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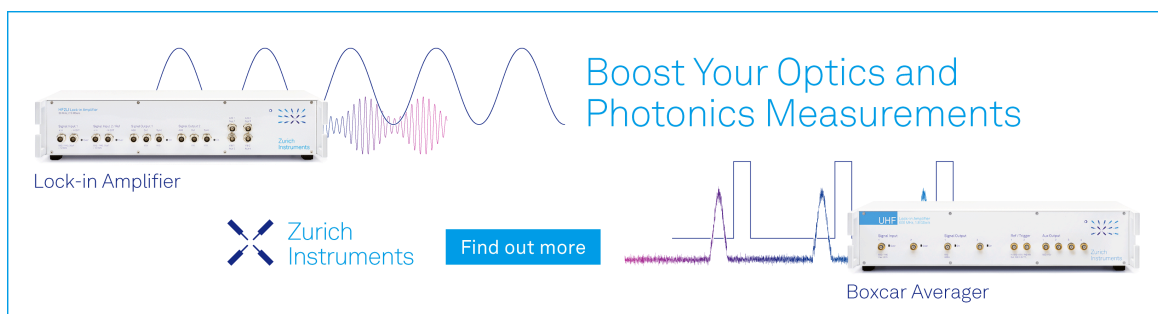


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Mitigation Measures for Delay in Dam's Project - A Case Study in Pakistan

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Abstract. Construction sector is known as main sector which contributes major role in term of employment as compared to other sectors in developing countries as well as developed countries. But unfortunately, this sector is still facing many challenges which including construction delay, construction cost overrun and also construction quality standards. Pakistan is also facing these problems for the last many decades. The main purpose of this research is to find out the significant factors which contribute construction delay in dam projects of Pakistan. To achieve the objective, a deep literature review and pass research was conducted which helped to identify 48 general factors of delay in the construction sector. On basis of general factors, a questionnaire was designed and distributed among stakeholders of dam projects. The designed questionnaire was based on Likert scale from 1 to 5. Gathered data from respondents was analyzed with help of average mean value which helped to identify the 8 significant factors which causes delay in construction of dam projects of Pakistan. Another questionnaire was prepared based on the critical factors identified in this case study will be beneficial for the stakeholders to control the significant factors in construction of dam projects of Pakistan.

INTRODUCTION

Construction sector is known as most significant sector that contributes considerably to the country's economic growth. It is also a versatile sector which play huge role in socioeconomic development of a country [1]. Moreover, this sector has provided the life standard by providing basic amenities like hospitals, infrastructure, buildings, roads and others [2]. Pakistan is the developing country where mostly all types of construction projects are facing the problem of delay which is known as a serious problem [3]. Government of Pakistan is working very hardly to overcome the three burning issues which are shortage of agriculture water and production of electricity in the Pakistan [4]. In order to resolve the issue of shortage of agriculture water and production of electricity, the government is allocating a huge amount of budget in each year [5]. In Pakistan, the total number for small and large dam is 150 dams. In which, 63 small dams are under construction and 51 small dams are completed. However, 12 large dams are under construction and 24 large dams are constructed (Water and Power Development Authority, 2020). It has been observed that constructions of all dams are delayed from the actual time [6]. This delay problem is not only delay the progress of the project but also impact on the economy of the Pakistan [5]. Though several factors has been identified for delay in dam projects if Pakistan. Their effective mitigation measures will be discussed in this paper.

LITERATURE REVIEW

A study was conducted in Oman for identification of significant causes and factors of dam projects by distribution of questionnaire among respondents. Among 43 general factors of delay, in total 12 significant factors were identified which were delay in supply of construction material at site, delay in approval of drawings, late payment to builder, weather impact at site, rapid changes in drawings, client interruption in the project, complex nature of design and poor site management [7]. Another research in Nepal for determination of causative delay factors in construction of dams and large hydro projects were carried out. Results of this research revealed that pre implementation assessment of project, delay in procurement process, delay in construction at site, poor planning and local challenges were found causative delay factors in construction of dam projects [8]. In Pakistan, a study was conducted to find out causes and

reason of construction delay in construction of hydro projects in Khyber PakhtunKhuwan province. After determination of 36 common delay factors from previous studies, a structured questionnaire was distributed among stakeholders of dam projects. Findings of this research were that political influence, interruption in construction work, late in releasing of funds from government, security issues and poor planning from starting of project [5]. Further research was conducted for identification of main factors of delay factors in construction of dam projects in Pakistan by conducting questionnaire survey. It was found that late in delivery of material, financial issues by contractor, weather issues, poor site management, and disputes at site were identified as main factors of delay [6]

METHODOLOGY

Research methods are defined as the systematic concentration of data for the purpose of finding a solution to a research problem or finding information for answers to research questions. The suitability of methods and methods depends on the research problem and its purpose. Research methods can be quantitative or qualitative or both [9]. The differences between qualitative and quantitative methods were summarized in research context whereby qualitative approach is to gather information focuses on describing a phenomenon in a deep comprehensive manner using interviews, open-ended questions, or focus groups. In most cases, a small number of participants are involved in this type of research [10]. While quantitative method is to gather information focusing on describing a phenomenon across a larger number of participants using questionnaire surveys. To achieve aim and objectives of any research a systematic methodology is designed in a specific manner. Methodology description is explained in this which was used for this study and was carried out based on mix mode research methodology. Using open-ended interview, it includes quantitative method and using structured questionnaire survey qualitative method. The purpose of using these two methods is to understand the perception of construction leaders about critical delay factors and effective measures in the construction of dam projects in Pakistan. Sample size adopted for case study is calculated by formula stated below:

$$S.S = \frac{z^2 * P(1 - P)}{C_2} \tag{1}$$

Where,

S.S= Size of sample

Z= Level of confidence (2.50 for 90% confidence level)

P = Percentage picking choice expressed as a decimal (0.5 used for sample size) C

= Error margin (10%)

$$S.S = \frac{2.5^2 * 0.5(1 - 0.5)}{0.1^2} = 157$$

DEMOGRAPHY OF RESPONDENT

Demography of respondent’s qualification, experience and organization are stated in the figure 1, 2 and 3.

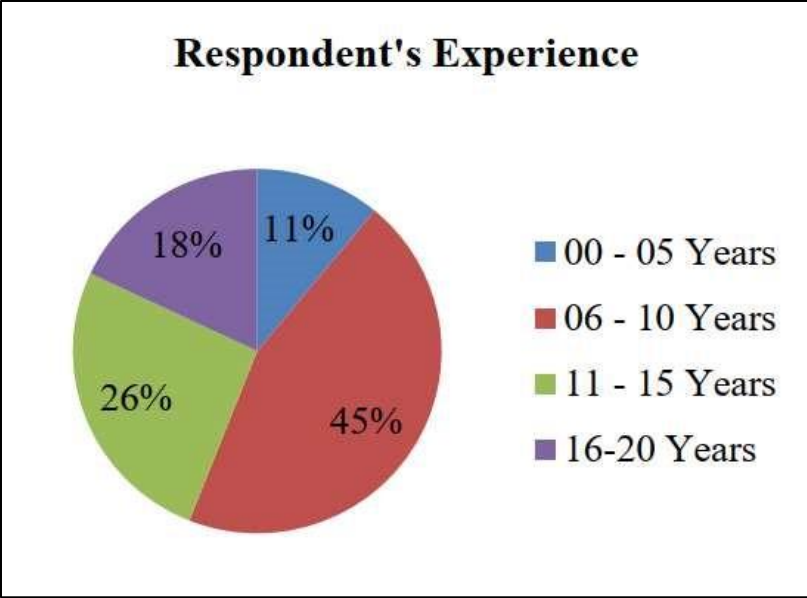


FIGURE 1. Respondents Experience in the field of construction of dam projects

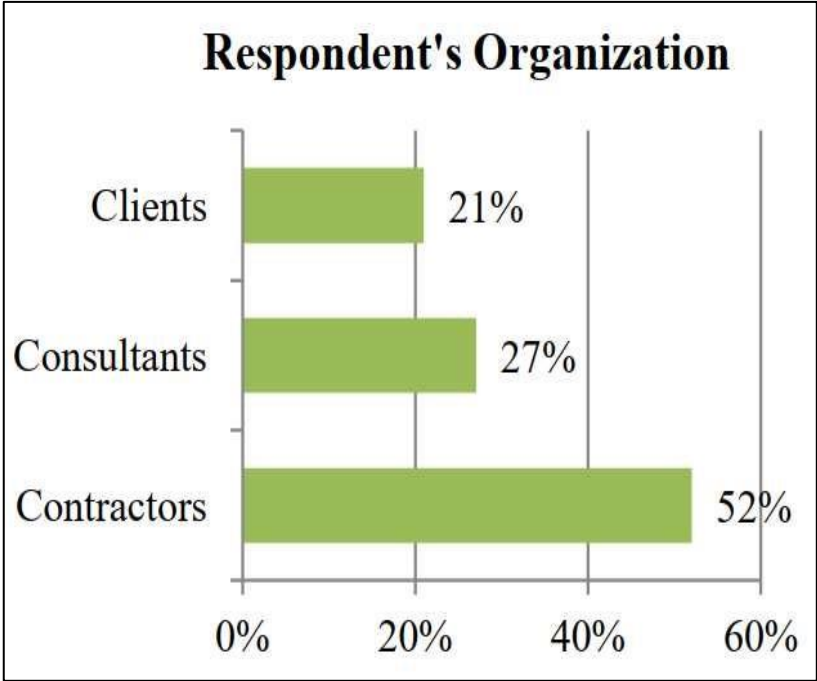


FIGURE 2. Respondent's Organization

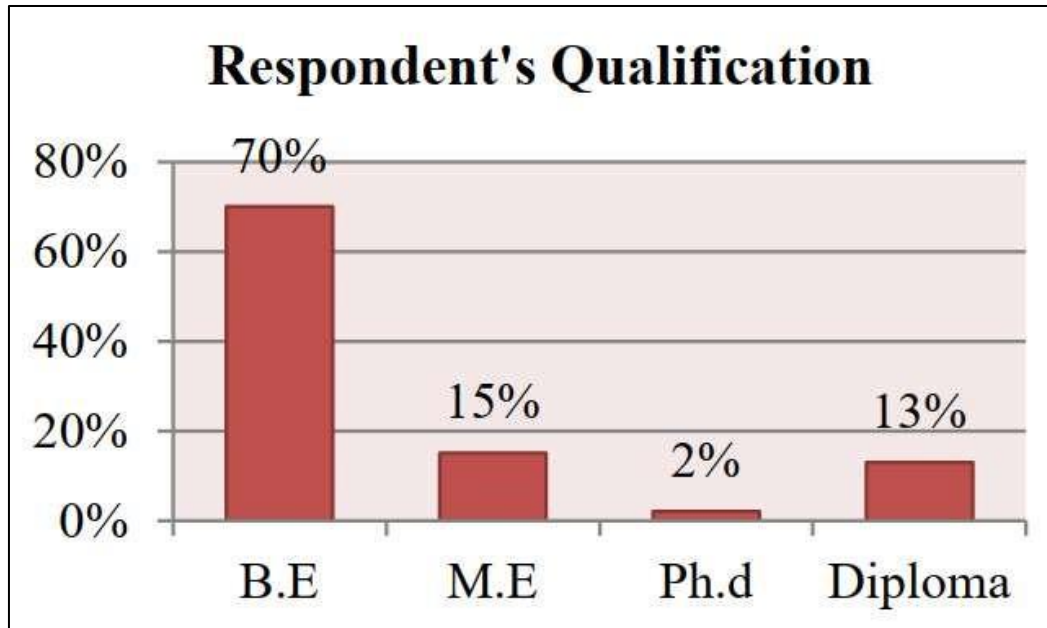


FIGURE 3. Respondents qualification working in dam projects.

Average Index Method has been used to obtain average index value from collected data. Table 1 illustrates average index value for relevant factors is set in descending order to obtain critical factors of delay in dam projects of Pakistan.

TABLE 1. Ranking of Causes of Delay in Dam Projects of Pakistan

Cause of Delay	A.I Value	Rank	Cause of Delay	A.I Value	Rank
Political interference	4.69	1	Poor qualification of contractor's staff assigned to the project	3.5	25
Financial difficulties to owner	4.58	2	Shortage of technical professionals in the contractor's organization	3.2	26
Policy of the Tender Winning at the lowest price	4.51	3	Incompetent subcontractors	2.59	27
Non consistency of policies	4.47	4	Ineffective monitoring & control of the project progress	2.55	28
Change in scope of project	4.40	5	High interest charged by bankers on loans received by contractors	2.46	29
Poor contract management	4.35	6	Inadequate contractor experience	2.44	30
Poor decision making	4.31	7	Schedule of subcontractors	2.40	31

Difficulties in financing project by contractor	4.26	8	Delay in preparation of shop drawings and submissions	2.36	32
Poor planning	3.89	9	Cash flow management by contractor	2.30	33
Un cooperative owner with contractor complicating contract administration	3.79	10	Excessive bureaucracy by owner's administration	2.25	34
Variations orders/changes of scope by owner during construction	3.53	11	Discrepancies between bill of quantities, specifications and drawings	2.22	35
lack of experience in dam projects	3.50	12	Project complexity	2.20	36
Compensation issues	3.48	13	Delay in performing inspection and testing	2.16	37
Late in revising and approving design documents	3.46	14	Preparation and approval of drawings	2.14	38
Slowness of the owner's decisionmaking process	3.43	15	Suspension of construction work	2.13	39
Delay in progress payment by owner	3.40	16	Unclear and in adequate details in drawings	2.11	40
Rework due to poor work /wrong materials by contractor	3.36	17	Inadequate consultant experience	2.10	41
Poor contract management	3.33	18	Mistakes and changes in design documents	2.9	42
Delay in contractor's claims settlements	3.26	19	Delays in producing design documents	2.8	43
Ineffective scheduling and planning of project	3.22	20	Lack of personnel training and management Support	2.9	44
Obsolete or Improper construction methods implemented by contractor	3.18	21	Poor communication among parties	2.8	45
Poor site management and supervision	3.16	22	Changes in top management of the Project	2.7	46
Frauds practices and kickbacks	3.10	23	Natural Disaster	2.5	47
Inaccurate technical study of projects time	3.8	24	Unforeseen conditions	2.2	48

Factors with average index value 4.00 or greater has been identified as critical factor and are stated in Table 2.

TABLE 2. Critical factors of Delay in Dam Projects of Pakistan

Cause of Delay	A.I Value	Rank	Cause of Delay	A.I Value	Rank
Political interference	4.69	1	Change in scope of project	4.40	5
Financial difficulties to owner	4.58	2	Poor contract management	4.35	6
Policy of the Tender Winning at the lowest price	4.51	3	Poor decision making	4.31	7
Nonconsistency of policies	4.47	4	Difficulties in financing project by contractor	4.26	8

MITIGATION MEASURES CAUSING DELAY IN DAM PROJECT OF PAKISTAN

An open-ended questionnaire was prepared and distributed to 15 stakeholders having experience more than 15 years in dam projects of Pakistan to obtain their concern on the identified critical factors of delay in dam projects of Pakistan. Content analysis technique has been adopted to determine mitigation measures in this case study.

- **Political Interference:** The most critical factor responsible for delay in dam projects of Pakistan is political interference with Dam is a mega project which last for years. During its execution phase many governments change. With every new government new policies are initiated which affects the projects duration. To encounter this critical factor it is important to fix policy for dam projects based on its feasibility report stated in PC-2.
- **Financial difficulties to owner:** The second most critical factor for delay in dam projects of Pakistan is financial difficulties of owner with average index value of 4.58. The owner of dam projects is generally government. Financing such projects by government with huge amount is major task for any government. Therefore, it is worth mentioning for any government initialing such mega projects need to specify effective financial phasing throughout its tenure.
- **Policy of the tender winning at the lowest price:** Contracting firms always priorities to win contract through bidding lowest rates as per tender winning policy. It is evident that contractor cut-off its man power to save labour cost. Ultimately the project time frame exceeds. To avoid such delay in project contracting forms need to study B.O.Qs and market rates to quote their rates effectively.
- **Nonconsistency of policies:** Inconsistent policies of government for mega projects affects the duration of projects. With every new administration priorities change and lead to delay in mega projects. Effective policies which should last throughout the project are made to avoid delay in dam projects.
- **Change in scope of project:** Changing project scope after or before execution has serious consequences of delay. As feasibility is seriously studied in such sophisticated projects, changing scope would seriously affect the duration of project.
- **Poor contract management:** Management is the basic tool for any project to be executed effectively. Proper contract management should be adopted to trace out the project activities.
- **Poor decision making:** Decisions during execution of projects should timely be taken to avoid delay. All stakeholders should set a proper platform where minor issues could be discussed and resolve them rapidly.
- **Difficulties in financing project by contractor:** Contracting agencies executing mega projects such as dams should avoid to hunt another projects in order to maintain their cash flow for single project.

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