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Assessment of Risks in Fast Track Projects: A Qualitative Case Study Approach

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Abstract— The primary objective of this research is to identify and analyze the risks that occur in the fast-track projects, utilizing the "Islamabad Metro Bus Project" as a case study. In fast-track projects, there is an over-lapping of design, procurement, and construction phases, leading to many risky events. Risk assessment deals with developing a plan for proper risk management in such projects. Formal application of project risk management (PRM) in fast-track projects is still a developing part of project management. PRM is the process of identifying, analyzing, and responding to risky events. The purpose is to increase the likelihood of success in a fast-track project by minimizing unexpected events. This paper interprets the related literature and catches the outlook from relevant experts. It identifies elements needed for structuring the PRM process and suggests mitigation actions for high-ranked risks. For practical validation, a case study is conducted. Unavailability of funds and design errors are considered as utmost critical risks of the project. Effective risk identification followed by analysis validates the efficiency of the proposed PRM plan for fast-track projects.

***Index Terms*— Risk Management, Fast Track Projects, Framework, Case Study, Risk Assessment.**

I. INTRODUCTION

IN, construction projects, reducing the project timespan is a significant achievement driver, resulting in tremendous savings in cost, consequently increasing project revenues while bringing other project benefits for the client and the contractor [1].

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Finishing a construction project before its estimated completion time is extremely rare, especially for the contractor [2]. In this regard, fast-tracking is the most common technique used for accelerating project activities. The main objective of fast-tracking is to complete the project as soon as possible [3]. Fast-tracking is a well-established technique in which several activities happen simultaneously, as there is an over-lapping of design, procurement, and construction phases [4]. It is implemented when project timespan reduction is of critical importance. However, this may adversely affect other project objectives [5]. Various project risks like errors in design, change order and rework arise as the project is proceeding with incomplete design information. As fast-tracking is now the need of an hour, identifying critical risk factors is truly significant before starting any fast-track project to avoid further losses. There is a need to maintain a check and balance between the project objectives without compromising project productivity, safety, and quality [6]. Higher exposure to risky events requires a more profound investigation of the risk profile. Risk is broadly defined as the probability of any inappropriate event and its possible impact on the project objectives. Risks occurring in complicated environments tend to be typically interconnected, and thus their possible impact is intensified as in fast-track projects [7]. For instance, a massive risk of rework is required in fast-track projects, as multiple activities start with incomplete information due to time constraints [8]. Systematic and up-to-date risk management is necessary for handling such complexities. The risks occurrence probability is high in some projects because of their uniqueness and complications in design [9]. To reduce a specific risk to a tolerable level, the process of "Project Risk Management" (PRM) is used, which involves the identification and application of various project management techniques [10].

PRM is an orderly process that commences with risk recognition and ends on controlling the risks notwithstanding the possible mitigation measures [11].

Risk identification and assessment are the most essential and challenging phases in the risk management process [12]. The risks that incur time delays in fast-track projects are analyzed via PRM, which is beneficial to all the stakeholders of the project. The implementation of a proper PRM framework would increase the probability of positive/beneficial events that would directly make the project free from crucial risks while allowing the contractor to complete the project according to the schedule. As the nature of fast-track project risks is different from conventional risks due to their separate overlapping activities, it demands a dedicated PRM process. Keeping in view the need for PRM in such projects, the three main objectives of this research include identifying risk factors in fast-track construction projects, analyzing the identified risks, and validating the critical risks through a case study. Several studies have identified numerous risks factors of fast-track projects. In this study, fifteen research articles published during the year (2003-2020) are analyzed. Fifty-three factors are identified from the articles that are given in Table 1. As there is no definite way to classify risks, review articles have different ways of classification. Still, the most commonly used method is to classify the risk according to its nature. Hence, the current study has classified the risk into seven categories in Table 1.

II. RESEARCH METHODOLOGY

The methodology is composed of three main stages; initial study, data collection and analysis, and study validation, as represented in *Fig. 1*.

A. Initial Study

As shown in *Fig .1*, the initial study comprises the research problem, objectives, and literature review. An extensive literature review was undertaken regarding risks occurring in fast-track projects. It was revealed that there is a need to manage such risks by applying different techniques at all stages of fast-track projects. Keeping in view the importance of PRM, the research objectives were established, namely risk identification, analysis, and validation via a case study. Information regarding risk management in fast-track projects was taken from different libraries like Google Scholar, Science Direct, Web of Science, etc. Different risk management techniques were studied, and the relevant risk factors associated with fast-track projects were extracted. Those risk factors were further classified into seven main groups.

A. Respondent Profiles

Fifty-three experts in fast-track projects had responded to the questionnaire survey. The recurring job title is Project Engineer, followed by the project manager, architect, consultant, and contractor, as listed in Table II. Most of the respondents have professional experience of six to ten years, followed by experience ranging from one to five years. The average professional experience is seven years.

B. Data Collection and Analysis

The second stage of this study comprised of data collection and analysis. A questionnaire survey is the critical source of data collection. The questionnaire used in this study comprises two sections. Questions associated with personal information and respondents' experience in fast-tracking composed the first section of the questionnaire. The second section contains the fifteen high-risk factors occurring in fast-track construction projects. Questionnaire survey respondents comprised wholly of professionals having knowledge and experience in fast-tracking and PRM. Nearly fifty-three individuals working on fast-track construction projects responded to the questionnaire. Intensities of the different risk factors were identified from the responses. As a thumb rule, the central theorem is satisfied when the sample size is 30 or above. [13]. The probability of occurring of different risk factors and their impact was determined from this questionnaire survey.

C. Study Validation

The most challenging stage of this research is study validation (third stage). A case study was conducted to verify and analyze the risks identified through the literature review. Different stakeholders involved in the project were interviewed. The professionals with their experience shared the risks involved in fast-track projects. To minimize the intensity of identified risks, proposed risk assessment techniques were discussed. After successfully validating the PRM framework, the professionals suggested different mitigation measures. Some of the mitigation measures are: project insurance, cost management, close monitoring, human resource planning, effective coordination between the stakeholders involved etc., which are expounded in the discussions and conclusions of this research.

III. RESULTS AND DISCUSSION

The RM and risk knowledge is crucial for limiting misfortunes and upgrading cost-effectiveness [14], as the RM process depends on experience, judgment, and knowledge [15]. Almost 34% of respondents possess exceptional knowledge of risk and risk management, while 52.83 percent have moderate knowledge.

TABLE I
FAST TRACK PROJECT RISKS

Sr.No	ID	Risk Factors	Risk Classification	Rate
1	A1	Late payment	Financial	Medium
2	A2	Unavailability of funds	Financial	High
3	A3	Appropriate funds and resource allocation	Financial	Low
4	A4	High purchasing cost	Financial	High
5	A5	Driving up cost	Financial	High
6	A6	High initial cost	Financial	High
7	A7	Cost incurred	Financial	Low
8	A8	Cost estimation	Financial	High
9	A9	Cost overruns	Financial	High
10	A10	Desired profitability	Financial	Medium
11	A11	Change in economic condition	Financial	High
12	B1	Project team conflict	Management	Medium
13	B2	Poor site management	Management	Low
14	B3	Delayed procurement	Management	Low
15	B4	Contactor productivity	Management	Medium
16	B5	Slow decision making	Management	High
17	B6	Unrealistic schedule	Management	High
18	B7	Overlooked work	Management	Medium
19	B8	Construction accidents	Management	Medium
20	B9	External site activity	Management	High
21	B10	Construction area	Management	Medium
22	B11	Time required in construction	Management	Medium
23	C1	Low quality work	Technical	High
24	C2	Selection of inappropriate method	Technical	Medium
25	C3	Design error.	Technical	High
26	C4	Contractor prequalified	Technical	High
27	C5	Vendor bondability	Technical	Medium
28	C6	Critical item import	Technical	High
29	C7	Equipment quality	Technical	Low
30	C8	Labour union	Technical	High
31	C9	Labour availability	Technical	Medium
32	C10	Secure material yards	Technical	High
33	C11	Replacement of material	Technical	High
34	C12	Change in design by consultant	Technical	Low
35	C13	Poor drawings	Technical	High
36	C14	Lack of communication	Technical	High
37	C15	Material wastage	Technical	Medium
38	C16	Inadequate details in drawing	Technical	High
39	C17	Rework	Technical	High
40	D1	Obstinate nature of owner	Legal	Medium
41	D2	Interference of employers	Legal	High
42	D3	Liability for design error	Legal	High
43	D4	Construction rework	Legal	Medium
44	D5	Design factors	Legal	Medium
45	E1	Health and safety	Environmental	Medium
46	F1	Overlapping activities	Time related	High
47	F2	Traffic conditions	Time related	High
48	F3	Time variance	Time related	Medium
49	F4	Time overrun	Time related	High
50	G1	Poor quality due to hurry	Quality	Low

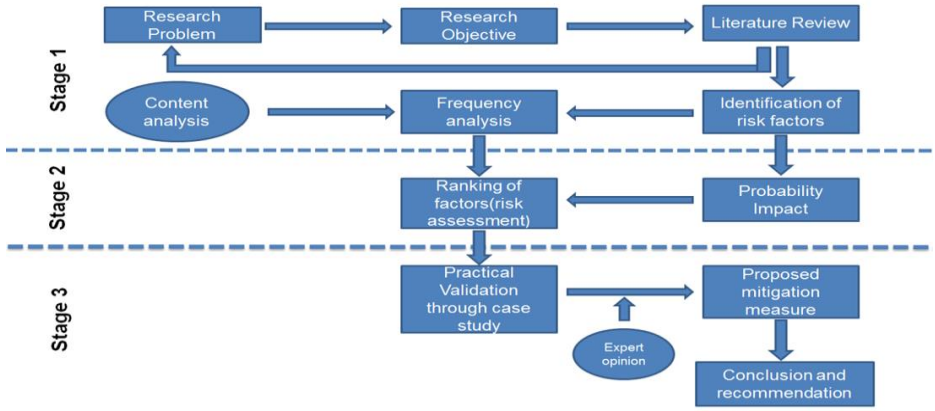

Fig. 1. Schematic plan of research

TABLE II
RESPONDENT PROFILES

Profile	Frequency	Percentage
Total Respondents = 53		
Job Title		
Project Engineer	15	28.30%
Project Manager	10	18.86%
Architect / Designer	8	15.09%
Consultant	6	11.32%
Assistant Manager	5	9.43%
Site Manager	5	9.43%
Other (Assistant Engineer, Contracts Engineer, In-charge Planning, Trainee Engineer, Professor, etc.)	4	7.54%
Years of Experience		
1 to 5 years	15	28.30%
6 to 10 years	19	35.85%
11 to 15 years	9	16.98%
16 to 20 years	6	11.32%
21 and above	4	7.54%
Fast-track projects undertaken in the past ten years		
1 to 10 projects	22	41.5%
11 to 20 projects	17	32.07%
21 to 30 projects	8	15.09%
31 to 40 projects	6	11.32%
Respondent's Risk Awareness		
Exceptional	18	33.96%
Moderate	28	52.83%
Somewhat	3	5.66%
Slight	2	3.77%
No understanding	2	3.77%

B. PRM Process

The most critical stage in risk management is the identification of risks. The main objective is to identify when, where, and how risks are likely to occur in the project. According to the authors ' opinion, fifty fast-track project-related risks identified from the extensive literature review are categorized into three different intensities; high, medium, and low.

Identifying risks is not sufficient [16]. The significant risks must be analyzed further. Semi-quantitative risk analysis technique was selected for risk analysis. The probability and impact (PI) matrix technique used semi-quantitative risk assessment. This matrix is used to establish the severity of identified risks [17]. The severity of risks is calculated according to the following Equation 1.

$$Risk=P*I \quad (1)$$

Where, P= probability, I= total impact.

Likert scale was used for identifying the limits of probability and impact scales, as given in Table III. The final impact was calculated by displaying the variables in

the PI matrix. After which RII (Relative Importance Index) is determined, as given in Equation 2 [18].

$$RII = \frac{\sum W}{A \times N} \qquad 2$$

W= weightage defined by respondents, N= total sample size, A= highest weightage.

The output of this process is the detailed description of the valid risk, along with its severity and priority. It is difficult to treat all the identified risks, so out of 50 top 15 severe risks were separated for validation as listed in Table IV. From this table, it can be seen that the riskiest events are not concurrent with their RII value. For instance, based solely on Total Risk, option A-2 (unavailability of funds) was identified as the riskiest event; however, it was a minor significant factor based on RII. Conversely, technical options C-3 (design drawing) and C-4 (prequalified by contractor) were the most significant risks based on RII, but their total risks are the lowest among the list of 15. If both total risk and RII are comparatively weighed, option B-5 (Slow decision making) appears to be the most significant risk overall. The possible occurrence of top risks were subsequently validated through a case study and possible mitigation measures.

C. Case Study

For validation, a fast-track construction project "Islamabad to New Airport Metro Bus Project", located in Islamabad, Pakistan, was selected. The distance of the track is 25.6 km. The general details of the project are given in Table V. The project initiated in January 2017 is scheduled for completion by August 2017. However, it is essential to note that the project is still in progress. The validation process involves interviewing the project's key stakeholders, including the project manager, construction manager, procurement manager, architect, and resident engineer. Semi-structured and non-structured interview sessions were conducted. They were asked to validate the identified risks based on the field conditions.

Unavailability of funds, design errors, and changing political situations are the most critical risks of the project. It is important to note that a risk management plan did not exist for this project, and, according to the project manager, this is one of the most important causes of project delay.

The primary objective of PRM is to establish a proper mitigation plan for risk control. Based on the knowledge and experience, the respondents were asked to suggest effective mitigation strategies for the high-ranked risks that occur in the project. The possible mitigation measures are listed in Table VI. This output is based on the severity of analyzed risks.

TABLE III
PROBABILITY AND IMPACT SCALES

Probability and Impact	Probability Scale	Impact Scale
Low	1 - 2	1 - 2
Medium	3 - 4	3 - 4
High	5 - 6	5 - 6
Very High	7 - 8	7 - 8

TABLE IV
SEMI-QUANTITATIVE ANALYSIS OF IDENTIFIED RISKS

Risk	Total Risk P*I	RII	Rank
A-2	55	0.11776	Very High
A-4	43	0.18240	High
A-5	43	0.2534	High
A-6	43	0.2954	High
A-8	36	0.3671	High
C-17	35	0.4807	High
C-7	35	0.52156	High
G-9	35	0.67914	High
B-5	33	0.67773	High
C-9	33	0.67773	High
B-7	32	0.68823	High
B-8	31	0.69324	High
B-9	30	0.70325	Medium
C-3	29	0.71256	Medium
C-4	29	0.71256	Medium

TABLE V
PROJECT DETAILS

Project Type	Fast Track Project
Location	Islamabad to New Airport
Distance	25.6 km
Cost	Rs 16.46 billion
Approved in	Jan,2017
Completed in	Aug,2017
Extend up to	Dec,2017
Further extend	Aug,2018
Deadline	Dec,2018
Current Status	Still in progress
Client	NHA
Contractor	NLC, FWO, MATRACON
Consultant	NESPAK

TABLE VI
POSSIBLE MITIGATION MEASURES

Sr.	Risk Factors	Migration Measures
1	Unavailability of funds	• Project Insurance.
2	High purchasing cost	• Purchase the things in bulk and store them. • Pick the correct type of contract if the contractor knows work material will not be wasted.
3	Driving up cost	• Manage your fleet cost-efficiently. • Hire a multitasking employee. • Reduce old technology with new.
4	High initial cost	• Use of suitable technology, appropriate construction design, and early consultation.
5	Cost estimation	• Allocate adequate contingency allowances. • Recognize the uncertainty that does exist in cost estimates.
6	Rework	• Close monitoring.
7	Equipment quality	• Must ensure timely availability of required finances for equipment maintenance.
8	Slow decision making	• Effective coordination between parties involved.
9	Labor availability	• Attract and recruit the best workers. • Retain the best workers. • Alternative contracting strategies.
10	Overlooked work	• Develop project schedule. • Planning human resources.

11	Construction accidents	• Monitoring and controlling. • Provide safety training to all employees. • Be careful with equipment. • Utilize protective clothing and gear.
12	External site activity	• Easy access to vehicles should be provided before the start of the project.
13	Design error	• To make a new design or slightly change the existing designs to remove or decrease the error. • Control the design change.
14	Contractor prequalified	• The contractor with enough experience and capability in dealing with project complexity. • Many contractors are not aware of all the risks that occur in projects. The prequalified contractor takes a project based on its experience and mitigates the issue or problems in the project.
15	Time overrun	• Increase the workforce. The planning of a project is not well. • Allocate sufficient time and finance.

IV. CONCLUSION

The concept of risk assessment in fast-track projects is brought forward to reduce the critical risks that cause adverse effects. The timely completion of any construction project is a significant success driver, resulting in significant cost savings along with an increase in project revenues. This study has proposed a plan for the conduction of risk management, and its findings are crucial for a thorough understanding of fast-track construction risks. The core of this research was the identification and analysis of critical risks in fast-track projects. Several interviews and brainstorming sessions with key stakeholders were carried out. Out of 53 risk factors that were extracted from the literature, the top 15 high ranked risks include unavailability of funds, high purchasing cost, driving up cost, high initial cost, cost estimation, rework, equipment quality, low decision making, labor availability, overlooked work, construction accidents, external site activity, design error, contractor prequalified, and time overrun. Based on the knowledge of the experts, effective mitigation strategies for these 15 risks are detailed. The practical implementation of the proposed plan would improve project performance by pursuing project objectives. Results are expected to identify and manage the multifaceted risk associated with the fast-track projects to profit. However, this qualitative research is only limited to risk assessment, a combination of identification and analysis. The quantitative analysis of the identified risk factors could be considered for further research.

REFERENCES

[1] Z. Rachid, B. Toufik and B. Mohammed, Causes of schedule delays in construction project, Algeria. *International Journal of Construction Management*, Vol. *19*(5), pp. 371-381, 2019.

[2] N. Rasul, MSA. Malik, B. Bakhtawar and M J.Thaheem, Risk assessment of fast-track projects: a systems-based approach. *International Journal of Construction Management*, Vol. 11(21), pp. 1099-1114, 2019.

[3] P. Ballesteros-Perez, Modelling the boundaries of project fast-tracking. *Automation in Construction*, Vol. 84, pp. 231-241, 2017.

[4] P. Pishdad-Bozorgi, JM. De la Garza and R B. Austin, Readiness assessment for flash tracking. *Journal of Construction Engineering and Management*, Vol. 142(12), pp. 6016005, 2016.

[5] Y. Khoueiry, I. Srour and A. Yassine, An optimization-based model for maximizing the benefits of fast-track construction activities. *Journal of the Operational Research Society*, Vol. 64(8), pp. 1137-1146, 2011.

[6] AA. Alhomadi, R. Dehghan and JY. Ruwanpura, The predictability of fast-track projects. *Procedia engineering*, Vol. 14, pp. 1966-1972, 2011.

[7] H. Thamhain, Managing risks in complex projects. *Project Management Journal*, Vol. 44(2), pp. 20-35, 2013.

[8] IM. Srour, MAU. Abdul-Malak, AA. Yassine and M. Ramadan, A methodology for scheduling overlapped design activities based on dependency information. *Automation. Construction*, Vol. 29, pp. 1-11, 2013.

[9] N. Javed, M J. Thaheem, B. Bakhtawar, A R. Nasir, K I A. Khan and H F. Gabriel. Managing risk in green building projects: toward a dedicated framework. *Smart and Sustainable Built Environment*, Vol. 9(2), pp. 156-173, 2019.

[10] R. Luppino, M R. Hosseini and R. Rameezdeen, Risk management in research and development (R&D) projects: The case of South Australia. *Asian Academy of Management Journal*, Vol. 19 (2), pp. 67-85, 2014.

[11] SA. Javed and S. Liu, Evaluation of project management knowledge areas using grey incidence model and AHP. Proceedings of the 6th IEEE International Conference on Grey Systems and Intelligent Services. Stockholm, Sweden, Vol. 10, 2017.

[12] J. Wang and H. Yuan, System dynamics approach for investigating the risk effects on schedule delay in infrastructure projects. *Journal of Management in Engineering*, Vol. 33(1), pp. 04016029, 2017.

[13] APC. Chan, A. Darko, AO. Olanipekun and E E. Ameyaw, Critical barriers to green building technologies adoption in developing countries: The case of Ghana. *Journal of cleaner production*, Vol. 172, pp. 1067-1079, 2018.

[14] AS. Akintoye and MJ. MacLeod, Risk analysis and management in construction. *International journal of project management*, Vol 15(1), pp. 31-38, 1997

[15] A. Serpell, X. Ferrada, L. Rubio and S. Arauzo, Evaluating risk management practices in construction organizations. *Procedia-Social and Behavioral Sciences*, Vol. 194, pp. 201-210, 2015.

[16] JF. Al-Bahar and KC Crandall, Systematic risk management approach for construction projects. *Journal of construction engineering and management*, Vol. 116(3), pp. 533-546, 1997

[17] A. De Marco, M J. Thaheem, S. Grimaldi and C. Rafele, A framework methodology for selection of risk analysis techniques in construction projects. In *Creative Construction Conference 2012 June 30–July 3, 2012 Budapest, Hungary*, 2012

[18] M L. Martens and M M. Carvalho, Key factors of sustainability in project management context: A survey exploring the project managers' perspective. *International Journal of Project Management*, Vol. 35(6), pp. 1084-1102, 2017