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Effect of Experienced Construction Manager Upon Completion And Handing over Mega Projects on Time.

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Abstract

Megaprojects in the construction industry have common challenges that make construction managers of these projects focus on solving critical issues and problems of major milestones of these projects to ensure that they will deliver them on time. Some of the common issues as identified in the literature review are the unrealistic duration of these projects, lack of contractor's management experience in constructing these projects, the unique design, limited experience of the management team, shortage of skilled manpower and materials, and lack of risk identification during the tendering phase of these projects. This research aims to find out the contribution of experienced and qualified construction managers who participates effectively in advance by reporting about all potential issues to their project managers to mitigate any disputes with clients of these projects.

Construction managers who have good experience can overcome and mitigate all types of challenges based on the appropriate utilization of principles and techniques of construction management. Actions, roles, responsibilities, and obligations of effective construction managers will be investigated through a designed questionnaire. The best practices and techniques that construction managers are adopting on daily basis will be investigated to find out how milestones can be tracked to ensure that the projects can be delivered on time. Process of project monitoring and control will be also investigated as a part of their roles and obligations. Study findings will be based on analysis of the questionnaires survey combined with interviews that are carried out with some experienced construction managers to identify the required necessary actions, and level of required experience that construction managers must have to deliver projects on time. In conclusion, internal coordination of construction managers with the project team including implications of construction management that must be shared with the project team must be utilized to complete and deliver the projects on time where the latest techniques of BIM and other innovative software's of construction can be adopted by them.

1. Introduction

Construction mega projects are increasing very fast in many countries all over the world, where construction managers are become more responsible in planning, managing, and controlling the project milestones and other project activities. Resource planning, e.g. manpower, materials and equipment's are having the highest priorities for the construction managers where ordering process is prepared in advance. They have special skills and behaves enables them managing and controlling work progress of main activities. This requires long practical work experience. The objective of the study is to analyze the capabilities, skills and competencies of construction managers and their effects and roles in completing and delivering projects on time without delays and accidents. The execution of all project activities requires proper planning that must be prepared by construction manager in advance in coordination with the project manager and planning engineer. Managing work activities of mega projects requires skills of communication and coordination that construction managers must have including the implications of principles of construction management. In addition, they should be equipped with the technical information pertaining to the project. Specialists of construction management are focusing on the integration and combination of effective project measures which is essential practice to mitigate and reduce any potential delays during

the project phases. This can be accomplished through proper utilization of technical experience and applications and techniques of construction management. Major reasons for project delays can be eliminated and mitigated at very early stage of the project if the construction managers know how to verify project drawings, technical specifications of materials with the proposed construction methodology through applications related to the field of construction management. Managing resources of domestic and nominated sub-contractors who works in the project is a part of construction managers responsibilities. That can be achieved through regular coordination skills that they must have. Since a project is to introduce many proposals into its field, therefore, it is essential for the construction manager to have the necessary experience to discuss, demonstrate, and argue to make it effective and practical.

2. Literature review

Construction management principles and techniques has been developed by establishing many technical competences related to planning, materials, control, drawings, method statement and man power in construction management that plays an important role complies with construction manager responsibility, which is necessary. It is necessary to understand the technical work sequence of the project that can be integrated with the above principles. Kenneth (2007) [1] stated that construction projects are different from

any kind of project, therefore, a construction project manager should have the technical expertise to understand the arrangement of the project. Many construction organizations request their construction managers to cope with latest techniques and implications of construction management. The principles and techniques are updated to comply with innovation and AI in construction. Besner and Hobbs (2008) [2] confirmed that principles of construction management has been developed for the last two decades where many discipline aiming to contain a diversity of concepts, tools, methods, concepts, and experiences whose boundaries are quite unclear. Accordingly, information and knowledge should be updated in regular basis.

The projects are built by people who simultaneously represent the potential issues and risks area for each project where some factors like lack of commitment, lack of monitor and control and poor follow up with work progress and internal poor coordination and communication, are some threat to the implementation of planned activities in construction project. All Projects participants and representatives will be affected and start blaming each other's for any cause of the delay. Ajibade and Henry (2006) [3] identified the sources of delays caused by the client, the consultants and the contractors, and those which are not caused by these parties to the design and construction process. It is important to communicate with project internal and external stake holders and update them through proper communication by the construction manager during the weekly meeting to avoid any delay. The regular successful interference of the tools and techniques of construction management must be always be regularized and updated by the construction managers of construction contracting firms to make sure that they will deliver their projects on time. E.g. lack of knowledge of material management by construction manager may cause big problem during project finishing phase that will lead to big delay in the project. Naief M. (2002) [4] stated that other causes of delay are attributed to improper management of materials and hampered by lack of explicit and detail model of project materials management process. Project monitor and control is a part of construction management techniques that is considered one of the important key factors of project success. Construction contracting firms are integrating the important factors of construction management to guarantee of the completion date of the project through continuous training and development of the construction managers of these projects. They always encouraged by the management to understand the scope of the work and area of activities that will be executed, this may lead construction manager to come out with some cost saving from project value. John and Woodaward (1997) [5] stated that the first major responsibility of construction managers will be to define the scope and the content of the project. The construction manager will have to be experienced in the type of the project and will have to be sufficiently strong character to instruct the team of their responsibilities.

The experienced construction manager adopts a completely different outlook towards the work and will treat his subjects differently as compared to a project manager. In addition, principals of ISO and quality management are one of the important subjects that construction managers should be familiar to maintain the quality of work. Yitmen and I. (2013) [6] confirmed that ISO provides strategic guidance and tools that help construction firms and organizations to minimize the errors, access the new market demands, specifications and increase the productivity. Quality of the work must comply with quality standards and project specifications. Some organizations focus on the motivation of their construction managers and train them to keep their clients always happy from the quality of the built work. Bon and Mostapha (2013) [7] stated that the number of fundamental principles of quality management including implication and motivation of higher management, customer focus, continual improvement and process approach are used to achieve customer's requirements and quality consistently. So, the allocation of experienced resources, proper training of manpower, and assignment of quality control staff and the use of latest techniques are recommended to maintain the quality standards of the work.

One of the important factors that construction manager must focus on during the whole phases of the project is man power capability and

human ability. More efficient and skilled manpower can work with good productivity. Mitra (2016) [8] stated that human/ manager has ability to control himself and things such as quality and productivity can be controlled by him. The drive and energy of whole management system in the project depends on the combined effort of teamwork. The communication between project team and the construction manager is essential to accomplish project success because success of the project depends on leadership and strong personality of the construction manager. Leadership characteristics are a set of qualities within a person that gives progressive impact on project performance.

Construction leaders should possess good leadership. Osabiya (2015) [9] said that the failure or success of any project organization in projects depends on caliber of leadership. Success of implementing construction projects depends on the eliminating of all challenges. This requires many techniques, tools and applications to overcome the challenges where leadership of construction manager should always exist. Nasaruddin and Rahman (2016) [10] confirmed that in construction projects organization, leaders and construction managers are persons who lead actions to ensure that the given tasks are successfully carried out. Construction leaders navigate the construction process in a sustainable manner. Construction managers should be always innovative, creative, and active to overcome all potential problems that may face during the work. Toors and Ofori (2006) [11] stated that good construction leaders should also be able to change the conventional pattern of management in the industry and setting ideal standards for other businesses to follow. For a successful project in the construction industry, it requires complex comprehensive knowledge of the different management areas like technical experience, reading the drawings, good personality, process and procedures, risk analysis, material management and personnel management. Bredillet, C. (2008) [12] said that it is especially important to have skills of limited resources and information to maintain and control uncertainty in the project. The aim should be to develop or refine construction management technique, to explore the experience of project teams to enable better understanding of what happens in project to develop performance metrics. The contractor's construction manager is the person who has the overall responsibility for the successful planning and execution of a project.

One of his responsibilities is meeting the project target by achieving the completion of the project within time under budget and in accordance with the required performance and quality level.

3. Research aims and objectives

The aim of this research is to find out how the effective construction manager can complete and deliver the project on time and how his roles can reduce the delay in major construction projects, mainly mega projects.

Meantime, the author intends to find out how the experienced construction managers can participate to overcome all potential challenges through the process of monitoring and control and through the utilization of best practices and techniques of principles of construction management which are implemented during his day-to-day actions, roles and responsibilities. Study findings will be based on analysis of the questionnaires survey combined with interviews that will be carried out with effective and experienced construction managers to identify the necessary actions that they must do to deliver projects on time. The study also aims to identify some factors caused by construction managers in projects that will lead to negative effects and cause some delay on project progress. The findings will determine essential roles that effective construction manager must have to deliver the projects on time. Scott S. (1997) [13] stated that there are of course, factors other than varied work that may delay the project, and it is also generally recognized that delays may be attributed to the Contractor. Much information are collected during the study from many sources such as literature review, questionnaire survey and interviews where the literature review provided much information about roles and responsibilities of construction managers of projects Findings and data analysis will of

questionnaire survey and interviews will be analyzed to assess and evaluate the actions that construction project managers must have to deliver the project on time.

4. Methodology

The research is prepared in a way to maintain the accuracy of information and analysis. The study is conducted in a proficient and skilled manner, in order to meet the objectives of the research without any biasness. Combination of comprehensive research methods was adopted in this study including literature review, questionnaire, and quantitative and qualitative analysis. This part focuses on the theoretical background of various research methodologies that presents the overall research process. The analysis are prepared to find accurate results to the best possible extent. This analysis is not only important in order to interpret the findings but also to set the frame of reference for solutions and recommendations parts of the study. Many variables have to be considered during research analysis to come out with accurate data, findings and analysis. Denscombe (2007) [14] stated that the importance of depended and independent variables cannot be ignored not only in frame of this research but in the frame of any other research. In short, quantitative analysis is the examination of data collected via survey techniques through statistical methods to ensure that the data collected is both reliable and significant. Quantitative tools provide much more depth to understand the reasons behind the scope of work, moreover, when taking a decision of strategic nature in a project. Davies and M.B. (2007) [15] confirmed that doing a successful research project using qualitative and quantitative method is very essential where differences of context of survey, questionnaire, sampling, and interviews should be identified to help the researchers to come out with an accurate data. Questionnaire surveys are a method of collecting data by asking respondents to complete a questionnaire. And a questionnaire may include a series of set questions, and either provides a space for an answer or gives several fixed alternatives from which the respondent must select.

5. Traditional Procurement Method

Traditional procurement method is the standard methods adopted by clients, consultants and contractors mainly for mega projects. It involves the separation of construction from design where the contractor is assigned to build what is designed and specified by the consultants based on client needs and requirements through a contractual agreement signed between the client and contractor. The contractor will be paid based on the work progress that complies with specifications and another contract document. Once the contractor starts the work in the project, the project manager, construction manager and the planning engineer verify all contract documents and they must report about any discrepancies between drawings, bill of quantities and specifications. Discrepancies must be sorted out with the consultant and the client to avoid additional cost that will cause major delay to the project.

The effective project team must have enough experience in the principles of construction management to verify the contract document, working process, and method statements of major activities. Common delays caused by contractor project manager is widely recognized as a major problem in construction, which often leads to costly disputes between the parties involved. The delayed projects will typically produce financial penalties due to the failure of the achieving the construction project goals.

The blame for most project delays is frequently attributed to project manager and construction manager. Some delays can be controlled by the construction project manager of the contractor. Chan D. and Kumaraswamy M. (1995) [16] stated that factors of the project delays are the project complexity, type and style of management, type of contract management, internal communication, level of experience of construction manager and the project manager. Therefore, it is the responsibility of the contractor to build the project according to what is specified in the tender documents. The execution of the contract is managed and administrated by the contractor's project manager who should have experienced effective qualified construction manager to

manage and control any unexpected potential issues or risk during the work.

The contractor project manager is the person who has the overall responsibility for the successful planning and execution of the project. In most of construction projects many factors affects the performance of the contractor's project manager and his team for carrying out their duties as it should be to deliver the project on time. Anderson W., (1997) [17] confirmed that factors are lack of experience in contract terminologies, and wrong interpretation of contract terms, lack of information's in condition of contract (Traditional type) and developing the methodology of the construction of the project. That's why roles and responsibilities of project manager and construction manager in any construction project should be clearly identified.

5.1. Roles of project manager

The main goal of contractor project manager is to deliver the project within the exact agreed duration, approved budget and the quality standards throughout an approved plan that supports all project teams to guarantee successful completion and delivery of the project. This can be accomplished through ensuring that the proposed management procedures are approved by senior management that complies with approved procedures. And making sure that all project team are aware of the project approved procedure and other contract documents. He must be able to advice his team about the reporting process and making sure that log system of all documents is controlled by experienced document controller. In addition he has to lead the team in reviewing the contracts documents and advice about any discrepancy that may affect work progress, and he has to report directly to the senior management about any deviation from project requirements considering the associated time and cost which might affect the work progress of the project. He must visit the site regularly to monitor the work progress of main site activities in terms of time, cost and quality and recommend for any corrective required action for any non-compliance procedures.

5.2. Roles of construction manager

Major roles of construction manager is to plan and supervise a wide range of construction project from start to finish. He should be able to organize and oversee construction procedures and ensure they are completed in a timely and efficient manner. Construction manager must be well-competent in all in all construction methodologies and procedures and able to coordinate a team of professionals of different disciplines to achieve the best results. A part of his responsibility is to make sure that project will be delivered on time according to requirements and without exceeding budget, this can be achieved through collaboration with engineers, architects and other project staff to maintain the specifications of the project. Supervising the work of laborers, sub-contractors. And giving them the guidance when required is a part of his responsibilities as well as evaluating progress and preparing detailed reports to the project manager. Ensuring adherence to all health and safety standards and report issues is also his responsibility. Checking regularly the status of the Martials submittals and approvals, submitted inquires and the action of the design team to close the pending inquires to avoid any delay for the project. In addition, establishing documented procedures to overview and comment on proposed other subcontractors, vendors, materials, shop drawings and any other transmittal documents by the contractor.

6. Design of questionnaire

Questionnaires are developed to gather the required data and information for identifying the essential roles of effective experienced construction manager that makes him able to apply and adopt the highest level of implications of construction engineering management. The applications of principles requires long and enough experience that helps construction managers to deliver their projects on time. A template has been developed to collect the information that was a part of the questionnaire method. Naoum (2004) [18] stated that form of data collection is the most widely used source of primary

research amongst researcher as it provided access to a wide range of professionals which would normally be beyond the reach of most researchers. The survey is prepared to evaluate the perceptions of construction managers to the applications of construction management process. This is based on listed seven important processes that have been identified in the literature review of this research. Construction managers are requested to identify the level of meaning of each process and the level of important of each principle as indicated in table 1.

- Required level of experience of assigned construction managers
- Level of his contribution in preparing over all construction methodology of the project
- Identifications of risk and potential problems at very advance stage of the project
- Verification process of the prepared detailed drawings
- Follow-up of project materials (submittals, approvals, order, storage and installation)
- Process of project monitoring and control
- Achievement of milestones and major activities of the project effective and practical.

Table 1. Several Important actions to be considered by project manager and his team

S N	Questions/ Process	Validity %	Means	Rendering	Stand ard. Dev.
1	Required level of experience of assigned construction managers	100	2.99	58%	1.690
2	Level of his contribution in preparing over all construction methodology of the project	100	3.25	61%	2.101
3	Identifications of risk and potential problems at very advance stage of the project	100	3.95	71%	3.110
4	Verification process of the prepared detailed drawings	100	3.52	65%	2.559
5	Follow-up of project materials (submittals, approvals, order, storage and installation)	100	2.40	52%	1.426
6	Process of project monitoring and control	100	4.13	73%	3.523
7	Achievement of milestones and major activities of the project effective and practical.	100	4.45	75%	3.812

7. Data analysis and findings

The questionnaire distributed to fifty construction managers working in ten construction companies who have more than five running projects. They all requested to fill the questionnaires. The common feedback of all participants was that, the identified principles listed in table 1 and related activities are a part of their responsibilities they practice on daily basis. 64.7% confirmed that they still need to improve, and they can be trained to cope with latest techniques and innovation related to the principles of construction management including the adoption of artificial intelligence in some activities. They all agreed that all construction managers of contracting firms must have at least 15 to 20 years of experience to run big size projects/ mega projects. Level of adoption of the processes is not the same, it varies from one to another based on the level of experience, level of commitment, level of responsibilities, level of cultural factors, personal behaviors with others and his own traditions. In table 1, the standard deviations, calculated rendering frequencies and means are to provide and analyze regression which identifies the estimated relationship among the variable's analysis are estimated.

The basis of data collection and analyses is to observe the level of commitment of construction managers to the implications of construction management principles that includes best practices to complete and handover the project on time. Regarding the first principle that is the appointment of construction managers of mega projects, 58% of respondents confirmed 15 years' experience is required to be appoint them, while others stated that some new skills

can compensate numbers of years required like the understanding of construction procedures and material and project management principles, familiarity with construction/ project management software, and excellent organizational and time-management skills. For the second principles that is the level of his contribution in preparing over all construction methodology of the project, 61% stated that they do contribute in preparing construction methodology at the beginning of project based on the available information they receive from tendering & technical department. Others stated that once the project start, issues of discrepancies in drawing appears which cause big impact in the cost, time and quality, so they recommended to have special soft wares that can help them preparing the overall construction methodology to avoid any impact. This can help them in preparing the shop and detailed drawings without any discrepancies for all activities. For the third principle, that is Identifications of risk and potential problems at very advance stage of the project, 71% confirmed that they meet/ work regularly with the project managers and present all potential risks in advance. They transfer and share all types of risks to senior management and keep follow-up the mitigation actions to close them.

Others advised that risk managers should be assigned from day one in the project to manage and handle all risks in the project because construction managers have many other works to be monitored and completed. For the fourth principles, it is about verification process required to prepare the detailed drawings. 65% of respondents stated that they are directly involved for this task, because they do compare quality, specification and quantities recorded in the tender documents with what is shown in the drawings. Accordingly, they can develop shop drawings and other coordinated drawings. This consume construction manager time that can be used for other work activities. Others stated to use the latest techniques of drafting software to reduce the time of verification. Regarding the fifth principle that is for materials management where 52% recorded that there their projects managers are asking them to compare data and technical specification of procured approved materials with the specified one of tender documents. Approval process and procurement follow-up is a part of their responsibility as well.

Others suggested not to be involved in procurement and sampling process except storage and installation of approved materials where construction managers can be communicated directly with suppliers for understanding the technical specifications and manufacturer recommendation of approved materials that will be delivered to the site. Process of monitoring and control, that is the sixth factor, where 73% of respondents stated that it is one of the important activities that construction managers are doing on daily basis. This process focusses in all responsibilities of activities, recoded in the metrics to ensure that the work progress of the project runs within the scope, and budget, this helps in reducing and controlling unexpected potential problems. Others recommended that they can fully authorized for immediate actions without referring to the project manager such as taking a corrective action whenever required. Controlling the working hours for the manpower on contracting basis rather than regularized hours to increase the productivity without affecting quality.

The last principle of construction management is achievement of milestones and major activities of the project where 75 % of respondents confirmed that it is their responsibility and they have to plan and coordinate with the team members of the project to achieve the milestones on time. Delay of milestones cause big impact on other activities which lead to a big change in the baseline schedule. Recovery program and new baseline must be developed to meet the new completion dates of some activities. This cause major impact on time, cost and quality of the project. Others recommended to sub-contract major milestones to specialists who can manage and coordinate all work activities, while some others stated that construction manager and his team can be compensated financially for each milestone completion as a kind of encouragement from senior management of the project to maintain the project performance. Cheung (2004) [19] stated that project performance can be measured and evaluated using a large number of performance indicators that could be related to various groups such as time, cost,

quality, client satisfaction, client changes, business performance, health and safety. One of factors contributes to project success is project control. It is important to control the project through monitoring the work progress on daily basis. Behm (2008) [20] stated that Measure of Project Success in the construction industry is dynamic in nature. Data gathering and analytical process are used by project team through proper communication on daily basis which requires accurate reporting system for the information depending on good facilities and templates designed by construction manager.

8. Conclusion

Delivering mega projects on time requires qualified experienced project team presented by the project manager, construction manager and the rest of project team. Skills of communication and coordination is extremely essential to enable them monitor and control daily activities of the project on daily basis. Construction manager must have the enough knowledge of standards of construction operations combined with work sequence planning, principles of health and safety, drawings reading and verification, resource scheduling, materials procurement, regular project reporting, preparing method statements, quality control, cost saving, monitoring and control process, identification of milestones of the project, risk management and control and follow-up of pending issues. These are a part of the implications and the techniques of construction management. Adoption of these principles help in identifying potential problems at very early stage of the project. In addition, the latest techniques of innovation, invention of artificial intelligence including the applications of BIM "Building Information Management" and other related soft wares of programing must be adopted by construction manager and his team.

The necessity of the applications of construction management by construction managers is identified based on the analysis of researchers as recorded in the literature review. Construction delays is very expensive and must be avoided through the experienced construction management team. Other important task of the construction manager that is a part of his responsibilities, is to set up qualified experienced project team to work with him. This can be reflected positively on the work progress and project delivery date. During mobilization period, he is required to prepare general construction method explains all operational process that covers sequence of work complies with project technical specifications, roles of health and safety and standards of quality assurance and control. Regular follow-up of the work activities and major milestones as per the baseline schedule is a part of the responsibilities of the construction manager. One of the main responsibilities of construction manager is to build the project according to the contract documents as per approved budget and time. The execution of the contract is administrated by the project manager who should have the qualified experienced technical construction manager.

9. Recommendation

Adopting construction management processes is essential to validate the performance of the project and solve any potential problem faced that may affect time, cost, and quality. The role of construction manager is very important because he must deliver the project on time. He should outline in detail the technical obligations to mitigate any potential conflict which might arise during construction phase. Activities should be planned according to the sequence of work and principles of planning. Experienced construction manager will most likely complete the project within the time limits and the rendered resources. The following are some recommended actions and recommendations that must be considered by construction managers of mega projects:-

- Developing automated system to monitor and control progress of mile stones and work activities
- Understanding latest standard model of maintaining internal quality system
- Working on the techniques of normal balancing model of effectiveness in construction
- Developing unified systematic forms covering all required actions of principles of CM

- Focusing on risk management applications and techniques till the project is completed
- Adopting policy of continues training and developments on the implications of AI, innovation and latest programs relating to construction like BIM

Declaration of Conflict of Interests

The authors declare that there is no conflict of interest. They have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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