Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 8, Issue 03, March -2021

Risk management in infrastructure projects

Knowledge-based technique

[1]Hussain Ahmad, [2]Muhammad Yaseen, [3]Osama Ahmad

University of Engineering and Technology Peshawar, Pakistan
CECOS University of IT and Emerging Sciences Peshawar, Pakistan
University of Swabi, Pakistan

Abstract: *Project manager performed important role in management of risk. But this job should be performed at the start of the project, if not then it becomes quite challenging. A proper and structured methodology and on top of that, expertise and experience is required for an actual and useful risk management approach. The efficiency of projects is seriously affected by poor risk management practicesof owner, client, and the contractor. In this paper discussion on the issues of risk management in infrastructure projects and fundamental research on introduction of risk analysis and its application is carried out. The process of risk management will be covered in depth in the paper.*

Keywords: *Risk management, Risk analysis, Risk management practices, Risk management approach, Infrastructure projects*

I. INTRODUCTION

Infrastructure projects are unique in nature. In the construction industry many problems arise, and several players from various departments has to act and play together during different stages of the project. Intricate and long-term companies are construction ventures ((Sudarshan et al, 2014))

It is necessary to design a structure in accordance with applicable codes and standards. To construct the structure on the site, drawings, designs, and specifications in appropriate detail must be made available. External variables, such as constant changes in labor laws/practices and government rules & regulations, also have a significant effect on the infrastructure project.

During implementation of the infrastructure projects risks are associated with them throughout the project. It is necessary to identify at each stage of the infrastructure project what kind of risks can be associated with the project and what remedial measures are and how expensive these measures are. To this end, it is important to identify the threats, potential risk costs, the steps, and the costs of the measures, and to identify suitable measures in orderto avoid future errors.

To create adequate and useful risk management, a suitable and organized methodology, and most significantly, knowledge and diverse experience, is required. For e.g., during the implementation of the project it is necessary to have knowledge and experience of the unforeseen events that may occurs. When unforeseen events occur project manager will take actions. Project manager will evaluate the risk or estimate the probability of occurrence of the risk. The results of the actions may be positive or negative

In the construction industry, decision making process is very significant, and decision about managing and analyzing risk is very crucial. A high degree of risk is correlated with all stakeholders in the construction industry because of the existence of macro-, meeso- and micro-environments unique to construction project. (Zavadskas et al., 2010); still, in most cases the construction industry fails to cope with risks since most of the projects do not completed in allocated time and cost.As a result, all the stakeholders' i.e. Customers, vendors, the public and others have suffered (Akande et al., 2010). The following factors should be taken into account: significance of the risks, currently available approach of the risk management, the current state of corporate risk management processes and from the viewpoint of key stakeholders, the barriers to successful risk management. It is clear from the analysis that most critical risks that construction sector typically attempts to adjust or avoid are economical and financial factors, followed by efficiency(Rafiq & Choudhry, 2013).Important part of the management of risk is perception of risk. For the analysis and management of risk, basics are Risk management attitudes and threats and perceived benefits. While numerous risk management papers have been written, most surveys are performed in developed countries, and there is little knowledge of risk awareness in developing nations (Hamid & Woo, 2007). How individuals in this industry view any risk is critical for successful management of risks in this industry.

The objective of this paper is to discuss and address, from a system perspective, the management of risk challenges in infrastructure projects and to analyze the risk management process in depth. Preliminary studies into the fundamentals of risk analysis in the construction sector and its application. Threat and vagueness are widely used concepts and have been clarified in detail as a result. In this paper for the infrastructure projects different risks are considered and different methods adopted for the analysis of risk are also discussed. Wide range ofsources of risk in infrastructure projects are also discussed.

II. RESEARCH METHODOLOGY

The research approach involves both general and comprehensive literature reviews for infrastructure projects that will help to structure a management system as a standard benchmark for assessing the situation in aninfrastructure project as shown in Fig 1.

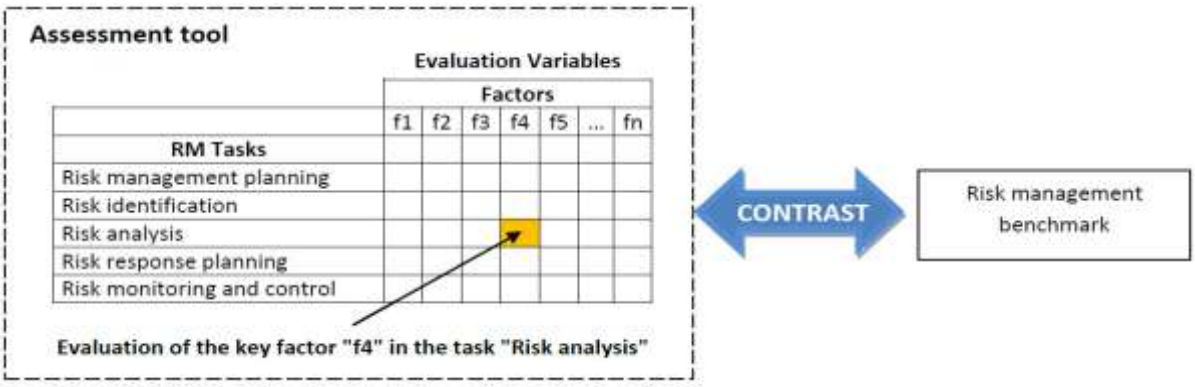

Figure 1: comparison of management benchmark and organization's risk management assessment framework

III. DISCUSSION

A. Definition of risk and uncertainty

Risk is an abstract term, difficult to describe, except in certain situations, and therefore hard to quantify with any accuracy. A reasonable description of risk as well as uncertainty in terms of economics and management of infrastructure projects: it is the risk due to which expected results of the a given event or operation is likely to be different from the estimated or prediction and it is the part of the project.(Chapman & Ward, 1997). When it occurs, any unknown event or situation will have an effect that may have a negative or positiveeffect on the goals of the infrastructure project. Thus, risk, if and when it arises, has a cause and a consequent effect.(Jaafari, 2001) defined risk as exposure ofgain or loss, or the probability of gain or lossrate multiplied to its corresponding magnitude. If probable rate of an event is 100 % then the event is called to be certain,on the other hand if the probability of occurrence is 0 %, then event is said to betotally uncertain. If there are multiple possibilities and no one is sure that what will be happen, then it is said that the case is an ambiguity. All activities in manufacturing, services and exchange are characterized by risks and uncertainties, affecting all the fundamental variables that decide preparation, execution, control, adaptation, actions and lead to decisions. Depending on the essence of the risk and what it applies, any explanation of risk may likely to bear a component of subjectivity.

- Risk occurs when an option is described in terms of the spectrum of potential outputs and when it is possible to apply known probabilities to the results.
- Uncertainty occurs when a course of action has more than one potential consequence, but the likelihood of each outcome is uncertain.

The distinction between risk and uncertainty was made by (Edwards & Bowen, 1998). Risk, therefore, has a place in the probability calculus, and relates itself to quantitative speech. In comparison, the situation in which there is no precedent relating to the circumstances or the situation in which there is no historical evidence available is called uncertainty.

Risk is usually interpreted only as a loss because risk has a negative effect on the project, most of the time, which is why individuals consider its negative side, otherwise risk may have a good impression on the project (Serpella et al., 2014). In the meantime, the concept of risk takes, not least, the chances into account. If business owner or project manager know his/her risk well enough then he/she can convert risk into opportunities. Management of risk is a technique for the prevention of losses and the use of available resources or opportunities that can arise from threats. The method allows the individual taking action to correctly analyze and evaluate the situation and the situations that are likely to arise in the future.Decisions are made on this basis in the hope that all risks will be avoided and that all resources will be used. This means identifying potential risk and violating the danger by preventing, avoiding, or reducing their harmful consequences.

B. Risk management

Management of riskis an essential aspect of infrastructure project management, it may not be easy to recognize the risks of the project and prioritize those risks (Serpella et al., 2014b).An essential part of the project management is risk determination and prioritization and is well known to most project managers (Serpella et al., 2014a);Perera & Holsomback, 2005; Alali & Pinto, 2009).

There are several phases in the risk management process which will be clarified below.

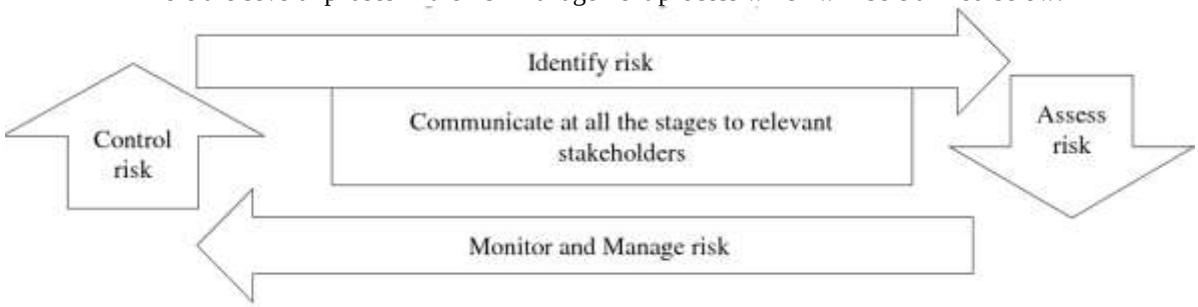

Figure 2: An insight of the process of Risk management in an infrastructure project.

C. Step 1 Identifying risks

Identification of risk is the process of identifying threats that may impede the achievement of its objectives by the program, organization, or investment. It requires the documentation and correspondence of the fear.Various sources of risk exist. The project team should examine project scope, budget estimates, timelines (including assessment of critical activities), maturity of technology, performance criteria, challenges of performance, expectations of stakeholders as per the plan, other dependencies, implementation challenges, proper integration, durability factors, and vulnerabilities in supply chain for risk identification. additionally, old data from historicalprojects, interviews, and other risk lists give useful information to risk-taking areas.

In projects which are broken down into risk categories, the following risks exist:

Quality risks are Flaw in interim outcomes, Lack of execution of project approaches**,** andfew or no checks / examinations

Personnel risksare Absence of expertise andthe squad disputes

Cost risksare Improvements in planning, Difficult conditions of projects, and Difficulty in disbursement of payment to consumers

Set date / target risksare Unable to deliver in decenttime, and the completion of the project has been postponed.

Risks of plannedchoicesare Inability to recognizeprobabilities, and Nonexistence of the opportunity to use chances regularly

Peripheral risksare Normal events, Shifts in politics, Culture changes, Market change / emerging markets, Legislative innovations - Legal changes, Changes in patterns in the sector, and Advances in technology

D. Step 2 Analyzing risks

Risk analysis can be multidimensional because you need complete details i.e. designs, plans, business financial records, market projection, security protocols, and several other relevant data. It's an important planning instrument, however, and one that time saving, money and prestige. The goal is to outline as absolutely and exactly as feasible the chance scenario and to prioritize the dangers. For this in regards to the probability in their incidence and the consequences at the project, the recognized dangers are investigated. In the primary place, a portfolio and a chance fee evaluation are used for category purposes, respectively. Criteria on the premise of which character dangers may be measured and as compared with every different ought to be defined.

A risk must be continually described as an impact of loss or damage resulting in the awarding of a specific charge. From there, the value of the risk can be determined primarily by the damage or loss measured in the form of cost and probability of its impact.

Risk evaluation approaches:

Analysis of Effect, Probability and Effect: This is a in large part formalized empirical approach for systematically covering, and calculating the risks associated with all potential errors. In this with the help of a general mistake, chance, and impact evaluation form, viable in all likelihood mistakes are decided inside a team, the consequences are investigated, and the reasons are observed and evaluated. Then reasons of errors are systematically measured in expressions of the chance in their occurrence, the customer's importance, and the chance in their discovery. At the end, suitable steps were implemented.

The Portfolio of Risk: Risks are grouped in accordance with the amount of damage or loss and the likelihood of their prevalence within the chance portfolio. The have an impact on at the undertaking and the want to do so are then assessed.

Overview of risk team analysis: The evaluation of risk is completed in the feel of project control via way of means of the project manager. Risks are assessed and evaluated consistent with the sorts and metrics for the occurrence of risk in the risk team study. From this, capacity interventions are established and described, and entities chargeable for risk tracking and reporting are identified.

E. Step 3 Evaluation of Risks

Theevaluation of risk includes both quantitative and qualitative evaluation of all characteristics of risk, also includes interdependencies of their results. For instance, using the outcomes of evaluation of risk, setof project risk may be

explained and also compared to others. Although for banking and insurance firms, it is useful to evaluate risk mathematically and statistically, and for the construction sector mathematical and statistical evaluation is not useful.
For evaluation of risk the following techniques can be used:
Key Performance indicators: Key metrics of achievement cowl quantitatively observable situations and for this reason offer a foundation for comparison. For danger evaluation, they are ideally consulted if a huge wide variety of statistics and figures must be compared. Threshold values from which a danger alert takes place are described for the principle overall performance indicators. Average running costs, common rent, and emptiness rate, or common hobby on outdoor capital, are conventional number one overall performance metrics withinside the actual property market.
Qualitative assessment: In the absence of reliable evidence, the risks must still be quantifiable and calculated. One technique is qualitative measurement and estimation; assessment of risks is done subjectively in line with their chance of incidence and the quantity of harm or loss.
Probable maximum loss: Thequantitative risk dedication approach mainly pursuits to estimate the possibilities of risky injuries inside a hazard scenario. For example, in figuring out the hazard of great harm or loss, the most capacity or likely harm or loss is determined.
ABC analysis: Analysis by ABC method is primarily based on the principles of impact on the largest part of the project due to small number of variables. Therefore, the reason of the look at is to determine out which variables make up the most important a part of the cost of the mission and beneath Neath which better making plans and manipulate disbursement is justified.
Risk map: The risk map indicates an enterprise's chance profile. The chance environment, chance map or chance matrix is noted as It may be examined in a chance map with what precedence the dangers must be dealt with. The threats that cannot be borne, that may threaten the company's endured life, are prioritized in this. The chance type in the chance matrix consequently permits type parameters to be taken under consideration in a differentiated manner: chance of incidence and anticipated benefit.

F. Step 4 Controlling of Risks

Controlling of riskin terms of evaluation is the measurement of active effect of the risk on the project.Controlling of risk also includes positive impact of risk on project. Causes of risks are eliminated or minimize the causes of risk and at the same time plans are developed to mitigate or minimize the loss or damage due to risk.
Risk management methods are Risk Prevention, Minimizing the Risk, and Transferring the Risk

G. Step 5 Monitoring of risks

It is an ongoing process in the organization to check of the efficacy of risk control initiatives. By adopting risk management's process in the organization, one cannot fully remove risks from the project. It helps to ensure that the negative effect of the risk on the project can be minimized.
Various analysis is carried out to curtail the effect of risk in infrastructure project. One of theparts of monitoring risk is establishing an inner control system of the risk within the organization. Continuous tracking of early indications and repeated risk verification shall be carried out on a case-by-case basis by the individuals responsible, no later than the respective deadlines for the milestone. A precondition for that is that a reporting and assembly method is stipulated withinside the corporation and for the project. New extra dangers need to be blanketed similarly to the pursuit of the danger repute and the development of the measures. Risks which have arisen need to be registered with the specified quantity of harm or loss; pressing instances need to be documented with the aid of using the control staff.

H. Step 6 Controlling goals

Measures for monitoring targets must be taken after risk identification, review, and evaluation. To control the goals of the project the whole method can be divided in categories: identifying target value, determiningactual value, comparingthe actual value and targetvalue,and analyzing the variance. In the sense of surveillance, risk detection, review, and control are reviewed as a permanent mechanism in order to assess if controlling of risk is carried out in due form. In the occasion of discrepancies among the actual chance state of affairs and the chance state of affairs sought, steps to specify the triggers have to be taken. The risk plan must then be modified or updated based on these acknowledgments. Consequently, risk tracking guarantees that the standards set for hazard control are taken into consideration.

IV. CONCLUSION

Riskcontrol correctly set up in the project offers the ability to attain a clean expertise of the service's priorities, responsibilities and content material and the project's feasibility. It gives an information base for quantitative data, taken care of via way of means of scale, for assisting decision-making purposes, which include selecting among expenses and the execution of products, or evaluating many potential alternatives. For this reason, but it's far critical that a excessive standard of data is constantly to be had in an effort to make determinations on the idea of beneficial and complete records. Consequently, risk can be easily control correctly measured and minimize its effect if communication networks are present within the organization. The standard threat of the assignment is damaged down into character dangers via way of means of the threat control hired. Corresponding steps can be taken for those. Nonetheless, residual dangers exist in any assignment. If those risks are taken and may be borne in the event that they stand up stays a strategic decision.

REFERENCES

[1] Akande, W. A., Adetoun, B. E., Tserere, M. M., Adewuyi, M. F., & Akande, E. T. Should we put locals in charge? Managing relationships within prospective us–South African joint ventures. Journal of Business Economics and Management, 11(4), 550–575.(2010).
[2] Alali, B., & Pinto, A. Project, systems, and risk management processes interactions. PICMET'09-2009 Portland International Conference on Management of Engineering & Technology, 1377–1386. (2009)
[3] Chapman, C. B., & Ward, S. C. Managing risk management processes: Navigating a multidimensional space. Managing Risks in Projects, 109–118. (1997).
[4] Del Cano, A., & de la Cruz, M. P. Integrated methodology for project risk management. Journal of Construction Engineering and Management, 128(6), 473–485. (2002).
[5] Edwards, P. J., & Bowen, P. A. Risk, and risk management in construction: A review and future directions for research. Engineering Construction and Architectural Management, 5(4), 339–349.(1998)
[6] Hameed, A., & Woo, S. Risk importance and allocation in the Pakistan Construction Industry: A contractors' perspective. KSCE Journal of Civil Engineering, 11(2), 73–80. (2007)
[7] Jaafari, A. Management of risks, uncertainties, and opportunities on projects: Time for a fundamental shift. International Journal of Project Management, 19(2), 89–101.(2001)
[8] Newton, M. A., & Raftery, A. E. Approximate Bayesian inference with the weighted likelihood bootstrap. Journal of the Royal Statistical Society: Series B (Methodological), 56(1), 3–26.(1994).
[9] Olsson, R. In search of opportunity management: Is the risk management process enough? International Journal of Project Management, 25(8), 745–752. (2007).
[10] Perera, J., &Holsomback, J. An integrated risk management tool and process. 2005 IEEE Aerospace Conference, 129–136.(2005).
[11] Rafiq, M., & Choudhry, K. I. Identification of risk management system in construction industry in pakistan. Journal of Managent in Engineering, 29, 42–49.(2013).
[12] Serpella, A. F., Ferrada, X., Howard, R., & Rubio, L. Risk management in construction projects: A knowledge-based approach. Procedia-Social and Behavioral Sciences, 119(2014), 653–662. (2014a)
[13] Serpella, A. F., Ferrada, X., Howard, R., & Rubio, L. Risk management in construction projects: A knowledge-based approach. Procedia-Social and Behavioral Sciences, 119(2014), 653–662.(2014b).
[14] Zavadskas, E. K., Turskis, Z., &Tamošaitiene, J. Risk assessment of construction projects. Journal of Civil Engineering and Management, 16(1), 33–46.(2010).

