

Learnings for construction project management personnel about offshore projects: a case study

Linda Kestle¹ and Adam McKernan²

¹Building and Construction Services, CIE, Unitec Institute of Technology, Auckland, NEW ZEALAND

²Arrow International, Auckland, NEW ZEALAND

E-mails: lkestle@unitec.ac.nz; Adam.McKernan@arrowinternational.co.nz

Abstract:

Involvement in the global construction project market is becoming more of a norm for designers and construction companies, no matter where the head office is located. As a result, practitioners need to be work-ready in order to be project leaders, consultants and managers on offshore projects, often at a relatively early stage of their careers. The experiences of industry and tertiary professionals also suggests that the challenges and opportunities presented by offshore projects, provide learnings that may also be applied to other construction projects, and should be included in construction sector training and development programmes. The paper and therefore the research question focussed on a qualitative case-study of an offshore tourist resort construction project involving a locally based New Zealand construction company that had recently completed the project. The methodology involved face-to-face interviews with the project management team personnel, as well as an integrated analysis of the project planning, procurement and communications' documents. Several unique issues and consequent opportunities for innovative solutions were identified for improved practice and training, including managing limited site accessibility, challenging logistics, staffing the teams, plant and materials availability, and maintaining effective communications.

Keywords:

Communications, construction management, logistics, offshore construction projects, staffing relationships.

1 Introduction

The success of construction projects is highly dependent on management staff and the coordination of multiple consultants and tradespeople. These managerial responsibilities significantly increase when the project is located offshore. With an increasing number of remotely located construction projects worldwide, particularly within developing areas such as the Middle East, Asia, Latin America (Lin, 2010) and Australia (Baroudi and McAnulty, 2013), including environmentally sustainable developments such as eco-tourist resorts, the demand for construction practitioners to be involved on these offshore projects is increasing. This has enthused a growing research interest within the construction industry (Lin, 2010). Management of construction projects is complex in nature due to the uniqueness of each project and the multitude of stakeholders involved (Weippert *et al.*, 2002). Previous literature has focused on remotely located construction projects, where for example, Kestle (2009), defined a remote site project as being one that is separated geographically and/or has only limited seasonal, logistical or communications access, and found that the main challenges were in the areas of communication, increased management requirements, a lack of human resources and

plant and materials, and experienced labour. It is clear that remote/offshore construction projects appear to have specific challenges that are not as commonly observed within urbanised areas (Baroudi and McAnulty, 2013). After undertaking a detailed literature review across a number of well recognised research data bases internationally, the objective of the research became, "How can the management structures and systems for offshore construction projects be further improved to be beneficial for construction management companies?" This has involved investigating the systems and structures that are currently used on offshore projects, and one in particular. This research may be of value for potential project management practitioners on the realities, and possible issues that may be experienced in the challenging environment of offshore construction projects.

2 Literature Review

Previous literature has suggested that there is a need for future research that focuses specifically on the realities of on-site remote construction projects, and creating realistic management frameworks for the use of construction industry practitioners (Kestle, 2009). Given the remoteness of these offshore projects the selected literature has been focused on discussing the challenges, improvement strategies and differing expectations regarding project outcomes for stakeholders and project management approaches.

2.1. The Importance of Effective Communication

Effective communication is essential for the success in any given construction project according to Weippert *et al.*, (2002), but when the construction project is situated in a remote /offshore location, the need for effective communication systems is amplified, as government authorities and project architects/engineers are not able to visit site as frequently, to maintain face-to-face meetings, (Sambasivan and Soon, 2007). This results in an increasing emphasis on alternative means of communication between on-site management and supporting /project personnel (Sidawi, 2012). In addition, Kestle (2009) found that there are multiple limitations for effective communication on remote/offshore construction projects, with for example, a frequent lack of internet and telephone connections and/or a lack of reliability or compatibility. Kestle (2009), also identified the greater risk of miscommunication and information lost due to poor communication connectivity in remote site locations.

2.2. Effective Management Requirements on offshore remote projects

For the purpose of this research, construction management refers to the organisation, coordination, monitoring, control and reporting of all physical construction works. With a project located in a remote or offshore setting, there are differing management requirements, and the role a construction manager may have to undertake (Potangaroa and Khan, 2003). Not only does the construction manager have to manage all the traditional requirements common to all construction projects, but also those associated with the specific remote location. Additional factors regarding the management requirements, are for example, the impact of the construction project on the local community, and the potential language barriers. Potangaroa and Khan, (2003), found that on-site management is key for offshore construction projects, compared with having distant /regional management, as on-site management is more effective. Case study results from the article by Lin (2010) have shown that mainland project administrators are favoured over employing a local as they are more likely to mitigate managerial flaws and reduce project losses. However, mainland site engineers are less

likely to work effectively with local employees, and in combination with their high wages, are less likely to add value and improve the overall project performance.

2.3 Human Resources

Construction companies are struggling to source quality labour and human resources within urban areas. This problem is heightened according to Baroudi and McAnulty (2013), when recruiting people with the right skills for offshore construction projects. This is thought to be because contractors have particular difficulty attracting skilled workers to remote areas. The additional challenge associated with the allocation of local versus expatriate workers can create difficulties in regard to providing jobs, gaining local community loyalty and improving their economy. Although benefits are necessary for local communities there is a lack of skilled and experienced workers compared to employing non-local or expatriate workers. There is potential for a lack of productivity and motivation within offshore projects and it can have adverse effects on the individual staff member including fatigue, family stress, homesickness and in some cases lead to increased alcohol abuse. This is often resolved by the implementation of Fly-in/Fly-out (FIFO) arrangements, as used within remote regions of Australia, (Baroudi and McAnulty, 2013), and was implemented for offshore oil projects in the 1940's (Houghton, 1993). There are increased expenses in association with the FIFO concept, including lodging, increased travel expenses between job and home base, and paying higher wages than paid to local employees. According to Lin (2010) hiring local employees offers an alternative that is generally cheaper, but there is an increased risk as they are often not as skilled or experienced, potentially leading to greater project losses, and reduced quality of the overall project outcomes.

2.4 Plant and Material Availability

Plant and material availability is a critical risk for remote construction project completion. Not only will the procurement of materials locally be difficult, there is also a likelihood that the material(s) is/are not available to be sourced locally at all. Therefore, materials and plant will have to be brought in, often from overseas. Therefore, forward planning is essential to ensure correct quantities and materials' specifications when order in as lead times for materials and plant are often dramatically increased when procured for a remote /offshore project (Cowie, 2002). Poor conditions and transport regulations can also be major barriers to the delivery of equipment and materials to remote projects (Sidawi, 2012). Sambasivan and Soon (2007) emphasised the fact that project success is risked with the possibility of transportation delays and/or limited materials and equipment.

2.4.1 The Lack of Infrastructure

Offshore construction projects are frequently hindered by the lack of infrastructure, such as access roads, power and telecommunication services, internet provisions, fibreoptics and water supply for example, (Kestle, 2009). The increasing demand in the construction industry for internet based communication and document sharing systems, means issues arise around maintaining up-to-date documentation (Brilakis, 2007). Road and highway regulation constraints in addition to limited access are often major issues affecting the delivery of materials and equipment to offshore projects. (Sidawi, 2012).

2.5 Increased Lead Times

For all construction projects there are a number of specialist or specific materials that have long lead times. For an offshore project though, supplies of all materials will have increased lead times. The transportation aspect of the lead time for offshore construction

projects can often be calculated in months, rather than days or weeks for projects in urban areas. As a result, the risk of miscalculating the required material on site increases too, and construction companies often send too little or an excess of materials to offshore sites. Usman and Ibrahim (2015) noted that as suppliers struggle to deliver materials to site, the requirement for construction waste removal is also increased.

2.6 Increased Financial Risk

The usual and expected risks for stakeholders, contractors and sub-contractors associated with the construction industry are intensified when the construction project is located offshore. A frequent shortage of materials within these projects can be a major issue, making contractors reluctant to undertake these projects due to the unpredictable cost and availability of materials, labour and transportation. One of the biggest risks is increased financial risk. Tam and Le (2016) suggested that the increased cost stems from the logistics of getting plant and material to site, which is sometimes greater than the actual cost of the materials.

3 Research Methodology

The most appropriate qualitative research methodology to answer the research question was a case-study approach, as the intention was to gain key insights by conducting an in-depth and detailed review of an individual case-study that had a few distinctive features, and could in turn have valuable implications for construction management practitioners. A case-study approach is useful when the researcher has little control over events or an ability /opportunity to change circumstances that naturally occur (Yin, 2003). It allows for a variety of multiple sources and data types as part of the investigation, and an opportunity to explain why certain outcomes occur, (Denscombe, 2008). A case-study lends itself to undertaking a holistic study of processes, relationships, successes and challenges within a particular real-world setting. This approach aligned well with the offshore construction project. The key limitations of this research related to the fact that this was just one offshore case-study, but the findings drew on several previous and relevant in-depth research publications into offshore and/or remotely located projects.

2 3.1 The Case Study

The selected case study was undertaken on a New Zealand project management company that had recently completed a remotely located construction project that involved the expansion of the existing resort facilities on an isolated south pacific island. The project comprised a 400m² 5star accommodation block, a 200m² conference centre, a new services and staff facility, commercial kitchen refurbishment and a drainage upgrade. All of this work was to be carried out whilst the resort remained fully operational for their tourist clientele. The project commenced with two shipments of materials to undertake the site establishment work in August and September 2016. The construction period then ran from October 2016 to August 2017. It was completed on time and was ready for the NZ Prime Minister to officially open the new buildings. This, despite an 8.5 week delay of a materials' shipment as the ship hit a storm and broke down, (and the captain actually passed away too). The resultant was that the materials' delivery sequencing was seriously affected. There was also a category 2 cyclone that caused a 3 day delay given the site was right on the coastline.

The case-study project was investigated from the main contractor's perspective, and all of the findings were drawn from an analysis of the project programming, procurement and communications, and after interviewing the five key project management

company's personnel. The site was described as offshore due to its geographical separation from immediate logistical support, lack of locally available materials, and limited means of physical access. Throughout most of the construction stages, there was only one international flight a week to the island, restricting access for the mainland project staff. All materials and plant had to be transported to the island via a monthly shipment from New Zealand.

3 3.2 Data Collection and Document Analysis

Qualitative semi-structured face to face interviews were conducted with the five key project management company's personnel. to hopefully gain a range of views and differing perspectives. Although the interviewees held different roles, all of the responses to the questions were relatively similar when identifying the struggles experienced, for example, throughout the offshore construction project period. The collected data were transcribed, codified, and tabulated, then collectively analysed and discussed in conjunction with the document analysis, to see how the data related or differed from the literature findings.

3.2.1 The Data Collection Instrument

Q.1. Management Structure

- a) Describe in some detail the management structure used on the offshore/remote project (s) that you have been recently involved on.
- b) Would an alternative structure have been more beneficial for the project(s) and why?

Q.2. Staffing Arrangements

- a) What managerial staffing arrangements were utilised during the offshore /remote construction project (s) you have been recently involved on, to maintain effective managerial roles?;
- b) Would employment of local managerial staff arrangements have been more beneficial and why?

Q.3 Communication

- a) In your experience, what types of communication systems/methods were/are used on offshore /remote construction project(s) and why are they selected for use?;
- b) Was a computer based communication system utilised on the offshore project you were recently involved on? If not, what was the reason for not having one on the project?

Q.4. Material and Plant Sourcing

Describe the actual processes used for managing the issues associated with the potential lack of plant and material availability commonly experienced on offshore/remote construction projects.

Q.5. Material and Plant Logistics

- a) In regard to the logistical process of getting plant and material to site, did the management structure, communication system(s) and staffing arrangements work well and why?;
- b) If not, how could they have been improved?

Q.6. Other relevant comments

In addition to the semi-structured face to face interviews, a document analysis was conducted on the project programming, procurement and communications documents, to investigate the systems used and their effectiveness according to the interviewees. Variations to the programme, procurement and communications, and any delays and/or impacts on the case-study project were also investigated.

4 Findings and Discussion

4.1 Management Structure

All interviewees confirmed that a hierarchical management structure was utilised on the case study remote construction project, with a general consensus that an alternative management structure for the projects team may have made little difference to the project's overall success. The hierarchical structure had been successfully used for all previous projects undertaken by the majority of this project team within the management company. However, one interviewee noted that they were new to the project team and the type of management structure. Pressure was experienced when communicating with senior managers and therefore an alternative structure might have reduced that sense of pressure. This finding differs from those by Sidawi (2012), who suggested that due to the introduction of electronic communication resources on offshore/remote projects that a more open management structure is possible, and offered a more effective process of sharing information and knowledge with the team. Similarly, Potangaroa and Khan (2003) suggested that on a remote/offshore project the construction manager has to not only manage the traditional project requirements, but also the impacts of the project on the local community, and the potential language barriers. Another interviewee noted that due to the project being largely set up and managed in a similar way to previous urban-based projects in New Zealand, logistics managers were not incorporated into the staffing team for the offshore project, thereby increasing the workload on other team members.

4.2 Staffing arrangements

According to the interviewees, the following staffing arrangements were those used for the duration of the case-study project by the New Zealand management company:

- Site managers (1x senior and 1x junior) Fly in - Fly out (7 weeks on, 1 week off),
- Project Manager flew in occasionally (approximately once a month),
- Site Administrator was locally employed,
- QS' (junior and senior) were New Zealand based.

There was a mix of responses from the interviewees regarding the adoption of the FIFO arrangement for the site managers for this project, believing that:

- There was a negative financial impact on the project when the employees' salaries, costs of flights, accommodation, food allowances and costs of compensation were considered.
- The FIFO arrangement is expensive but the alternative would be to employ a local as the full time site manager, but this could have had a greater negative financial impact, as the 'local' would be less experienced, leading to potential project losses. This finding was fully supported by Lin (2010) in the literature findings.
- A full-time remotely based site manager would have been better for the project, as the FIFO arrangement time period of 7 weeks on the island was too short, leading to information loss.
- 7 weeks was a long time for site managers to be away from their families.
- A site manager on-site full time is beneficial for the project, however FIFO is a better arrangement for the site managers.

4.3 Employment of locals:

The general response from all interviewees was that employment of locals as managers on-site would be financially beneficial, given their local knowledge and familiar methods of communication throughout the construction of the project. However, all of

the interviewees suggested that locally employed management staff would definitely require training prior to the project commencing.

The specific views expressed by the interviewees were that:

- Local employment of site management staff could be an option if they had sufficient support from FIFO managers, and a sound communication plan to ensure clear communications between NZ based managers and the site manager.
- The employment of one local site manager (to reduce the financial impact of two FIFO site managers), and maintain one FIFO site manager to lead the site team. Lin (2010) supported this by indicating that hiring locals is often cheaper, but that there is an increased risk of them being less skilled and experienced, resulting in reduced quality, time overruns and the potential for increased financial losses.
- A local site administrator was hugely beneficial for communications, local knowledge and the relationship with the local community.
- Multiple locals were employed throughout the project for roles such as labouring on site or catering and cleaning for the FIFO managers and subcontractors.

4.4 Lack of plant and material availability

All of the interviewees noted that the most challenging aspect of the entire project was the procurement of plant and materials and the associated logistics of actually getting the materials to site. For example:

- The process of procurement included standard processes, with the addition that all materials, whether concrete, timber, finishing materials and fixings *et cetera*, were required to be shipped to the island.
- The implications of once a month shipments highlighted the need for forward planning and ordering materials three months prior to when they were actually required on site. It was forward planning that the project management team struggled with the most, and this supports Cowie's (2002) comments on the absolute need for thoroughly detailed and sequenced forward planning on offshore projects.
- Management's decision for procurement to be the main contractor's overall responsibility, to ensure that specified materials and correct quantities were delivered to the island. This reduced the risk of re-ordering incorrectly delivered or short-supplied materials. As a result, subcontractors were signed up on labour-only contracts.
- The lack of effective communication led to a disconnect between construction and procurement teams, creating unnecessary pressure for the project team, and meant that some materials were delivered out of sequence, increasing the demand for on-site storage (not allowed for in the budget), and potential for a financial loss on the project.
- The plan was to have all the construction materials delivered to the island before the 'cyclone season'.

However, due to unusual weather patterns a cyclone in the Pacific Ocean caused delays to the second to last shipment of materials which impacted on the project programme incurring a 3 week delay. This finding fits with Usman and Abraham's (2015) finding that climatic delays need to be factored into the lead times for materials' availability.

It was originally planned to employ a logistics manager but due to the shortage, management struggled to employ someone. As a result it became a part of the QS' responsibility and meant the project team had to share and cover the additional workload. All of the interviewees noted that:

- Employment of a logistics manager would have benefitted the project. Issues experienced throughout the project were: timing of material deliveries; the quality of the material when it arrived on the island due to damage during shipment, and incorrect materials being ordered or supplied and needing to be replaced. A logistics manager would have carried out the required checks before the materials were packed into containers for dispatch to the site.
- A better communication system would have benefitted the logistical process. For example, being able to communicate on a more regular basis; share documents such as the construction and procurement programmes between the team to ensure alignment; ensuring materials were delivered to site when required to reduce storage requirements or delays due to late supply.

4.5 Communication

According to the case-study planning and procurement documents, an ICPM (internet-based construction project management) approach was planned for the offshore case-study project. The views expressed by the interviewees were that:

- ICPM was selected as the main communication channel for the project to create a common database for documentation, and to hopefully improve collaboration and communication between team members. This approach was supported in the literature by Sambasivan and Soon (2007); Alshawi and Ingirige (2003), and Stewart and Mohamed (2004) where project team members (for example, architects and engineers) are regularly located at distance from the offshore site during the project, and that a web-based project management system be considered, to support project personnel.
- During site establishment the site team struggled to find sufficient internet connection. However, it was just enough for basic communication such as emails, but insufficient for downloading or sharing larger documents such as drawings.
- Poor connectivity forced the abandonment of ICPM and the team reverted back to emails and phone conversations as the primary means of communication.
- Email correspondence and communication was slow compared to the ICPM system causing delays on site when urgent design clarifications were required.
- Information was often lost or miscommunicated because it was being double handled between site managers and senior managers, then senior managers to the consultants.
- The establishment of an alternative such as using a satellite or wireless internet connection was deemed too expensive for a project of this size. The ICPM approach is only effective if all project members use it, and before it was abandoned, several of the project team members chose not to use it anyway.

Brilakis (2007), and Kestle (2009, 2011), identified and acknowledged the possible limitations of communication access due to issues such as a lack of infrastructure internet provisions /reliability. This is causing major barriers to communication on a number of remote/offshore projects.

Overall the findings identified that an online communication system is more likely to be used on a large scale project but only if an alternative form of internet connection can be shown to be financially viable for the stakeholders and clients.

5 Conclusions and Recommendations

The experiences of industry and academic research suggests that the challenges and opportunities presented by offshore projects provide learnings that may also be applied

to other construction projects, and be included in construction sector training and development programmes. The research question was focussed on a qualitative case-study of a recently completed offshore tourist resort construction project involving a locally based New Zealand construction company. The literature review and analysis initially concentrated on the selected topic of offshore projects and associated keywords, where common issues identified in the literature were: communication, increased management requirements, lack of skilled labour resources, and issues about plant and materials availability. Interviewees shared first hand experiences of the management structure and systems used on the recently completed offshore case-study construction project, including the differing staffing arrangements on offshore construction projects to maintain effective managerial roles within project teams. Literature findings drew comparisons between the FIFO arrangement of current employees of construction companies and the employment of local personnel to fill the remotely based management roles, and suggested that locally employed managers are financially more beneficial compared to FIFO arrangement for the project with regards to cost of flights and accommodation. The effectiveness of such arrangements though were limited to the skill and experience of local employees, with the potential for an increased risk of project losses, reduced quality and poor project outcomes. Interviewees supported these findings by suggesting that the optimal staffing arrangement is the employment of local's as managers with the support from FIFO management staff. It is evident from this case-study that construction practitioners interested in offshore construction projects need to consider changing from traditional hierarchical management structures and systems to make those projects more beneficial for the construction management company and the stakeholders.

The lack of plant and material availability was another key factor investigated throughout this research, and it is clear that in more remote locations, the availability of specific materials is often limited and therefore construction practitioners are required to adopt alternative means of procuring materials. The literature and interviewees identified issues of needing to ship materials, and the increased lead times as a critical factor for practitioners to consider. Interviewees discussed the processes adopted for the case-study project that included making the supply of all materials the main contractor's responsibility, to ensure the specified materials were ordered, and correct quantities delivered to reduce the risk of causing project delays.

The final issue discussed in this research was about the communication system(s) used on offshore projects as identified by interviewees and in the literature as a key factor for the success of a project. Online communication systems were the preferred method of communication where all project members can access a central database for all channels of communication and documentation sharing. However, it was highlighted by most of the interviewees and in the literature, that due to the reliance of such systems on sufficient and reliable internet connectivity, they are not often used on remotely located projects. The implementation of alternative internet connections is possible but currently too expensive to establish for most offshore projects.

6 5.1 Recommendations

The following recommendations outline some of the key issues practitioners need to consider based on the above findings in relation to the research question "How can management structures and systems for offshore construction projects be improved to be more beneficial for construction management companies?"

1. Employment of local personnel to fulfil some of the managerial roles to support FIFO management staff, in order to gain the benefits of local relationships, local knowledge, and ease any communication and language barriers.
2. Establish a logistics manager to support the procurement process of plant and materials. The role being to manage the coordination and additional workload of getting the right materials to site when needed.
3. Establish effective, accessible communications systems for all project personnel.
4. Establish alternative means of internet connection to support the use of online communication and document sharing systems.

Future Research could be on how to improve offshore infrastructure, and the use of satellite or wireless internet connections and drones, at a viable cost.

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