ISSN No:-2456-2165

Factors Impeding the Completion of Scheduled Tasks on Construction Sites within the University of Jos Premises

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Abstract :- The construction industry in Nigeria has continually been thriving at the apex of the nation' economy and has all the while persistently not measured up to global standards largely due to staticity and inadequacies of the planning systems to reliably foresee and forecast what would happen in the construction stage thereby giving rise to costly delays. This research was conducted by reviewing relevant literature and primary data were collected by oral interviews and site investigation which was carried out daily for 11 weeks on three independent sites within the premises of the University of Jos permanent site taking records of all activities in the weekly work programs and subsequently comparing the work progress with the work program and taking records of the various reasons for plan deviation. A Pareto analysis was applied to identify the vital factors responsible for 80% of the reasons for plan deviation and they are; Performance variation and lack of resources, the trivial factors responsible for 20% of reasons for variances are; Lack of prerequisites, non-value adding work and lack of directives. The study came to a conclusion that projects suffer mainly due to performance variation and lack of resources due to the absence of collaborative planning involving all the stakeholders in the project.

Keywords: *- Assignments, Construction Sites, Delay, Lean Construction, Trivial Factors, Workflow, Vital Factors*

I. INTRODUCTION

The Nigerian construction sector has incessantly made headway in terms of the nation's economy.It has thus far consistently performed far below average in the way capital infrastructural developments are controlled (Moavenzadeh, and Dantata, 2007; Dantata, 2008; Olusegun and Michael, 2011) and this has a straight impact on the economy of the nation as most projects are deserted, in a poor state of completion or not completed within budgetary confines.

Construction is an intricate trade, whose schemes are progressively more technically tricky as well as exposed to shorter execution plans and costs due to industry demands. In the course of the construction stage, projects are affected by improbability consequential from pressing necessities, non-consistent construction structures, and lack of harmonization at the supply chain, project scope fluctuations, and poor quality, amongst others. It appears that the joint outcome of intricacy and uncertainty in projects creates variability in the construction processes (Horman 2000). Variability is widely problematic in the construction sector and can prompt dynamic and unanticipated situations, unsteadying project goals and obscuring the means to attain them. On the flip side variability leads to a total depreciation of projects on scopes such as: cycle time (González and Alarcón, 2005), labour output (Thomas, Marossezky, Karim, Davis, McGeorge,2002).

A major contributor to improving workflow consistency has been the explicit use of production management procedures as inspired by Lean Construction principles. A key component in addressing work flow reliability is comparison between work planned and work performed on a weekly basis, or any other project appropriate resolution (Abdelhamid Gafy & Salem, 2009). "Lean Construction scholars have typically referred to two types of failure in production work. The first type is planning failures or factors that essentially prevent a work (assignment) from starting, the second type is execution failure or factors that prevent an assignment from being executed completely.

Eliminating squandered time and effort epitomizes the biggest prospect for performance Improvement (Egan report, 1998).

This research work sought to identify the factors predominantly impeding the execution of assignments in the weekly work programs in construction sites.

II. AN OUTLOOK OF THE NIGERIAN CONSTRUCTION TRADE IN THE CONTEXT OF DELAYS

A foremost disapproval fronting the Nigerian construction industry is the degree of delays in project execution and delivery. Delay is a condition where either the contractor or the client or both partake in activities that leads to the non-completion of the project within the postulated contract period. According to Chan and Kumaraswanmy,(1993), on-time and on-budget delivery of projects within the standard of technical requirement by the client is a pointer to effective project delivery.

Mansfield, Ugwu & Doran (1994), carried out a questionnaire survey amongst 50 construction industry stakeholders in Nigeria revealing the vital variables triggering delays in construction are poor project

management, funding, fluctuations in site situations, unavailability of materials, plants, changes in design, suppliers and subcontractors.

As revealed in the study of Olusegun and Michael, (2011), the reasons for abandoned project within Nigerian are inadequate or poorly executed project planning, deviation of project scope, defective designs and erroneous estimates.

➢ *Nigerian Construction Clients*

According to Business Dictionary (2011), a client is a customer of any qualified service supplier or the principal of any agent or contractor. The client the sponsor when it comes to acquiring goods or services for his consumption or use in other words the construction client somewhat a customer (Vennstrom, 2008). In the context of this research however, a client is acknowledged as the person that consigns others to execute construction projects/assignments. They are separated into two chief categories viz.; public sector clients and private sector clients (Othman, 2011).

According to Othman 2011, Public sector clients comprise of Corporations, National, State and Local government parastatals in Nigeria that carry out construction projects, on the other hand, the private sector clients comprise of individual, commercial, cooperate and industrial and developers who carry out the production projects in Nigeria.

➢ *Nigerian Construction Industry Contractors*

In Nigeria, the construction trade is characteristically controlled by small and medium sized indigenous contractors who are mostly tangled in private residential building projects, these set of contractors are typically billed as unorganised groups and contracts awarded to them commonly comprise of simple residential building projects built by private clients constructed through the work of hired artisans and labor and in some cases, the client often supervises the construction directly, with the government not having any direct power on the project activities.

On the other hand, the foremost contractors who constitute the organized sector are made up of reputable contractors who are formally listed and licensed execute construction activities and their workforce is mainly comprised of skilled workers from different parts of the world and Nigeria inclusive. Local contractors are contracting organizations that are completely owned and managed by Nigerians (Idoro and Akande-Subar, 2008).

The deliberation on project management output in the Nigerian construction trade hinges primarily on the performances of foreign and indigenous contractors" (Idoro and Akande-Subar, 2008). The performance of projects under the control of indigenous contractors are superior and appealed they can be assigned with big and exceedingly methodical projects, however, other researches revealed that their performance is categorized by features of project management failure stemming from: neglect, cost and time overruns, poor workmanship, poor organization capability, financial difficulties, poor preparation, poor mechanization and high regularity of litigation (Idrus and Sodangi, 2010).

Numerous studies have linked Nigerian indigenous contractors below-par performance to inability, inexperience, poor forecasting and the implementation of traditional organization methods; which have proven to be unsuccessful in managing construction projects" (Ekundayo, Jewell and Awodele, 2013). Most of homegrown contractors project management performance failings can be mitigated by way of training, pre-construction planning and the adoption of modern construction procedures and, these can be generally restrained through the application of project management techniques (Aniekwu and Audu, 2010).

➢ *The Performance of the Nigerian Construction Industry*

The Nigerian construction trade have been challenged by numerous factors that tend to impede its growth (Oluwakiyesi, 2011). The industry has been suffering due to such factors as; complication of project; incomplete working drawings; lack of tools and equipment's by contractors; partial specification; rigidity of clients; financial shortcomings; sub-standardisation of design; construction inexperience by the client; ineffective communication; lack of harmony between the designers and contractors (Aina and Wahab 2011), According to Windapo & Olusegun (2011), contractor capability; external forces; contract deferments; conflicting site settings; labour; accessibility to equipment; changes in scope of work; erroneous designs; inflation; labour disputes. All these attributes to project delays, cost overruns and poor quality work.

➢ *Project' Constraints*

To quantify the efficiency of the construction system to execute tasks, the number of completed tasks is conveyed as a ratio of the total number of tasks committed in a given week. This ratio is known as the Percent Plan Completed or PPC (ranges from 0 to 100%) which is a metric reflecting the effectiveness of production planning and the reliability of workflow from one trade to another (Ballard 2000).

At present, there is no device to anticipate the effect of recognized production constraints on workflow before continuing with the work, furthermore, not understanding the relationship between production constraints and workflow prevents the differentiation of the constraints based on high or low impact. This may be an underlying reason for why getting to 100% PPC values, in a given time period, is still not achieved in practice (Ballard, 2000).

➢ *Classification of Production Constraints*

Lean Construction scholars have characteristically referred to two types of failure in production work. The first type is planning failures or factors that essentially prevent a work (assignment) from starting. These factors

ISSN No:-2456-2165

are identified during the constraint analysis stage as well as during the weekly work planning meetings. It is suggested here that these fall into three broad categories, namely: Pre-Requisite Work, Directives, and Resources. These groups characterize the comprehensive list of factors that if present will prevent the planned assignment/work from starting. Examples of these include coordination issues, regulatory inspections, unapproved submittals, lacking specifications, incomplete change order authorizations, availability of space, labor, material, and/or equipment" (Mitropoulos, 2005).

If all the rudiments covered under Prerequisite work, Directives, and Resources are satisfied and available, then the start of work is secured – there are no planning failures. However, this does not ensure the finish of the work that is started. This is because finishing a started assignment to its required conditions of satisfaction depends on having no execution failures, execution failures come from three main types of elements. According to Liker (2004), these are Muda (Unnecessary work/waste), Mura (Variation), and Muri (Overburden).

Figure shows the relation between these three elements relative to the crew capability (capacity) for work. For example, if the crew is working much below capability, then there is waste. Conversely, if the crew is working above capability, then there is overburden and likelihood of fatigue and accidents increases" (Abdelhamid .et al,2009).

- *Analysis of the Correlation between Construction Constraints and Construction Workflow: An Sem Approach (Source: Abdelhamid .Et Al, 2009)*

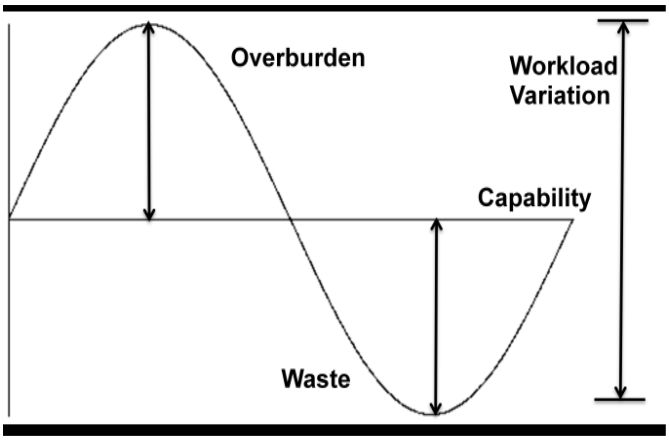

Fig 1:- Relation between Waste, Overburden, and Variation Relative to Crew Work Capability

Consequently, it is essential to view these three types of execution failures as they impact finishing work after it has resumed. Therefore, all the different types of factors that fall under Mura, Muri and Muda should be considered as important production constraints that lower workflow reliability.

III. METHODOLOGY

This study was designed to test the performance of the planning structure employed in the Nigerian construction trade in order to learn about planning failures, the research looked to identify areas in the planning system that needs critical attention in order to make planning more reliable. Primary data was obtained by oral interviews to site participants and daily site investigation. The research entailed a site investigation of the construction process of three sites: The first and second sites involved the construction of faculty blocks of offices with a schedule of construction up to 24 weeks and 22 weeks respectively; the third site involved the construction of a hostel block with schedule of construction up to 55 weeks. A weekly work chart was designed to aid the site investigation and oral interview process, the chart had columns for assignments, make ready needs and reasons for non-completion of assignments. The data collection process entailed studying the weekly work program of each site and each assignment on the work program was entered into the weekly work chart designed for data collection purposes, at the beginning of each week assignments that are ready to be started were highlighted and those not ready were also highlighted and adjudged to be planning failures. In the course of daily investigation those assignments that were found to be ready to start at the beginning of the week but due to one reason or the other deviated from the plan were also highlighted and adjudged as execution failures. With the aid of the weekly work chart designed for data collection and by the way of oral interviews, the underlying reasons for each planning and execution failure were recorded on daily basis, the reasons for each planning failure was recorded under the column of 'make ready needs' while those of execution failures were recorded under 'reasons for variances'. The period of data collection for site A was 10 weeks when the work completion for the stipulated time was 51.5% whilst for site B, the period of data collection was 11 weeks when the work completion at the stipulated time was 76%. For site C, the period of data collection was 4 weeks with a work completion of 13.2%. Data analysis was carried out using the Pareto principle – The use of a Pareto chart to separate the "vital few" from the "trivial many." These charts are based on the Pareto Principle which states that 20 percent of the problems have 80 percent of the impact. The 20 percent of the problems are the "vital few" and the remaining problems are the "trivial many." A Pareto chart can be used for separating the few *major* problems from the many possible problems so you can focus your improvement efforts. The figures 80 and 20 are illustrative – the Pareto Principle illustrates the lack of symmetry that often appears between work put in and results achieved. For example, 13% of work could generate 87% of returns. Or 70% of problems could be resolved by dealing with 30% of the causes.

ISSN No:-2456-2165

IV. RESULTS AND DISCUSSION

The research results are based on the analysis of data collected in the course of site investigation regarding the construction processes of the aforementioned three construction sites. An oral interview was conducted in order to identify the various reasons for both planning and execution failures. All factors were grouped into their respective categories and analysed as appropriate.

➢ *Factors Responsible for Plan Variation*

Lean construction scholars have typically referred to two types of failure in production work. The first type is planning failures or factors that essentially prevent a work (assignment) from starting. The factors of planning failure recorded in the data collection are shown in Table 1

Finishing a started assignment to its required condition of satisfaction depends on having no execution failures, the execution failures come from three main elements, these are Muda (Unnecessary work/waste), Mura (Variation) and Muri (Overburden), the reasons for non-completion of planned assignments were recorded and grouped into the main elements of planning and execution failures, the factors of execution failure and the various reasons grouped into the different elements recorded in the research are shown in Table 2. Table 3, shows the factors responsible for plan variation in descending order with their respective cumulative percentages.

Factor	Reasons for non-completion of assignments	Frequency of occurrence	
Prerequisite work	Unavailability of prerequisites	11	
Directives	Incomplete drawings	2	
Resources	Shortage of funds from client	7	
	Shortage of materials on site	8	16
	Shortage of workers present	1	

Table 1:- Planning Failures Resulting to Non-Completion of Weekly Assignments

Table 1 above shows that the availability/unavailability of resources plays the biggest role in planning failures with sixteen (16) occurrences with Prerequisite work coming next having 11 occurrences while directives came a distant third with just two (2) occurrences.

Factors	Reasons	Frequency of occurrence	
Performance variation	Rainfall interruption	8	
	Poor commitment from workers	9	25
	Delayed supply of materials	3	
	Change of priority	5	
Non- value adding work	Additional work caused by accumulation of rain water in trenches	3	
	Human error during construction leading to rework	2	5
Overburden		0	

Table 2:- Execution Failures Responsible for Non-Completion of Weekly Assignments

From Table 2 above it could be seen that the major cause of execution failures emanated from performance variation which occurs 25 times all through the site investigation period with Non-value adding work coming a distant second with 2 occurrences while Overburden did not appear to have any consequence on execution failure with zero occurrence.

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Factors		Frequency	Percentage %	Cumulative percentage
Performance Variation	PV	25	42.4	42.4
Resources	R	16	27.1	69.5
Pre-requisite Work	PW	11	18.6	88.1
Non-Value Adding Work	NVAW	5	8.5	96.6
Directives	D	2	3.4	100
Overburden	O	0	0	100
Total		59	100	

Table 3:- Factors Responsible for Variances on Construction Sites

Table 3 shows the cumulative frequency of all factors responsible for plan variation.

➢ *Data Analysis*

A Pareto analysis was carried out on MS Excel to identify the predominant factors responsible for plan variation at the construction stage by separating the vital few from the trivial many using the 20/80 rule as explained in chapter three.

A Pareto chart showing the vital few factors and the trivial many is shown in figure 2, According to the Pareto rule only 20% of factors are responsible for 80% of the major problems, going by this rule Performance variation (PV) and Resources (R) are the predominant factors that needs the most attention in the planning process in order to achieve a reliable work flow and are shown at the left side of the intersection of the cumulative frequency curve and 80% mark on the secondary vertical axis of the Pareto chart (Figure 2)

The trivial or less important factors that also affect workflow at the construction stage are shown on the right side of the Pareto chart. The breakdown of the vital and trivial factors are shown on table 4

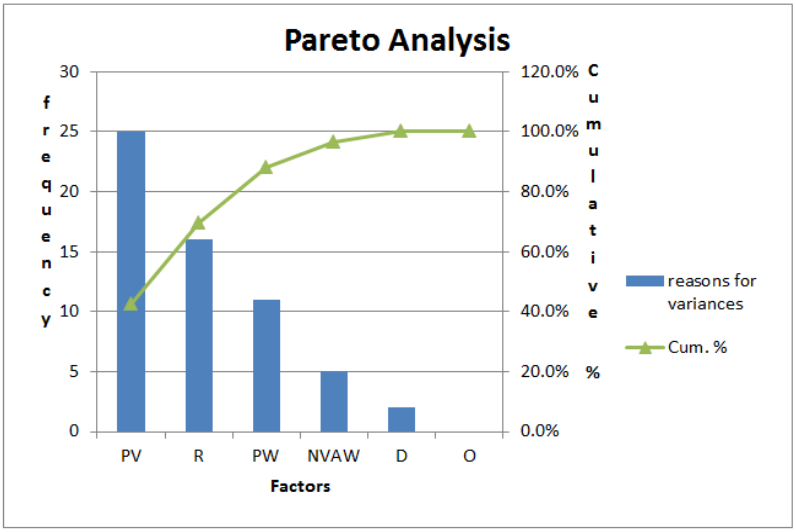

Fig 2:- Pareto Chart Showing the Major Causes of Variance No Construction Sites

Vital factors	Trivial Factors
Performance variation	Non value adding work
Resources	Prerequisite work
	Directives

Table 5:- The Vital and Trivial Factors Affecting Work Plans

Table 5 above shows the vital and trivial factors affecting workflow on site as indicated, the vital factors are Performance variation and Resources while the trivial factors were found to be Non value adding work, Prerequisite work and Directives.

V. CONCLUSION

From the above findings, the predominant factors affecting workflow reliability are; Performance Variation and Resources, and the major reasons attributed to these factors are poor commitment from workers, adverse weather conditions, delay from suppliers, change of priority, lack of funding from client and shortage of materials onsite.

Other factors accounting for 20% of plan variability are in descending order; Prerequisite work, Non-value adding work and Directives and the reasons attributed to these factors are mainly lack of predecessor tasks, human errors leading to rework, incomplete and unavailability of drawings, additional work caused by adverse weather.

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