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REVIEW ON RISK MANAGEMENT IN EPCM PROJECT

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Abstract - Considerable work has been carried out on risk qualitative and quantitative assessment but far less on risk identification. This paper introduces a newly developed method for risk identification, based on micro risk breakdown structure and newly introduced identification procedure called preventive root cause and effective remedial. Project risk management has evolved over the past few decades. It probably could have started with astute project managers anticipating problems during project execution and developing a pre-planned strategy to overcome these. It has now advanced into a structured risk management process that is well integrated into all project management Knowledge Areas. The relationship between the client's project team (CPT) and the consultant's or the engineering, procurement, construction and management project team (EPCM) will be a determining factor in the success of the project. It is essential that a spirit of co-operation, support and respect be nurtured throughout the project life cycle. Should this aspect be neglected, relationships will soon spiral down to an adversarial and pejorative mode with dire consequences for the project as a whole. Certain hold points will be indicated by the CPT for which approval must be sought by the PM before work can proceed on any activity. This process will be accurately defined and included in the schedule

***Keywords*:** Procurement Construction Management (EPCM), Client Project Team (CPT), Risk Management, User Requirement Statement (URS).

1. INTRODUCTION

Engineering, Procurement, and Construction (EPC) projects are multi-year, long duration projects. During their initial stages, the project manager should do a contract summary briefing to all key players, including engineering leads, procurement and contracting managers, and corporate/functional managers [1]. It may be necessary to conduct "re-emphasis" sessions during critical stages of the project as well as necessary to have regular risk reviews on the project, including briefing new key players on contractual and close-out aspects of the project. In EPC projects, because of long duration, the warranty phase would seem to be too far to attract enough care and attention [2]. A problem to be fixed under a warranty may cost more than getting things right in the first place. The project manager must use organizational process assets and quality audit/quality control to ensure quick detention of any inadvertent errors followed by remedial action taken on time. Communication on delivery as per the contract, without gold plating, is equally important. The relationship between the client's project team (CPT) and the consultant's or the engineering, procurement, construction and management project team (EPCM) will be a determining factor in the success of the project. It is essential that a spirit of co-operation, support and respect be nurtured throughout the project life cycle [3].

1.1 Background

Should this aspect be neglected, relationships will soon spiral down to an adversarial and pejorative mode with dire consequences for the project as a whole. Therefore it is imperative that much work and effort be directed towards this goal. More specifically, we can now look at some of the contractual obligations of the parties. Whereas the EPCM project manager (PM) is accountable for the outcome of the project in terms of performance (P), cost (C), time (T) and scope (S) constraints, it is incumbent upon the PM to determine the project processes [4]. The PM will execute the project with due care and diligence in accordance with the contractual definition of the deliverables. The client's project team (CPT) will determine the product as specified by them and submitted to the PM before any work commences. To this end, the CPT will draw up a comprehensive user requirement statement (URS) [5].

In many instances, the EPC agreement functions as a turnkey contract. Whatever the scope of the work, be it an entire refinery or a small addition to an existing plant, the Contractor**2** will design the facility, build the structures from foundation to trim, buy and install the equipment, perform all remaining construction, test all major and minor equipment and operations, train the operators, and hand over the complete drawings and operations manuals. Of course, Owners may create many variations on this theme, such as ordering long-lead time equipment for the EPC Contractor [6]. However, the core of the EPC agreement is that the same entity is responsible for all of the operations from creation to certification of completion. Of course, that entity subcontracts out vast amounts of the work, and it certainly does not manufacture the equipment or create the materials. It may hire almost all of the labor for the project [7]. Nonetheless, the EPC Contractor performs all the work, directly or indirectly, and represents to the Owner a single point of responsibility. The Engineer still curtails its project risk, in keeping with providing service and not a complete project [8].

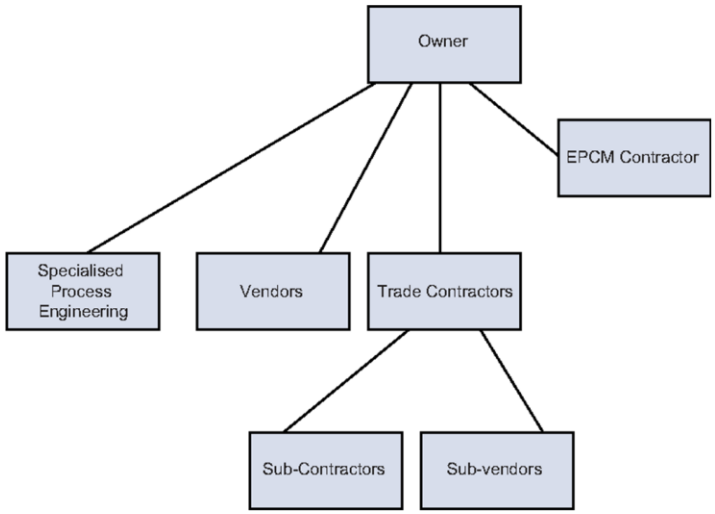

Figure 1. EPC Arrangement Source : Author [9]

1.2 Motivation

EPCM (Engineering, Procurement and Construction Management): means the company is contracted to provide engineering, procurement and construction management services. Other companies are contracted by the Owner directly to provide construction services and they are usually managed by the EPCM contractor on the Owner's behalf [10]. Think Professional Services contracts, where the project is largely Owner managed and the cost risk and control is weighted towards the Owner. Included is a simplified Chart showing the differences in the type of contracts and how each would differ under the same situations? The list below is not a complete list of differences between EPC and EPCM contracts but it does address many of the major contractual differences. The way each of these issues is handled can be modified during contract negotiations to suit the situation and overall goals of the project [10].

2. LITERATURE SURVEY

Alfredo Federico Serpella et al.[1] This paper has presented a brief description of a research effort which is underway at this moment and has the purpose of creating a knowledge-based approach to risk management in construction projects. The motivation of this research is the very limited application of risk management in Chilean construction projects as has been reported by previous research work and the urgent need to improve this function in both, owners and contractors. The results expected from this research will help owners and contractors to have a more systematic and formal approach to risk management and to make use of their own knowledge and experience as well as international best practices.
A Nurdiana et al.[2] this study it can be seen that from the perspective of the owner, the highest risk in the EPC project were Contract Change Order by contractor and results of the initial study (engineering and environment) that were less accurate than expected. 12 risks were identified, and most were in the low risk level. Further research can assess risk from the perspective of other stakeholders involved in an EPC project. The aim of this study is to analyze the risk from the perception of the owner of the project with the Engineering, Procurement, and Construction contract type. Primary data collected were in the form of identification and assessment of the impact and risk probability obtained by interviews and questionnaires.
Bart Lenderink et al.[3] In this paper, the development and application of a public-client-led method is investigated that enabled the development and implementation of a radical green innovation in a civil engineering project. Addressing the implications and research opportunities of the findings of this study in future research, could make important contributions to the understanding of the determining factors and mechanisms that influence the successful development and implementation of radical innovations in civil engineering projects. This will also open up opportunities to find solutions for the grand challenges our physical environment is facing.
Hu Jinrong et al.[4] The main purpose of this article is to define engineering risk existing in the process of the development of Energy Performance Contracting (EPC) and to provide a system and quantitative evaluation method to reduce engineering risk of EPC. We systematically studied the engineering risk existing in EPC: the political and legal risk, market risk, technology risk, management risk, financial risk, project quality risk and client risk. By using the mature ideas, tools, and technology of risk management experts' marking methods and synthetic evaluation method based on fuzzy theory, the target system of evaluation on EPC is discussed, qualitative and quantitative risk evaluation is conducted, and the guiding ideas and the model are provided. At last, by putting forward the corresponding measures for the EMC to control risk in the operation, this article provides reference point for the risk management planning of EPC.
K T Liew et al.[5] There is lack of studies focused on the risk assessment of infrastructure projects cost overruns during the tendering stage based on the results of the review analysis as mentioned in section III. It is suggested for future research to be focused on the risk assessment of infrastructure project cost during other project stages (e.g. operation stage). This is because different stages of project life cycle could have different risks which can cause different level of significant impact on project cost. Lastly, it is very important to manage risks as they are the key factors that causes cost overrun and affect the successful implementation of infrastructure project. The identified knowledge gap leads us to conduct a study about the risk assessment of infrastructure projects cost on tendering stage. In a future research which is on-going, critical risks that could cause a significant negative impact to the infrastructure project cost during tendering stage will be identified. It is expected that the critical risks will be the useful information to the industry parties involved in the infrastructure projects in managing project risks.
Mr. Nagarajan Muthukrishnan et al.[6] This Research paper aims to study the risks and risk management practice adapted in the construction project through various roles from top management to worker level. The questionnaire survey has been prepared and responses were collected with a

sample of 132 Professionals / respondents across India. The respondents are requested to provide their opinion based on their expertise through their present & past project experiences. The Construction professionals from various industrial sectors have participated in through online survey.

Ms. M Sivagami et al.[7] A major conclusion of this paper is that risk management in construction projects is still ineffective due to various reasons. Therefore, there is an urgent need for further research for improving risk management in construction sector which should employ sophisticated techniques yielding better result.

Phong Thanh Nguyen et al.[8] This paper investigates the risk factors affecting the implementation of DB projects in construction industry in Vietnam. The results showed that the top three critical risk factors in descending order of importance are: delays in project approval and licensing, interest rate fluctuations, and design or technical specifications deficiency and change. We expect that the research results will support researchers and project managers in the DB contract approach in project management.

Qing'e Wang et al.[9] The research results impel contractors of the international EPC projects to pay close attention to the key risk factors in the project procurement process. After recognizing the risk transfer path, contractors can take measures to avoid risk to reduce the possibility of project failure as soon as possible. This research can provide support for managing procurement risk in the international EPC project.

Robert Osei-Kyei et al.[10] Construction risks are multi-faceted both in developing and developed countries. The economic situation in a country may also dictate the risks that countries may face. Construction risks are inherent and challenging to deal with. This study conducted a scientometric analysis of the research trend on risk management in construction. Scopus was selected as the database for the analysis. The study contributes significantly to the existing body of knowledge on risk management in construction. It informs researchers on how well studies on risk management in construction have progressed and suggests some of the possible future studies that can be conducted. The findings provide researchers with knowledge on the genesis of risk management in construction and the research trend over the past four decades.

Ximena Ferrada et al.[11] This paper has presented a brief description of a research effort which is underway at this moment and has the purpose of creating a knowledge-based approach to risk management in construction projects. The motivation of this research is the very limited application of risk management in Chilean construction projects as has been reported by previous research work and the urgent need to improve this function in both, owners and contractors. The results expected from this research will help owners and contractors to have a more systematic and formal approach to risk management and to make use of their own knowledge and experience as well as international best practices.

Yimeng Song et al.[12] This article uses the ISM model to analyze the risk factors of international EPC projects systematically, which directly reflects the relationship between risk factors of international EPC projects. Therefore, it helps project managers to find the fundamental and important factors that relate to international EPC projects. At the same time, it provides a new analysis idea for the risk management of international EPC projects. Risks are unavoidable in the construction process of international EPC projects, which needs to be estimated in advance. Soberly, improve risk assessment and prevention capabilities, and establish a scientific risk management system to effectively avoid and diversify risks and improve international competitiveness.

Conclusion

Mega projects vary by industry, by public-private ownership, by risk of technology and development, and by a host of other factors. No single contract form, even those as flexible and developed as the EPC or the EPCM models, will suffice for every need. These points of comparison should help sort out the qualities that an Owner may want to include in its ultimate agreement. Parties working with that Owner, as well as their attorneys, need to keep these subjects of risk allocation in mind, if the project is to succeed and if they plan to move on to the next big undertaking in a highly competitive environment. The cancellation of mega projects and the postponement of many more make all parties more dependent on "getting it right" when they are able to work together. Tailored transactions are becoming more common as 'usual' delivery and procurement methods fail or fall into disputation and as the understanding levels rise that an appreciation and adaptation of available options can be critical to the success of a project. The parties must consider the particular requirements of the project from invitation, to tender, to selection, to contract and not let the contract drive the project. The selection of the correct method of project delivery may however still be described as more an art than a science. Project objectives of quality, time and cost fit every project. However to risk manage a project it is important to identify, analyse and respond to the weighted risks. Careful selection of the delivery process is one of the most important decisions that an owner will make in the development of a project. No one delivery process is suitable for every eventuality. A suitability matrix for evaluating and selecting the appropriate project delivery system is a useful tool and one which can be worked through to establish whether or not a traditional/hard dollar or more non-traditional/soft dollar delivery method may work best and so should be chosen.

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