COMPARATIVE ANALYSIS OF SIMILAR PUBLIC SECTOR PROJECTS WITH DIFFERENT SUCCESS OUTCOME

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ABSTRACT

This paper analyzes two cases of construction projects executed by a large public sector organization (anonymity requested), referred in this paper as Public Engineering (PE). PE is responsible to meet the civil works requirement of Public Sector. The institution is as old as British era and possesses well established procedures and mechanism to execute civil works. However, project success is found variable in spite of observing all rules and regulations. Reasonable number of projects goes into cost or schedule revision and or both sometimes. There is a need to find out the factors which if controlled can contribute towards success of a project.

This study finds out the antecedents of projects success by comparing two similar projects but with different success outcome. Both the projects were identical residential buildings constructed at capital city Islamabad. Effort has been made to bring out the essentials for success of project by interacting with stakeholders and deep analysis of documents of the projects.

Key words: Project Success, Project Management Case Study, Public Sector Project Management.

INTRODUCTION

Construction has a share of $1.7 trillion in the worldwide industry thus making 5 to 7 percent GDP in most of the countries. The industrial sector of Pakistan has contribution of 20.30 percent in GDP and share of construction in industrial sector is 12 percent and is one of the potential components of industries. It also contributes significantly in the provision of job opportunities to the labor force and has registered a growth of 7.05 percent in last financial year (Pakistan Economic Survey, 2014-15).
Construction projects involve a multitude of stakeholders – Client, Consultant, Architect, Engineers, Financer, Contractor and number of subcontractors. Also, the Construction Industry is exposed to multiple risks, threats, and management issues due to which success of projects vary. The phenomenon is more pronounced in developing and third world countries, public sector being the most affected. Projects are delayed and ultimately, the cost of the project increases. Flyvbjerg et al. (2003) observed that 9 out of 10 projects worldwide are subjected to cost overrun of approx 28% higher than the planned cost.

Public Engineering (PE) in Pakistan is an authority responsible for civil works pertaining to Public Sector. The procedure involves contracts through tendering and competitive bidding. Projects are executed by contractors and monitored by executives ex PE. Project is considered successful if quality work is completed within planned time and budget. To achieve this, PE has well elaborated and in detail procedures. However, in spite of all efforts, number of projects undergoes revision of cost and schedule. In PE, it has been observed that sometimes similar projects produce different success outcome, no matter majority of influencing factors are constant i.e. cost, schedule, approving auth, executives and location, whereas, official processes and contractor are variables.

Both construction projects under study are residential multi-storey buildings and were constructed in Islamabad. The initial approved cost of project A and B was Rs 28.35 Millions and Rs 28.80 Millions (Mn) with duration of completion as twelve months. One building was completed within the revised cost (Rs 31.518 Mn due to necessary site constraint) and planned schedule, whereas the other was completed in 2 yrs and 4 months with three revisions in cost and concluded at Rs 37.25 Mn.

Rational of study

Based on above discussion, the research problem can be framed as follows:

*Can antecedents of project success be determined by comparing projects with different success outcome?*

Why it is important to know antecedents of project success in PE? Construction activity is long process and in public sector it also involves official processes and formalities prior
start of project. Then there is a comprehensive mechanism of contracting, execution, funding and monitoring of the projects. These prior start processes span over two years. However, due to lengthy processes and lack of good management, reasonable number of projects undergoes rescheduling of time and cost.

Though, numbers of studies have been conducted in past regarding Success factors, cost and schedule overrun however, still there is a requirement to find out the reasons of variation in success outcome specially in public sector. This study through comparative analysis of two similar projects (where most of influencing factors were constant) will find out the antecedents of project success in PE and reasons of varying success in public projects in general and PE projects in particular.

Research Questions

- What are key determinant which ensure the project success in PE?
- Can success factors be implemented as check list to avoid failure at later stages?
- Why variations of success outcome in PE exist in spite of predefined and prescribed procedures?

To answer these questions thorough review of the available literature on the topic was carried out in first phase. Effort has been made to benefit from available studies conducted on public sector projects. Related books and regulations for PE were also consulted to view the project realities in canvas of these regulations. In second phase of research selective interviews of stake holders of both the projects were conducted. The stake holders included architect, structural engineer, middle and senior managers, officials involved in approval process of project, contracting authority, field executive and contractors. This study has made endeavor to dig deep into the project history to reach causative factors of variation in success outcome. Focused question were asked from the interviewees. The answers are critically analyzed for agreements and difference of opinion on project approval process, structural design, cost, schedule, pre-qualification of contractors, availability of funds, additions and alterations, quality and legal bindings. In third phase, necessary documents related to projects were analyzed to reach up to a conclusion, purely for educational purposes.
The study integrates the multiple aspects of Construction Projects i.e. feasibility and approval, planning and conduct, budget and constraints. Scope of study is specific to construction projects in PE. Therefore, the type of construction projects considered in this study is specifically construction projects of PE. Since similar procedure is adopted in other public sector projects as well, the findings of this study should hopefully be useful for engineers and managers working in Public Works Department (PWD).

Being public sector project, the project data was only subject to audit, however, for educational purposes data has been used in this study.

LITERATURE REVIEW

A thorough and deep review of literature was carried out to identify the antecedents of project success in PE. No worthwhile literature specifically on construction project in PE could be found. In this effort, several factors were considered through study of available literature, which play a significant role in success and failure of a public construction projects. However, PE regulations which lay the basic guiding principle to ensure smooth execution of project were consulted.

Antecedents of Project Success in PE

Nevertheless, the core parameters that express the elements with regard to the actualization of success in PE is the achievement of the core objectives as well as the effective management of the flaws and loopholes that are identified while the construction projects are carried out. The element of competence and commitment are the two core aspects because these two aspects express the achievement of the core motive for which the entire project is initiated. The element of commitment will enhance the overall dedication of the workforce in terms of enhancing the progress towards the construction of the project. For example, if a Public Engineering provision team is not dedicated towards the accomplishment of the designated objectives then the element of commitment will not be fulfilled or integrated in the coms of PE projects. The absence of this element means that entire project will not be stated as successful.

The integration of the competence element on the other hand might also enhance the overall effectiveness of the project construction in terms of success. The core reason with
regard to the effective integration of this particular element will express the core capabilities of the project that whether the particular project will be able to satisfy the needs of the particular associated entities. If the project deems to satisfy the needs expressed by the associated entities, then there is an increased probability that the project will be stated as successful in Public Engineering. For example, a project designed to overcome the particular barriers while the military assets are being transferred from one destination to another destination then the project is stated to be effective and successful. The core reason of the particular project to be successful is to overcome the barriers that not only increases the element of risk but it also increases the investment of time and efforts of the individuals to overcome those highlighted barriers.

Young and Samson (2007) found out different groups of project team factors which have direct bearing on project success and drive project cost, schedule, and operability. First bundle i.e. efficacy of project team, multi-functional project teams, project team structure, and virtual office usage were the strongest predictors of project cost effectiveness. Continuity of project leadership, cross-functional project teams, and project manager incentives were the strongest predictors of project construction schedule. In contrast, clear project goals and an office design to facilitate effective communication were the main predictors of plant operability.

Apolot et al. (2011) concluded that failure is contributed to cost overrun and can be avoided by controlling changes in scope of work, late payments and effective monitoring. Abdullah MR, Abdul Azis AA and Abdul Rahman I (2009) concluded that time overrun has positive and strong linear relationship with cost overrun. Lo, Fung, and Tung, (2006) stated that this effects into negative rate of national economic growth and monetary loss. Chimwaso (2001) highlighted four major factors causing cost overruns are design changes, inadequate planning, unpredictable weather conditions; and fluctuations in the cost of building materials.

The success factor can be implemented as checklist to avoid failure; however, this particular integration into the checklist of the project to a certain extent is ineffective. The core reason with regard to the ineffectiveness of this particular aspect is the inappropriate or uncertain situation rising in the scenario of construction of the project. For example, a
project that contain the changes of effective component integration by 50% then the integration of element of success into the checklist of the project cannot be carried out as the current situation of the project is not depicting an effective image of success. On the other hand, if the particular project is being constructed in the appropriate designed manner then the element of success can be integrated in the checklist in order to avoid failure at later stages. However, the integration of this particular aspect means that the firm has to overcome all of the possible barriers and dilemmas that might reduce the effectiveness of the system. The possibility of the error might arise either on the higher extent or on the lower extent yet the increased probability of the identified risk and threat might reduce the effectiveness of the project in terms of achieving the desired success.

**Variation in Success due to Contributory Factors**

Memon, A. H, Rahman, Abdullah and Azis, (2010) found 15 causative factors for failure of a project related to contractors. The top five include late payments to contractors, poor site management and supervision by contractor, less experience, Shortage of skilled workers, lack of planning and scheduling. The uncertainty in scheduled cost and duration of project is significant in construction industry. Folwell argued (as cited in Melo 2014) that time and cost predictability of construction industry came out to be 34% and 61% respectively.

Along with other contributory factors in project success or failure is the choice of right contractor. Prequalification is major criterion in selection of contractor for public sector projects. Hatush and Skitmore (1997) concluded that previous failures, financial stability, experience, credit ratings, ability, personnel management and knowledge are dominant contractor selection criteria affecting all three project success factors (cost, time and quality) whereas the length of time in construction industry being perceived to have the least effect overall.

Nevertheless, the variation occurrence in the success outcome of the project in PE regardless of the predefined and prescribed process is the element of error that might occur. The designing of the project and the actual visualization of the project is different from each other at certain stages. The core element of difference between these two aspects is present due to the actualization of the forces that are implicated on the project.
yet these forces are not highlighted in the project design. The absence of the forces in the design means that the influence of these forces in the project cannot be calculated. The absence of the calculation and the occurrence of the project after the completion express the variance from the outcome that had been stated in the designs. In addition to this, there is also other aspect that also expresses the variance in the project, which is associated with the effectiveness of the predefined and prescribed procedures. If a project can be developed in single way, then another alternative should be explored because the element of convenient or the element of compatibility might not be present in the predefined alternative.

Regardless the determined alternatives for the effective actualization of the project, the overall estimation might not be effective and this intense scale of ineffectiveness might express the variation in the extent of success. In other words, it can be stated that there is a reduced probability that the determined sources and the predefined and prescribed methods might correlate with each other. The core reason with regard to the ineffective integration of the predefined process is the defined methods but the sources are not defined. The absence of the defined sources means that the project might not be carried out as it was planned.

In an overall perspective, it had been assessed that the background of the project success is based on the predefined objectives followed by the core competencies and associated competencies of the project. However, to a certain extent, the core competencies are majorly dependent with regard to the determination of the project success in Public Engineering because it justifies the core motive for which the entire project is carried out. The accomplishment of the core motive of the project expresses the success of the project in terms of its construction. The success factor can be implemented in the checklist but the core flaw that might be present in the project is the early stages of the project that whether the entire project will be carried out as per the highlighted methods or certain changes needs to be made. Nevertheless, the element of variation occurs in the project if the actual and the deigned project differ from each other. The element of variation occurs if the consideration for the forces is not carried out in an appropriate manner.
RESEARCH METHODOLOGY

Bryman (2012) explain that the research philosophy indicates the criteria through which the results of the research are interpreted. The philosophies of the research are also the paradigm of the research since the past theories and the studies are reviewed with the help of the paradigms set by the researcher. Flick (2015) added that there are three common types of research philosophies known as positivism, interpritivism and realism. Dörnyei (2007) stated that positivism research philosophy is used when the researcher aims at interpreting quantitative data. While on the other hand, Leitch, Hill, and Harrison (2009) explained that interpretivism research philosophy is used when qualitative data is interpreted in the study such as the views and the ideas of the people that are available in quantitative manner. In the same manner, Nieswiadomy (2011) added that the realism philosophy is used by the researcher when both qualitative and quantitative data is analyzed in the research.

The research under discussion is based on the interpretive philosophy because this study has been executed through the scientific method of inquiry. Moreover, the multiple set of observation is another aspect behind the adoption of interpretive philosophy for this study. Furthermore, the authors of this study have prior insight in research context and expanded the findings in detail. Therefore, the interpretive research philosophy has been adopted to conduct this study.

The two basic types of research approaches include deductive approach and the inductive approach. The deductive approach is also called as the top down approach since in this research approach the researcher firstly develops research hypothesis based on previous research findings and presented theories (Neuman, 2005). In contrast, Leitch, Hill, and Harrison (2009) stated that inductive research approach is used in qualitative research design when the researcher aims at testing a new theory or idea.

This specific research is based on the inductive approach because an author of this report has conducted an interview from associated members who are involved in the selected case studies. Another reason behind the selection of an inductive approach is the bottom-up approach because the researchers have collected the data through generalized concepts and created a specific notion related to the subject of an issue. At last, the
qualitative based research is an additional reason behind the adoption of inductive approach.

There are three main types of research studies which are; explanatory, exploratory and descriptive (Gay, Mills, and Airasian, 2011). Exploratory research design is adopted when the researcher aims at exploring an unexplored topic. While on the other hand, once the research topic is explored the second step is to discover the variables that affects the explored research topic, whereas, the explanatory research design is used when the aim of the study is to explain the relationship between the research variables (Mackey and Gass, 2013). The research under discussion is comprised of the descriptive study because this study provides details of the discussed cases.

This specific study is based on the case study approach because the research compares and contrasts the two similar projects in order to obtain the findings related to the subject of an issue. The main focus of this study was to find out the antecedents of project success in PE. However, after going through the literature, it was found that there are over hundred factors which can contribute in the success of any construction project but all of these might not be applicable in PE setup. Therefore, the foremost thing was to find out the most important factors. To find out the pertinent contributory factors in PE, a questionnaire was formulated and feedback on Likert scale was obtained from the respondents. As the study was to be conducted on projects of PE, therefore the population was considered as user, engineers, consultant, designer and consultant of PE and purposive sampling was conducted with sample size of 50. The results were analyzed by statistical technique of Relative Importance Index (RII). The top eight factors were chosen for discussion and analysis in both the projects. Also these factors were mainly discussed in the interviews with the stake holders involved in the two projects.

Data collection method

This specific research is based on two types of data which includes; primary data and the other one is secondary data. The primary data is comprised of interview analysis and case study of selected projects. The primary data has been collected by taking interview from the relevant respondents in order to collect the first hand information and their accurate
view related to the subject of an issue. Other than that, the secondary data of this study have been gathered by the help of previously conducted research articles relevant to this specific area. Therefore, the secondary data have helped in reviewing the literature and to collect the relevant views of different authors related to the research subject.

Research instrument

The primary data have been collected through the interview questions therefore; the main research instrument of this study is the interview. Also the survey conducted helped to further narrowing down the scope of study. The study was designed to find out the antecedents of project success by comparing two similar projects; a successful and the other delayed and expensive project. This could only be done by deep analysis of project documents and interview with all those who remained involved in these particular projects. However, to bring the interview and study to a logical conclusion, certain factors which determine the project success were found out by a survey. Also, the researchers of this study have created the interview questions in order to collect the views of relevant people with respect to the project.

Data Analysis

The data obtained from survey was analyzed by a statistical technique RII as under:-

\[
RII = \frac{\sum W}{A \times N}
\]

Where:
- \( W \) = Weight of each factor (1-5)
- \( A \) = Highest weight (i.e. 5)
- \( N \) = Number of respondents

Higher the RII value, most critical will be the factor. Out of 25 factors, eight most critical factors were selected for analysis or discussion with interviewees.
The data obtained in interviews has been assessed through ethnographic content analysis, using ethnographic content techniques.

Flow Chart of Research

![Research Flow Chart](image)

**Figure 1**: Research Flow Chart

**Ethical considerations**

Three main ethical considerations which include; confidentiality, autonomy and anonymity were emphasized. The explanations of these three ethical considerations are discussed below.
Since the information of both cases is highly confidential henceforth, the study has not represented the exact information in this research but collected the relevant information and discussed in this research. Consequently, this research covers the element of confidentiality with respect to ethics.

Complete freedom was conveyed to the respondents to express their views related to the research subject. Therefore, the data for this study have been collected through the independency of respondents.

The secondary data have been collected and expressed it in the literature of this study. The entire secondary data is comprised of proper and authentic in-text citations which refer the researchers for the specific set of information. Therefore, the credit of information have been provided to specific group of researchers.

**DATA ANALYSIS AND DISCUSSION**

The result of survey for most critical factors is shown in the table below. During the interviews, the top eight influencing factors were mostly discussed as these were directly related to the civil works in PE.

This study assesses the data by discussing the eight factors at various stages of the selected project, in order to understand the role of each step and the actions taken at every step. First of all, project site has been discussed to highlight the peculiarities of construction site. Then initial estimation and sanctioned cost of project has been discussed because it variation between initial estimation and sanctioned cost. Moreover, trending and contracting is the second part of data analysis which explains the receipt of bids from contractors. Furthermore, the cost and time schedule included in this section explains the time and cost taken for project A and project B. Other than that, the structural design and deviation order is based on the architecture of buildings and the buildings were designed by PE architect and structural engineer. Apart from this, allotment of funds and release of payments is the second last heading discussed in this section which discusses the fund management and the time allotted to release the payment.
The quality of work is the last part discussed in this heading which explains the quality level and benchmark to measure the quality of the projects. The last part discussed in this section is associated to the Job Educational Background of Contractor.

**Site of Projects**

Both the projects were executed at capital city, Islamabad. The site had excellent accessibility and no site restriction was mentioned by the stake holders during interviews. Market proximity was also very good. However, labor had to undergo a long procedure and

**Table 1: Critical Factors**

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>RII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Funds</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>40</td>
<td>0.960</td>
</tr>
<tr>
<td>Quality of Work</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>0.840</td>
</tr>
<tr>
<td>Planning Cost</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>32</td>
<td>0.860</td>
</tr>
<tr>
<td>Tendering and Contracting</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>37</td>
<td>0.920</td>
</tr>
<tr>
<td>Schedule relation</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>13</td>
<td>22</td>
<td>0.808</td>
</tr>
<tr>
<td>Project Site (Easily Accessible or otherwise)</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>13</td>
<td>30</td>
<td>0.872</td>
</tr>
<tr>
<td>Structural Design and Changes after start</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>42</td>
<td>0.968</td>
</tr>
<tr>
<td>Educational Background of Contractor</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>16</td>
<td>27</td>
<td>0.880</td>
</tr>
<tr>
<td>Government Policies</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>21</td>
<td>19</td>
<td>0.800</td>
</tr>
<tr>
<td>Availability of latest equipment</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>14</td>
<td>15</td>
<td>0.700</td>
</tr>
<tr>
<td>Transparency</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>16</td>
<td>19</td>
<td>0.804</td>
</tr>
<tr>
<td>Availability of Labor</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>11</td>
<td>25</td>
<td>0.788</td>
</tr>
<tr>
<td>Site Management</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>23</td>
<td>0.784</td>
</tr>
<tr>
<td>Coordination among stake holders</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>14</td>
<td>23</td>
<td>0.804</td>
</tr>
<tr>
<td>Weather effect</td>
<td>1</td>
<td>4</td>
<td>18</td>
<td>16</td>
<td>11</td>
<td>0.728</td>
</tr>
<tr>
<td>Social issues of Labor</td>
<td>8</td>
<td>7</td>
<td>16</td>
<td>12</td>
<td>7</td>
<td>0.612</td>
</tr>
<tr>
<td>Corruption</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>17</td>
<td>22</td>
<td>0.808</td>
</tr>
<tr>
<td>Communication/Coordination</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>29</td>
<td>0.800</td>
</tr>
<tr>
<td>Political Influence</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>16</td>
<td>19</td>
<td>0.752</td>
</tr>
<tr>
<td>Supply of Material</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>15</td>
<td>21</td>
<td>0.764</td>
</tr>
<tr>
<td>Monitoring</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>15</td>
<td>17</td>
<td>0.716</td>
</tr>
<tr>
<td>Poor workmanship</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>15</td>
<td>19</td>
<td>0.764</td>
</tr>
<tr>
<td>Safety Practices</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>12</td>
<td>21</td>
<td>0.736</td>
</tr>
<tr>
<td>Market stability</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>19</td>
<td>20</td>
<td>0.788</td>
</tr>
<tr>
<td>Contractor’s experience in the field</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>30</td>
<td>0.788</td>
</tr>
</tbody>
</table>
clearance to reach up to project site. Same procedure was adopted when change in labor list occurred. Considering the casual nature of labor in developing countries, the long procedure of security clearance was a serious impediment in execution of project. Since problem existed for both the projects therefore this aspect could not be a major reason for delay. When interviewed, the contractor of Project A did not highlight this as problem. However, contractor of Project B highlighted this aspect as one of the reason of time overrun. This shows that contractor of project A had labor on his inventory which had been working as team on other projects in the complex. Therefore it can be concluded that for project in restricted areas, contractor must have permanent and trustworthy labors on his inventory.

**Projects' Initial Estimated and Sanctioned Costs**

The procedure of evaluating a new project from conception till bidding process was explained by all interviewees. When a project is conceived by the user, approval of competent auth is obtained on the basis of rough estimates. A feasibility study in form of a Sitting Board is convened and approved as per financial powers. The initial or in principal approved amount of both projects was 25.20 Mn each. As per regulations, the cost at which sanction for the work is issued shall not vary more than 25% of the initially approved cost. If the case arises due to any eventuality or change of design, approval of highest auth i.e. government is obtained. The final approved estimated cost of project A and B was increased to Rs 28.35 Mn and Rs 28.80 Mn respectively.

**Discussion**

The concerned engineer involved in preparation of project estimates and official involved in approval process were interviewed. In their opinion the project estimates underwent routine procedure during preparation and approval. The process is lengthy and spanned over two years involving conception and rough estimation of cost on plinth area rate, in principle approval, convening of siting board and its approval, preparation of detailed estimates and final approval. After going through long well established procedures, chances of missing out something are minimal. However, unforeseen aspects could not be highlighted prior start of work on site, though 5% contingency charges are kept in the estimates. But efficacy of 5% contingency charges is questionable.
If cost of project is increased more than 10% of the approved cost, revision in the cost is then approved from the authority that initially approved the project as per financial powers. In this case GoP was the approving auth.

Conclusion

From above discussion it can be concluded that projects did not have any foreseeable problem or risk factor at the stage of preparation and approval of project estimates.

**Tendering and Contracting**
After formal sanction of a project, tender is floated for receipt of bids from contractors. Project more than 2.5 million worth are also advertised on website of Public Procurement Regulatory auth and after 14 days received bids of prequalified contractors and firms are opened by a board. The lowest bid is accepted as successful and contract is awarded (PPRA Rules, 2004). However, due to any technical reason, any bid can be rejected by superior technical authority.

Discussion

The projects under study were advertised under rules and procedures and lowest bidders in both cases were awarded the contract. The questions related to tendering and contract agreement were asked from PE official in an interview. It was highlighted that contractors of both the projects had membership of Pakistan Engineering Council (PEC) and were enlisted with PE after prequalification. Contractor of Project A was enlisted in category C-3 and had been working with PE for a long time, whereas, contractor B was enlisted in bit lower category and comparatively a new entrant in PE. Furthermore, bidding amount was less as compared to actual cost of the project, thus contractor's profit was very less Contractor.

A quoted bid of Rs 26.45 Mn and contractor B quoted bid was Rs 25.15 Mn and being lowest bids, contracts were awarded.

This situation sometimes arises when contractor in an attempt to obtain contract reduces his profit percentage. According to field executive, this was one of the reasons for failure of the project B. Lowest bid criteria is mostly criticized by the field executives of PE. Though as per procedure, mobilization advance is paid but contractor must have some capital to sustain for few days during the execution phase if there is delay in payment.

It was also highlighted by the interviewees that some contractors do not maintain the inventory as they establish for the membership of PEC.

Conclusion

From facts established after interview with stake holders involved in contract section and projects documents, following can be concluded;
• Lowest bid criteria for award of contract may be beneficial to generate a competition among bidders and ultimately save some public money but it can also cause failure of project, if contract is awarded to financially weak contractor or in cases where technically it is not possible to complete the project in quoted amount. In present case contractor A quoted better workable amount, whereas, contractor B quoted fewer amount in order to get the contract.

• Award of Pakistan Engineering Council membership require strict scrutiny of contractor and can be helpful to eliminate contractors with fake inventory of men and material. This will definitely reduce the causes of cost and schedule overrun in Public Projects.

Cost and Time Schedule

Contracts agreements for execution of project A and B were concluded at a cost of Rs 26.45 Mn and Rs 25.15 Mn respectively, with completion time of 12 months. Accordingly, project timeline and payment schedule was form part of contract. During the interviews of stakeholders, questions were asked about the efficacy of time i.e. 12 months for the completion of project. It was told by staff officer contract section that 12 months is good enough time for execution of a four storey residential building. However, due to change in design of foundation, extension of three months was granted. The field executive also replied affirmative. Interviewee were also asked that why extension was not granted for period of non-payment to contractor. No satisfactory answer as per spirit of contract could be given. It was told that had delay been occurred due to non-payment then project A must have also been delayed. It was further added that circumstances do arise in public works where payments are delayed but contractor must carry on the work. In public works payment may be delayed but cannot be denied.

The Project timeline and payment schedule (common for both projects) are as under:
Table 2: Payment Schedule

<table>
<thead>
<tr>
<th>Project Stage</th>
<th>Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior Start (Mobilization Advance)</td>
<td>10%</td>
</tr>
<tr>
<td>Completion of Ground Floor structure</td>
<td>20%</td>
</tr>
<tr>
<td>Completion of 2nd Floor Structure</td>
<td>25%</td>
</tr>
<tr>
<td>Completion of 3rd Floor Structure</td>
<td>25%</td>
</tr>
<tr>
<td>Completion of Building</td>
<td>15%</td>
</tr>
<tr>
<td>Retention money (After 1 year warranty period)</td>
<td>5%</td>
</tr>
</tbody>
</table>

**Structural Design and Deviation Orders**

The buildings were identical four storey residential apartments with two apartments on each floor. The buildings were designed by PE architect and structural engineer. In this regard both architect and structural engineer were interviewed. Focused questions about efficacy of design of the buildings were asked. As per information provided by the interviewees, all details at the minutest level were included in the drawings. However, change of design due to an unexpected ground condition or change in user requirements are made during currency of the project.

It was found that during excavation of foundation, an underground aquifer was encountered. Therefore, design of foundation of both buildings was changed from split to raft foundation. Accordingly, financial effects were processed for approval.

The financial effects are more than 10% of the project cost are approved by the same financial authority who gave sanction of the work. In this case, financial effects of Rs 3.168 Mn for each block were processed with GoP for approval. The case was initiated by field executive, technically checked by chief engineer and processed by user. The process of approval took three months. Now the cost of building A & B reached up to Rs 31.518 Mn.
and Rs 31.968 Mn respectively. The time line for completion was not increased due to this unforeseen delay.

Table 3: Activity Schedule Chart

Both contractors demanded change in completion date. Initially, three months were granted as an extra time. The contractor A resumed project activities forthwith as per new design, whereas contractor B insisted to increase it to 6 months as quantum and scope of work was increased. This tussle wasted another month and contractor had to resume the work without any gain.
Discussion

An unforeseen technical problem was encountered during early stages of the project execution. The neglected aspect of planning stage was soil test of the site. It was considered that since soil properties do not change drastically in an area, therefore, soil test report of existing buildings surrounding the site was taken as reference. It was also observed that when the financial effects of deviation were processed for revision of cost, the work was not suspended or project was not frozen which forced contractors to demand extra time. As highlighted earlier contractor A had enough labor and equipment on his inventory and did not go into scuffle after getting three months extra time. He focused on the job with believe in his team. The contractor B did not have enough experience working with PE and went into time wasting scuffle. It is very difficult for a contractor to get complete demands accepted from a government department.

The work was resumed on project B but contractor faced difficulty to gather labor force once again.

Conclusion

From above discussion and facts, following can be concluded:

- In order to avoid delays during execution of project, detailed planning and designing based on ground realities is must. Soil investigation for construction was not conducted.

- In case scope of work is increased, additional time must be granted. Additional time in cases under discussion was not given. However, time equal to delay in approval of revision was granted.

- Wise and timely decisions on disputes are beneficial rather to linger upon it.

- To have guaranteed labor on inventory is extremely important. Contractor was resourceful and manage to re-assemble his work force, whereas, contractor B faced difficulty in gathering labor force.

Allotment of Funds and Release of Payments

To explore the cash flow within the projects under study, it is important to understand the system of allotment of funds in PE. The system of funds allotment follows a long chain. Funds against each project are provided by GoP on annual basis upon approval of complete
Annual Capital Works Program (ACWP). Funds are allotted to Budget Directorate of respective Service Headquarters and further disseminated to works directorate. Works directorate further disseminates it to field executives for execution of project. A separate bank account is opened for each project.

Discussion

With this background knowledge, in detail interviews of Staff Officer PE, Director PE, Field Executive and Contractor were conducted. During interview, focused question ranging from allotment of funds and its distribution till any financial difficulty faced in projects. It was found that funds were allotted initially and contractors were given mobilization money in advance. However, due to delay in approval of financial effects, unexpended funds were surrendered to GoP at the end of financial year (FY). This was the dilemma which further complicated the situation. Again for the next FY, funds were demanded and distributed through proper channel as mentioned earlier.

During this period, Contractor A continued work on project on his own expense. However, being financially weak and reluctant to take risk, contractor B did not start work. Work on project B resumed after five months. Payments were made to both contractors. It was highlighted that during this period contractor A completed ground floor and in contrary to this, contractor B was still working on foundation.

Conclusion

- It was observed that there were financial constraints due to rules and procedures imposed on PE projects. The work at project B was severely affected due to non-availability of funds. However, being financially good, contractor A was able to overcome these constraints. From this finding following can be concluded:

- Continuous availability of funds is an important driving factor for any project. Availability of funds was delayed due to necessary procedures for public projects ultimately further delayed the project.
To complete a project successfully, financial health of contractor plays an important role. Therefore, in prequalification and award of contract, it may be ensured that contractor has some resources to sustain delay in release of funds in public projects.

Quality of Work

Quality of work in PE is ensured by the field executive. As such there is no separate department for quality control. However, field executive is empowered to reject any substandard work. The same powers are highlighted in the contract agreement thus bounding contractor to quality work. The work after completion is inspected by a special team of experts of Directorate of Inspection and evaluation (DI&E). If work is found defective, plenty is imposed on the contractor for defective work and amount is recovered.

Discussion

During interview with field executive, pertinent question about quality were asked. It was told that during execution of project, both contractors were asked to rectify defective work. Contractor A took it positively and kept on giving quality work. But contractor B mostly retaliated to the instructions and reduced the pace in spite of regular payments. Therefore, he was served written notice to rectify the defective work and expedite. At few occasions, work was rejected due to poor quality. This re-doing of work further delayed the work and also initiated a rift between contractor and field executive. The contractor B requested for extension of time which was refused as completion time was already over. Project A had completed and inspection process was under progress at that stage. Contractor B in retaliation, stopped the work and approached higher authorizes of PE. The structure of building was completed and wood work was in progress. It was further found that dispute prolonged and contract was terminated by the competent authority of PE. New tender for the work was floated on PPRA website and print media for the left over works. The matter was taken to the court of law. Court issued stay order and no further work could be carried out for completion of building by re-tendering or risk and cost of contractor.

Conclusion

From above discussion following points are concluded:
• Quality of work is related to the expertise of contractor and involvement of field executive. A contractor with experience, skilled labor and equipment corresponding to his enlistment category can produce better results.

• Redoing of a work already executed due to poor quality tax the contractor and involves delay, therefore it is better to do it right first time.

**Specific to Job Educational Background of Contractor**

Specific education to the field of work is an important contributory factor to the success in any field. Likewise, contractor with the background knowledge and education can contribute towards success of a project. Both the contractors were also interviewed to investigate this aspect. It was found that both the contractors did not have any education on civil works. However, Contractor A had 20 years experience in construction business. The contractor B was relatively new and had only 6 years of experience. As per opinion of field executive, most of the contractors in Pakistan do not have any civil works education. They work merely on their experience.

**Discussion**

From the interview and projects documents, it was found that contract A was well aware of project management tools. Contractor B had no such educational background. Due to lack of technical education, the contractor B could not ensure quality from his labor. Ultimately, field executive of PE had to intervene more frequently either to get the work rectified or reject it entirely. This action was considered as victimization by the contractor. During the interview, it was noticed that contractor B lacked in technical knowledge of the civil works and for this he was dependent on his supervisor. On the other hand contractor A had thorough knowledge on the subject combined with experience.

**Conclusion**

• Contractor with the technical education about project can contribute in a better way towards success of project.
Lack of technical knowledge of contractor contributed towards the cost and schedule overrun of project B.

SUMMARIZED ANALYSIS AND CONCLUSION

The study has been conducted on the basis of three research tools; review of the relevant literature, a survey within PE to find out most influencing success factors, interviews of all major stake holders involved and project’s documents. The studies earlier conducted on project success factors (PSFs) are mostly generic in nature and are applicable to all civil works project. The three PSFs highlighted were time, cost and quality.

In this study, efforts have been made to remain specific to PE and to go beyond three PSFs. Therefore, eight factors (Accessibility of site, Cost, Time, Quality, Tendering and contracting, Specific to the job education of contractor, Availability of funds, No change in scope of work) were considered. It has been found that all the eight factors are interlinked with each other and affect the project success in different ways. Each interviewee was requested to rank the factors from 1 to 8. The mean of the each factor was obtained to reach up to prioritized antecedents of project success in PE.

1. Accurate Cost
2. Realistic schedule
3. Quality of work
4. Availability of funds
5. Right selection of contractor (pre-qualification and contracting)
6. No change in scope of work
7. Specific to the job education of contractor
8. Characteristics/Accessibility of site

These eight factors are the most important antecedent of project success in PE and have trigger effect on each other. If time is overrun, then cost will definitely be increased. If change in scope is carried out, it will have effect on cost and schedule both. If time and cost is reduced, it will directly affect the quality of work. If initial cost and schedule is not realistic, it will affect the project success. The selection criteria of contractor also affect three PSFs (cost, time and quality). Availability of funds greatly contributes towards success.
of the project. Specific to job education of contractor can contribute towards success by ensuring quality, within cost and schedule construction.

The rules regarding these factors are already established in PE in the form of regulations and instructions. For prequalification, contract and detailed project estimates, separate instruction in the form of booklet are available. Change in scope of work must not be allowed except due to technical reasons.

The lengthy processes, casual response of dealing staff and non availability of competent authorities for approval causes delay at various levels. The process can be altered to eliminate redundant steps which merely increase the work load.

The result of research indicates that detailed planning and careful study of site selected for project are mandatory aspects for project success. As a whole there are eight factors which directly or indirectly affect the success of project particularly in PE. These factors are sometimes related to one another. The further study can be conducted to establish the type of dependency and relationship of factors. These factors can also be incorporated as check list prior start of project. In fact, these can contribute towards success of the project and bring consistency in the success result of PE projects. The study in general is useful for all managers and engineers in public sector and particular in PE.

The variation in PE projects is mainly because of two most important persons, i.e. field executive and contractor executing the project. The contractor executes the work and field executive is the authority to accept or reject the work executed. It is always better to do it right in first attempt. The rectification in civil works is merely impossible and mostly done by demolishing the executed work, which causes delay and wastage of money and resources. PE lacks in latest software based project scheduling and risk assessment and mitigation techniques. Therefore it can be concluded that detailed latest software based planning, effective monitoring and careful execution of project can reduce the inconsistency in PE projects.

PE is an old organization with established rules and procedures however, owing to delays involved in certain lengthy procedures it is imperative to modify rules and redundant steps may be eliminated. The eight success factors highlighted in the study may be incorporated in planning and execution phases to ensure success of project. The criteria of registration
and enlistment of contractor be re-evaluated and strictly implemented. The PE engineers and managers be trained on latest project management software including risk assessment.

The future work in this field is welcome and the relation between success factors may be explored so as to find out the exact behavior of factors in relation to each other and also feasibility of publishing these factors as check list in PE instructions.

REFERENCES


