.* (2012) so it should be more frequent than ever because it is a strategy used to attain maximum skills of construction knowledge throughout the construction process and balance various project constraints to achieve building performance.

Rework Occurrence and Superstructure Elements

Ransom (2017) stresses that defect in buildings occur not only due to lack of knowledge but also by non-application and misapplication of knowledge. Despite the considerable amount of research that has been undertaken, there is limited evidence that rework has been reduced to improve project performance (Aiyetan 2013; Hwang *et al.* 2014; Kakitahi *et al.* 2014; Taggart *et al.* 2014; Jingmond and Agren 2015). According to Dahanayake and Ramachandra (2015), building elements that can be affected by rework and their percentage of occurrence are as follows; Block work in superstructure, Door 5%, Window 5%, Column

27%, Beam 27%, Lintel, Slab 27%, Roof 11%, Plastering 10%. According to Aiyetan (2014); Frame and Upper floor, Stair, Slope, Floor opening, Balustrade, Handrail. Factors influencing rework occurrence are as follows; wrong laying of forming course (block work), poor quality of concrete, poor plastering, deflection of part of slab, lack of attention to quality, lack of support to site management, ineffective coordination and integration of components, use of poor materials, use of poor materials, omissions during construction, quality failure, lack of proper monitoring and evaluation, errors during construction, overlooked site condition, poor site practices Aiyetan (2014). In addition, poor communication and improper use of technology leads to rework, lack of experience and knowledge of design and construction process and lack of client involvement in the project according to Love *et al.* (2012a) and Ye *et al.* (2014). Subcontractor selection is also vital as was proposed by Tiamsiyu (2012) because it can improve or reduce the overall performance of the project. Mastenbroek (2010) suggested that work preparation before design and construction stage is essential.

METHODOLOGY

The criteria set for this research are as follows; it must be a commercial building, it must be an ongoing project, it must be located in Abuja, it must not be an abandoned project, it must be 75% complete. This percentage completeness of a building is determined by the number of items completed, also Actual Time Elapsed/ (Actual Time Elapsed + Remaining Duration) and during the course of data collection, 25 construction companies met the research criteria that was why the sample size was selected. As such, 25 Questionnaires and checklists were administered based on the targeted population for this research which is 25 commercial ongoing building projects supervised by 25 different construction companies within Abuja metropolis. The questionnaire is the primary source of data collection which identified factors causing rework and the superstructure elements ranked by the respondents based on a 5 point likert- scale using Relative Importance Index (RII).

RESULT AND DISCUSSION

The questionnaire and check-list respondent profession consists of Quantity Surveyor, Architect, Civil Engineer, Builder and a total of twenty-five questionnaires and check-list were returned showing an effective response rate of 100%.

Figure 1, Quantity Surveyors emerged the largest contributor to this research with percentage of 48%, followed by the Architects with percentage of 28%, next is the Civil engineers with percentage of 16% and lastly the Builders with percentage of 8% which is the lowest.

Figure 2 shows the academic qualifications of respondents, respondents with BSc. / B. Tech made the largest quota of responses to this research with 63%, followed by M.Sc. / M. Tech with 20%, Diploma with 15% and PhD with 2% respectively.

Figure 3 shows the years of respondent's experience in the Nigerian construction industry, where less than 5 years, 5 – 10 years, 11 – 15 years and 16 – 20 years have 15%, 55%, 20%, 10% percentage contribution respectively. This shows that the respondents are experienced and can provide useful information for this research.

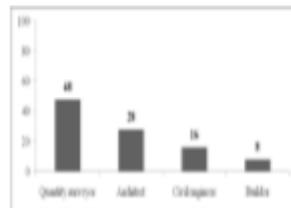


Fig. 1: Profession of Respondents

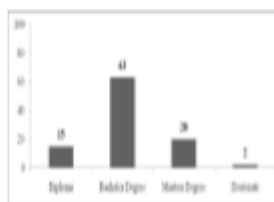


Fig. 2: Academic Qualifications of Respondents

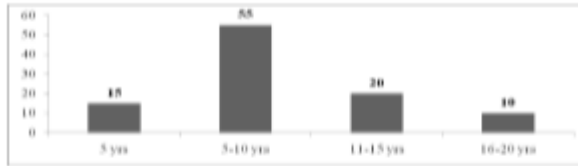


Fig. 3: Experience of Respondents

Table 1: Factors Causing Rework.

Factors	1	2	3	4	5	RII	Rank
Poor workmanship	0	2	2	5	16	0.88	1 st
Defective materials	1	1	2	7	14	0.86	2 nd
Incompetent supervision	2	3	0	5	15	0.82	3 rd
Insufficient supervision	1	2	5	5	12	0.80	4 th
Lack of coordination	1	5	0	9	10	0.78	5 th
Errors and omission in drawings	0	3	8	5	9	0.76	6 th
Deviation from drawing	5	0	4	5	11	0.74	7 th
Improper subcontractor selection	4	5	1	4	11	0.70	8 th
Improper work sequencing	5	4	5	5	6	0.62	9 th
Wrong materials	5	8	9	0	3	0.50	10 th

Source: Researcher's Analysis (2017)

Table 2: Level of Occurrence of Rework

superstructure Elements	1	2	3	4	5	RII	Rank
Blockwork	0	1	11	12	1	0.70	1 st
Roofs	0	4	9	10	2	0.68	2 nd
Plastering	0	2	16	6	1	0.65	3 rd
Beam	0	5	17	3	0	0.58	4 th
Column	0	6	16	3	0	0.58	4 th
Lintel	0	6	17	2	0	0.57	5 th
Slab	0	9	13	3	0	0.55	6 th
Frame & floors	0	17	6	2	0	0.48	7 th
Door	1	19	4	1	0	0.44	8 th
Window	1	19	4	1	0	0.44	8 th

Source: Researcher's Analysis (2017)

Table 1 shows the ranking of the factors causing reworks in ongoing building projects using relative importance index, the greater the index score the higher the rank. Therefore, the main causes of reworks are: "Poor workmanship" ranked 1st with RII of 0.88, followed by "Defective materials" and "Incompetent supervision" with RII of 0.86 and 0.82 respectively. "Insufficient supervision" ranked 4th with RII of 0.80%, "Lack of coordination" ranked 5th with RII of 0.78%, "Errors and omission in drawings" ranked 6th with RII of 0.76%, "Deviation from drawing", "Improper subcontractor selection", "Improper work sequencing", "Wrong materials" with RII of, 0.74, 0.70, 0.62 and 0.50 respectively.

Table 2 shows the ranking of the level of occurrence of rework in superstructure elements using relative importance index. The effect of rework in the superstructure elements are: "Blockwork" was ranked 1st with RII of 0.70, "Roof" was ranked 2nd with RII of 0.68, "Plastering" was ranked 3rd with RII of 0.65 while Beam, Column, Lintel, Slab, Frame & floors, Door and Window with RII of 0.58, 0.58, 0.57, 0.55, 0.48 and 0.44 respectively.

The first objective of this study was to identify the factors causing reworks in selected ongoing building project. Comparing this research with that of Tiemiya (2012), Poor workmanship was ranked first which disagrees with his. Defective materials were ranked second in this research whereas his is poor workmanship. One of the reasons why many construction projects experience rework is as a result of poor workmanship offered by the contractors and subcontractors because leads to cost overrun in construction projects.

The second objective of this study was to determine the level of occurrence of rework in selected superstructure elements. Rework occur most in Blockwork, Roofs and Plastering based on the analysis result whereas in Tiamsiyu (2012), Blockwork, roofing and finishes were ranked 1st, 7th and 8th. On average, the research concurs with Tiamsiyu (2012).

The third objective of this study was to determine the difference between cost of rework and initial cost of superstructure elements. From the result of the analysis carried out, rework often lead to cost overrun in building project which means there is significant difference between initial contract sum and final contract sum. If the client is not able to meet the financial commitment this may result to project abandonment.

Table 3: T -Test Analysis For Significance Test

S/ N	Variable	Year Span				N	95% CI for Mean Difference	R	T	Df	Remark
		Initial		Rework							
		M	SD	M	SD						
1	Cost	6346266.67	4650067.95	554266.67	623231.01	15	3646767.06, 8075252.06	0.7	5.34*	14	SS

Source: Researcher's Analysis (2017)

CONCLUSION AND RECOMMENDATION

This research work revealed the factors causing rework and elements that can be influenced by it. The factors causing reworks are: Poor workmanship, Defective materials, Incompetent supervision, Insufficient supervision, Lack of coordination, Errors and omission in drawings, Deviation from drawing, Improper subcontractor selection, Improper work sequencing and Wrong materials. The elements that can be influenced by it are: Blockwork, Roofs, Plastering, Beam, Column, Lintel, Slab, Frame & floors, Door and Window. Therefore, it can be concluded that the factors considered in this study has a profound impact on the selected building elements considered in this study. New method of construction need to be adopted including intensive training in other to attain constructability thereby minimizing deviation of cost and time overrun and quality and hereby recommends the following.

- i. Attention should be given to the management style of different construction organizations as it contributes to constructability in the construction sector, negligence during construction, should also be avoided.
- ii. Constructability should be implemented by construction organizations to help renew their system of operation and reinforce them for higher levels of performance.
- iii. Construction organizations should re-examine the way they conduct their operations, become technically oriented and prevention-focused to strive for better organizational management.

REFERENCE

- Adejim, A. (2005). Poor building maintenance in Nigeria: Are Architects free from blame. *Being paper presented at the ENMIR international conference on Housing: New challenges and innovations in tomorrow's cities*, (pp. 1-16). Iceland.
- Aiyetan, A. O. (2013). Causes of Rework on Building Construction Projects in Nigeria. *J. Construction Project Management Innovation*, 12(3), 1-15.
- Aiyetan, O. A. (2014). Rework Cost on Building Projects in the South western part of Nigeria. *Journal of Construction Project Management and Innovation*, 1-15.
- Baker, B. N., Murphy, B.C. and Fisher, D. (2000). Factors Affecting Project Success. *Dahanayake and Ramachandra . (2015). 6th International Conference on Structural Engineering and Construction Management*. Kandy, Sri Lanka.
- Enache-pommer E and Homsan M. (2009). In *"Key Processes in the Building Delivery of Green Hospitals" Building Sustainance Future*, (pp. pp. 636-645.).
- Hwang, B. G., Thomas, S. R., Haas, C. T., and Caddas, C. H. (2009). Measuring the Impact of Rework on Construction Cost Performance. *Journal of Construction Engineering and Management*, 135 (3): 187-198.
- Ibrahim Mahamid. (2016). Analysis of Rework in Residential Building Projects in Palestine.

- Jingmond, M., and Ågren, R. (2015). Unravelling Causes of Defects in Construction. *Construction Innovation*, 15, 198-218.
- John M. Kakitahi, H. M. (2014). A Comparison of Construction Related Rework in Uganda and Mozambique. *Journal of Construction Project Management and Innovation*, 1-12.
- Kakitahi, J. M., Alinaitwe, H. M., Landin, A., and Rodrigues, M. J. A. (2014). Comparison of Construction-related Rework in Uganda and Mozambique. *J. Construction Project Management Innovation* 4(1), 770-781.
- Love, P. E. D. (2002a). Influence of project type and procurement Method of Rework Costs in Building Construction Projects. *Journal of Construction Engineering and Management*, 128 (1): 1-29.
- Love, P. E. D. (2002b). Auditing the indirect consequences of rework in construction: a case based approach. *Managerial Auditing Journal*, 17 (3): 138-146.
- Love, P. E. D., Edwards, D. J., and Irani, Z. (2012a). Moving Beyond Optimism Bias and Strategic misrepresentation: An Explanation for Social Infrastructure Project Cost Overruns. *IEEE Trans. Engineering and Management* 59(4), 560-571.
- Love, P. E.D., Edwards, D. J., Smith, J. (2005). A forensic examination of the causal mechanisms of rework in a structural steel supply chain. *Managerial Auditing Journal*, 20 (2): 187-197.
- Love, P.E.D. (2010). Determining the Causal Structure of Rework Influences in Construction.
- Love, P.E.D., Holt, G.D., Shen, L.Y., Li, H., and Irani, Z. (2002). Using systems dynamics to better understand change and rework in construction project, management systems. *International Journal of Project Management*, 20 (6): 425-436.
- Mastenbroek Y.C. (2010). *Reducing Rework Cost in Construction Project*. Published Bachelor Degree Thesis.
- Mosuka, T. O., Kehinde, J. O and Kuroshi, P. A. (2006). Control of Building Practice for Sustainable Development in Nigeria. *Matters Arising : proceeding of the international conference on the built environment, innovation, policy and sustainable development* (pp. 26-33). Ota, Lagos: Department of Architecture, Covenant University.
- Navigant Construction Forum. (2012). *The Impact of Rework on Construction and Some Practical Remedies*.
- Othman, N. L., Jaafar, M., Harun, W. M., & Ibrahim, F. (2014). A Case Study on Moisture Problems and Building Defect. *Procedia - Social and Behavioral Sciences*, (pp. 27 -36).
- Oyewobi L.O. , (2011). Evaluating Rework cost- A Study of Selected Building Project in Niger State, Nigeria. 147-151.
- Oyewobi L.O., Ogunsemi D.R. (2010). Factors Influencing Reworks Occurrence in Construction: A Study of Selected Building Project in Nigeria. *Journal of Building Performance*, Volume 1 (issue 1 2010). *Journal of Building Performance*, Vol.1 (issue 1).
- Oyewobi, L.O. and Ogunsemi, D.R. (2010). Factors influencing rework occurrence in construction: A study of selected building projects in Nigeria. *Journal of Building Performance, The Institution of Surveyors Malaysia*, 1 (1): 1-20.
- Ramson, W. (2017). In *Building Failures: Diagnosis and Avoidance: analysis. Automation in Construction* (pp. 20, 1051-1059). London: E & FN Spon.
- Tiamiya A. L. (2012). *Factors Influencing Reworks Occurrence in Selected Building Project*. Abuja.
- Ye, G., Jin, Z., Xia, B., and Skitmore, M. (2014). Analyzing Causes for Reworks in Construction Projects in China. *J. Management Engineering* 10.1061/(ASCE)ME.1943-5479.0000347, 04014697.

