Annotated Bibliography

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**Renuka, S. M., Umarani, C., & Kamal, S. (2014). A review of critical risk factors in the life cycle of construction projects. *Journal of Civil Engineering Research*, *4*(2A), 31-36.**

**A Review on Critical Risk Factors in the Life Cycle of Construction Projects**

This is a review article in which 50 articles that are published in the last twenty-five years have been included. During the 1990s, identification of risk factors and techniques for assessment became a hot research topic. Most of the contractor's formulated a chain of thumb rules to assess and analyse risks. As a result, most of the projects of construction failed to attain their quality goals, time and cost. The project uncertainties and goals in time and cost can be achieved by a systematic approach during the stage of estimation to minimise the effect. This approach includes the identification of sources, assessment of effects on projects and selection strategies to control them. The risk sources were categorised based on uncontrollable and controllable risks that lead to time and cost overrun. On the basis of this, different models of risk assessments have been developed to assess and analyse the risks of project during the stage of bidding of a construction project. Till 2000, some attempts have been made on the assessment and identification of risk factors in the construction projects. This results in a lack of systematic approaches to manage and identify construction projects. After 2010, most of the researchers have made an attempt to propose the complexity and imitation of risk assessment tools, i.e. hierarchical analytical process and decision support system. The sharp increase has been seen in the risk assessment and identification after 2010. Many sophisticated tools and model have been formulated by different researchers for risk assessment integration in the framework of decision-making. The main strength of this article is that it provides a comprehensive review of the risk factors in the construction project that are based on an extensive literature review. Another major strength of this article is that it discussed the literature review over the last three decades on the assessment and identification of different risk factors. The main weakness of this article is that it did not discuss in detail the strategies that were adopted in mitigating risk in the last few decades (Renuka, Umarani, & Kamal, 2014).

**Kaplinski, O. (2013). Risk management of construction works by means of the utility theory: a case study. *Procedia Engineering*, *57*, 533-539**

**Risk Management of Construction Works by Means of the Utility Theory: a Case Study**

The construction projects are mostly implemented under the risk conditions. This article has provided the risk analysis methods that are based on utility theory. This theory utilises data about construction and economic situation and also include the relationship between demand and supply seasonality. This approach also involves different variants of the utility function, historical data and conditional probability. The utility function is defined by the process in which decision-makers such as building site manager or contract engineer makes decisions regarding risk management. Utility theory has different applications such as it is applied in the quantitative assessment of the socioeconomic system, life cycle building, small business, construction modelling and the crisis of real estate, risk transfer and flexibility, and consumer lending. The most common use of this theory is in decision making. One of the most important factors of decision making in the execution and preparation of construction work is the predilection and aversion to risk-taking. The attitude of risk managers towards risk-taking is very important in the assessment of different options in the decision making a process in construction projects. In this article different tests have been carried out to determine the impact of the attitude towards risk while managing the construction projects. Tests have been carried out to confirm the main thesis of this paper regarding the significant influence of attitudes towards risk while managing construction projects. It is demonstrated in this article that risk influences operational strategies and at the same time also indicates the requirement of personal aspects of the decision-maker. In construction projects, it is advisable to use a utility function while recruiting management staff and making decisions. One of the strengths of this article is that it discusses the decision-making mechanism related to psychological and economic aspects. The method suggested to identify and analyse the attitude towards risk is based on the maximisation criteria of expected utility (Kaplinski, 2013)

**Taofeeq, D. M., & Adeleke, A. Q. (2019). Factor's Influencing Contractors Risk Attitude in the Malaysian Construction Industry. *Journal of Construction Business and Management*, *3*(2), 59-67.**

**Factor's Influencing Contractors Risk Attitude in the Malaysian Construction Industry**

This is a review article that is carried out to identify different factors which influence the risk attitude of contractors. This article has demonstrated different factors that impact the risk attitude of the contractor. The strength of this study is that it is important to all stakeholders and individuals in the construction industry. Another strength of this study is that it categorised the specific human risk factors affecting the risk attitude of contractors in the construction companies of Malaysia. This study provides a basis for a conceptual framework for determining risk management in the construction industry. It is found in this study that the risk attitude of contractors is influenced by the human-related factors, external environment, project-related factor, and capital. Another strength of this article is that it provides information regarding risk factors which will help contractors, academician, engineers, project managers to control risk in the construction industry. Stakeholders can use this information for formulating strategies on the risk attitude of contractors. This research has some weakness as well; for example, the study is conducted in Malaysia Pahang; therefore, the generalizability of results should be made with caution. According to this study, attitude is based on the personality, negative and positive evaluation of the concerns of the specific behaviour type, knowledge, and own principles. The risk attitude of contractors affects their decision of bidding in which they are exposed to competition and uncertainties. It is found in this study that most of the professional managers are risk-averse. The human factors such as skills and expertise, labour strike, efficiency, productivity, lack of efficient workforce, design error, lack of teamwork, delay in delivery, owner group, financial failure and owner are all involved in the risk management process in the construction industry. Other important human-related factors that affect the construction projects include staff turnover, education background, skills and expertise of project team lead and experience of contractors (Taofeeq & Adeleke, 2019).

**Part B**

Over the last 10 years, the construction industry has rapidly changed, and most of the companies are facing uncertainty and risk. Clients are expecting more, and they are more likely to engage in litigation if anything gets wrong. For any project, risk management has become an essential part of the management process. I have chosen a construction company for the risk management evaluation. This construction company is present in the United States and specialises in industrial, commercial and civil construction projects. This company was developed in August 2000. At the start, this company has faced many issues such as cost overrun, contractor strikes, and delayed projects. After 2010, the company has adopted different risk management strategies that help in improving its standards of sustainability, safety, and quality. In this study, history of company risk has been evaluated, and the strategies which this company has adopted for the management of risk are discussed. The aim of risk assessment analysis is to identify the risk and to examine the risk management strategies adopted by the construction company.

**Objectives**

* To identify the external and internal risk present in an organisation
* To determine the effective risk management strategies

**Scope**

Construction industry is influenced by many factors such as planning, complexity, design and presence of different interest groups (contractor, stakeholder and supplier), resources (equipment, funds, material and manpower) and environmental and political factors. Different risks are present in construction industry and risk management is important to manage different types of risks. The risk assessment analysis of this company will help to determine the different risks and also the effective strategies that are important in mitigating risk and to achieve the project objectives

**Risk Analysis of Construction Company**

In this construction firm, both external and internal risks are present that needs to be managed.

Economic risk: These are the risks that are associated with the supply of material and labour, equipment availability, company fiscal policies, the increment of prices of construction material, inflation and exchange rates.

Financial risks: The company's financial risks consist of interest rates, cash flows, capital supply, rentals, and credit rating. As many local partners are involved, such as suppliers, customers, and contractors, the risk of reliability arises.

Legal Risk: Another risk that is present in this company is a legal risk. These risks are associated with regulation and codes, approval and issuing of drawing and contractual clauses.

Managerial risk: These risks are associated with quality control, productivity, and human resource management.

Safety Risk: The safety risks that are present in this company include work quality, competency, and productiveness.

Technical risk: These risks are associated with different technical factors related to the processes such as design failure, site location, technology failure, estimation error, safety and health aspect and breakdown of equipment.

Environmental risk: Environmental risks are always associated with the company due to its location. These risks include weather conditions, soil conditions, and the impact of the environment.

For this company, the risk management process has an important role in the process of decision making. If risk management is not done properly, then it can affect the quality performance, budget, and productiveness of the projects. Although it is not possible to eliminate risks, they can be transferred, reduce and held back. The main reasons to adopt the risk management process are to limit or cut down the uncertainty and to take hold of different opportunities.

The major risks that are present in this company include a lack of coordination between client and team and material and human-based risks. In the past, both these risks have adversely affected the performance of the company. The company uses traditional methods of risk management. Formal risk analysis and risk management techniques were rarely used by the company. This may be due to the inadequate knowledge and doubts on these techniques suitability. It can also be due to the lack of responsibilities of contractors in different steps of projects. The company ignored the fact that risk can occur anytime. The problem should be analysed by taking into consideration different approaches towards the risk. Operational management strategies should be adopted to mitigate the risk that arises and its effect on the planning management should also be considered. In this case, a synchronised approach should be used for the risk assessment. In this case, a well-structured risk management process will prove to be very effective.

The strategies for risk management, which this company has adopted, are based on the following model. The risk management process consists of two main phases: risk assessment and risk control. Risk assessment usually includes risk identification, risk analysis and risk prioritisation. Risk control includes risk resolution, risk management planning, and risk tracking, monitoring, and corrective action. The construction projects of this company are managed by using different risk management techniques and tools. The application of different risk management tools depends on project nature, the policy of company, project management strategy, resource availability and risk attitude of contractors and project managers. A risk model is used to determine the risk scores for different construction activities.

Another risk which this company mostly face was a delay in payment in both private and public construction projects to prevent this the company has developed a schedule of construction risk model that is known as Evaluating Risk in the Construction Schedule Model. This model provides the company with decision support to consultants, project owners and researchers as a tool for project delay prediction. This company also uses a cost time risk diagram which helps contractors and project managers to consider the risk present in the project while monitoring and controlling the cost performance and project schedule.

The company is also facing great competition in the industry. The competition in the market is developed by different competitors that may behave differently in an uncertain environment. It usually depends on the risk attitude. The company has now developed its own culture. Risk culture helps the company to define its approach to deal with uncertainty and risk. The company now determine losers and winners through the competition in a market. Organisation culture is a complex set of beliefs, symbols, values, and assumptions that usually define how a company conducts its business. Risk attitude is described as "state of mind concerning risk and uncertainties that could have a negative and positive effect on objectives". Risk attitude is categorised into three main types: Risk-neutral, risk-averse and risk-seeking. As in this company project managers are somehow risk-averse and heterogeneity is present in risk attitude. Therefore, the utility function has been used by the company to manage the risk. In this construction company, the contractors are usually risk seekers because the job which they take is much riskier and in fact, most of the contractors in this company consider themselves as risk averter instead of risk seekers. The risk that is associated with this company is an error in estimating the delay in risk that is caused by the client or his representative, client financial failure and cash flow problem. Due to this, there is a need to better understand what contractor term 'uncertainty' and 'risk' in this peculiar environment to determine to assess the risks and its negative impact on the predefined objective of the company. The systematic risk management value of the project activity is not recognised fully by construction industry. The company has taken steps at coordinating risk analysis management between all the stakeholders. The process of risk management involves four processes (Banaitiene & Banaitis, 2012):

Risk identification: In this risk that is more likely to affect project are determined, and the characteristics of each risk are documented.

Risk Quantification: This risk is evaluated to determine the possible range of project outcomes.

Risk Response In this enhancement, steps for responses to threats and opportunities is determined.

Risk Response and Control: In these changes in risk are responded throughout the project.

Risk is present in the construction industry because of the unknown future and is a consequence of uncertainty. Uncertainty is defined as a" difference between the required information for decision and available information". As the construction process usually occurs in different phases, the nature and degree of emerging risk can vary with the complexity of the project. This will also change depending on the company culture, project type and experience of the project team. For the risk Analysis Company uses different methods in risk management practices. The traditional method of risk analysis, such as judgment, intuition, and experience, are found effective.

The company has adopted a risk management technique in all its construction projects. The company is not only taking the responsibility of all risks to the project success but also secure a commitment towards continuous and uninterrupted improvements from its partners. The challenges that the company is facing include future survival, company reputation, balance sheet, and cash flow. The company has also adopted an integrated project team approach to keep talented employees organised and motivated to get the maximum output from them. The root cause of each risk is determined which enables the company to eradicate risks in the most effective way. Risk hinders the ability of the company to provide its stakeholders and investors with expected returns. The company can reduce or mitigate the negative exposure to risk by identifying the external and internal risks. Internal risks are usually faced by a company within its organisations and can also arise during normal company operations. These risks that arise can be forecasted with reliability, and the company can reduce effectively internal risks. The main types of internal risks include technological factors, physical factors and human factor. Human risk includes employee dishonesty, union strikes, external suppliers and producer’s failure, inability to pay on the part of customers and clients and ineffective leadership and management. Personal issues can lead to operational challenges. The staff who becomes injured or ill are not able to work properly and can decrease production. A company usually require to hire a person that is key to the success of the company. Technological risks consist of unforeseen changes in the delivery, manufacturing, and distribution of company services and products. The strategy which this company has used to reduce the internal risk include credit insurance that provides protection against debt defaulters and is usually comprehensive.

External risk occurs due to the economic events that arise from outside and cannot be controlled and forecasted by the company with increased reliability. Therefore, these risks are difficult to manage. The three types of economic risks are natural factors, economic factors, and political factors. Economic risks are associated with the fluctuation in the market, such as the overall downturn of the economy can lead to unexpected revenue loss. Natural risk factors are comprised of natural disasters that can affect the normal operations of the business. Political risks are associated with changes in government policy and political environment.

Due to the inadequate practices of risk management, many projects of this company in the past have not been completed within the allocated budget and on time. There is still a great need to educate and train employees about practices of risk management. To resolve this, the company has developed a risk management framework based on utility theory. In this construction company, different risks are present in construction projects which needs to be assessed, but due to the inadequate system of risk identification, most of these risks are not identified properly. To manage this, the company should use different risk identification techniques such as brainstorming, checklists and interview sessions (El-Sayegh & Mansour, 2015). Other techniques are not used by this company because of insufficient knowledge about the applicability of these tools in the construction projects. Risk management techniques rely heavily on the company's historical data of risks and judgment of main actors that are involved in particular construction projects as the company relies heavily on the utility theory for the identification of risk under uncertainty. This theory is criticised for its rationality and assumption as decision-makers mostly use inconsistent heuristics in most of the decisions related to different construction projects. In this case, the prospective theory will found to be very effective in which the decision-makers usually assign values to loses and gain instead of final assets. Due to its artificial nature of decision problems, utility theory has also been criticised. Risk is an important part of any construction projects, and the most challenging activity is to find risks that are present in the projects and how to prioritise these risks according to the severity. Effective risk management is very important and it requires systematic and proper knowledge, methodology and ways to determine the risk probability. To avoid these in future this company should periodically evaluate different project risk and an effective risk mitigation plan should be developed for the project progress. Proper planning should be done to cope up with both internal and external risks present in an organisation. A risk management plan should be developed by the company which outlines the direction and nature of the projects. There is a need to develop a risk management policy that allocates the responsibilities and roles of different personnel in a project.

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