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Challenges Associated With Remote Sites Project Management

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***Abstract*—A Remote sites means an extreme working condition, often in isolated location, these sites are facing higher risks than average construction sites in well located areas. Remote projects have their unique problems that are caused mainly by the remoteness of the project itself in spite of rapid progress in the project management field. All project parties experiences countless difficulties and cumbersome management problems, which negatively affect project quality and cause substantial delays and increases cost. The aim was to review the risk involved in project management of remote site constructions. This study was carried out through interviews and observations. It was discovered that: mobilization risk, procurement risk and economics of scale factors, affect remote site significantly, and professionals are advised to improve on planning and scheduling in order to overcome these factors.**

Keywords—Remote site; construction; project management

I. INTRODUCTION

Remoteness of a construction site could be as a result of labour, materials, plants and communication risks due to its location. Accessibility and human resources are major factors which make it difficult for firms or organization to manage projects in remote location. Remote projects have their unique problems that are caused by the remoteness of the project itself, thus the loose control over communication and management [1]. The dilemma of managing remote projects is highlighted by [2], who mentions that the extensive physical distance between project participants, sometimes extending over national boundaries, is the primary cause of delays in decision making. The project team has to not only tackle traditional management problems, but those that specifically occur as a result of the remote locations of these often environmentally sensitive sites [3]. Generally, project management is complex and differs from one firm to another, as the sense of reasoning differs from one person to another, therefore their perspective of thoughts will also be different and this complicate issues, because for one to achieves a desired result to satisfy the client, extra work have to be done, management of projects especially in remote sites present numerous challenges, hence it takes adequate knowledge of risk involve in construction project of remote sites to be able to enhance construction productivity.

II. THE NIGERIA CONSTRUCTION INDUSTRY

The global construction market is worth as estimate of 7.5 trillion dollars, representing 13.4% of global gross domestic production (GDP), but by 2012, construction will be a 12.7 trillion global market, an overall growth of 70% in the next decade. The construction in 2020 will account for 14.6% of global GDP [4].

In developing countries, investments in construction projects could be as high as 50-60% of national budgets [5].

The construction industry which is vital to growth and development is one of the oldest in the world. Construction activities forecast the general direction of an economy and for this reason; the industry is often described as a leading economic sector. The construction market in Nigeria contributes to the nation GDP of less than 2% is quite negligible when compared with some African countries. Although the industry is a relatively small in terms of Nigeria's gross domestic product, it is a very active sector that is sure to also benefit from double – digit growth.

In Nigeria, the construction industry was the determinant contributor to the nation's GDP in the 1980s, accounting for about 70% of the GDP (planning committee on National construction policy, 1989). The Industry has been devilled by a combination of low demand, consistent low productivity and poor performance over the years [6].

This has reduced its contribution to the national economy to a mere 1% of the GDP in 2002. The Nigerian construction industry expanded 13.1% in 2008 despite the global crisis. While the government is by far the biggest client for the industry, private sector client are set to take on a large share of building contracts. As such Nigeria construction industry need to respond to the increased demand for their services in these locations [7].

III. PROJECT MANAGEMENT

Project management is the discipline of planning, motivating and controlling resources to achieve specific goals. A project is a temporary endeavour with a defined beginning and end, undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value. The temporary nature of projects stands in contrast with business as usual which are repetitive, permanent or semi-permanent functional activities to produce product or services. The primary challenges of project management are to achieve all of the project goal and objectives while honouring the preconceived constraints. The primary constraints are scope, time quality and budget. The secondary challenge is to optimize the allocation of necessary inputs and integrate them to meet pre-defined objectives.

Project management institute defines project management as the application of knowledge, skills, tools and techniques to abroad range of activities in order to meet the requirements of a particular project. Projects are temporary endeavour with a defined beginning and end, project management is a discipline of planning organizing to achieve a specific goals. It's important to create a place of coordination.

IV. REMOTE SITE CONSTRUCTION

There are many and varied issues confronting remote construction work. Communities closest to the remote sites are major facilitators for construction activities. These includes: mining companies, contractors, supplier's retailers, banks residents and government agencies [8].

Beyond the challenges of attracting and retaining skilled workers for city based projects, contractors face significant challenges attracting workers to rural, regional and isolated [9] Also [10] content that in times of local economic buoyancy, firms experience difficulty allocating resources to remote sites and staff members are generally unwilling to relocate until the buoyant stage of the circle ends.

[11] studied that the Australian construction industries has similar characteristics to many construction industries around the world, However, the construction industry needs to service the country with a large percentage of remote and isolated areas. These remote and isolated areas have recently seen major demand for construction works in a large part due to the current resources boom. Remote construction projects introduce many challenges not witnessed in urbanized locations if construction companies' faces supply problems in urbanized areas then remote locations potentially fare worse as construction project in general are complex and required a high degree of management. [1] depict that remote projects have their unique problems that are caused mainly by the remoteness of the project itself in spite of rapid progress in the project management field, remote construction projects exist in many regions throughout the world, these are locations with rough terrain such as mountains and deserts they are far from the supervision team office, the contractor's office and major urban concentrations in which during construction, all project parties experiences countless difficulties and cumbersome management problems, which negatively affect project quality and cause substantial delays and increases cost. Furthermore, it is established that these projects have certain characteristics such as they are remote and difficult to access, as such difficult to frequently monitor and control the project processes, outcomes and provision of supplies to the sites. The remoteness of the project also complicates the building permission process as it's extremely difficult for government inspectors to visit regularly. The manufacturers of building materials experience difficulties in providing deliveries to the site, and the construction waste and disposal cannot be easily transferred away. Construction projects by their nature are fragmented, complicated, risky and uncertain; as a result problems around communication, coordination and management occur especially in remote construction projects, in which stakeholders are all located indiscrete locations. These problems may affect the project negatively by reducing the project quality, it cause delays, increase cost and imply all project parties to higher risk chances.

[12] discusses building information modeling (BIM) based design and construction process for efficient and effective management of remote construction projects as the needs for appropriate materials management system and design cost information, especially in remote construction work. [13] Proposed advanced computer based management and communication since conventional technologies are seen as not capable of meeting required process and project improvements for the remote construction projects. Previous literatures indicates that there are many potential concerns for construction companies operating in remote locations, key issues would appear to exist within human resources skill and labour availability, production procurement and related cost issues, and the need for adequate infrastructure and communication [9].

V. REMOTE SITE AND PROJECT MANAGEMENT CHALLENGES

Construction projects by their nature are fragmented, complicated, risky and uncertain. These challenges are arguably, exacerbated in remote construction projects which have their unique problems cause mainly by the remoteness of the project itself, resulting in the loss of control over communications and management, including lack of management skills, human resources and infrastructure. As a result, problems around communication, coordination and management occur especially in remote construction project, in which stakeholders are all located in discrete locations [14].

A. Challenges of Remote Site Project Management

Project management involves coordinating various aspects of a project in order to bring forth a positive

result, undertaking of construction works presents numerous challenges and these are amplified when working in remote locations [9].

The construction sector council (2006-2010) suggests that some aspect of project management that are particularly challenging as quality, cost and schedule, sometimes have much impact on project manager's control.

The first aspect of project management that can be problematic in remote site is the area of quality. The owner representative (also known as the client) may not be focusing on quality as they should, especially when a third party is being involved. The second area that is challenging throughout the life of a project is cost, in some cases, projects are started out with misinformation, because the project estimate is made to appear lower than it would be in reality, in order to get final project approved especially in remote sites. A major challenge of any project is the contracting of work especially in an environment of scare labour resources, lack of competition in the bidding for contracts can increase project cost. The third major area that can have impact on project management is schedule. Many contractors do not have appropriate staffing levels to supply planners and schedule for large projects. These can cause confusion about the project schedule and productivity plans.

B. Remote Construction Sites in Perspective

1. Remote Work

The reluctance of most trades and skilled labour to work in remote communities' reported by all participants, and the resulting lack of competition, exacerbates price increases beyond that caused by the skills shortage alone. Lifestyle comfort may be as decisive a factor as money, and with no shortage of work in town, few builders and trades people are willing to go to bush. Working in remote communities not only means being away from family and friends for weeks, but also after a day's hard physical work, often in harsh conditions, very few creature comforts are available to rest and relax with: the usual camp set up is caravans with noisy reverse cycle air-conditioning, and little privacy.

2. Risk Associated with Remote Area Construction

There are unique risks in remote Indigenous housing delivery. These risks drive prices high and drive builders away. However, many builders left the Indigenous housing field because they got 'badly burnt', having been locked into unrealistically low prices. By better sharing or managing these risk factors, the escalation of the cost of Indigenous housing may be contained.

3. Mobilization Risk

One of the most often mentioned risk factors is distance. The vast and dispersed "workplace" is characterized by long transport distances between regional centres and communities, and between the communities themselves. The isolation and long transport distances have a compounding effect on all other logistics issues, thereby increasing normal risk. This means that any unforeseen events, conditions, or even small mistakes like miscalculating the amount of material needed, or forgetting a tool, can have substantial consequences. Occasional misjudgement of the range and quantity of stock that is needed to be carried by the building team to undertake work in remote locations, and lack of preparedness for unforeseen necessities was reported by even experienced builders.

In Central Australia, where the Alice Springs-based industry covers an area of approximately 600km radius, there is a lot of travel between jobs. This is the case even with regional building contracts when builders work in several 'neighbouring' communities, and work gangs follow each other around. Similarly to the builders, consultants and project managers reported spending too much time on the road 'jumping between jobs'. Difficult road conditions mean longer travel time, with consequences for productivity and wages; they also cause substantial wear and tear on vehicles. Building components may arrive damaged and need to be repaired or replaced. Climatic conditions impose a certain work rhythm as very little work can be scheduled for the hot summer months.

Another severe risk factor is unpredictability. Weather conditions, particularly heavy rain, can render even well-maintained dirt roads impassable in Central Australia, and can interrupt the construction process causing its progress to slow down and fall behind schedule. Other conditions are also often unpredictable. For example, ceremonial or 'sorry business' can close down a community or a road for a while; community employed staff turnover is generally large, affecting negotiated provision; and the availability of local workforce is inconsistent. The difficulties associated with finding trades and labour to work remotely is a concern shared by all industry players. Many participants noted that only exceptionally good pay can overcome the shortage, and even then only for short spells.

The logistics of providing accommodation for the building team is almost always difficult. There is usually no capacity in communities to house a construction crew, and when there is, according to industry sources, there is often an extensive charge. The challenge of sourcing plant and equipment out bush is another issue many builders face. The unpredictability of equipment condition and safety of operation makes this an often unattractive option, with builders preferring to transport their own equipment and further increasing transport costs. Builders have to be thoroughly familiar with local conditions in order to manage these uncertainties.

The transient nature of the workforce in client organizations or in the building team also poses a risk for consultants and project managers and can cause

coordination problems and delays. Lack of coordination between the allocation of housing and provision and maintenance of infrastructure services may cause severe delays or cancelled projects according to a project manager. Examples included communities that have been given funding for new housing but have no serviced sites.

4. Procurement Risk

One avenue where it may be possible to reduce risk is through improved procurement processes. Although many people considered there are problems with the current process, there was no clear advice on how to improve it. Under the old procurement system, builders were directly engaged by the community organizations, and contractors and subcontractors used to build up relationships with communities. This helped both parties better understand circumstances and expectations and enhanced trust.

The new tender process does not support the development of relationships between builders and community organizations and individuals. Tenders are run by consultants on behalf of community councils, who are usually provided no choice but to accept the list of selected contractors. This affects the community-builder relationship in a way that contributes to construction work in remote communities being at times a negative experience.

The risks and costs associated with issues of trust and relationships can range from loss or damage to property to loss of workforce, recruited locally or elsewhere, resulting in delays and problems with quality. Tight construction schedules imposed by government spending cycles are often unrealistic and with high penalty rates. Builders who incur penalties get hurt and either do not want to get involved with remote work again or charge much more to cover the risk associated with meeting contract requirements. Because of the length of time the tender process takes, builders are unable to plan the work knowing which tradespeople or subcontractors are going to be available and at what price when the work materializes. Therefore, they make an estimate at their subcontractors'' costs, trying to err on the safe side.

There are risks associated with the procurement process for consultants and project managers as well. These are manifested in the lack of qualified tenderers; instances when all tenders come in above budget; and delays beyond their control in the release of financing and in letting the tenders.

VI. POSSIBLE SOLUTION TO THE CHALLENGES OF REMOTE SITES

Economies of Scale

This is a possible area to reduce risk identified by industry participants in relation to economies of scale. It was generally agreed that it was not good business to undertake construction below a certain volume of work, though opinions varied on what this minimum is, or whether the difference has a great impact on the cost of the project. A clear message was that there is *"nothing worse than one house in a community"* for project management, design, or construction work alike. For smaller builders of on-site projects, economy of scale starts at four houses in one location, with a cost reduction of 10 – 15%. One example was given in Kintore, where the cost of constructing two houses is now at $370,000 per house, while building four of the same dwellings may have reduced this amount by $40,000 for each.

Increasing contract size for a single project, with a few houses in each location, and a few locations in one region, is an attractive option for builders. A single mobilization reduces the required workforce relative to one house as well and the remote infrastructure that supports them, as a builder's example shows: while they would need a 10-man camp for the construction of four houses, a 30-man camp is necessary for the building of 16 houses within the same area. For prefabricated dwelling good economic value represents 20 to 30 houses *"going through the shop"* per year, and at least three houses to be delivered for any given location.

Quantity surveyors challenge the view that considerable savings can be achieved by improved economies of scale, claiming that increasing contracts in the past have seen a cost decrease of only about 10% maximum. They argue that as the whole of the construction industry is not large enough to achieve sufficient economies of scale to make a dramatic difference in cost. To provide perspective, they refer to individual builders in Queensland who build 1200 homes a year, in comparison with a total house market of 600-700 new houses each year in the Northern Territory.

VII. Prefabrication

Prefabrication, that is, the fabrication of whole houses to be transported to remote areas or building components transported in kit forms, is thought to generally reduce risk associated with transport, on-site labour availability, coordination and project management and other unpredictable factors. This mode of construction moderates the effects of unpredictability such as road closures and allows for scheduling in a way that best fits with seasons and other local factors. This is especially true with fully transportable houses where builders only have to spend 5-7 days on site, but can work at the plant continuously. Outcomes and actual construction costs, were funded for site visits, and were more actively involved with the tender process. According to one project manager, a different project management approach could reduce costs in some cases. This involves the project manager being directly involved with the engagement of subcontractors and suppliers, charging a pre-set fee rather than the usual up to 15% margin of head contractors.

The main risk factors in the construction of remote Indigenous housing are related to the vast distances

that building components and construction workforce have to travel, and a high level of unpredictability, mostly due to environmental and social factors.

Management of these risk factors requires changes in the procurement process to allow the development of delivery models more suited to the remoteness and the rhythm of construction seasons, and less dependent on the yearly funding cycle. Devising the scope of the contracts to improve economies of scale and to take advantage of prefabrication technologies are other recommendations from the building industry. However, there is a concern among the majority of industry participants that present prefabrication technologies do not offer the same long term value-for-money as on-site construction.

VIII. PLANNING

Handling remote teams is extremely challenging to most managers, in order to get the best the contractor need to establish a clear communication routine, take extra steps to build trust and review, processes often to make sure they are working for everyone. There is also the need for a process in place for tracking any changes in scope and forecasting any additional cost that may arise from scope change for project control to be effective, the project management team should regularly schedule update meetings with a consistent structure and standardized reporting formats. This will help ensure that information is clear and unaffected by varying ways of tracking and reporting cost and schedule.

For particular areas undergoing labour shortage especially remote sites, then the project manager should realistically build that into their initial project deschedule. Contractors are bond to clearly defined duties and liabilities regarding remote environments and transform risks into opportunities.

IX. SCHEDULLING

The construction programme plays a significant role in project management. Programming involves gathering information from the intended building occupants and users groups through group and individual interviews. A construction programme is usually a mandatory element in modern construction management. A goal and effective construction programme provide construction team with the tools for project monitoring and control during the construction stage. The major benefit of a construction programme is that it function as a performance indicator to monitor performance of site filed work against that originally planned, so as to alert at the earliest opportunity any risk of the guide to the project team in respect to the future activities so that resources can be properly arranged sufficiently in advance.

X. CONCLUSION

Remote construction sites pose challenge to project management in the following ways among others:

- The problem of location, which is long distance transportation to remote site.
- The issues of logistics or cash flow
- The problem of quality workmanship due to project location
- Technological set backs
- Environmental issues
- Time constraint in service delivery
- Communication gap etc

It was also discovered that the reliability and relevance of professionals and project managers in remote construction delivery cannot be over emphasized. It was also discovered that it is easier to manage projects in urban areas as compared to remote areas.

Project management could be very effective on a remote site if the right factors are put in place and consideration is been given on the following.

- In executing construction project on remote sites, the right tendering process and contractual arrangement should be in place.
- The involvement of qualified professionals or project managers on remote site construction is very paramount.
- All should be done to ensure that all the factors mentioned above that can hinder the success of remote construction project should be made available at all time.
- The government should enhance good road networks for accessibility.
- The stake holders in the construction industries should enhance availability of construction materials.

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