

## Effective Project Controls at Project Development Stage



### Engineering

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### ABSTRACT

*Project development process has planning, scope definition, designing and bid process management phases. Project controls planned and documented at project development stage has large influence on project results. Internationally important factors in project development are well documented and large organizations develop projects considering these factors. In India, earlier projects undertaken by Government were largely managed by departmental planners and engineers. However, after globalization the number of projects has gone up and with that outsourcing practice has started. This has created need for better project management practices. The research aims at identifying project control factors that has major influence on project results. The project control factors were identified in five control areas namely safety, cost, schedule, quality and risk. Total 18 factors were identified using brainstorming sessions. Relative importance index (RII) was found out to understand which area to focus on during project development. Quality control was found to be of highest importance according to survey of 83 participants.*

### INTRODUCTION

Construction sector contributes to almost 6.5% of the GDP of India. In spite of this, construction industry is considered as an under-performed sector compared to other industries. Iyer and Jha (2005) have reported that over 40% of Indian construction projects are delayed ranging from 1 to 252 months. The projects are delayed, shows cost overrun and has many other performance issues reported by the stakeholders. The problem is attributed to poor project development practices. The globalization has put up pressure on industries to implement project faster. On the other hand government has responsibility of creating matching infrastructure. This calls for better project management practices. Currently the projects are at receiving end with inadequate time given for the project development. The project controls as a part of project development plays vital role in the successful implementation of a project.

### PROJECT CONTROL FACTORS

There are five factors which need to be controlled for better project controls. They are 1) Safety 2) Quality 3) Cost 4) Schedule and 5) Risk.

#### Safety Control

Construction industry is considered to be hazardous industry. Health and safety are very important for any project and Project Manager has to ensure that project is completed without any untoward incidents. Although the actual safety is solely managed by the contractor (Kartam, 1997), the owner must have provided necessary controls at bid level to guide the contractor. Kartam argues further that that owner needs to have system and tools to evaluate contractor's safety performance. Hinze et al. emphasized on the need to built construction worker's safety into design itself. Koehn et al. suggested that the responsibility of the safety should be shared between owner and contractor and for monitoring and control a committee should be formed. According to Hislop (1991) implementation, operation, and monitoring responsibility of the program should be clearly defined at the beginning of construction activities which should include following key areas for safety control.

1. A comprehensive safety policy statement
2. A review of constructability
3. Reliable contractor screening
4. Preconstruction safety review meetings
5. Inspection

6. Good housekeeping

#### Quality Control

Quality in work is important factor to avoid rectification and rework at later stage which also consume additional cost and time. This shall be achieved by preparing and successfully implementation of quality policy, quality assurance plan, measurement and controls, and continuous quality improvement system.

The technical specifications plays vital role in controlling contract with reference to performance of construction work (Jackson, 1990). The intent of the specification must be precise. For better quality control well drafted specifications with special consideration for desired quality is foremost important. Quality audit or third party audit are necessary to check the corruption in construction, which is more prevalent in developing countries. Collection and analysis of testing data helps achieve quality control objectives.

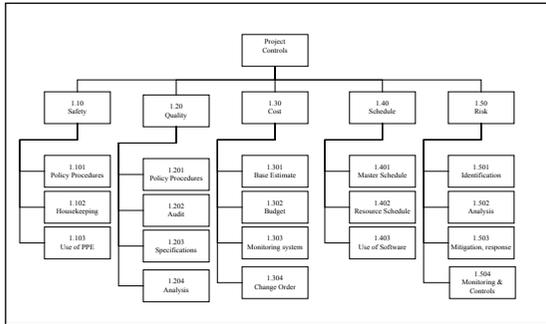
Quality control deals with monitoring pre-identified project results to determine whether they conform to quality standards or not. It also aims to eliminate and control unsatisfactory results (PMBOK, 2005). It is ideally performed throughout the project. Project results include end product results and project management results. Quality control is often a separate department but generally everyone within organization responsible for quality.

#### Cost Control

The factors that adversely affect project's cost performances are: conflict within project participants; ignorance and lack of knowledge; generalization of project attributes, poor cooperation; hostile socio economic and climatic condition; hesitation in decision making; aggressive competition at bidding stage; and inadequate bid preparation time (Iyer, 2005). To overcome poor cost performance owners and contractors both need to establish project controls at budget and expenditure level. The execution being responsibility of contractor, often this is not checked.

Cost control is concerned with (PMBOK, 2004) a) influencing the factors that impact baseline cost b) determining that there is actual change in cost baseline, and c) managing the actual changes as and when they may occur. Cost control includes: monitoring cost changes, preventing unauthorized changes in cost base line and communicating authorized changes to stakeholders. To manage this, necessary tools such as Earn Value Management has used. The use of software is also highly desirable.

**Figure 1 : Hierarchy of Project Control Factors Identified using Brainstorming Session**



**Schedule Control**

The Schedule Control process is involved with determining the current status of the project schedule and it influences factors that create schedule changes (PMBOK, 2004). All changes are managed as they occur. During each reporting period, two kinds of data or information need to be collected.

1. Data on actual performance.
2. Information on any changes to the project scope, schedule or budget.

To control schedules tools such as Earn Value Management are useful. The use of software is must.

**Risk Control**

All projects are subject to change, which results in uncertainty. The uncertainty creates risk. (Lockyer, 1996). Risk Management provides product development teams and managers for managing innovation risk in an effective cross-functional manner. Risk monitoring and control process keeps track of the identified risks (PMBOK, 2004). It further monitors residual risks and identifies new risks, ensures execution of risk plans, and continuously evaluates their effectiveness in risk reduction. Risk monitoring and control is a continuous process throughout the life cycle of a project.

**SELECTION OF PROJECT CONTROL FACTORS**

The brainstorming session was conducted with one government and one private agency. Roads & Buildings department of government undertakes wide variety of government projects including residential, institutional, infrastructure, rehabilitation. The other organization is a real estate group which is a multinational group which dealing with private projects. Participants were explained the objectives of research and asked to suggest factors that affect efficient project development. Shortlisted factors concerned with project controls are presented in form of a hierarchical structure are illustrated in figure-1.

**IMPORTANCE RANKING OF MAIN PROJECT CONTROL FACTORS**

A survey questionnaire was framed with a view to understand which indicators are more important, a questionnaire survey was carried out where the experienced participants from the client, consultant, and contractors' organization were asked to rank the indicators in a Likert scale of 1 to 5, where 1 is least important and 5 is most important. Likert scale was selected mainly because it is simple to construct and it permits use of latent attitudes. It is also considered to be a reliable scale (Baker, 1997). The questionnaire responses provided an indication of the varying degree of influence that each factor has on project controls.

Questionnaire was sent to 116 qualified engineers/architects. On completion, 83 valid responses were gathered with response rate of 71.55%. The questionnaire had a section for collection of respondent information. The type of respondents and experience varied from Project Engineer to Director/President in private organizations and Assistant Engineers to Superintending Engineer in Government organizations. Respondents included

Planners, Design Engineers, Project Managers, Construction Managers, Procurement Specialists, and Contractors. Wherever it was feasible a small workshop was convened where possibility of gathering five or more responses was there. The questionnaire information was further analyzed for the qualification of the respondents. The distribution of the respondents by their qualification is given in table 1 below.

**Table 1 Education profile of Respondents**

Sr. No.	Education	Count	Percentage
1	Diploma	1	1.20%
2	Bachelors	42	50.60%
3	Post Graduate	37	44.58%
4	Ph.D.	3	3.61%
	Total	83	100%

It was also ensured that the respondents were having necessary years of industry exposure. The distribution of the respondents by their experience is given in table 2 below. Total collective experience of the respondents is 1843 years.

**Table 2 Respondent profile by their work experience**

Sr. No.	Work Experience	Count	Percentage
1	< 5 Years	11	13.25%
2	6 to 10 Years	12	14.46%
3	11 to 20 Years	16	19.28%
4	> 20 Years	44	53.01%
	Total Experience (in Years)	1843	100%

As identified during the preparation of the survey, the respondents were asked to select amongst seven possible organization types. The distribution of respondents by organization type is shown in Table 3 below.

**Table 3 Distribution of respondents by organization type**

Sr. No.	Type of Organization	Count	Percentage
1	Builder/Owner	7	8.43%
2	Contractor	5	6.02%
3	Consultant	34	40.96%
4	Government	23	27.71%
5	Academics	7	8.43%
6	Semi-government	6	7.23%
7	Others	1	1.20%
	Total	83	100%

**Relative Importance Index**

To understand the significance of each factor, a relative importance index (RII) was used to rank the factors according to their influences. The relative importance index ranges from 0 to 1 (Le, 2007). The RII can be calculated as under:

where, w is the weight given to each factor by the respondent, ranging from 1 to 5, (n1 = number of respondents for least important response ... n5 = number of respondents for most important). They were asked to give importance ranking to the above mentioned five factors in a scale of 1 to 5. The respondents were having experience of 5 to 42 years in the construction field. The respondent profile is given in table-3. A total of 83 valid responses were received with a response rate just above 50%.

**Table 4**  
**Relative Importance Index of Project Control Factors**

Sl. No.	Factor	Importance Ranking					Mean	RII
		1	2	3	4	5		
1.101	Safety	3	2	20	26	32	3.99	0.7976
1.102	Quality	2	0	8	29	44	4.36	0.8723
1.103	Cost	1	3	15	37	27	4.04	0.8072
1.104	Schedule	0	3	17	41	22	3.99	0.7976
1.105	Risk	0	6	30	27	20	3.73	0.7470

guides the owner, consultants and contractors to execute the project to achieve project goals. Since time, cost, quality and safety are also the performance goals, it is desirable to control the parameters as early as possible. The safety, quality, cost, schedule and risk are basic control factors. A questionnaire survey to determine the relative importance of the factors resulted in ranking of control factors with quality control perceived as the top control factor. This is followed by safety, schedule, cost and risk. While the improper risk control may affect the schedule and cost, risk control is considered to be relatively less important. It is planned to devise weight to level 3 factors using analytical hierarchy process in future.

**CONCLUSIONS**

Project controls established at the project development stage

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