**Identification and Assessment of Factors Causing Delays in Construction Projects at Public Sector Universities in Khyber Pakhtunkhwa, Pakistan**

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***Abstract***

*In recent years, Pakistan has faced many challenges in promoting higher education. According to government vision 2025, Pakistan is facing numerous problems; one is the provision of higher education. Although many new public sector universities are under construction, public sector universities are usually overloaded due to higher enrollment demand. Besides other construction sector projects, public sector university projects in Pakistan usually face lengthy delays. This research investigated the factors that cause delays in constructing public-sector university projects in Pakistan. Initially, a pilot study was conducted, and structured survey interviews were prepared in consultation with the field experts. Cronbach’s Alpha statistic method was also applied. The result of this study shows that the main delaying factors for public sector university construction projects included: dishonesty in the projects, hiring of irrelevant Project Directors, and allocation of technical positions to incompetent staff, as the top three significant delaying factors. Identifying top delaying factors and their appropriate management will be useful in similar nature projects for timely completion within the allocated budget avoiding time delays and cost overruns.*

**Keywords:** *Causing Delay, Public Sector Universities, Civil Works Projects, Cronbach’s Alpha, Relative Importance Index (RII).*

**Introduction**

Construction projects play a fundamental part in the development of nations. Construction projects undertaken by the public sector are viewed as a means of providing economic and social support for the upkeep of rural and urban communities, thereby contributing to the prosperity of their inhabitants ([Hussain et al., 2017](#_ENREF_10)). The government's goal for public sector university funding is to increase productivity, local businesses, poverty reduction, agricultural development, and easy access to great markets. The concept of win-win policies is appealing due to the potential for improved health services and access to high-quality education ([Frimpong et al., 2003](#_ENREF_7)). Improving construction projects i.e. roads, buildings, power stations, bridges, and infrastructure, is a measure of the financial empowerment through which humanity achieves its objectives of rural and urban development ([Ali et al., 2020](#_ENREF_3)). The duration of a public sector university construction project is typically foreseeable; however, delays may occur throughout the project's life cycle. A delay is defined as a situation in which the client and the contractor, either jointly or independently, have contributed to the project not being completed in accordance with the terms of the initial contract ([Assaf & Al-Hejji, 2006](#_ENREF_4)). Daley can be minimized when related causes are recognized ([Abdul Rahman et al., 2013](#_ENREF_1)).

 This research paper focus on the Khyber Pakhtunkhwa public sector university projects. Khyber Pakhtunkhwa (KP) is an independent, self-governing province under the managerial control of Pakistan. In recent years, public sector universities have played a central role in modifying and enhancing the province's public infrastructure and becoming more attractive to students. Developing countries, especially in Pakistan, criticize the construction delays. However, limited research has been done in the case of the public sector universities of KP, Pakistan, to provide a significant successful way for construction stakeholders for the new Public Sector Development Sector Projects (PSDP). PSDP construction projects in KP are managed by the Higher Education Department (HED) and the Higher Education Commission (HEC) of Pakistan ([Ali et al., 2020](#_ENREF_3)).

The Pakistan Public Sector Development Program (PSDP) assists public-sector universities in implementing infrastructure projects in various ways, aiming to improve their quality of life and sustainability ([Ali et al., 2020](#_ENREF_3)). The government of Pakistan finances both ongoing and new public-sector university infrastructure projects to resolve public issues and enhance the standard of education for the people of Pakistan ([Khan et al.,](#_ENREF_14) 2019)

 Public sector universities play a pivotal role in the provision of higher education and the progress of different sectors of society. In poor areas of developing countries, public university infrastructures are placed for sustainable advancement and dynamic and internationally competitive higher education (Ahmad & Mohamand 2014). In the year 2002, the government of Pakistan established the Higher Education Commission (HEC) of Pakistan to promote and enable higher studies in Pakistan (Akram et al., 2015). Pakistan has had many changes recently with the growing economy and other fields. Furthermore, the faster the population increase, the faster the demand for higher education increases. The government made the policy to increase the number of higher education institutions to accommodate the higher demand of students for enrollment. Pakistan had 130 public sector universities up to 2021 <https://en.wikipedia.org/wiki/List_of_universities_in_Pakistan>. The number of universities is less than the government’s target for various reasons. However, two main reasons are: (1) the allocation of funds for public sector universities project does not meet the population growth and requirement of the residents, and (2) the delay in completing the public sector universities project.

 According to the Higher Education Department, there are 33 public sector universities in Khyber Pakhtunkhwa province (Ali et al., 2020). Maximum public universities have been completed for a long, although some are under the construction phase, for instance, FATA University, Swabi University, Khushal Khan Khattak University, the University of Lakki Marwat, University of Shangla, University of Buner.

 Therefore, this study aims to determine construction stakeholders related to projects and evaluate the factors that promote their implementation. A quantitative approach was adopted to achieve the aim of the study by selecting the public sector universities of KP, Pakistan. The study provides insight into the problems of bottlenecks and impediments in completing construction public sector projects.

The main goals of this study are:

* To identify the critical delaying factors in public sector university PSDP projects in KP, Pakistan.
* Figure out how significant each stakeholder's delay is and divide them into groups based on their importance.
* To identify the relationship of the selected factors by using a correlation matrix.
* To suggest remedial actions for the causing factors of public sector university construction projects in Khyber Pakhtunkhwa.



**Figure 1. Public Sector Universities in Pakistan**

**Literature Review**

*Delay in Construction*

 The construction delay is when the client and contractor bilaterally or individually do not execute the project as per the original agreement period ([Assaf & Al-Hejji, 2006](#_ENREF_4)); ([Iyer & Jha, 2005](#_ENREF_13)). [Frimpong et al., (2003](#_ENREF_7)) stated in his study that the delays were caused due to monthly payment problems, unskilled staff of the contractors, material shortages, unfamiliar with the advanced techniques, and the unavailability of price adjustments in the contract. [Abdul Rahman et al., (2013](#_ENREF_1)), three dynamic-causing factors in Malaysia. Mostly payment problems, price adjustments on materials, dishonest project audits, and lack of new management techniques. [Kim et al., (2016](#_ENREF_14)), stated that the top cause’s factors in Vietnam are financial problems of the organizations, irresponsible project staff, frequent changes on site by the clients, incapability, and inadequate experience of the contractors. [Iyer & Jha, (2005](#_ENREF_13)), stated that the Indian construction projects, from the preceding research papers, literature found that the top seven factors are, project accomplishment factors encompass the capability of the leader, sustenance, and relationship with top management.

*Public Sector Development Projects (PSDP) Pakistan*

 The mechanism of PSDP is the fundamental asset for developing schemes in Pakistan. The Planning Commission of Pakistan described that the PSDP projects help achieve the goals, establish the government in the plan, and bring fundamental change toward supportable and quantifiable financial goals ([Rehman et al., 2011](#_ENREF_18)). [Hussain et al., (2018](#_ENREF_9)), concluded in his paper that the causes occur in the Annual Development Projects (ADP) in the Baltistan province of Pakistan. The Baltistan province is one of the inaccessible and underprivileged zones in Pakistan. Due to this cause, most of the construction equipment and materials are delivered late to the site. [Sweis et al., (2008](#_ENREF_20)), stated that the top rank cause of delays is the payment problems in Pakistan. HEC and the planning commission are expected to finish the projects within a specified time.

In recent years, many researchers have worked to identify the cause of delays in different construction projects. In Pakistan, such research is minimal and unavailable. The policymaker and public sector institutions need to be aware of the causes of delays in construction sector projects for better decision-making, specifically in public sector university projects.

 Identifying and understanding these factors would help the organizations reduce the impact of these delaying factors on the projects. Identifying factors is yet challenging, and prioritizing these delaying factors is needed.

 Therefore, this study aims to identify and assess the primary factors causing delays in public-sector university construction projects in KP. Further analysis of those factors through SPSS software. A quantitative approach suggested remedial measures to overcome the delay factors. Table 1 presents the group-wise factors related to the public sector university infrastructure project in KP under the investigation of this study.

**Research Method**

*Research Methodology*

 This research study used a descriptive methodology. This design is suitable for defining the state of delaying or for describing the relations among the various groups and their factors in each group. Khyber Pakhtunkhwa, Pakistan, was selected as a case study because much improvement can be made in constructing public sector universities in KP, Pakistan. Most of the factors were self-developed with the interview to collect the qualitative viewpoints of the experts, and most of the factors taken from the literature were modified as per the study environment to fulfill the study objectives. A quantitative survey method was adopted by checking the importance of each factor in different groups. The output of this study is a gateway to improving delaying factors in the construction of public-sector university projects. Finally, the data were statistically analyzed using Statistical Packages for Social Sciences (SPSS), the relative importance index (RII), to check the importance level of each factor based on the received feedback. The higher the RII value, the more important the factor. Similarly, the Cronbach Alpha test was conducted to check the factor limit if greater than 0.60 may be considered reliable. The research flow chart is presented in Fig. 2.

 The questionnaires have two parts. The first part is the main chapter of the questionnaire. In this chapter, the respondents assessed the sixty-seven factors in the questionnaire. Five-point Likert scale of 1 to 5 was adopted to assess each delaying factor's influence. These numeric values are assigned to the respondents’ rating: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree. The second chapter of the questionnaires has questions regarding respondents’ information, in which they have provided details such as Gender, Age, Designation, Experience, Education, etc. A clear explanation was provided to respondents about the questionnaire before responding to the survey questions.

*Target Population and Sample Size*

 The sample size is typically split into subgroups based on demographics, such as gender, age, position, experience, and education, to ensure that the total sample accurately represents the whole population.

***Table 1***

*Description of Factors and their references*

|  |  |  |
| --- | --- | --- |
| **S.No** | **Factor** | **Reference** |
| 1. **Higher Education Commission (HEC Related Factors)**
 |
| 1.1 | PC-1 goals not matching with the real project | (Establish through interviews) |
| 1.2 | delay in running IPCs payments by the department  | (Establish through interviews) |
| 1.3 | Delay in the recruitment process of consultants | (Establish through interviews) |
| 1.4 | Non-availability of Project Director | (Establish through interviews) |
| 1.5 | Delay in the approval of a Master Plan | (Establish through interviews) |
| 1.6 | Lack of Communication with HEIs | (Establish through interviews) |
| 1.7 | Availability of funds for variations | (Establish through interviews) |
| 1.8 | Non-availability of a legal advisor | (Establish through interviews) |
| 1. **Higher Education Institution (HEI) Related Factors**
 |
| 2.1 | Corruption tendencies  | ([Kim et al., 2016](#_ENREF_14)) |
| 2.2 | Selection of Incompetent Project Director | (Establish through interviews) |
| 2.3 | The hiring of non-technical staff for a technical position | (Establish through interviews) |
| 2.4 | A complicated system of file processing | (Establish through interviews) |
| 2.5 | Lack of interdepartmental SOP's | (Establish through interviews) |
| 2.6 | Law regulations of Pakistan i.e., PPRA, KPPRA  | (Establish through interviews) |
| 2.7 | Inadequate project feasibility study | (Establish through interviews) |
| 2.8 | Office Politics | (Establish through interviews) |
| 2.9 | The slow decision-making process by the HEI | (Establish through interviews) |
| 2.10 | Lack of Planning & management of Works staff | (Establish through interviews) |
| 2.11 | Variation in scope, contract of works | (Establish through interviews) |
| 2.12 | Selection of incompetent consultants | (Establish through interviews) |
| 2.13 | No sanction power with Engineering Staff | (Establish through interviews) |
| 2.14 | Strength of Engineering staff | (Establish through interviews) |
| 2.15 | Incompetency of Engineering staff | (Establish through interviews) |
| 2.16 | Lack of belief in Engineering staff | (Establish through interviews) |
| 2.17 | Delay in running bills payment of contractors  | (Establish through interviews) |
| 2.18 | Land clash during purchasing of land | (Establish through interviews) |
| 2.19 | Procurement rules complexity  | (Establish through interviews) |
| 1. **Consultant (CON) Related Factors**
 |
| 3.1 | Newly established consultants win the project by quoting less rates | (Establish through interviews) |
| 3.2 | Errors and discrepancies in the contract documents | (Establish through interviews) |
| 3.3 | Inadequate and wrong bidding documents | (Establish through interviews) |
| 3.4 | Uncertain and insufficient particulars in the drawings | (Establish through interviews) |
| 3.5 | Interruption in the endorsement of a master plan | (Establish through interviews) |
| 3.6 | Regularly change of project execution staff | (Establish through interviews) |
| 3.7 | unclear feasibility report and survey of the project | (Establish through interviews) |
| 3.8 | Unauthorized consultant project execution staff | (Establish through interviews) |
| 3.9 | Designing not as per advanced Engineering Software | (Establish through interviews) |
| 3.10 | Lack of supervision by the staff  | (Establish through interviews) |
| 3.11 | Time extension and payment dispute | (Establish through interviews) |
| 1. **Contractor (COT) Related Factors**
 |
| 4.1 | Deployment delay of the contractor | (Establish through interviews) |
| 4.2 | Unavailability of advanced construction equipment | (Establish through interviews) |
| 4.3 | Incompetent contractors win the bid | (Establish through interviews) |
| 4.4 | Absence of specialized techniques by the contractors | (Establish through interviews) |
| 4.5 | The gap between the department and the consultant  | (Establish through interviews) |
| 4.6 | Unstable ground for sub-contractors of the project | (Establish through interviews) |
| 4.7 | Shortage of skilled labors | ([Haseeb et al., 2011](#_ENREF_8)) |
| 4.8 | The low productivity level of skilled labors | ([Haseeb et al., 2011](#_ENREF_8)) |
| 4.9 | Non-availability of remote location costs | (Establish through interviews) |
| 4.10 | Financial constraints of contractor | (Establish through interviews) |
| 4.11 | Lack of labors compensation policy | ([Aibinu & Jagboro, 2002](#_ENREF_2)) |
| 4.12 | Poor managerial skills | (Establish through interviews) |
| 4.13 | Absence of Safety actions for labors | (Establish through interviews) |
| 4.14 | Unproductive outcomes of testing equipment | (Establish through interviews) |
| 4.15 | Financial indiscipline/dishonesty | (Establish through interviews) |
| 4.16 | Selection of incompetent contractors | (Establish through interviews) |
| 1. **Material (MA) Related Factors**
 |
| 5.1 | Scarcity of already approved materials | (Establish through interviews) |
| 5.2 | Client requirements for special materials | (Establish through interviews) |
| 5.3 | Lack of locally approved material at the project sites | (Establish through interviews) |
| 5.4 | Causing delays in material delivery | (Establish through interviews) |
| 5.5 | Site materials test failure | (Establish through interviews) |
| 5.6 | Variations in material prices | (Establish through interviews) |
| 1. **External (EX) Related Factors**
 |
| 6.1 | Political/bureaucratic impediments | (Establish through interviews) |
| 6.2 | Unreliable suppliers | ([Sambasivan & Soon, 2007](#_ENREF_19)) |
| 6.3 | Public interference | ([Doloi et al., 2012](#_ENREF_6)) |
| 6.4 | Terrorism/militancy  | (Establish through interviews) |
| 6.5 | Natural Disaster  | ([Hwang et al., 2013](#_ENREF_11)) |
| 6.6 | Unfavorable weather conditions | ([Olawale & Sun, 2013](#_ENREF_17)) |

 The inhabitants of the research study are 18 public universities in Khyber Pakhtunkhwa. The results shall be obtained from factors sample statistics that were generalized as per the target population.

 The sample size for the research study was designed on the ([Krejcie & Morgan, 1970](#_ENREF_15)) formula. A sampling design was used for the selection of respondents. The sample size stood at 153 respondents from 18 public universities. The sample size was designed using equations (1) and (2).

 $X=Z^{2}x π x (1-π) $**------------ (1)**

 $n= \frac{NX}{((N-1) E2+X)}$ **-------------- (2)**

Where Z =1.96 for a 95% confidence interval; *P* = 0.50 for n needed; n = sample size; N = population size = 686; and *E* = maximum error (0.07). Inputting the required values, the following sample size was estimated:

$$ X=1.96^{2} x 0.5 x \left(1-0.5\right)=0.9604$$

$$n=\frac{NX}{((N-1) E2+X)}=\frac{686 x 0.9604}{(\left(686-1\right)\left(0.07\right) ^{2}+0.9604))}=152.61$$



**Figure 2. Research Work Flow Chart**

 Based on the equation, the required sample size is 153. To be on the safer side, 163 copies were distributed among the sample group because it was expected that a few responses might be rejected due to incompleteness or any other reason. Of 163 copies, 153 questionnaires were returned with a response rate of (153/163 x 100) = 93.86%. Thus, the total number of questionnaires recovered and valid for statistical analysis is 153 questionnaires. Good feedback was achieved on the questionnaire due to the personal visits to the concerned universities and relevant officers.

*Pilot Survey*

 A pilot study was conducted to assess the feasibility of the factors on the questionnaire before it was circulated to the target population. In this study, the questionnaire was drafted after structured interviews with experts in the public sector university employees. Therefore, 16 questionnaires were distributed appropriately to participants based on which modifications were come and incorporated into the questionnaire. The feedback of the expert verification the modifications were made, and then a final study was performed.

*Questionnaire Design*

 The questionnaire is divided into two segments. The first segment included the respondent demographic characteristics. The second segment is further divided into six sections. The complete questionnaire detail can be found in Table 7 of this article.

*Data Collection and screening*

 One hundred sixty-three questionnaires were distributed among the eighteen public sector universities of Khyber Pakhtunkhwa, Pakistan. The questionnaire was prepared and circulated in the Microsoft form platform for the study in 2020. The circulated data were received in 2 months (from July 2020 to August 2020). One hundred and fifty-three (153) responses (93.86%) were received.

*Data Analysis*

Reliability

 In this study, the data was passed through the statistical test method of Cronbach’s Alpha to measure the data reliability of the psychometric test. In statistics, Cronbach’s coefficient of interior reliability ([Aibinu & Jagboro, 2002](#_ENREF_2)) ; ([Doloi et al., 2012](#_ENREF_6)); ([Assaf & Al-Hejji, 2006](#_ENREF_4)). It was first named Alpha by Lee Cronbach in 1951, as he had intended to continue with additional coefficients. The data found reliable, accurate, and employed for further analysis; the limit of the value if greater than 0.60 or above, the data may be considered reliable ([Cronbach, 1951](#_ENREF_5)). The following table shows the standard values of the data reliability. Standard Cronbach’s Alpha formula is.

$α=k\frac{r^{'}}{1+\left(k-1\right)r^{'}}$ **---------------- (**3)

Where k is the number of respondents and $r^{'}$ is the average correlation.

***Table 2***

*Data Reliability Guidelines*

|  |  |  |
| --- | --- | --- |
| **Cronbach’s Alpha (α)** |  | **Internal Reliability**  |
| 0.900 ≤ α |  | Excellent |
| 0.700 ≤ α < 0.89 |  | Good |
| 0.600 ≤ α < 0.69 |  | Acceptable  |
| 0.500 ≤ α < 0.59α < 0.5  |  | PoorUnacceptable |

 Table 2 represents the check for the reliability statistic by Cronbach's Alpha, the values acquired from the selected variables through Cronbach's Alpha. The values in the table show that maximum reliability statistic values are recorded for Material (MA) causing factors, and the lowest value was noted in the sponsoring ministry (HEC) category.

***Table 3***

*The Coefficient for Reliability: Cronbach*

|  |  |  |
| --- | --- | --- |
| **Group** | **Cronbach's Alpha** | **Number of Items** |
| Overall reliability analysis | 0.789 | 71 |
| Sponsoring Ministry (HEC) | 0.613 | 8 |
| Higher Education Institutions (HEI) | 0.799 | 19 |
| Consultant (CON) | 0.702 | 11 |
| Contractor (COT) | 0.739 | 16 |
| Materials (MA) | 0.85 | 6 |
| External (EX) | 0.636 | 7 |

*Relative Importance Index (RII)*

 [Ali et al., (2020](#_ENREF_3)) and [Olawale & Sun, (2013](#_ENREF_17)), have applied the RII method to define the ranking of delaying factors. This research has applied the same method to find the relative importance index. The following formula is used to calculate RII.

(RII) = (∑W / (A\*N) ------------------ **(4)**

Relative Importance Index (RII)

 RII indicates the relative importance index, W is the factor weightage by the respondents, A stands for the highest weightage (i.e., 5 in this case), and N is the number of respondents. The higher value of RII indicates the higher importance of delaying factors.

Mean and Standard Deviation

 This study used the Arithmetic Mean value to perceive the bearing of diverse causing factors. In the below arithmetic mean formula, Σ represents the sum of all the values of the factor, $X\_{I}$ Moreover, the entire number of annotations is epitomized by $n.$ The arithmetically mean is.

$\overbar{X}=\frac{ΣY\_{i}}{ n}$ -------------------------------- **(5)**

The available data's standard deviation can be calculated using the following formula.

$Std.D=\sqrt{\frac{Σ\left( \left(X-\overbar{X}\right)^{2}\right)}{n}}$ ---------------------- **(6)**

**Results and Discussion**

*Participant General Information*

 The result in Table 4 shows that all the respondents are male, at 100%. Most respondents are aged 31-40, with a percentage of 40.50. Table 5 shows that most respondents hold a bachelor’s degree, and 49% have 05-09 years of experience. Table 5 presents that all the respondents are classified as Clients (Public Sector Universities). According to their position title, the respondents were mostly Assistant Director Works and Deputy Director P&D at 10.50%. The following table shows the general information of the participants.

*Factors Ranking*

 Table 5 shows that the research study comprises six broad groups further divided into sub-factor questions, and each of the groups was examined through Cronbach's Alpha. All the values show that the data are reliable for statistical approaches.

 Table 6 illustrates that the delays associated with the project feedback received from public sector universities were isolated and analyzed on a case-by-case basis and ranked according to the RII methodology. Moreover, the data were passed through Mean level and Standard Deviation with the help of the data of RII. Table 8 elaborates on the complete details.

***Table 4***

*Respondent's Demographic Information.*

|  |  |  |
| --- | --- | --- |
| **Characteristics** | **Frequency** | **Percentage** |
| **Gender** |
| Male | 153 | 100 |
| Female | 0.0 | 0.0 |
| **Age** |
| 21 to 30 | 32 | 20.90 |
| 31 to 40 | 62 | 40.50 |
| 41 to 50 | 39 | 25.50 |
| Over 50 | 20 | 13.10 |
| Total | 153 | 100.0 |
| **Position** |
| PD | 11 | 07.20 |
| DoW | 12 | 07.80 |
| Dy. DW | 15 | 09.80 |
| Assist. DW | 16 | 10.5 |
| Dy. P & D | 14 | 09.20 |
| Dy. Director P & D | 16 | 10.50 |
|  Other | 69 | 41.10 |
| Total | 153 | 100.0 |
| **Experience** |
| 01 - 04 years | 45 | 30.10 |
| 05 - 09 years | 76 | 49.00 |
| 10 - 15 years | 18 | 11.10 |
| Over 15 years | 14 | 09.80 |
| Total | 153 | 100.0 |
| **Education** |
| Bachelors  | 57 | 36.60 |
| Masters  | 54 | 35.90 |
| Doctorate | 05 | 02.60 |
|  Other | 37 | 24.80 |
| Total | 153 | 100.0 |

***Table 5***

*Results of Reliability Analysis*

|  |  |  |
| --- | --- | --- |
| **Group Name** | **Cronbach’s Alpha (α)** | **Sub Factors** |
| HEC | 0.613 | 08 |
| HEI | 0.799 | 19 |
| Consultant | 0.702 | 11 |
| Contractor | 0.739 | 16 |
| Material | 0.850 | 06 |
| External | 0.636 | 07 |

***Table 6***

*RII and Ranked for Delaying Factors*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Delaying Factors** | **RII** | **Rank** | **Overall Rank** | **Mean** |  **Std. D** |
| **Higher Education Commission (HEC) Group** |
| PC-1 goals not matching with the real project | 0.9124 | 01 | 05 | 4.56 | 1.01 |
| delay in running IPCs payments by the department  | 0.9019 | 02 | 06 | 4.5 | 1.15 |
|  |
| Delay in the recruitment process of consultants | 0.7843 | 03 | 13 | 3.92 | 1.15 |  |
|  |
| Non-availability of Project Director | 0.7751 | 04 | 16 | 3.87 | 1.22 |  |
| Delay in the approval of a Master Plan | 0.7542 | 05 | 21 | 3.77 | 1.39 |  |
| Lack of Communication with HEIs | 0.7150 | 06 | 36 | 3.57 | 1.27 |  |
| Availability of funds for variations | 0.6575 | 07 | 44  | 2.55 | 1.60 |  |
| Non-availability of a legal advisor | 0.5111 | 08 | 55 | 3.28 | 1.22 |  |
| **Higher Education Institution (HEI) Group** |   |  |
| Corruption tendencies  | 0.9346 | 01 | 01 | 4.67 | 0.87 |  |
| Selection of Incompetent Project Director | 0.9307 | 02 | 02 | 4.65 | 0.91 |  |
| The hiring of non-technical staff for a technical position | 0.9300 | 03 | 03 | 4.65 | 0.86 |  |
| A complicated system of file processing | 0.9150 | 04 | 04 | 4.57 | 1.01 |  |
| Lack of interdepartmental SoPs | 0.7908 | 05 | 11 | 3.95 | 1.00 |  |
| Law regulations of Pakistan i.e., PPRA, KPPRA  | 0.7712 | 06 | 18 | 3.85 | 1.08 |  |
| Inadequate project feasibility study | 0.7660 | 07 | 19 | 3.83 | 1.15 |  |
| Office Politics | 0.7529 | 08 | 22 |  3.76 | 1.04  |  |
| The slow decision-making process of the HEI | 0.7464 | 09 | 25 | 3.73 | 1.21 |  |
| Absence of management of Planning and Works staff | 0.7450 | 10 | 26 | 3.72 | 1.17 |  |
| Variation in works scope, like description, and contract of works | 0.7398 | 11 | 28 | 3.69 | 1.22 |  |
| Selection of incompetent consultants | 0.7372 | 12 | 30 | 3.68 | 1.26 |  |
| No sanction power with Engineering Staff | 0.7249 | 13 | 33 | 3.64 | 1.14 |  |
| Strength of Engineering staff | 0.7111 | 14 | 38 | 3.55 | 1.20 |  |
| Incompetency of Engineering staff | 0.7019 | 15 | 41 | 3.50 | 1.30 |  |
| Belief absence in Engineering staff | 0.6483 | 16 | 45 | 3.24 | 1.28 |  |
| Interruption in running IPCs payments to the contractors  | 0.5895 | 17 | 47 | 2.94 | 1.44 |  |
| Land clash during purchasing of land | 0.6039 | 18 | 46 | 3.01 | 1.17 |  |
| Procurement rules complexity  | 0.4575 | 19 | 56 | 2.28 | 1.12 |  |
| **Consultant (CON) Group** |   |  |
| unskilled consultants win the project by below rates | 0.8143 | 1 | 08 | 4.07 | 0.95 |  |
| Errors and disagreements in contract documents | 0.8091 | 2 | 09 | 4.04 | 1.18 |  |
| Inadequate and wrong contract bidding documents | 0.8013 | 3 | 10 | 4.00 | 1.20 |  |
| Uncertain and insufficient details in the drawing | 0.7790 | 4 | 15 | 3.89 | 1.10 |  |
| Interruption in the endorsement of a master plan | 0.7738 | 5 |  17 | 3.86 | 1.00 |  |
| Regularly change of project execution staff | 0.7450 | 6 | 26 | 3.72 | 1.14 |  |
| unclear feasibility report and survey of the project | 0.7320 | 7 | 32 | 3.66 | 1.27 |  |
| Unauthorized consultant project execution staff | 0.7215 | 8 | 34 | 3.60 | 1.18 |  |
| Designing not as per advanced Engineering Software | 0.7124 | 9 | 37 | 3.56 | 1.075 |  |
| Improper supervision of the staff | 0.7098 | 10 | 39 | 3.54 | 1.26 |  |
| Time extension and payment dispute | 0.7071 | 11 | 40 | 3.53 | 1.29 |  |
| **Contractor (COT) Group** |   |  |
| Deployment delay of the contractor | 0.7830 | 1 | 14 | 2.62 | 1.37 |  |
| Unavailability of advanced construction equipment | 0.7555 | 2 | 20 | 3.50 | 1.18 |  |
| Incompetent contractors win the bid | 0.7516 | 3 | 22 | 3.74 | 1.10 |  |
| Absence of specialized techniques by the contractors | 0.7490 | 4 | 24 | 3.71 | 1.21 |  |
| The gap between the department and the consultant  | 0.7450 | 5 |  26 | 3.66 | 1.23 |  |
| Unstable ground for sub-contractors of the project | 0.7424 | 6 | 29 | 2.83 | 1.32 |  |
| Shortage of skilled labors | 0.7346 | 7 | 31 | 3.74 | 1.10 |  |
| The low productivity level of skilled labors | 0.732 | 8 | 32 | 3.71 | 1.21 |  |
| Non-availability of remote location costs | 0.7111 | 9 | 38 | 3.42 | 0.97 |  |
| Financial constraints of contractor | 0.7006 | 10 | 42 | 2.90 | 1.51 |  |
| Lack of labors compensation policy | 0.6849 | 11 |   | 3.77 | 1.04 |  |
| Poor managerial skills | 0.5816 | 12 | 48 | 2.87 | 1.02 |  |
| Absence of Safety actions for labors | 0.5751 | 13 | 49 | 3.55 | 1.14 |  |
| Unproductive outcomes of testing equipment | 0.5673 | 14 | 50 | 3.6 | 1.23 |  |
| Financial indiscipline/dishonesty | 0.5254 | 15 | 54 | 3.91 | 1.01 |  |
| Selection of incompetent contractors | 0.4405 | 16 | 57 | 2.20 | 1.05 |  |
| **Material (MA) Group** |   |  |
| Scarcity of already approved materials | 0.7738 | 1 | 17 | 3.86 | 1.23 |  |
| Department requirements for superior construction materials | 0.7464 | 2 | 25 | 3.73 | 1.26 |  |
| Absence of Local material at the project sites, not approved material | 0.7437 | 3 | 27 | 3.71 | 1.22 |  |
| Delay in material delivery | 0.7320 | 4 | 32 | 3.66 | 1.07 |  |
| Failure of tests of site materials  | 0.7189 | 5 | 35 | 3.59 | 1.07 |  |
| Fluctuation in material prices | 0.6666 | 6 | 43 | 3.33 | 1.26 |  |
| **External (EX) Group** |   |  |
| Political/bureaucratic impediments | 0.8405 | 1 | 07 | 4.20 | 1.02 |  |
| Unreliable suppliers | 0.7882 | 2 | 12 | 3.94 | 0.97 |  |
| Nonexclusive interference | 0.7529 | 3 | 22 | 3.76 | 1.09 |  |
| Violence/militancy  | 0.7437 | 4 | 27 | 3.71 | 1.14 |  |
| Mishaps in construction sites | 0.5594 | 5 | 51 | 2.79 | 1.25 |  |
| Natural disasters i.e. (floods, hurricanes, earthquakes) | 0.5385 | 6 | 52 | 2.69 | 1.46 |  |
| Unfavorable weather conditions | 0.5320 | 7 | 53 | 2.66 | 1.31 |  |

*Five Top Delaying Factors*

 The top five delaying factors are presented in Table 8 from all six groups, which include: dishonesty in projects, hiring of irrelevant PD, technical position allocated for incompetent staff, the complex administrating system of file, PC-1 goals not matching with the actual project, delay of running IPCs payments by the department, bureaucratic impediments, unskilled consultants win the project by below rates. The results presented in Table 8 depict that four factors were related to the group of HEI, two were related to the group of HEC, and three were related to the groups of External (EX) and Consultant (CON).

*RII and Ranking of Overall Groups*

 The overall ranking of the groups with higher RII has computed the critical indices of the delaying factors and ranked them among the top five delaying factors, are shown in Table 7.

***Table 7***

*Relative Importance Index and Ranking Top Five Delaying Factors*

|  |  |  |
| --- | --- | --- |
| **Factor** | **RII** | **Ranks** |
| Dishonesty in projects | 0.9346 | 1 |
| The hiring of an irrelevant PD | 0.9307 | 2 |
| Technical position allocated for incompetent staff | 0.9300 | 3 |
| Complex administrating system of file | 0.9150 | 4 |
| PC-1 goals do not match the real projects | 0.9124 | 5 |

*Higher Education Commission (08 Attribute)*

 Table 7 presents the group-wise and overall ranking of causing factors. The causing factor of PC-1 goals not matching with the actual project was high in rank. The respondent's assessments were adequately comparable and agreed that this attribute leads to the undertaking delay and primarily affects the construction project. It is worth noting that the factor was 1st in group rank, and overall rank is 5th in the HEC group. The second and third causing factors were delays in running IPCs (Interim Payment Certificates) payments by the department and delays in hiring consultants. The maximum Mean value of the factor is$ \overbar{X}$ = 4.56.

*Higher Education Institution (19 Attribute)*

 The Higher Education Institution (HEI) group is the second and most significant group of the causes of delaying factors. The respondents agreed, and their views were similar in the Higher Education Institution delaying factors group. The utmost significant delaying factor was Corruption tendencies, the hiring of non-technical staff for a technical position, and the selection of an incompetent Project Director is the top three delaying factor. The maximum Mean value of the factor is X = 4.65.

*Consultant (11 Attribute)*

 In Table 7, the consultant-related delaying factors, the group is ranked the third most significant. The results show that the unskilled consultants win the project by below rates, Errors and disagreements in contract documents, and Inadequate and wrong contract bidding documents are the top three delaying factors. The Mean value of the group is X = 4.07.

*Contractor (16 Attribute)*

 Table 8 shows that the top causing factors are deployment delay of the contractor, unavailability of advanced construction equipment, and incompetent contractors winning the bid, the top delaying factor in the group. The Mean value of the group is X = 3.74.

*Material (06 Attribute)*

 Table 7 material related shows that this group credits lead to extension and consequences for the development progress. The top three delaying factors were Scarcity of already approved materials, department requirements for superior construction materials, and near the project sites, the local materials not approved material were the top delaying factors. The maximum Mean value of the group is X = 3.86.

*External (07 Attribute)*

Table 7 shows that the respondents agreed these qualities lead to project delays and impact construction progress. The top three delaying factors were Political obstructions, Undependable material dealers, and local Community interventions in the project sites. The Mean value of the top factor is X = 4.20.

*Correlation Matrix*

 The correlation results, as described in Table 8, show that the relationship between the selected factors is interdependent. The HEC closely connects with MA and HEI, CON, COT, and EX. Moreover, this connection is fascinating positively as these factors are directly related. Similarly, the connection of HEI with CON, COT, and MA is noted as positive, while with EX.

***Table 8***

*Correlation Matrix of Causing Factor*

|  |
| --- |
| **Relationships** |
| **Factors** | **CHEC** | **CHEI** | **CCON** | **CCOT** | **CMA** | **CEX** |
|  | Correlation of Higher Education Commission  | Correlation of Higher Education Institutions | Correlation of Consultant | Correlation of Constructor | Correlation of Material | Correlation of External |
| CHEC | 1.0 | 0.096 | 0.071 | 0.042 | 0.177\* | 0.083 |
| P-Value |  | 0.232 | 0.373 | 0.596 | 0.026 | 0.302 |
| CHEI |  | 1.0 | 0.123 | 0.062 | 0.198\* | -0.131 |
| P-Value |  |  | 0.133 | 0.441 | 0.013 | 0.102 |
| CCON |  |  | 1.0 | -0.027 | 0.197\* | -0.123 |
| P-Value |  |  |  | 0.740 | 0.015 | 0.126 |
| CCOT |  |  |  | 1.0 | 0.660\*\* | 0.082 |
| P-Value |  |  |  |  | 0.00 | 0.314 |
| CMA |  |  |  |  | 1.0 | -0.178\* |
| P-Value |  |  |  |  |  | 0.027 |
| CEX |  |  |  |  |  | 1.0 |
|  |  |  |  |  |  |
| \*. Correlation is significant at the 0.05 level (2-tailed). |
| \*\*. Correlation is significant at the 0.01 level (2-tailed). |

*Discussions*

 “Corruption tendencies in the project” was a critical causing factor in KP public university projects. The same has been proved and ranked as the peak-causing factor ([Sweis et al., 2008](#_ENREF_20)). Most of the projects were delayed due to high dishonesty inclinations due to public university officials' monitoring system, and there are no regulations to penalize dishonest practices.

 The hiring of irrelevant PD is the second causing factor. Project Directors of public university projects lack communication and problem-solving abilities and management techniques. This is the government's concern to deploy the relevant PD for projects. The technical position allocated for incompetent staff is documented as a third important causing factor in KP public University. Furthermore, technical positions must be employed by experienced professionals. The causing factor complex administrating system of files is documented in the fourth position in the ranking. In public university projects, the project staff lacks technical and skilled experience and does not have progressive electronic system-generated logs to sustain the filing process.

 The causing factor of PC-1 goals not matching the actual project is documented fifth position ranking. The study results determined that the consultant did not concentrate on the feasibility study before the project design. In most cases of ambiguity in PC-1, clashes between the department and contractor occur during the execution phase. Table 9 presents the top five causes of delays and corresponding remedial measures identified through the survey with experts in the relevant field. The survey included face-to-face interviews to identify and suggest remedial measures to counter the delaying factors in university construction projects. Table 9 elaborates on the remedial measures.

**Conclusions**

 The study determined the delaying factors in PSDP-funded public university projects in KP. A literature review and comprehensive one-to-one interviews with public-sector university infrastructure project experts were conducted. Through structured interviews, found a total of 67 delaying factors. The factors were tested and divided into six groups. The data were collected from 153 public sector institutions in KP Pakistan. The data were computed from different statistical tools and techniques. Based on the Cronbach Alpha, (α) data were reliable, accurate, and employed for further analysis. The RII values, delaying factors, and groups were then ranked. Important delaying factors were determined based on ranking results. Mean values were used to observe the impact of each factor and then calculated the standard deviation from the results. In the Correlation Matrix of the overall factors, the results showed that the connection of the selected variable exists as all the selected variables are interdependent. HEC-related causing factors closely connected with material and HEI, Consultant, Contractor, and External.

 The study identified the best ways to identify and prioritize the main reasons for delays in public-sector college infrastructure projects. Public sector institutions say that project corruption is the biggest reason for delays. The study also found that university administrations were the most significant cause of delays in public-sector university construction. It is worth noting that HEC has funded the KP public sector universities project, but there are inefficient planning and utilization of PSDP funds by the KP universities. The causing delays are hiring non-technical staff for a technical position, selecting an incompetent Project Director, the complex administrating system of files, and PC-1 goals not matching with the actual project.

**Recommendations**

 In public sector institutions of KP, the Federal Bureau of Revenue (FBR) department of the government of Pakistan properly monitors the financial status of institutions and senior officials of the public sector institutions. Before creating posts, the public sector institutions monitor the financial status of the posts and check the impact on the budget of the university projects. For any financial matter, make a Financial & Planning Committee (F&PC) to monitor post-creation properly.

 In continuing and promoting administration and project staff of the public sector institutions, we suggest they prepare the staff on the latest market demand and thoroughly judge the balance of satisfactory performances. The designer makes most public sector universities’ infrastructure project designs without visiting the actual project sites. The authors suggest they visit the project sites before properly designing and avoiding guesswork before bidding. It will reduce the variations in civil works and minimize the causes of delays during the execution phase.

***Table 9***

*Remedial Measures for the Top Causes of Delays*

|  |
| --- |
| Remedial Measures |
| Delaying Factors | 1 | 2 | 3 | 4 | 5 |
| 1 | Dishonesty in projects | Encourage transparency and access to evidence | Frequent monitoring of senior officials of the department | Break the corrupt practices and cycle of exemption | Prevent the budget information and dishonesty of resources | Educating role of auditing agencies for financial strengthening  |
| 2 | The hiring of an irrelevant PD | Well communication and problems resolving skills | Administration responsibility to deploy pertinent PD  | Team building, and leadership services | Quick decisions power/skills | Integrity and project management skills |
| 3 | Technical position allocated for incompetent staff | Hiring with sound knowledge and expertise in filing | Communication and writing skills for coordination | Seminars arranged for the latest market demand | Office for proper coordination with concerned stakeholders | Promotion based on a reasonable concert |
| 4 | Complex administrating system of file | Instructions and meeting minutes must be in timely communicated  | Authorized head allocated to avoid the tail neck at the PD | Electronic tracking and system-generated logs  | For the record, maintenance establish a record room | Designated office for dispatched |
| 5 | PC-1 goals not matching with the real projects | PC-1 goals and objectives are practicable  | Accurate cost and risk investigation | Comprehension tasks formed in PC-1 | PC-1 must be equipped by specialists | The probability report should be precise |

 Most public sector university projects in KP do not include proper planning for timely work completion, appropriate construction methods, and scheduling projects. They construct the projects using their traditional way, and many mistakes occur during the project's construction phase, which causes a severe delay. The public sector institutions of KP should follow the strict rules for dispatch and office records of correspondence with contractors and consultants. Installing proper tracking and system-generated logs throughout the institutions will also be suggested. The following are the recommendations for the public sector University of Khyber Pakhtunkhwa.

1. To reduce corruption in Pakistan, the government should improve the role of the audit agencies, and it is essential to punish dishonest practices and break down the set of exemptions.
2. The appointment shall be grounded on sound knowledge, and this will be the responsibility of the government to create relevant posts for the suitable person.
3. The public university management should organize sessions for information on the up-to-date market request and confirm the employee’s promotion based on adequate performance.
4. The instructions and meeting should be opportune and communicated both in printed and oral, and a section head should be assigned to avoid the tailback up to the PD.
5. A nominated office for communication and other correspondence, advanced tracking, and electronic logs should be installed for timely completion.

**Declaration of Competing Interest**

The authors would like that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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**Conflicts of Interest**

 The authors declare that there is no conflict of interest.

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