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Factors of Delay in Highway Construction Projects In Pakistan

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Abstract
A project is called successful when that project is completed on approved time. However, due to so many reasons construction industry is failed to complete projects within approved time frame. Construction industry of Pakistan is facing a critical problem of delay in construction of highway projects which has adverse and negative impact to many stakeholders. The main objective of this research is to identify the most critical factors of delay in construction of highway projects and mitigation measures. A questionnaire was designed and distributed among 130 respondents of highway projects and they were asked to rank each factor according to experience. After analysis, mitigation measure of each factor was asked by same respondents. This research will help to stake holders to overcome identified factors of delay by using mitigation measures suggested by respondents.
Keywords: Construction of highway projects, Delay, Critical factors, Pakistan.

1. Introduction

Construction industry plays a fundamental part in the economic growth of any country as it stimulates the development of other industries too (Rum and Akash, 2011). Delay can be defined as when project exceeds the time frame which was mentioned in contract on which all parties agreed for time period of the project (Ahmed et al.,2002). Delay in construction projects can be defined as when the project is not completed within given time. Construction projects are facing problem of delay worldwide. This problem varies from country to country and project to project (Aziz et al.,2016). According to Hasan et al (2014), the delay in construction can be defined as postponing the project completion time due to predicted and unpredicted causes. Construction industry is not well reputed in terms of completion of projects within time. Ignorance of delay analysis resulted many projects to fail on completing tasks in given schedule (Duran, 2006). According to Trigunarsuah (2004), only 47% of projects were completed within time frame, 38% of projects were behind time frame and 15% of projects were completed ahead of time frame in Indonesia.
Many research have been carried out on identifying factors which causes delay in construction industry of Pakistan but no any single study has been found to identify factors which cause delay in construction of dam projects in Pakistan.

2. Previous studies

Various studies has been conducted on delay in construction projects. Chan and Kumaraswey (1996) identified 83 potential factors of delay and he arranged factors in 8 groups. By using relative importance index, the five causes of delay were identified as (i) Poor supervision and site management (ii) Late in decision making (iii) Owner interference in project (iv)Change in ground conditions (v) necessary variation of owner. Another study conducted by Mansfield et al., (1994) in which 16 critical delay factors were found (i) Financial and payment faced by contractor of completed work (ii) poor contract management (iii) site situation (iv) Improper planning and (v) delay in materials. Fugar et al., (2010) conducted survey from 130 engineers of contractor, consultant and client. From survey results, the critical causes of delay in construction projects were delays in honoring certificates, shortage of materials, change in price of raw materials, lack of site management, problem in bank credit. Ogeno (2016) design questionnaire and distributed to experts of construction industry in Nigeria. After analysis from literature, the critical factors which causes delay were lack of skills of sub-contractors, shortage of skilled labor, poor site management, shortage of materials and defective in works.

3. Research Methodology

To achieve objective of this research, study is divided into two phases. In phase A, factors of delay were identified from deep study of literature review and also from unstructured interviews. Identified factors were merged in designed questionnaire in which respondents were asked to rank each factor according to their

knowledge. In second phase, questionnaire was designed and distributed among same respondents to find out most appropriate mitigation measures which were identified from literature review and interviews from experts.

4. Data Collection and analysis

Developed questionnaire was distributed among 120 selected respondents from client, contractors and consultant of highway projects of Pakistan. 91 questionnaires were revived back from selected respondents. Details of distribution of questionnaires presented in Table 1

Table 1: Details of conducted survey

Parameter	Value
Total number of questionnaire distributed	120
Total number of questionnaire received	91
Total number of incomplete information	02
Total number of valid questionnaire	89
Total % of questionnaire received	76
Total % of questionnaire valid	98

Each respondents were asked to rank each factor on five point Likert scale designed questionnaire. RIW method is used in many studies as accurate results and successful method of analysis (Ballard et al., 2001). Analysis was done by following formula of RIW

$$RIW=\frac{\sum ai\ xi}{\sum xi} \quad \ldots\ldots\ldots(1)$$

Where ai indicates constant which shows the weight given to I, xi is a variable denoting the frequency of the response for; i is 1,2,3,4 and demonstrated as, x1 is Least effective and equivalent to a1 is 1, x2 is the Less effective and illustrated as, a2 is 2, x3 is the effective and corresponding to a3 is 3, x4 is Very effective and equivalent to a4 is 4, x5 is the Most effective and corresponding to a5 is 5.

Results of this research showed that financial difficulties faced by contractor, poor site management, error in estimation of time, rapid design changes, delay in supply of materials, inexperience contractor, shortage of skilled labour, disputes at site and natural disaster with, score of 4.391, 4.283, 4.251, 4.174, 4.170, 4.093 and 4.071 respectively are the most critical factors of delay in constriction of highway projects in Pakistan. Results are shown in table 2.

Table 2: Critical Factors of Delay

Rank	Identified Critical Factors	Score
01	Financial difficulties faced by contractor	4.319
02	Poor site management	4.283
03	Error in estimation of time	4.251
04	Rapid changes in design	4.174
05	Delay in supply of material	4.170
06	Inexperience contractor.	4.134
07	Shortage of skilled labour	4.110
08	Disputes at site	4.093
09	Natural disaster	4.071

1. Financial difficulties faced by contractor

After analysis of gathered data financial difficulties faced by contractor was found the critical factor of delay in highway projects of Pakistan. Mostly contractors delayed and stopped the activities at constriction site due to shortage of funds. No doubt contractors plays important role for completion of project from execution to completion of project. (Frimpong et al., 2003).

2. Poor site management

Daily routine construction activities are not well planned at construction site as per schedule given by project managers. Poor site management factor arises because of incapable and inexperience appointment of project managers. Sometimes experience project managers quite from project and construction activities remains suspended up to new appointment of leader of project. (Le-Hoai et al.,2008).

3. Errors in estimation of time

Appointment of inexpereince engineers and planners in consultant firm causes mistakes in estimation of time frame of the project. Estimation of any project based on available resources and outputs (Sweis et al., 2008). Mistakes in time estimation causes delay in construction of highway projects

4. Rapid changes in design

Client and consultant are responsible for rapid changes in design of project which causes delay. Mostly contractor's starts projects very fast but because of rapid changes in design delay the construction activities. Sudden and frequent design changes delay the construction activities of project which causes delay of project in approved time frame. (Aziz et al., 2013).

5. Delay in supply of material

Delay of supply of material is one of the critical factor of delay in highway projects suggested by experts. Delay in supply of material at construction projects stopped and delayed construction activities at site which definitely causes delay in completion of project (Faridi et al., 2006).

6. Inexpereinced Contractor

Appointment of inexperience and in competnat contrcator causes delay in highway projects because contractor is not familiar and well experinece in construction of highway projects as wel as he no any well experince and skilled labour to complete the project within time frame. Many contrcators are appointed on favouritism basis which causes delay in completion of project within time frame (Alaghbari et al., 2007).

7. Shortage of skilled labour

In construction industry of Pakistan, construction of highway projects are going on same time so it is facing problem of shortage of skilled labour. Construction of highway projects are mostly in remote areas and it is quite difficult to arrange skilled labour at site. Shortage of skilled labour very serious problem which leads to delay of projects (Sambasivan et al.,2007).

8. Disputes on site

Disputes between labors and sometimes disputes between management and labors delay the approved time frame of the project. Many projects are delayed because of disputes at the construction sites which takes time to resolved and with this project time duration exceeds from approved one (Alaghbari et al.,2007).

9. Natural disaster

Construction industry of Pakistan is facing natural disaster problem like heavy floods, heavy rains and earthquake which stops and delayed construction activities for long time. Weather and natural disaster impacts projects to complete in given time frame (Al-Momnai, 2000).

The second phase of this study was mitigation measures which were found from deep literature review and unstructured interview from respondents. A questionnaire was designed and then respondents were asked to highlight the relative importance of mitigation measures on Likert scale. The collected data was analyzed by RIW method. Table 3 shows the results of mitigation measures of critical factors in highway projects of Pakistan.

Table 3: Mitigation measures of Most Critical Factors

S.NO	Mitigation Measure	Score
01	Adequate funds should be kept for each project	3.31
02	Experience and qualified engineers should be appointed by contractor	3.23
03	Sufficient field data should be investigated	3.11
04	Sudden and frequent design changes should be avoided	3.08
05	Sufficient quantity of material should be stored	2.97
06	Contract should be awarded on merit & experience basis.	2.91
07	Skilled labor should be hired by giving good rates	2.88
08	Coordination should be adopted between labor and management	2.82
09	Arrangements should be in heavy rain and flood areas	2.81

5. Conclusion

This study was carried out to find the most critical factors of highway projects and most significant mitigation measures of those critical factors. The factors were identified from deep literature review and unstructured interview from experts and after statistical analyzes the most critical factors of highway projects were delay in financial difficulties faced by contractor, poor site management, error in estimation of time, rapid design changes, delay in supply of materials, inexperience contractor, shortage of skilled labour, disputes at site and natural disaster found. The most significant mitigation measures to avoid most critical factors which cause delay were identified as below:

I. Adequate funds should be kept for each project from starting to end of project.
II. Experience and qualified team of engineers should be appointed by contractor on each project.
III. Sufficient data of site should be investigated to overcome mistakes in estimation of time duration of project.
IV. Sudden and frequent design changes should be stopped to overcome delay in construction of highway projects
V. Sufficient quantity of material should be stored at construction site
VI. Experience and competent contractor should be appointed by client on merit basis.
VII. To avoid shortage of skilled labour good rates and facilities should be given to available labour.
VIII. Coordination between management and labour should be adopted by arranging frequent meetings
IX. Proper arrangements should be done in heavy rain and flood season.

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Finding of this research will not be only helpful to control the factors which causes delay in highway projects but also be helpful for improvement of environment because all highway projects of Pakistan are facing delay problem from many decades.

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