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Success Factors for Effective Implementation of Project Controls In Contracting Companies: A Qualitative study
TITLE  

Success Factors for Effective Implementation of Project Controls in Contracting Companies: A qualitative study.

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DECLARATIONS

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(3) that unless this dissertation has been confirmed as confidential, we agree to an entire electronic copy or sections of the dissertation to being placed in the archives, if deemed appropriate, to allow future students the opportunity to see examples of past dissertations.

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AUTHORS: **BHARADWAJ DUNNA**  
**VARA PRASAD BURELA**
**Abstract:**

Project control systems are increasing in importance as more and more projects are being restricted to budgets, schedules and other performance measures. Project controls bring information close to the decision makers in a timely and effective manner so that correct decisions can be made. Construction is an industry where large scale projects are undertaken and for these projects various project control systems are used to gather information. The project controls systems are implemented stage wise, to meet the demands of large scale construction projects in contracting companies.

To investigate the various factors for effective implementation of project controls this research employs a multiple case study analysis, where construction projects are studied for analysis through a questionnaire based approach. Primary data is collected using questionnaires from selected respondents. Findings are based on qualitative analysis; conclusions are made with respect to findings and the existing literature. The research successfully identified 10 key threshold factors for effective implementation of ‘control process’. Also the research attempt to identify the characteristics of the control process yielded considerable results. The work would be a beneficial for the practitioners in improving the control process. The theory developed from the research identified similarities between monitoring and evaluation stages.

**Key words:** Project Controls, Construction Industry, Threshold factors, Key characteristics;
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I, Vara Prasad Burela dedicate this work to my wife who whole heartedly supported me all during this educational endeavor, inspite of her bad health due to accident. I also dedicate this work to my baby Chy Bala Lakshmi Sanjita, whose fond memories had given me great joy and strength to work in my lonely times.

I, Bharadwaj Dunna would like to dedicate this work to my mother, words can never be enough to praise her and her support, some things are better conveyed through sheer silence, this is one such ............
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Chapter 1

INTRODUCTION

The importance of project management and its concepts are increasing by the day. One of the reasons being, the success that project management brings to businesses and organizations. Success of projects is a topic of discussion for both academicians and practitioners. The body of knowledge continues to evolve with more and more innovative methods being employed. An important topic for discussion is “the success of projects, and what factors contribute to project success?” The question appears pretty straightforward, only, the answer not quite. Shenhar and Wideman (2000) have broadly classified success factors as project efficiency, impact on customer, business success and preparing for the future. But, achieving all the set criteria in any given project is difficult. In support of this, Shenhar and Wideman (2000) and Cooke-Davies (2002), mention that there is no agreed understanding of success concept. Success is perceived differently from different contexts, as an example consider the Sydney Opera House. Jugdev and Muller (2005) mention that the construction of the Sydney Opera House which took 15 years to build was 14 times over budget, was successful because it was finally delivered, but, the same project is a failure from project management practice. The major reason could be the fact that the project was not managed in terms of time, quality and costs (the most important project management practice concept). So, the question of project success factors is not so clear after all and needs a lot of thought and research. As, Jugdev and Muller (2005) mentioned that, “project success is a complex and ambiguous concept and it changes over the project and product life cycle”. But, in-spite of the ambiguity, its continued contribution to understand the goals makes success factors relevant. Various success factors can be listed for projects, these could range from cost to time and quality or many other factors. Iyer and Jha (2006) research mentions that over 40% of Indian construction projects are facing time overrun and identifies 55 attributes responsible for impacting performance of the projects. Not all these 55 attributes could be identified as success factors, only those which are critical shall be considered. These factors could be unique to industry, sector and or each individual project. Iyer and Jha (2006) mention that the single most important factor for project is schedule overrun and if the same could be controlled, a major part of cost overrun including general escalation and interest during construction could also be contained. So, from the research conducted by Iyer and Jha (2006), they found that project scheduling is a success factor; this may not be true for all projects. Their research itself was based only on construction projects in India. Iyer and Jha (2006), further mention other factors and their importance in terms of percentage to the project:

- Project manager competence at 27.95%
- ‘Owners & Top management Support at 15.84%
- ‘Monitoring, Feedback, and Coordination’ at 15.24%
A similar finding was also made by Falco and Macchiaroli (1998). The interesting findings from the research are the fact that monitoring, feedback and coordination feature as one of the factors contributing towards project success. The significance and scale of monitoring and control in project management can best be explained by looking at Apollo 13 project. Cleland et al. (1998:203) say that “only due to effective control from time to time by both scientific approach and human abilities, Apollo 13 avoided disaster”. This example explains the importance of control procedures in a project. Project controls has attracted a lot of attention and makes an interesting area to explore for the authors.

The above was a brief introduction of project management and what might contribute towards the success of projects. The next section will further explore the subject and identify the aims and objectives for this research.

1.1. Framing the research question and objectives

Project controls are aimed at increasing the performance of the project. Kerzner (1995) mentions controlling as a three step process i.e. Measuring progress, Evaluating what remains to be done, and Corrective actions to achieve or exceed the objectives. Project Control mechanisms are being implemented in many industries and sectors today. One such industry is the construction industry. Project monitoring has already been found to be an important contributor towards success of construction projects in India by Iyer and Jha (2006). Construction projects are subjected to large stakeholders and environmental issues making it susceptible to deviations from planned progress and budget. So, much emphasis will be given to project control during execution phase. In construction projects, this execution phase is usually carried out by contractors, hence, the proliferation of engineering and contracting companies world over, especially in the construction industry. General terms of contract document by FIDIC (FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS) indicates that the control aspect of projects is more a responsibility of the contractor, than the client engineer (FIDIC, 2007). Contracting companies view projects as a place to implement control strategies to maximize profits and also to meet customer requirement. In view of this, contracting companies implement vigorous control procedures to achieve both operational and strategic control of projects. Today research and the markets are working together to increase usage of ICT tools in the construction industry and improve processes and productivity.

Fortune and White (2004) mention that ‘performance monitoring system’ monitors deviations, so that the organisation or manager can initiate corrective action where necessary. In addition, Angus et al. (2000) mention that a loose project management can result in a project getting out of control and on the other hand extreme and over reactive control can bring the project to a stand still. They further mention that controlling a project too tightly makes team members nervous and may lead to be less creative. Linen (2004) research indicates that there is a positive co-relation between control systems and administrative task and negative co-relation with technical task.
Since, construction projects involves multi tasking involving relationships and innovation, the control procedures should be varied considerably over the period of construction. Angus et al. (2000) also confirm that monitoring and controlling of a project must be done very carefully. The balance between the three controlling aspects varies from project to project and also from time to time in the same project. The framing of the research question can be illustrated as,

Considering the growing importance of project controls and the various influencing/threshold factors in construction projects the research question is framed as:

“What are the success factors for effective implementation of project controls from the perspective of construction contracting companies?”

1.2. Statement of Problem:

The study proposes to identify factors influencing/ threshold for implementing project control mechanism in construction projects.

1.3. The detailed aims and objectives for the research are:
1. What are the influencing/threshold factors for effective implementation of ‘Project controls’ in construction projects?

2. What are the key characteristics of the ‘Control Process’ in construction projects from the perspective of contracting companies?

1.4. Importance of the study:

Choice of subject: Considering the importance of project controls and the various stages involved the authors have chosen this particular area for research. Construction projects provide scope for an in-depth study on the topic and also, one of the authors has been involved in and is well versed with construction projects, this lead to the choice of the subject.

For academicians: Project controls are an area with a growing body of knowledge, this research makes an effort to contribute towards the body of knowledge with a particular emphasis on construction practices being currently implemented.

For Practitioners: Even though the research focuses on construction projects, the findings and the outcome could be relevant to practitioners in other industries with particular emphasis on the various stages involved in project controls.

1.5. Scope of the Research:

The research makes an effort to identify the influencing/threshold factors for project controls and how this control mechanism can be implemented effectively towards the success of projects. Hence, identifying the factors for effective implementation of project control mechanism. The research is confined to the construction industry, and whilst the conclusions will make an effort to generalise the findings.

1.6. Research Structure:

The structure is presented as:

Chapter 2-Literature Review
This chapter discusses prior research conducted on the topic in order to explore the current body of knowledge. Beginning with trying to understand how projects are managed in the industry (construction) followed by project control mechanism in construction projects. This chapter is also divided into sub-sections to make it presentable as,

• Project management in construction industry
• Success factors in the industry
• Project control mechanism in construction projects
Chapter 3 - Research Methodology
This chapter will discuss the methodology employed to carry out the research, discussing the research structure along with the limitations and ethics.

Chapter 4 - Case Analysis
A brief background for the organizations chosen for data gathering will be provided.

Chapter 5 - Findings, Analysis and Evaluation
This chapter will analyze the data gathered employing the chosen research methodology. The main aim of this chapter is to discuss the findings to draw conclusions.

Chapter 6 - Conclusions
This chapter will provide the conclusions for the study, where the analysis and findings will be related to the literature. Also, limitations for the research process will be disclosed, finally recommendations for future research will be discussed.

To begin the research relevant literature has to be identified. The literature review is presented in the next chapter.
Chapter 2

LITERATURE REVIEW

This chapter looks at the literature available which is relevant to the research topic. According to Babbar et al. (2000), “literature for graduate students can be of great value, mainly as they assess the fit of various institutions for their training and research”, making this part of the dissertation vital. Construction projects are complex and diverse in nature and new effective methods to control the projects for better performance are always being tried by contracting companies. The Literature review studies various areas of interests in order to answer the research questions and contribute to the growing knowledge base of projects controls in construction projects. Initially, the study focuses on the importance of construction projects and tries to identify ‘Project Controls’ as an important factor for improving project performance. The Literature review also identifies various concepts of success factors and reasons the need for study of success factors specific to a project process, instead of complete project. Later, the review explores the concepts of project controls and highlights it in the context of construction projects. Also the literature review tries to identify a set of influencing factors derived from earlier concepts and similar studies. The review explores the subtopics such as the latest developments in monitoring tools, evaluating methods and corrective actions for project success.

This study is expected to develop further understanding for the authors to conduct the research successfully. Below are the topics which form the bases for Literature review.

- Construction Industry
- Success Factors
- Project Controls with particular emphasis on documentation, tools and techniques, it in construction, reporting systems and business process, threshold skills required.
- Achieving success through effective project control process.
- Conclusion

2.1. Construction Industry

Construction Industry is the backbone for economic development. Kenny (2007: 1) mentions that “construction sector role in economic development is Undeniable”. In view of its importance, large investments were made by governments all across the globe for many years. In view of its identity as world oldest engineering division, construction process and practices has evolved over the centuries. As, Gyula (1998: 10) mentions that “During last 100 years, technology in construction has developed drastically paving way for modern buildings and scientific designs”. Also, the importance of construction was aptly brought out by Leesard (2001: 34) which says that “Large engineering projects are important not only because they transform the physical landscape and change the quality of human life, but because they are the crucibles in which new forms of collaboration are
developed”. Now, during last few decades there has been increasing importance to improve the practices and quickly contribute to the growing needs of society. History of construction projects can be traced back to Egyptian Pyramids, early Greek settlement around Mediterranean, Roman empire constructions of temples and structures in medieval age. (Ngowi et al. : 2005). As it is known that in the 18th Century is Renaissance period which saw much significance to architecture and industrial revolution. Also, 19th century saw large improvements in construction industry particularly in railways and buildings. Ngowi. et al (2005) mentions that during 1959–1969, the construction of Suez Canal was an international project of great proportions and contractors had gained experience in the construction of large buildings, railways, petrochemicals, dams and reservoirs. Ngowi.et al (2005) mentions that Great Britain was first to go global with railway construction and the first major international construction company was built up by Pearson in Great Britain at about the turn of the century. Now there are massive projects constructed all over the world, driving the national economy. Leesard (2001) mentions that Large engineering projects such as airports, transport, power, oil & gas constitute most important business sectors in the world. This massive infrastructure investments has lead to the emergence of companies such as Bechtel, Warren, Fluor, Kellogg, Skanska AB. Kenny(2007:1) mentions that “Construction is a $1.7 trillion industry worldwide, amounting to between 5 and 7 percent of GDP in most countries”. Some statistics for the construction industry can be listed as under.

- Construction represents as much as 10% of GNP for some of the nations and employees 111 million.
- The report also mentions that every construction employment generates two other employments elsewhere in the economy.
- In Europe construction amounts about 40% of energy use and in US, it is the source of largest green house gas emissions.
- 97% of Construction industry consists of SMEs with few employees.

(Source: CICA (Confederation of International Contractors Association), 2002: 9,10)

Also the structure of the industry is fragment with increasing number of small companies and consolidation of large companies. Kenny (2007:1) says that the international construction is dominated by very large contracting firms such as Bechtel, Skanska AB and Taisei Corporation, who undertake large volumes of work. Construction process is labor intensive includes management of difficult site condition, bulky materials. Construction companies are diversified, have low fixed assets, have positive cash flow, and subcontract extensively (Gyula, 1998: 248). Lessrad ( 2001: 2) says that the “strategic systems are the determinant of the success or failure of Large engineering projects”. Strenman (1992) mentions that “Construction projects are inherently complex and dynamic”. Also, every construction project is unique having its own set of stakeholders and unique environment. Construction industry is diverse with projects ranging from small to large and very large contracts such as $14.7 billion Channel Tunnel Project and $20billion Hong Kong International Airport.(Bechtel, 2007). The environment governing every project changes rapidly and cannot be compared to each other. So, the governing principle connecting all construction projects can be said as
‘Project Management Practice’. Gyula (1998: 265) mentions that “Management in construction, on the other hand, has always been based on experience and organizational talent”. In most of the construction projects, technicalities are frozen during design phase. Gyula (1998 : 248) mentions that the important category in constructions is construction firm i.e. Contractor because, Contractor gives real shape to the product following the design. So, the main issue lies in managing resources, material, equipment, stakeholders effectively by the contractor. Murdoch (2000) mentions that main contractor is employed to build what designers have specified and contracting was a response to the sophistication of industrialization. Also the issues such as economies of scale, employment, multiple use of plant etc, are some issues which made ‘contracting business popular and viable (Murdoch, 2000).

Construction projects typically involve a sponsor who funds and owns the project. The sponsor/sponsors are normally large public bodies such as local government or multi lateral agencies. Estache (2006) says “A considerable portion of public investment goes to construction –not least, governments remain the dominant provider of infrastructure services worldwide, accounting for 78 percent of investment 1984-2003” as cited in Kenny (2007: 1). The sponsor engages various consultants to undertake design, supervise and project management of the work. Also the sponsor engages various contractors as per procurement strategy and contract documents. Speaking about contract documents, Jackson(2004: 87) mentions that the every aspect of the project will be controlled by contract documents and the work of contractor is judged by them. Jackson (2004) also mentions that contractor is not involved in actual design. Major construction contracts world wide are governed by FIDIC (FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS) & New Engineering Contracts. These model contracts are understood to bring balance in power & advantage for both employer and contractor. So a typical contracting company manages various contract agreements.

When it comes to performance, large contracting companies such as Bechtel, Skanska, Fluor, engage better project management tools such as Primavera3, Six-Sigma etc which increase the control mechanism and improves the predictability of project outcomes. In spite of all the best practices, predictability of project outcomes is still an issue of concern. Sambasivan and Soon(2007) mentions that failure to achieve targeted time, budgeted cost and specified quality result in various unexpected negative effects on the projects. Baker, et al. ( in Lewis, 1998:43) mentions that if the project meets technical performance and achieve high level of satisfaction among key players and various stakeholders, then the project is considered as overall success. Also, Lewis(1998: 43) mentions that important aspect about success is perception and further quotes that “If the right people perceive that the project was a success, then it was, for all practical purposes”. The reasons for success and delays are mostly attributable to differing and vested interests of participants and stakeholders.

Also, performance measurement is a neglected issue in construction industry. Now large organizations are implementing performance measurement models to improve business process such as balance score cards and EFQM Excellency models. Performance management models can help construction organizations develop strategy for sustaining
long term business objectives. Robinson et al.(2005) mentions that by adopting performance management models, construction organizations can develop coherent approach to changes, continuous improvement, innovative solutions. Gyula(1998: 265) quotes that “Construction has begun to apply up-to-date information technologies, data management and client/server systems. Great efforts are being made to devise integrated information systems that can be used by different clients, designers, general contractors and subcontractors”. Robinson et al. (2005) through their case study approach identifies that long working hours, honesty, integration of knowledge into practice, distance between projects and corporate operations, are few main barriers in improving business in large construction organizations. In view of this, a further study of success factors for performance improvement of construction projects is very much needed.

2.2. Success Factors

The concept of ‘Critical Success Factors (CSF)’ was originally developed by D. Ronald Daniel of Mc Kinsey and Company in sixties, but was popularized by Jack F Rokart of Sloan School of Management (12manage, 2007). Jugdev and Muller (2005) mentions, that success factors are the factors to achieve established goals & objectives. Further Jugdev and Muller’s (2005) retrospective study of the concept of success factors indicates the following:

- During 1960’s – 1980’s, the literature on success factors is largely limited to time, cost, specification and some extent client satisfaction
- During 1980-90’s the stress was much on a project being a success or failure
- Mid 90’s saw some publications involving stakeholder satisfaction
- During 1990’s-2000’s, there are contributions in the form of integrated frameworks.
- Now during 21st century, the concept took a rationale on the agreement on CSF’s before start of the work and empowerment of the project manager to achieve goals.

(Source: Jugdev and Muller: 2005)

Fortune and White (2006) researched ‘critical success factors’ across 63 publications and identified more than twenty factors which can influence project success. Also, the framework by Shehnar and Widerman (2000) broadly classified success factors as project efficiency, impact on customer, business success and preparing for the future. However achieving all the set criteria in any given project is difficult. There are also some criticisms on the concepts of success factors. Shenhar and Wideman (2000) & Cooke-Davies (2002) mentions that there is no agreed understanding of success concept. Also, Jugdev and Muller (2005: 29) mention that “project success is a complex and ambiguous concept and it changes over the project and product life cycle”. However, in spite of the ambiguity, its continued relevance in better understanding of goals is widely accepted by industry and academia. Jugdev and Muller (2005) says that success factors in 21st century is more about rationale agreement before start of the project.”Turner and Cochranes -
"Goals and Methods Matrix" (cited in Payne and Turner, 1999: 57) identifies projects into four types on the bases on methods and goals i.e. Engineering, Product development, Systems development and finally Research & Organizational Change projects, indicates that all projects are not same and need separate treatment. In view of the above, having common CSF’s for projects which have uncommon goals of a project is not rationale. So, it is considered that identification of success factor for a specific process (or) component of the project can help be more helpful.

![Goals and Methods Matrix](Image)

**Figure 1  Turner and Cochrane’s Goals and Methods Matrix**

(Source: Payne and Turner, 1999:57)

Speaking about Critical Success Factors (CSF), Chan et al. (2004) mentions that CSF’ can be grouped into 5 main categories namely project related, procurement related, project management and project participant related factors. Where as, Chua et al. (1999) suggest hierarchical model for construction project success with budget, schedule, and quality are key measures. And, Trop et al. (n.d.) conducted a survey on large public project in Norway and listed ‘Project planning and controlling’ as the third most import aspect for CSF for Project performance after project organization and contract strategy. The above research showed little similarities between approaches and results. As, Strenman (1992) says that construction projects are complex and involving multiple feedback processes, leads us to an understanding that CSF concept could be better understood if it can be focused on a particular ‘Process’ rather than on the complete project, which is complex by nature. The reason behind research on CSF’s is to improve project performance and reduce time and cost over runs. In this regard, Iyer and Jha (2006: 871) research shows that over 40% of Indian construction projects are facing time overrun and identifies 55 attributes responsible for impacting performance of the projects. Iyer and Jha (2006: 871) also mention that the “single most important factor for project is schedule overrun and if the same could be controlled a major part of cost overrun including general escalation and interest during construction could also be contained”. This indicates that ‘Project Control’ can play an effective role in containing cost and time
over runs. Falco and Macchiaroli (1998: 51) research mentions “A recent investigation upon project failures confirms that Organization & management plays a major role as the main cause of project failures, representing 32.7% and 36.7% of the total reasons in respectively, the periods 1986-1992 and 1986-1994. Another big role is played by Planning and Monitoring which is at 15%”.

Also, Iyer and Jha (2006) research on CSF for a construction projects indicate that:

1. Project manager competence at 27.95%
2. Owners & Top management Support at 15.84%
3. Monitoring, Feedback, and Coordination’ at 15.24%.

(Source: Iyer and Jha, 2006)

In both the findings the percentage of ‘project monitoring and controlling’ was the only factor matching i.e. at 15%, which makes the studying the process of “Project monitoring and controlling” necessary and interesting.

Chau et al. (1999) conducted research on CSF in construction projects, where the factors are divided into four groups i.e. project characteristics, project participants, contractual arrangements, and Interactive process. The research indicated that ‘monitoring and feedback factors’ was identified as most influencing among ‘Interactive Process’. Also, Chau et al. (1999) in their research, concluded that further work can be carried with limited sets of success related factors discarding less important factors. Ironically, being an established field, construction projects are subjected to huge public debate due to its time and cost over runs. As, Strenman (1992) mentions that construction projects are complex, and dynamic, construction projects seldom run as planned. Al-Jibour (2003: 143) quotes “A project is highly unlikely to proceed in all respects entirely according to plan, particularly when the plan has been expressed in some detail”. So, a study on factors which can help improve controlling can more useful. In view of the above said arguments, the author intends to conduct a study in ‘Construction Project Control’, keeping aside other aspects.

Nguyen et al. (2004) research on ‘success factors in Vietnam construction industry’ showed that contracting companies had ranked factors different compared to owners & consultants. Also, the research by Sambasivan and Soon (2007) on causes for delays in Malaysian construction projects found that clients, consultants and contractors have ranked differently. This signify that success factors in the selected sector is dependant of ‘Perception’. As Lewis(1998:43) mentions that “important aspect about success is perception”. Also, PEPDS (2004) defines success factors in business context as, “Any knowledge, skill, trait, motive, attitude, value or other personal characteristics that is essential to perform the job or role and that differentiates solid from superior performance” cited in (Nguyen et al. 2004:405). This again differs from other conventional definitions of CSF and indicates that successes factors would be different for contracting companies and sponsor companies because of the change in their business goals and objectives. Again as per FIDIC contract documents, controlling is a function of
both owner, consultant and contractors. However FIDIC (2006:20) contract indicates that monitoring, progress reporting, corrective actions, reworks, liability are the responsibilities of Contractor, which signifies that contractor is financially liable for project performance. Also, the work of Sambasivan and Soon(2007) research in Malaysian construction projects and found that ‘Contractor related issues ’ was ranked most for the cause of delays.

In view of the above mentioned details, the author intends to study the ‘success factors’ from the perspective of contractors. Having established the importance of project performance from the perspective of contracting companies, the need to study further concepts on project controls is essential.

2.3. Project Controls

PMBOK(2000: 30) defines “Controlling process – ensures that project objectives are met by monitoring and measuring progress regularly to identify variances from Plan , so that corrective action can be taken when necessary” and further identifies controlling process to have links with planning and executing process. Also, Kerzner (1995) mentions controlling as a three step process i.e. measuring progress, evaluating what remains to be done, and corrective action to achieve or exceed the objectives. While, Fortune and White (2006: 56 ) quotes “The performance monitoring subsystem is charged with observing the transformation process and reporting deviations from the expectations to the decision – making subsystem so that it can initiate corrective action where necessary” IPMA (1999) mentions “In project management, control is based on a comparison of baseline plans and contracts with actual events, and deciding what to do ( i.e. re-planning ) when the two do not match” as cited in Gardiner ( 2005: 284). Also, Zhang (1998) mentions that the three gorges project cost was perfectly controlled within the approved budget as cited in Dai et al. (2006). So, in practice, it is possible to achieve perfect control of the project. PMBOK(2000) indicates the following control activities for project knowledge areas.

<table>
<thead>
<tr>
<th>Knowledge Areas</th>
<th>Control</th>
<th>Input</th>
<th>Tools &amp; techniques</th>
<th>Out Put</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Integration</td>
<td>Integrated Change Control</td>
<td>Plans/ Reports/Change Requests</td>
<td>Performance Measurement/ Information systems</td>
<td>Plan Updates/ Corrective actions</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project scope Management</td>
<td>Scope verification/ Scope Change/ Control</td>
<td>WBS/ Reports/Change Requests</td>
<td>Performance Measurement / additional planning</td>
<td>Adjusted baseline/ Corrective actions</td>
</tr>
<tr>
<td>Project Time Management</td>
<td>Schedule control</td>
<td>Project Schedule/ Reports/Change Requests</td>
<td>Performance Measurement / PM Software/ Add. planning</td>
<td>Schedule Updates/ Corrective actions</td>
</tr>
<tr>
<td>Project Cost Management</td>
<td>Cost control</td>
<td>Cost Baseline/ Reports/Change Requests</td>
<td>Performance Reports/ EV Management / IT Tools</td>
<td>Revised Cost/ Corrective actions</td>
</tr>
<tr>
<td>Project Quality Management</td>
<td>Quality Control</td>
<td>Quality Plan</td>
<td>Inspection</td>
<td>Improvement / Rework</td>
</tr>
<tr>
<td>Project Communications</td>
<td>Performance Control</td>
<td>Reports/ Plans</td>
<td>Variance analysis/ EV analysis/ IT Tools</td>
<td>Performance Reports</td>
</tr>
<tr>
<td>Management</td>
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From the above table, it can be seen that PMBOK(2000) have reports and plans as inputs for ‘Monitoring’ and IT & performance reports as tools for ‘Evaluation’ and ‘Corrective actions’ is the Output. However interestingly, PMBOK does not mention any control actions for Human resource and Procurement knowledge areas, which is an integral part of construction projects.

Again, as per Ahern et al. (2001) ‘Monitoring’ includes planning parameters, risks, stakeholder involvement, milestone reviews, commitments, data management, progress reviews and ‘Managing’ includes analyze and take action. Gardiner (2005) mentions that informal project control mechanisms exists when the projects are small and the team members are highly motivated and decision regarding formal control system should be based on risks involved and cost of control system. He further mentioned that in construction projects, the complexities are large and require dedicated control system. Falco and Macchiaroli (1998) mentions that the projects are dynamic and carried out in changing environments needing monitoring and control actions. Though PMBOK (2000) had elaborated the details of controls are various knowledge areas, there is always a need to understand the key success factor, which when implemented effectively will enhance the control procedures in any organisation. The below diagram indicates the project control cycle as illustrated and explained by Jackson (2004).
From the diagram, it can be seen that project control cycle starts with project plan and ends at evaluation, which again will start a new cycle with amended plans. The diagram shows the iterative nature of ‘Project Control’. In practice, project control is mainly exercised during execution stage, due to deviations effecting planned work. Project control mainly depends on field data for assessing, analysing and corrective actions. So, quality and quick access to field data is important. This would be best possible, when the team works in co-ordination with site management. Also, Reschke and Schelle (1990) mentions that “Control’ is the skill required to bring a project from the start to the end without jeopardizing pre-defined goals” Jackson(2004) mentions that seven fundamental steps for project control cycle are (1) develop the project plan, (2) establish the project benchmarks, (3) monitor the project performance, (4) identify performance deviations, (5) evaluate corrective options, (6) make adjustments as needed, and (7) document, report, and evaluate results. So, for effective project control understanding the following is required.

2.3.1 - Documentation and Data Collection
2.3.2 - Tools and Techniques.
2.3.3 - Use of Information technology in Control process
2.3.4 - Threshold skills required for Control process
2.3.5 - Reporting system and Organizational business process.

Apart from above, project controls in a contracting company is more than a project specific and is understood to operate as a program management. However this needs to be ascertained from the practitioners. Also further study on industry perception of
monitoring, evaluation and corrective actions as an integral component of ‘Projects Controls’ need to be ascertained.

2.3.1. Documentation and Data Collection

Aitken(2000) mentions that Project reports are an essential way of keeping everyone informed. PM BOK(2000) mentions that Base line plans, Cost budgets, Risk management Plan, Quality Plan, Contract document are the best inputs for monitoring stage. Again, PMBOK(2000) mentions that change requests shall form the main ingredient to changes to planned documents. In view of this, monitoring is starting stage of ‘Project controls’ and involves report generation. Frigenti(2002) mentions that efficient monitoring and control systems will enable project participants to receive relevant and accurate information in a consistent and timely manner. Aitken (2000) mentions that a typical report include executive summary, bar chart, variations to time, cost and scope including risks. However the quality of information is important. As, Jackson (2004), mentions that the work sites are busy and do not provide monitoring personnel with much needed information. So, getting complete and accurate data from field is very important and is also a weak link in the project control process.. Jackson(2004) also mentions that monitoring report should focus on project targets, vulnerable work sections, productivity growth/decline, projected completion date & budget and outcome. Aitken (2000) mentions that a typical project reporting to be produced at regular intervals to project manager and other senior management and client and further mentions that reports should be made in a way which can be understood by non-specialists. However, there it is necessary to know how much quality information is being produced by the project controllers and how much time is being spent on data collection and what kinds of skills are required for such activity.

2.3.2. Tools and Techniques in Monitoring and Evaluation Stages

Many times, actual progress do not match the planned progress making it essential to keep the management, client engineer, and sponsor, informed of the progress and the precise conditions that can effect each occurrence. Fringenti (2002) mentions that controlling includes monitoring, but it also includes taking timely, corrective action to meet project objectives or goals. So, depending upon the extent of variation between planned and actual, the management should initiate appropriate control actions. Aitken (2000) mentions that most information is analyzed by variance i.e. difference between planned and actual performance and it is the management which is will determine what is useful in analyzing individual situation. Also, Changes in time, cost, scope and quality leads to variations and many times variations leads to cost escalation than savings (Aitken, 2000). There are many techniques which can be used for monitoring variations such as Bar Charts, CPM, PERT etc. However, Ahuja and Tiruvengadam (2004) mentions that network-based techniques such as CPM (critical path method) and PERT (program evaluation review technique) are having limitation due to growing complexity of projects. During construction phase, actual progress is recorded and compared with planned progress and budget. There are many forecasting methods, for example Shi et al. (2001) methods using mathematical equations for generating information on project
delays as cited in Ahuja and Tiruvengadam (2004, 28). Also, Barraza et al. (2000) concept of project control involves stochastic S-curves (SS-Curves) as an alternative to commonly used monitoring tool i.e. deterministic S-curve technique (as cited in Ahuja and Tiruvengadam, 2004, 29). Ahuja and Tiruvengadam (2004: 29) mention that “SS-curves provide probability distributions for expected cost and duration for a given percentage of work completed”. Also, in practice Bar charts, one-dimensional histograms, pie-charts, turkey box plots, scatter plots, linked histograms are being used to show visually effective reports. Songer (2004) multidimensional visualization is a concept of project control involving mapping the data in the form of a visual. Songer (2004) approach takes into account that construction industry creates voluminous data and generating such data in the forms of tables and reports may not help in actual understanding of the progress. So the visually effective method employs 2D & 3D images to represent actual progress and other related information. However managing such report generation require additional and specialized skills.

(Source: Songer, 2004:185)

Kemps (1992) mentions the use of Earned value analysis for measuring project performance. Aitken (2000) says that the reason for doing earned value calculations is to attempt to predict costs to completion and relies on subjective judgment in many cases for percentage completion. However, Gardiner (2005) mentions that the main difficulty of EVA is the calculation of earned value (BCWP) because of the need to estimate the percentage complete. Fringenti (2002) mentions that the purpose of monitoring is to highlight deviations form the plan and identify the bases for taking corrective action, before it become uncontrollable. Gardiner (2005) also mentions that the effectiveness of the control system can be measured by its average response time and the ability of the control system to identify the source of the problem causing the delay. In order to achieve
traceability, an appropriate data structure should be in place. Bayesian networks and influence diagrams can be used for root cause analysis of identified problems. Weidl et al (2002) investigates the use of Bayesian networks and influence diagrams to study the root cause analysis of urgent actions. The research shows that root cause analysis incorporate the chain of causes and events, decision support on efficient sequence of actions and alternative action, and early risk assessment.

2.3.3. Information Technology in Control Process

Some times the detailing become complicated and cannot be explained by simple tools such as bar charts, CPM charts, EV curve etc. So, the construction companies should use modern project management tools based on Information technology for effective monitoring. Similarly, Aitken (2000) mentions that factual and quantitative information should be computerized to speed preparation, collation and assimilation. However, construction is technology shy and does not extensively use information technology. Jean-Marc et al. (2006) mentions that construction sector uses extensive information for decision making process, but does not use much information available else where for eg, internet and other software products. Aitken (2000) mentions that there are large variety of software project management product, which can be used effectively for monitoring process. Apart from stochastic SS curves and network charts, monitoring practice today has become advanced using latest Information technology (IT) tools. The use of IT improves better coordination and communication among project teams and participants. It increases the speed of communication and decreases documentation errors. Lee et al. (2007) research on a budgeting process in a Korean company identifies

(a) differences in budget estimations between the field and office
(b) Incorrect calculations
(c) Insufficient budget tracking are few of the reason related to delays and waste in control processes.

(Source: Elimination of waste by BPM’s functions, Lee et al, 2007: 59)

This is true to many medium and large construction companies and can be overcome by establishing standardized IT tools across various departments. Further, the concept of using world wide web (WWW) in construction was first postulated by Walker and Betts in 1997 (cited in Nitithamyong and Skibniewski; 2006: 80). Now the concept of web and its associated technologies are being studied for effective use in construction projects. Typically large construction projects are located in remote areas, where communication methods are restricted. In such situation World wide web (www) will effectively reduce the inefficiency in communication and increases the effectiveness in implementing the planning and control. Nitithamyong and Skibniewski (2006) mentions how the extensive use of IT technology has been used by large organizations for effective monitoring of construction projects. Also, Peansupap and Walker (2005:135) quotes “Information and communication technology (ICT) is identified as an effective facilitator for improving information integration.” They mention that web based project management system
WPMS promises to enhance the construction documentation. ENR reports showed that there has been remarkable increase in the usage of WPMS. Buzzsaw by Auto desk, Project Talk by Meridian project systems, PrimeContact by Primavera, Viecon by Bentley an VISTA 2020 by market street technologies are few important Project management ASP’s which are being extensively used by many construction companies world wide (cited in Nitithamyong and Skibniewski; 2006: 81). The sole motive for such IT platform usage is to improve effectiveness and predictability of project outcomes in planning and controlling process. However, the industry practice in terms of usage of IT based tools in ‘project controls’ can enhance the effectiveness of the project implementation. Nitithamyong and Skibniewski (2006) mentions that apart from PM-ASP’s there has to be equal importance to other factors such as process, personnel and team management. Also the effectiveness of PM-ASP’s is not yet as high as initially expected, mainly because of uncertainty about measures that’s should be used to evaluate system performance.

2.3.4. Threshold skills required in control process

As, Nitithamyong and Skibniewski (2006) mentions that apart from project management practices, there has to be equal importance to other factors such as process, personnel and team management. Also, apart from decision making tools, construction industry depends on the managers ability to take decisions. The main reason for the challenger disaster is that the decision makers did not heed the warnings from engineers about the ice on the launch pad (Cleland et al.: 1998). A similar experience from NASA Skylab mission 3, where the crew went on a strike for 24 hrs against the wishes of ground control staff, demonstrates the need for exemplary decision making skills to avert disasters. Though systems and process are in place, both the disasters are due to failure of human abilities. In practice, construction managers such as project managers, project controllers are the drivers of the project and the success of the project depend on their ability to take corrective actions appropriately. Turner and Muller(2005) mentions that project success factors had ignored the qualities of project manager and it was concluded that the competence of the project manager has a measurable impact on the performance of the project. Also the research by Muller and Turner (2007) indicated that engineering and construction projects need project managers with qualities such as conscientiousness and transactional styles leadership. Burn (1978) mentions that transactional leadership is all about the exchange between the leader and subordinate cited in Aronson(2001). This appears suitable for short term benefits which are more valued in constructions. However Conger and Kanungo(1998) mentions that “transactional leadership is not at all a leadership, but just a managerial quality” cited in Aronson(2001). Snowden and Boone(2007) mentions that effective leaders change their decision making styles and their research indicated that in complex situation, decision making involves, probing, respond, create environments, increase levels of interactions etc.. for achieving goals. PMBOK (2000) mentions that the project manager should have an open positive ‘can do’ attitude, common sense, open mindedness, adaptability, inventiveness, prudent risk taker, fairness and commitment. Gharehbaghi and McManus (2003, 57) mentions that a “successful construction manager must have a solid understanding of leadership
philosophy in the construction delivery process”. They further mentions that construction manager should develop the team including teaching, counseling and involvement. Apart from leadership skills, project managers in construction projects should be very communicative. The study by Hyvari (2006) indicates that project communication as an important CSF. Also, the research by Shohet and Frydman (2003) mentions that project manager communicates both in formal and informal methods. The project Manager play a critical role in communicating with multiple participants like contractor’s management, owner, client’s engineers, execution team, control teams, design teams, suppliers, sub contractors, local authorities and other stakeholders. The main portion of Project Manager’s communication is directed towards managerial issues. The research by Shohet and Frydman (2003) also mentions that

- Written communication constitutes 52% time,
- Meetings constitutes 28%,
- Electronic communication constitutes 20%.
- Functional division shows construction instructions as 30%, materials & equipment 11%, quality management 13%, allocation of manpower 30%, cost control 16%.

(Source: Shohet and Frydman, 2003: 573)

Apart from leadership qualities and communication, industrial relations are also an important aspect in construction projects. Weil (2005: 450) mentions that a construction project involve, “coordination between separate enterprises and workers with varied responsibilities, skills, and roles” making the management complex and sensitive. In view of the industrial relation issues, project manager seldom have time to devote to technicalities and analysis. So a dedicated control engineer/ manager is required to guide the project manager and the corporate management on all aspects of the project. Jha and Iyer (2006) mentions that the apart from project manager, the role of project coordinator has become critical for project success and involves activities such as planning, coordinating, analyzing and organizational understanding, which are again similar to ‘control manager/ engineer’. Top 10 of the identified 24 traits of a project coordinator are

- Relationship with client, consultant and contractor,
- Timeliness,
- Technical knowledge of the subject,
- Belief in team playing spirit,
- Coordination for achieving quality,
- Understanding of contract clauses,
- Monitoring skills,
- Maintaining records,
- Planning skills,
- Liaison skills,

followed by skills such as Analytical skills, Forecasting skills, Knowledge of project finance etc.
Jackson (2004) mentions that the riskiest and important aspect of project control is in estimating productivity. Also, Jackson (2004: 308) mentions that “forecast is to predict the final cost and schedule outcomes on a project while the work is still in progress”. So, predicting project outcomes based on the information available need special skilled & experienced managers. This point was emphasized by Kemps (1992) who says that “the human factor helps to smooth out the work’s progress”. Pearman (2006) announces that many UK based construction companies are sourcing experts from US and other countries. The role of experienced managers are always on demand and they contribute in planning the project and also in controlling the project. Also the project control division/engineers/managers are the medium of communication between the project manager and other corporate managers such as finance, legal, human resources and directors. So the role of the control team/managers is crucial and sensitive involving human relationship. However this aspect is required to be ascertained from the industry. This study would provide literature and evidence, so that greater importance can be made for employing managers with appropriate skills.

2.3.5. Construction Business Processes

Marasini and Dawood (2006) mentions that many monitoring tools are focused on controlling time and cost and ignore the interrelationships between various external and internal variables impacting a business process. Payne and Turner (1999) research in large, medium and small companies, shows that the percentage of project success is more in case of tailored made control procedures compared to standardized control procedures. However, there is no clarity regarding the extent of standardization and tailor made control procedures. But, Falco and Macchiaroli (1998:51) mentions “despite the continuous evolution in project management field, it appears evident that the traditional approaches still show a lack of appropriate methodology for the project Control”. In view of these arguments, and complexity of operating multi projects, it would be appropriate to use an standardized control procedures with slight modifications from project to project. This involves improvement to existing control processes and also use of best practices. However there is also a need to know the basis of grouping of the projects by the industry. Bechtel (2007), was the first few construction and engineering companies, who started implementation of Six Sigma quality practices in the year 2000. But, the practices of Six-Sigma is active in production industry starting from 1990’s. Traditionally, construction Industry is slow in responding to business process changes, due to its operational complexity and diverse stakeholder interests. However, study of Organizational Project Management Maturity Model (OPM3) and Capability Management Model Integration (CMMI) shall further the understanding of the best practices.

PMI has mentioned

- Organizational Project Management (OPM) as a systematic management of projects, programs and portfolio’s to achieve an organizational strategic goal
• OPM focus on the “co-relation between organizational capabilities in the management of projects and effectiveness in implementation of strategy
• Organizational Project Management Maturity Model (OPM3) model can be established to an entire organization or a business unit
• OPM3 improves project management overall effectiveness
• OPM3 model provides Advance strategic goals, Understand best practices, Identify Maturity and Plan Improvement activities and facilitate the development of capabilities that help users and their organizations to navigate the process of performance management in a course of time.

(Source: PMI, 2007)

Where as, CMMI is the Capability Maturity Model Integration. Ahern et al (2001) mentions that:
• The fundamental concept of CMMI model is the process areas.
• CMMI selects only important aspects of process improvements and groups them in areas.
• In Integrated Project management (IPM) process area in CMMI.
• The goal for a project is to use a defined process that is tailored from the organizations set of standard process.
• So at Level 3, the process is proactive and at level 4 the process is measured and controlled and at Level 5 the process focus on continuous improvement.
• CMMI recognizes Project Monitoring and Control as a key process in Project management.
• The process has two specific goals i.e. monitoring actual performance and managing corrective action

(Source: Ahern et al. 2001: 65, 126, 127)

Close to CMMI and OPM3, Sarshar et al. (2004) presents SPICE (Structure Process Improvement for Construction Enterprises), which is a process improvement framework particular to construction organizations. SPICE is a step by step maturity framework. It assesses an organization’s performance against levels of process maturity, identifies their strengths and weaknesses and highlights their improvement priorities. SPICE was tested on real projects. SPICE suggest modifications to Level 3 and Level 2 of CMMI and included ‘project tracking and monitoring’ in Level 2.

Level 2 key process are:

- Brief and scope of work management
- Project planning
- Project tracking and monitoring
- Subcontract management
- Project change management
- Health and safety management
- Risk management
- Project team co-ordination
Following diagram illustrates the maturity model at level 2

![Maturity Model Diagram]

**Figure 4** Design and project management team’s process capability
(Source: Sarshar et al. 2004)

The SPICE maturity model application between a major client and a major contractor explains the concepts of ‘Project Tracking’ which involves Evaluation, Verification and Ability. This concept of ‘Project Tracking’ can be compared to Project Control, which is again Monitoring, Evaluating and Taking Corrective decision as per PMI and AMPI. Through this model, it can be seen that ‘Monitoring and Evaluating’ can be classified as process enablers and ‘Corrective actions’ as ‘Ability’. Robinson et al. (2005) through their case study of four major construction companies identifies that integration of knowledge into practice as one of the main barriers in improving business process in large construction organizations. However due to lack of proper literature, the concepts of integration in project controls and its interdependency nature is to be further explored from practitioners. The above literature review identified issues such as business process and relation between various functions in construction projects. But, there is no much literature on inter-relationship between management, project control and project team and need further study.

2.4. Achieving successful project control process

Krazner (1995) mentioned that project controlling is a combination of monitoring, evaluating and taking corrective action. The same is the underlying principle with PMI and also IPMA. Angus et al. (2000) has elaborated that a loose project management can result in a project getting out of control and on the other hand extreme and over-reactive...
control can bring the project to a stand still. They further mentioned that controlling a project too tightly makes team members nervous and may lead to less creative. Angus et al. (2000) also confirms that “monitoring and controlling of a project must be done very carefully”. The balance between the three controlling aspects varies from project to project and also from time to time in the same project. Also, the balance depends on the maturity of the organisation. So, it is more than necessary for companies to implement best practices in control process. Jackson(2004) mentions that information and good reporting system are essential for an effective project control system. The process established should enable accessing quality information from projects. Fringenti (2002) mentions that performance information is easier to get than progress information which is subjective. The success of the St.Lucie Unit 2 nuclear power project can be attributed to timely reporting of results, skilled personnel, team work for solving problems, quality improvement program, indicators, and incentives. This explains the reason for balance between process approach and ability approach in controlling (Cleland et al. 1998).

Also, Cleland et al. (1998: 441 and 583) though various cases such as New England power company, Iowa Public service co, NEPCO Supra Re Salem Nuclear Generating Station, Minnesota Power and Light company, mentions that the strict contract laws prove shadowy behavior, poor qualities of project managers, improper use of project management tools as factors for project failures. This again brings out the importance of balance between the tools and abilities. Construction companies when confronted by cost and time overruns, becomes un-balanced in control approach i.e. they either over do (or) under do controlling process in terms of monitoring, evaluation or corrective actions. As, Jackson(2004) mentions that tracking deviations between actual and planned performance through out the project will help in taking corrective actions. So, establishing good practices in a process enables effective monitoring in all stages of the project. In order to establish best practices, the success factors facilitating process improvement and ability drivers in all three stages of project control i.e. monitoring, evaluation and corrective actions has to be determined. Based on the earlier works such Nguyen et al. (2004), Chan et al. (2004), Chau et al.(1999) and Iyer and Jha (2006) and other mentioned literature including PMBOK(2000), a new set of influencing factors for Monitoring, Evaluation and Corrective Actions can be deduced.

<table>
<thead>
<tr>
<th>Nguyen et al</th>
<th>Chan et al.</th>
<th>Chau et al</th>
<th>Iyer and Jha</th>
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<tbody>
<tr>
<td>Comfort factors such as funding, contract documentation, resources, competent managers.</td>
<td>Project Management Actions such as communication, planning, implementation, control, subcontractors etc.</td>
<td>Project characteristics such as Political risks, economic risks, funding, location etc.</td>
<td>Project managers Competency</td>
</tr>
<tr>
<td>Competence factors such as technology, past experience, project team, awarding bids</td>
<td>Project Related factors such as type an size of projects</td>
<td>Contractual arrangements such as clear objectives, risk identification and allocation, specifications, formal dispute resolution process etc.</td>
<td>Top Management support</td>
</tr>
</tbody>
</table>
Commitment factors such as objectives, scope, top management support.

External Environment like political, social, and environmental.

Project participant factors such as PM competency, authority, commitment and involvement, capability etc.

Monitoring, Feedback and Co-ordination.

Communication factors such as community involvement, channels, progress meetings.

Project procedures such as procurement and tendering methods.

Interactive Processes such as communication, control and feedback, meetings, reporting, budgets etc.

Commitment of all participants.

Human Related Factors, client perception, skills, commitment, team working etc.

Owners Competency.

The above table indicates various factors deduced from the research on construction projects. The factors appear exhaustive in numbers and also diverse in context. Frigenti (2002) mentions that “project information needs to be measured through meaningful control systems in an economical manner and systems need to be appropriate for the size and complexity of the project”. In view of this, there is a great need to understand the threshold factors to effectively implement appropriate control process in any given organization / project. As, Aitken (2000) mentions the need for computerization and Jean-Marc et al. (2006) says that construction is IT shy, thus makes it interesting to learn what minimum IT tools and technology are required for implementing control procedures in a medium to large construction project. Also, as Turner and Muller (2007) indicated, project managers in construction projects to have qualities such as conscientiousness and transactional styles leadership and coupled with Weil (2005) remark that construction projects are complex and sensitive. This again makes it interesting to learn how to balance between corporate management requirement and site needs. Also there is a need to understand what specific type of skills are required by project control team at various stages i.e. monitoring, evaluation and corrective actions. Also, Falco and Macchiaroli (1998) comment on lack of project control methodology makes it interesting to know the reality from the practitioners and explore futuristic process models such as SPICE, suitable for improving control process.

So, effectively, a understanding of the following is needed to further improve or effectively establish project control process in a construction company.

- Data Collection methods
- Time spent on data collection and data analysis.
- Appropriate tools and techniques.
- Use of Information technology in Control process
- Threshold skills required for Control process
2.5. Conclusion

The literature review briefly explains various concepts of ‘success factors’ and choice of industry i.e. construction and particular type of organization i.e. ‘contracting companies’. The study also identified the existing gap and explains ‘Project Control’ as an important aspect for undertaking the research. Author also attempts to identify the influencing factors of project control in the process and skills required. The review also included the study of various tools and techniques, IT, maturity models, soft skills. Figure 2.2. as shown below indicates the flow of information of the literature review. The illustration indicates the arguments made at each stage, and sets the need for the next phase of information.
Identifying the Knowledge Gap

The literature study provided information for the importance and need for research on ‘success factors for project controls in contracting companies’. However there is no appropriate literature giving information to answer the ‘success factors only for project controls’. This knowledge gap is required to be fill up with appropriate inputs from construction control process, project success factors and practitioners views on success factors for ‘project controls’

So, the author intends to source this information by seeking knowledge from practitioners. Since the practitioners of projects controls are best suitable to give answers, the researchers intend to send questionnaire to selected practitioners in construction projects. The results thus obtained shall be further analyzed as per the research methodology mentioned in the subsequent chapter. From the above, a more specific questions which can be deduced from the questionnaire shall be as follows.

- What is current practice of data collection?.
- How effective the time of control managers is?.
- Do control process generate unnecessary documentation?
- What are various tools and techniques being in use?
- How advanced the construction companies are in IT usage?
- How effective and how frequent are control meeting?
- What skills are required for managers at Monitoring stage?
- What skills are required for managers at Evaluation Stage stage?
- What skills are required for managers at Corrective actions stage?
- What control process are now in use by industry?
- Is Project Controls are empowered to take decisions?

In order to answer the above specific questions, a questionnaire is constructed, which is enclosed in the appendix. Data collected will be analyzed qualitatively; the following chapter presents the detailed research Methodology employed.
Chapter 3
Research Design

3.1. Introduction

This chapter presents the research design, where the appropriate data collection and data analysis methods are explained. Further, as it is always a good practice to include ethics in conducting a research, the authors have included the relevant ethical issues. This chapter begins by introducing the research philosophy which shapes the entire research design. As, Easterby-Smith et al. (2002), say research philosophy helps the author to identify specific research methods to be used.

3.2. Research Philosophy

Research philosophy provides the author with a specific direction to conduct the research, offering a framework of theories, methods and ways of defining data (Collis and Hussey, 2003). Saunders et al. (2003:83) provide the framework called the ‘Research Onion’, where the outer circle of the “onion” is the research philosophy and from there, by choosing the appropriate philosophy the entire research design takes shape. Hence, choosing the right philosophy is important not only for the research design but, also, for the data collection and analysis which follow. There are two kinds of research philosophies which are relevant for conducting business and management research:

- **Positivism**: This philosophy involves quantifiable observations that lend themselves to statistical analysis, where the researcher assumes the role of an objective analyst.
- **Interpretivism**: This takes a descriptive, subjective approach to research based on the premise that the social world is too complex for scientific study, hence, a subjective analysis is preferred.

(Adapted from Saunders et al. 2003)

The authors take an interpretive philosophy to conduct the research. According to Saunders et al. (2003), business situations are complex and unique, so it is impossible to generalize. *This means that positivism is not relevant for this study as the study is looking at specific construction projects.* According to Creswell (2003:15), “[In interpretivism], the researcher identifies the “essence” of human experiences concerning a phenomenon……” The nature of this study is exactly this, the research is being conducted specific to the construction industry where project control factors are being analyzed. Hence, the findings would be difficult to generalize. Considering that the study involves identifying human experiences “Project managers and teams, specific to individual projects” concerning a phenomenon “project control factors”, interpretivism is chosen as the research philosophy.
3.3. Research Methodology

Research approach will be chosen here, one of the ways of choosing a particular research methodology could be based on:

- The research question
- The author/s comfortable ‘style’ of doing research

(Minocha, 2005)

The research question is industry specific and deals with a particular area in the subject of project management (project control factors) which might vary from project to project. Keeping this in mind and being consistent with the chosen research philosophy, inductive research approach is considered. The research methodology chosen is based entirely on the research question. The methodology is also consistent with the ‘Research Onion’ framework suggested by Saunders et al. (2003). Hyde (2000:83) says, “Inductive reasoning is theory building process, starting with observation of specific instances…..”.

For this research, the authors intend to observe specific projects studying various project control factors in order to build theory. Hence, as Hyde suggests inductive methodology is chosen for this research to build theory by collecting data from specific instances. This would mean the while choosing organizations for data collection the authors are looking at aspects such as ranking, reputation and specific contacts and requirements for the research, along with quality of data that will be available. Saunders et al. (2003) say that inductive methodology should satisfy the below:

- Gaining an understanding of the meanings humans attach to events
- The collection of qualitative data
- Less concern with the need to generalize

The research involves trying to understand how organizations employ project control factors, and how monitoring, evaluating and corrective actions are implemented by various project teams. The authors intend to collect qualitative data from various organizations to gain an understanding of how project controls are implemented. Since, different projects employ different project controls, and the monitoring, evaluating and corrective actions will differ from project to project obtaining quantitative data would be cumbersome. Also, generalizing the findings will depend on a large sample size for data collection. As, inductive methodology is being employed there is less concern with the need to generalize findings. The authors will look to build theory based on findings from data collected. The research methodology chosen appears to be consistent with the above criteria given by Saunders et al. (2003), hence inductive methodology is chosen over deductive methodology.

3.4. Research Strategy

According to Minocha (2005: 89), “A research strategy may be defined as a general plan on how one will go about answering the research question”. “It will contain clear
objectives ……., specify sources ……… and also consider constraints ……..”, Saunders et al. (2003, P.90). Research strategy provides the authors with a clear direction leading to the analysis part. The different research strategies are:

- Experiment
- Survey
- Case study
- Grounded theory
- Ethnography
- Action research
- Cross-section and longitudinal studies
- Exploratory, descriptive and explanatory

(Source: Saunders et al. 2003)

It has to be understood that though the ‘Research Onion’ from Saunders et al. (2003) suggests that generally for an inductive methodology, action research would be an appropriate strategy. But, the research question along with objectives and time constraints are taken into consideration. As, Saunders et al. (2003) suggest that a particular strategy should be appropriate with the research question as well as the author/s being comfortable with it. From the various strategies available, the authors have chosen a strategy which employs characteristics of both ‘survey’ and ‘Case study’ to conduct the research.

**Reasons for chosen methodology:**

**Survey Methods:**

“In a survey research data are collected predominantly by questionnaire……., …….. which are then examined to detect patterns of association” (Bryman and Bell, 2003:49).

The research tries to understand any meaningful relation/ association in the success factors for different projects, so a survey would be an appropriate strategy for data collection. Some other factors which contribute to implementing survey as the research strategy would be:

- The purpose of this research is to infer some characteristics, attitudes of project control factors from a sample of construction projects, hence a survey was deemed appropriate as characteristics, attitudes and factors can be compared from different respondents.
- (Babbie, 1990; Fowler, 1988) cited in Creswell (2003) say that some of the advantages of survey is the economy of design, and rapid turn around in data collection.

Adapted from Creswell (2003),
**Case study:**

It is important to understand the sample size and if the sample size is appropriate to conduct the research, this is always an issue in any survey research. As, Janes (2001) says that the major concern is the representativeness of the sample, whether the sample is enough to answer the research question. Normally for a survey a sample size of around 70 or over is recommended by most researchers, due to time constraints the authors would not be able to make such a survey making them adopt a strategy close to multiple case analysis, where each case can be explored in-depth. As according to Stake (1995), in a case study the author/s explore in depth a program or an activity or one or more individuals. The nature of this research is to analyse project controls for various projects collecting detailed information on each project and analysis will be based on comparison of information collected from the survey. Kos (1991) in a research, conducted a multiple case analysis developing a ‘purpose statement’ as: “The purpose of this study was to explore affective, social and educational factors that may have contributed to the development of reading disabilities ……………..” cited in Creswell (2003). The authors have adopted the same philosophy of conducting multiple case study analysis, developing a Purpose statement for the research: *To explore the factors that may contribute towards effective implementation of project controls in multiple projects undertaken by various organizations.*

**Implications of the choice**

Considering the above advantages of both survey method and multiple case analysis, the authors will be employing questionnaires for data collection whilst employing multiple case analysis strategy. The main reason in employing a survey strategy (Questionnaire) is for *standardization* where similar kind of data will be collected from all respondents, whilst, to explore the topic *in depth* a multiple case analysis is preferred. This can be represented as:

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Multiple project cases (9))</td>
<td>(Questionnaires; sample size&gt;70)</td>
</tr>
</tbody>
</table>
As shown in the above illustration, the authors will be employing a strategy which is closer to case study analysis whilst also employing a questionnaire for data collection as would normally happen in a survey method. Since, the authors have employed the above said strategy, it is necessary to provide a rationale for the cases chosen to collect data.

**Selection of cases:**

The authors have made a strategic selection of organizations for data collection on the basis of:
1) The organizations chosen are well know firms from ENR top 100 companies
2) The authors also have contacts (particularly project managers and controllers) in the chosen organizations matching the requirements for the research and quality of responses. Also, with the contacts in the organizations the responses would be received quicker saving time

The individuals selected from these organizations are people who are working as project manager / project controllers. So their response is expected to be of imminent value to our work. Also the research questionnaire is sent to one person per company. This means that the individual represents the company (i.e. Case) and their answers provide us the practices of the company in ‘project controls’. In view of time available, the authors have considered taking help from those individuals that the authors have contacts with. So, the authors have contacted those individuals to either answer the questionnaire or help us give the contact details of those individuals who work in project controls in their organisations. Hence the data collected will be authentic and shall meet the requirements of the research to large extent. Also response even from few can be of great value to the work. The companies which are contacted and where known persons are working are all of reasonable size and magnitude. This again indicates greater management practices and hence can expect quality information.

3.5. **Data Collection Methods:**

Data is essential to answer the research question and compare findings with the identified literature, also, to draw conclusions. Now what kind of data should be collected depends on a number of factors. According to Polonsky and Waller (2005:105) “the author should ensure that the data collected is focussed towards answering the research question”. Generally in any research there are two forms of data which can collected, in some cases both forms of data are used. They are:

- **Primary data:** This is the data which is collected by the researcher/s for the primary purpose of answering the research question, Malhotra et al. (2002) cited in Polonsky and Waller (2005).
- **Secondary data:** Data collected by other authors which the author uses to answer his/her research question (Minocha, 2005).

Usually most authors prefer primary data, as the authors are in a position to collect first hand data than depending on data collected by other researchers as is the case with
secondary data. Some of the other factors to be considered to evaluate data gathering methods are,
- Validity
- Reliability
- Costs
- Time restraints
- Researcher’s ability

(Source: Polonsky and Waller 2005)

Keeping in mind the research question and requirements to conduct the research primary data is gathered. Since, the data is collected first hand through questionnaires, the validity and reliability issues do not rise. Bryman and Bell (2003), say that in a survey research data are predominantly collected by questionnaire. The authors have designed a customized questionnaire which will be discussed below. Using a questionnaire saves time and costs. This is also one of the reasons why the authors will not be implementing action research strategy to collect data. Also, interviews (semi structured or structured) haven’t been considered, due to time constraints and the fact that the questions aimed at answering the research question need thought process (time to answer the questions) from the respondents based on their expertise and experience (than spontaneity), and a questionnaire was deemed appropriate. Hence, collecting primary information using questionnaire survey is considered for this research. One of the important aspects of this kind of data collection is the questionnaire itself and its design. One of the main objectives for the authors in designing the questionnaire is to obtain relevant data/information to answer the research question. Sudman and Bradburn (1982), say that there is codified principle/s to design questionnaires, nevertheless, its upto the authors to make sure that the questionnaire is relevant to the research. Keeping this in mind the authors after a review of literature on success factors have designed the questionnaire as,

**Questionnaire:**

Having identified the list of factors for implementation of project controls, the next task is to frame the questions. From the literature, the identified factors on which the questionnaire will be based on are:

a) *Factors are to be considered for ‘Monitoring’*

b) *Factors are to be considered for ‘Evaluation’*

c) *Factors are to be considered for ‘Corrective Actions’*

MRS (2006), provides certain rules to be followed in the writing of the questionnaire, some them can be listed as:

- The questions should be fit for the purpose and respondents have been advised accordingly.
- The design and content is appropriate for the audience and the industry chosen.
- The answers are capable of being interpreted in an unambiguous way.

Taking into consideration the above rules, the write up of questions has been carried out by the authors. Each question has been carefully framed keeping in mind the ‘fit for
purpose’ i.e., (the research topic). Also, the content is appropriate as the questions have been framed only after a review of literature as listed above. Literature further identifies that for effective project controls understanding the following is required:

- Documentation and Data Collection
- Tools and Techniques.
- Use of Information technology in Control process
- Threshold skills required for Control process
- Reporting system and Organizational business process.

The designed questionnaire has also been checked with an appropriate person regarding its content and fit for purpose (the research). The feedback has been positive and suggested changes have been implemented. A copy of the final content of the questionnaire has been attached to the appendix. The authors will look to collect data on the above, which will lead to identifying the above said three factors (monitoring, evaluation, corrective actions) required for successful implementation of project control mechanisms. Although a questionnaire has been employed for data collection, the research focuses on case analysis. Data is gathered from multiple cases using a questionnaire, and as stated above this research employs both survey and case analysis strategies. Also, another important aspect as given by Foddy (1994:13) is “the researcher has clearly defined the topic…[for the respondents, so that they could have an idea of the purpose]….”. The topic and the required information have been briefly disclosed for clarity and purpose of gathering relevant data. The most important outcome from the questionnaire is to gather relevant data with an aim to answer the research question, the data analysis methods employed are explained in the following section:

3.6. Data Analysis

For any research data analysis begins with considering the analysis either as descriptive or explanatory. According to Saunders et al. (2003),

- Descriptive Research is undertaken using attitudes, opinion questionnaires and organizational behaviour measurement
- Whilst, explanatory research makes the researchers to examine and explain relations between variables, in particular cause-effect relationships

Understanding the research aims and objectives and also, using a questionnaire for opinions as a means for data collection, the research can be considered as explanatory. There are two methods to conduct data analysis, depending on the requirements of the research:

- Qualitative
- Quantitative

Each of the above said methods have different strengths and logics, and are often used to address different kinds of questions and goals (Maxwell and Loomis, 2002) cited in Maxwell (2005). The authors have employed a questionnaire to collect data from respondents, and data analysis will be qualitative. The reasoning behind choosing qualitative approach is, as Maxwell (2005:22) says “the strengths of qualitative research derive primarily from its inductive approach, its focus on specific situations or people
and its emphasis on words”. The research methodology employed is inductive, and the study focuses on specific cases/situations, hence, using qualitative methods appears to be compatible with the chosen methodology. Also, the questionnaire has been designed taking into consideration that the responses will be analyzed qualitatively. Further, the authors will employ generic analysis of data received (from questionnaire). This view is supported by Potter (1996) who says that, in genre analysis researchers first construct categories by:

- Identifying and describing similarities such as point of views (of each respondent)
- Looking at this in terms of historical, technological factors (literature)

This way the analysis will be focussed to avoid deviations. This is one of the strengths of the research methodology employed here. Also, Hackley (2003) says, the fact that the questionnaire is expected to generate specific answers from the respondents will simplify the analysis process for the authors. For the analysis part, the authors will employ the following procedure,

- To generate responses (Questionnaire) from the respondents
- The initial step is to read the response and categorize, to identify connections
- The final stage is to build theory based on responses, which is the primary aim of the research (research objectives).

(Adapted from: Maxwell, 2005)

Responses received will be understood in-terms,

- Documentation and Data Collection
- Tools and Techniques.
- Use of Information technology in Control process
- Threshold skills required for Control process
- Reporting system and Organizational business process.

The next step is identify connections and categorize data into the following factors,

d) Factors are to be considered for ‘Monitoring’

e) Factors are to be considered for ‘Evaluation’
f) Factors are to be considered for ‘Corrective Actions’

The final step is to answer the research question comparing the findings with literature.

3.7. Research Limitations:
Some research limitations considered are:

Research strategy: The strategy employs characteristics of both survey and case study, Bryman and Bell (2003) suggest that one of the limitations of survey research is the problem of meaning, where respondents may vary interpretation of questions. This is a limitation for this study as response from participants may not generate the required information. Saunders et al. (2003), say that one of the limitations of case study analysis is the ‘unscientific’ feel it has. The authors will not be restricting the research to a single case study, but, will be analyzing multiple cases with an effort to make the findings and conclusions more relevant to the research topic than restricting to one or two cases.
**Data collection:** A questionnaire based survey is employed for data collection. Some of the limitations can be listed as; questionnaires provide “indirect” information filtered through views of the respondents. Also, the sample size (9) will not be appropriate for data collection using a survey making this research closer to case study, where, the authors will adopt a multiple case analysis.

**Data analysis:** Data is analyzed qualitatively, from Potter (1996), some the limitations for qualitative analysis are: The analysis will be conducted based on findings gathered from the questionnaires, one limitation is to what extent the authors can extend the findings/arguments beyond the evidence from questionnaires employing qualitative analysis. Since, the survey is limited to the sample size, generalizing the findings and its validity can be considered a limitation in this research.

**3.8. Ethics:**
In any research ethical concerns will emerge as the authors collect data (questionnaires), analyze it and report findings (Saunders et al., 2003). Some ethical concerns in the research are:

Data collection: In, this particular research the main ethical issue is regarding the questionnaires, and seeking proper authorization from the respondents for using their responses for analysis and reporting. The authors will be sending a cover letter stating the purpose and usage of the data along with the questionnaire; this is to seek access to the data from respondents and also to convey the nature and purpose of the questionnaires for the research.

Data analysis: The interpretive nature of this study means that the published results are only a version of truth and the validity of the findings must be judged in relation to how data was analyzed Easterby-Smith et al. (2002). For this research data is analyzed qualitatively and the findings are entirely based on the data collected through questionnaires. Hence, the validity and truth of the conclusions will entirely be based on the findings. Saunders et al. (2003:139) say “… maintenance of your objectivity will be vital during analysis stage …..” Data will be analyzed objectively, for this precise reason questionnaires have been standardized for all respondents. The final stage of the research is to report the findings, and draw conclusions. Minocha (2005), says that there should not be any mis-reporting and it is the authors’ responsibility to report findings honestly and accurately. Major ethical consideration for this research is the findings should not be disadvantageous to participants. The authors will not intentionally mis-report findings which would be disadvantageous to the participants. Polonsky and Waller (2005) suggest three broad issues in communicating results:

- Plagiarism
- Academic fraud
- Misrepresenting results

Harvard referencing style is employed, and due references have been included in text and a reference list has been provided at the end. Academic fraud will be avoided as the study has no intentional misrepresentation.
Chapter 4

CASE/S BACKGROUND

Since, the authors will be implementing the chosen research methods (said above), it would be appropriate to provide the background details of cases chosen

Case A

The company is US based ranked no 1 for last 9 years by ENR. The Company is has diverse portfolio comprising of construction projects in energy, transportation, mining, oil & gas, airports, seaports and other services. The company has operations in almost all parts of the world and engages many professionals from different nationality. The company has 40,000 employees and $ 20.5 billion revenues for the year ending 2006. The company has zero accident policy. Projects are well integrated with most advanced tools and systems operating round the clock. Management practices are best in the industry. The company is pioneer in construction industry to adopt Six Sigma approach to improve efficiency and quality. The projects undertaken are large and have a good mix of all management involvements. For example, in the case of $ 20 billion Hong Kong Airport infrastructure project, the company helped NAPCO to oversee the work of 170 contractors in 200 major contracts with Scheduling, progress monitoring, cost control, technical support, claims settlement and environmental co-ordination. The extensive controls operated by the company had benefited the work in reducing the cost by $ 1.1 billion. Such robust are the control systems in the organisation.

Case B

The company is in business of extracting oil and is a Canadian subsidiary of Company A. However, due to its independent working, there cannot be much operational similarity with Company A. However being big in its own field of extraction of oil including construction of process plants and refineries, the company has established several best practices in project management. The company is expected to have revenues of approx. $ 1 billion and under takes projects ranging from $ 200 million to $ 2 billion. The company service clients such as Sucor, Shell, Petro-Canada, EnCana, TransCanada and Nova Chemicals. The company offers turnkey solutions starting from feasibility studies, detailed engineering, procurement, project management, construction, commissioning and start-up and also operations assistance. The company is the largest licensed user of 3D modeling

Case C

The company is Swedish and is in the business of producing electricity and heat to customers in Europe. The company is a nearly a century old and became large by acquisitions of major power producers in Europe. The company became public in 1992 and from 2006; the brand is replaced with local brands in Germany and Poland.
The company is committed to investing in sustainable development. The company has sales of more than 10,000 Million SEK mainly attributable to Germany operations. The company builds own and operate many power projects in Europe and also offer consultancy in various arrears. The company is also committed in providing heating to various homes in Europe. The nature of the work is more like a sponsor with large public accountability. The company engages various contracting companies for construction of power plants.

**Case D**

The company is Finnish company and active in the construction of Housing, Infrastructure and Telecommunications. The company focus is mainly Nordic countries. The turnover of the group in 2006 is 3.3 billion euros and have more than 22,000 employees. The company started in 1991 changed its name many times. In 2001, it acquired the majority share and thus obtained the name with more customers across Europe. Housing is a major area of work and the company is focused in providing quality homes. Towards this, the company engages many tools and techniques starting from Design to Handing Over. The other activities also include construction of Port Structures and Treatment plants including desing work. The company is committed to quality and acquired many certifications towards this.

**Case E**

The company is North American and is fully integrated construction and production company for energy. Head quartered in Canada, the company’s services extend from wellhead to processing plants. The company has 37 centers in Canada and 23 in US and have some 9000 + employees. The company recorded $1.45 billion revenues in the year 2006. The company has successfully established best contracting practices. The construction involves complex integrated process including design, procurement and erection of large structures both inland and off shore. The work calls for a high degree of planning and control techniques.

**Case F**

The company is a leading construction company in India with focus on Build, Own and Operate large infrastructure and power projects. Established in the year 1988, the company has two decades of strength in construction of power projects. The company has recorded $200 million revenues in the year ending March 2007 and have some 2000 people employed all across India. The company is investing heavily into best project management practices and houses. The company constructs structures such as Long Bridges, Roads, Expressways, Ports, Housing, Power Projects. The work involves planning and control techniques to meet the requirements of clients and contract. However the company practices may not be the best in the industry, but certainly can provide us an insight into the operations of a small company.
Case G

The company is India largest engineering and Construction Company. Founded in 1938. Founded three decades ago, the company is the Top construction company in India. The total group sales are more than $4 billion. The company is in the construction in all most all kinds of structures and specialized in design and construction and operations spread in many countries. Due to its sheer size, the company’s operations are unique and have a high degree of control techniques. The Company as a strategy also has many Strategic JV companies particularly in Real estate development and Housing. Planning and Control is backbone for such a large company.

Case H

The company is a UK based company having presence in few other countries such as Ireland, Germany, India, United Arab Emirates and Australia. The company is active in the construction of very large Infrastructure projects in Airports, Sea Ports, Tall Buildings, Landmark structures, Expressways, Bridges etc. The company is active in undertaking infrastructure projects on build, own and operate basis. The group has a total turnover of £22 Billion. Indian operations are mainly focussed on the construction and project management of Residential, Commercial and Landmark Building Projects. The work involves bringing the groups best practices to India. The planning and control function is a main ingredient to its operations. The above presented a brief background on the chosen organizations for data collection. Questionnaires designed for this research will be distributed to the authors’ contacts (Project managers and controllers) from these organizations. The next chapter will present the analysis from data collected (questionnaire responses).
Data collected using questionnaires is analyzed qualitatively. The questionnaires and data gathered from respondents are attached to the appendix whilst this chapter presents the analysis and discussion. The analysis is conducted based on Figure:2, as identified from literature. From the Literature (Ahern et al. (2001); PMI) it can be seen that the factors for effective implementation of the project control depends on the maturity of the organization. At the same time, various aspects such as organization size, skills of the people and the existing process will determine the successful implementation of project controls (Shohet and Frydman (2003); Jha and Iyer (2006)).

In order to assess the above aspects during monitoring, evaluation and corrective actions stage, data from selected respondents from large contracting companies are sought. The detailed provided by the selected respondents are analyzed for its accuracy and relevance to the subject topic of the thesis. As, Best and Langston (2006: 439) quoted “Any sort of comparative study has a number of inherent problems, the most common being that of the comparability and representativeness of data”, the qualitative data sent by the respondents is difficult to be compared. However in view of the focused questionnaire, the data to large extent was able to be translated to finite results. However there were few difficulties in analyzing data, particularly when to comes to ranking of skills, which will be discussed in details separately. To begin with, the information regarding the respondents is provided below to underpin the strategic selection of organizations and respondents for data collection.

The respondents are all over 10 years of experience, which indicates that the information provided is from professionals who have adequate knowledge on the subject. Also 80% of respondents are working with companies having more than € 300 million turnover. This indicates that the organizations are well structured with adequate investments into project management practices. Again 90% of the respondents work with contracting companies which implements infrastructure projects such as refinery process plants, offshore platforms, roads, high speed rails, housing etc. The projects with which the respondents associated are very complex engineering projects requiring high degree of project management practices. Also 90% of respondents are working in the capacity of either a project controller or project manager.

5.1. Factors for effective project controls:

From the Literature review, it can be seen that PMI and other practitioners viewed project controls process in there parts i.e. ‘monitoring’, ‘evaluation’ and ‘corrective actions’. The literature review brought out various aspects and discussed in length each aspect based on both academic and practitioners views. The review also tried portray the past, present and future trends and practices in ‘project controls’. Below are the broad areas covered under
Literature review and are transferred into questions which are sent to selected respondents.

1. Start of ‘Control Process’
2. Data Collection methods & Documentations.
3. Tools and Techniques being used during monitoring process
4. The extent and type of Information Technology during monitoring process
5. Human Related Factors such as Skills and Relationships.
6. Business Process such as interrelation between departments, set-up, meetings, and level of maturity.

The discussion is focused on analyzing the factors related to above aspects and will make an attempt to know the underlying common factors governing all the three stages. The analysis shall also make an attempt to understand the sensitivity of ‘control process’ and construct a theory based on the threshold factors, creativity and balance required in controlling process.

The illustration for analysis is provided below for readers’ convenience.

![Diagram](figure from literature)

The details of the responses for each stage i.e. monitoring, evaluation and correction is collected and presented vide appendix. Now from the basic analysis of the data, the followed topics are further analysed in detail.

**Starting of the Control Process**

It can be seen from the literature (PMBOK (2000)) that the project controls start from project plan and end with documentation of revised plan. This process is likely to occur during any stage of a project. So typically, major and frequent deviations are likely to happen during the executions stage. In order to understand this aspect better, a question was asked to respondents and 75% have said that ‘control’ starts at conception stage and others said Design and Execution stages. Taking clue from the background of the companies, it can seen that companies which implement ‘Construct only’ projects
indicated ‘execution stage’ where as companies which implement ‘design and construct’ projects indicated ‘design stage’. However respondents who have been working with top companies indicated ‘conception stage’. So we can conclude that ‘control process’ starts from conception stage and project management practices should either have a control team right from conceptions stage or should be made aware to all the project management practitioners.

Data Collection and Documentation

Literature indicated (PMBOK(2000); Aitken (2000); Jackson(2004); Frigenti(2002)) that data collection and documentation is starting of ‘control process’ and many organizations involve large manpower resource for data collection and storage facilities both in soft and hard copies. Also the time required for collection of the required data is very difficult and some times pain taking. The respondents are asked about their experiences in difficulties of data collection methods. They said that 10% to 40% of the time is being spent on data collection. 20% of the respondents have mentioned 40% where as remaining are varying from 10%, 15%, 20% and 30%. This aspect is critical and needs a careful understanding.

Average time as per all respondents is 25%, which is still very high. Normally data means progress charts, plans, and budgets both actual and planned etc (Aitken (2000)). These documents normally are made periodically and available freely to all functional people. However when one of the respondents who indicated 40% informed that relationship building for getting exact and appropriate information takes time. Another mentioned that sometimes the date is available in the form of drawings and it takes time to convert into real figures. So, it should be noted that more efforts should be made to reduce this time in data collection.

Also as against the question regarding the Over documentation, the respondents have divided opinion. 50% mentioned that they produce over documentation and others have said that they produced appropriate documentation. On further analysis, respondents who have mentioned that they spend 40% and 30% of time, mentioned that they produce more documentation, while respondents who have mentioned 20%,15% and 10% said they do not. It can be derived that the chances of producing unnecessary documentation is possible in monitoring stage. So every effort should be made to control documentation.

In view of above, it is suggested that the control team should engage junior cadre persons for data collection, so that senior and professional control engineers are effectively used for other works. This supports literature on data collection and documentation.

Similarly respondents mentioned that they spend 20% to 50% of the time on Evaluation of the data collected. One respondent mentioned that the ratio of time being spend on monitoring and evaluation 70 : 30. However, average time as per all respondents is 36%, which is also high. Normally evaluation means, study of the reports and data, and analyze various options and present the data in a more orderly form, so that it can discussed and deliberated for results and actions. This process is considered vital for taking corrective actions. During this process of evaluation, control engineers prove their
analytical and computer operational skills in preparing charts and reports. Data collection and documentation has to be optimum in the phase as this leads to taking the required corrective actions.

The usage of IT during this process is also high. As mentioned by Navon R and Haskaya I (2006), the Daily Site Report can be used as an effective and low cost data for actual progress and which also minimize the efforts of securing information from site when required. However they suggest that the ‘Daily site reports’ should be stored in soft copies, which can be analyzed using specialized IT tools for more benefits. The following section deals with this aspect in detail.

**Tools and Techniques**

The respondents have expressed wide range of tools being used during monitoring stage. Few tools that are commonly being used are ‘MS Project’, ‘Primivera P3 version’ and ‘Trend Forecasting’. Other tools which are mentioned are agresso web info, web based project management systems, JB Edwards quantities database.

From this, we can say that ‘Primavera P3 version’ is still popular tool and can be treated as a threshold factor during project monitoring stage.

The Literature (Ahuja and Tiruvengadam (2004); Shi et al. (2001); Barraza et al. (2000)) described many tools and techniques and identified few such tools. And the findings are somewhat same as that described in literature. But surprising is that the P3 is still a favorite than that of web based project management tools. In evaluations stage, all most all the respondents have expressed that the tools and techniques are the same being used for monitoring purpose. This is another point which supports that practitioners view monitoring and evaluation stages as a single stage. This may be due to the commonality of the resources which will be engaged during these two stages. In contrast to PMI (2000) version which mentions that monitoring and evaluation as two separate stages, the identical nature of both the stages needs to be taken into account, particularly for construction projects.

When it comes to ‘corrective action stage’, many respondents have expressed that they do no use much tools and techniques for taking corrective actions. However few have mentioned that they use tools such as sigma, which is not a tool but a process. Stewarti and Spencer (2006) thorough their case study research indicates that Six-Sigma would be an effective tool for process improvement and to reduce waste and other non-value added activities. So for the subject research, it can be said that there are no suitable tools and techniques for taking corrective actions. So the quality of the decisions lies in the ability of the project manager and project control team.

The above analysis indicate that during monitoring and evaluation, there is a great importance on tools & techniques, relationship, team work, which slowly reduced during the last phase i.e. ‘corrective actions’, which can be said as a culmination of all the efforts.
and energy. This phase also brings out the importance of creativity and leadership roles, which can again be seen in next section i.e. ‘Skills requirements’

**Skills requirement in ‘Control Process’**

This is an important aspect which was discussed in length in the literature. The literature (Turner and Muller(2005); Muller and Turner (2007); PMBOK (2000); Gharehbaghi and McManus (2003); Hyvari (2006); Shohet and Frydman(2003); Jha and Iyer (2006)) identified few skills, which further refined to 9 skills. The same has been made part of the questionnaire and requested the respondents to rank them for each stage i.e. monitoring, evaluation and corrective action stage. It was found that 80% of the respondents made an effort to rank the skills. Best and Langston (2006) mentions that any sort of comparative study is difficult. The rankings given by respondents are difficult to be analysed for comparison because of the randomness of the rankings. This is not expected during the design of the questionnaire. So, we have considered those skills which are ranked either 1,2,3 or 4 and identified top 4 skills required for monitoring purpose. The skills that came up are ‘Analytical, Relationship, Leadership, and Computer Operational’.

Also, It can be seen that ‘Leadership skills’ in monitoring stage is not discussed in literature. But few respondents found that team monitoring the project should also exhibit leadership skills. Also almost all the respondents have mentioned that the level of skills required during project management should be ‘HIGH’ for project controllers.

Similar to monitoring stage, the literature had identified 9 important skills for evaluation process and requested the respondents to answer them. And similar to monitoring stage, we have considered those skills which are ranked either 1,2,3 or 4 and identified top 4 skills required for evaluation purpose. The skills that came up are ‘Analytical, Computer Operational, Technical, and Risk assessment’. It can be seen that the above skills are very much included in the literature review. Also, all most all the respondents have mentioned that the level of skills required during project evaluation to be ‘VERY HIGH’ for project controllers / control engineers.

The literature review discussed in details various skills required by project managers and project controllers in detail. Based on the inputs from literature review, the respondents are asked to identify and rank the top important skills required during corrective action stage. The respondents most of whom are project managers and project controllers have mentioned Leadership, Technical, Presentation and Negotiating skills as four important skills required for taking corrective actions. Also, all most all the respondents have mentioned that the level of skills required during ‘corrective actions’ to be ‘HIGH’ and ‘VERY HIGH’

The above indicate that the skill requirements have shifted from basic analytical, computer operational skills to more advanced / matured skills such as Leadership, Risk assessment and Negotiating skills. This can be due to the shift from a team work during monitoring and evaluation stages to ‘Individual’ in corrective action stage.
Responsibility

After discussing ‘Skill requirements’, the responsibility for control process is needed to assess the nature and people involvement in control process. Towards this the respondents were asked questions related to this aspect. The respondents indicated that almost all have project monitoring process as a team effort. Also, the respondents have indicated that almost all have project evaluation process as a team effort. This indicates that the process involves human relationships among people working in project controls. Also, the data indicated that the control set-up is same in both during monitoring and evaluation stages.

Also, earlier in ‘tools & techniques’, the discussion brought out the respondents view of monitoring and evaluation stages as same, due to application of similar tools during both the stages. Again the respondents have mentioned that the set-up for both monitoring and evaluation stages is same. This indicated that there is evidence to prove that resources required for both monitoring and evaluation stages is common in construction projects. However this needs to be verified for other type of projects also.

This can also be treated as a deviation to what was found in the literature where the PMI practice has identifying ‘Monitoring and Evaluation’ as two separate components of ‘Project Controls’. The objective in treating monitoring and evaluating stages of project controls together could be to reduce time and cost in terms assigning responsibilities and setting-up teams and implementation.

When it comes to ‘corrective action stage’, 80% of the respondents have answered that the project manager is generally assigned the responsibility for ‘corrective actions’. Some of them also mentioned that the responsibility is upon other managers and project controllers. For all practical issues, ‘Project Manager’ can be treated as the person responsible for ‘corrective actions’. So this again shows the shift from team work during monitoring and evaluation stage to individual in corrective action stage.

Key characteristics of ‘Control Process’.

The data indicated that the most companies practice both centralized and project specific ‘control process’. This indicates that the organizations have a control team to monitor the project closely apart from the site team and report directly to the management. This point brings out two aspects i.e. TRUST and UTILISING HIGH CALIBRE PEOPLE. This means that the corporate office / management / owners do not trust the site efforts and may wish to have a separate team to oversee what site do. This can also means that the management may wish to utilize the existing resources by deploying few at site and few at centralized office. Since the questionnaire did not include this aspect, there is no conclusive evidence and hence cannot be analyzed more.

Also, the relationship between Project Controls, Site Management and Corporate Management is an important issue connected to the balance of control process in any organization. In this regard the questionnaire asked respondents the practices in their
respective organizations. Towards this, more than 50% mentioned that the control process is neutral. However some mentioned that the control process is between corporate management and neutral and other mentioned that it is between site management and neutral. This indicates that there is evidence of biased control process existing in the contracting Industry. This is an important issue challenging the practices of ‘Project Management’. So, contracting companies should in every possible way ensure fair practices in ‘control process’ and encourage best practices. Towards this, implementation of CMMi (or) SPICE models for process improvement can better the quality of decision making.

The creativity of ‘Project controls’ can best be explained by the interlinking and classifying the skills from monitoring to corrections actions. Literature identified 9 important skills requested for control process. And respondents have ranked the skills required at each stage.

Now for identifying most creative skills in control process, an attempt is being made to assign creativity marks to each skill on a comparable basis. The marks as based on the level of creative intensity required in the process. Based on this new scale, the skills set will be as below.

<table>
<thead>
<tr>
<th>Skill</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Analytical Skills</td>
<td>2</td>
</tr>
<tr>
<td>b) Relationship Skills</td>
<td>3</td>
</tr>
<tr>
<td>c) Leadership skills</td>
<td>9</td>
</tr>
<tr>
<td>d) Computer Operational skills</td>
<td>2</td>
</tr>
<tr>
<td>e) Presentation skills</td>
<td>5</td>
</tr>
<tr>
<td>f) Technical (incl. engineering &amp; contractual) Skills</td>
<td>5</td>
</tr>
<tr>
<td>g) Liaison skills</td>
<td>5</td>
</tr>
<tr>
<td>h) Negotiating Skills</td>
<td>9</td>
</tr>
<tr>
<td>i) Risk assessment &amp; Forecasting</td>
<td>9</td>
</tr>
<tr>
<td>j) Political and Maneuvering</td>
<td>8</td>
</tr>
</tbody>
</table>

From the responses, considering the most important skills for each stage, and the corresponding score from the above table:

The creative marks that can be allotted for Monitoring Stage is an addition of the marks for Analytical, Relationship, Leadership, Computer Operational’ (these four skills are the most important for this stage). This value shall be 2+3+2+9 = 16

Now for the creative marks that can be allotted for Evaluation Stage is an addition of the marks for Analytical, Computer Operational, Technical, and Risk assessment (these four skills are the most important for this stage). This value shall be 2+2+5+9 = 18
The creative marks that can be allotted for Corrective actions Stage is an addition of the marks for Leadership, Technical, Presentation and Negotiating (these four skills are the most important for this stage). This value shall be $9+5+5+9 = 28$.

The difference in totals amongst the three phases of project controls (monitoring, evaluating and corrective actions) leads to the conclusion that different project control teams/individuals have different perceptions regarding project control mechanism. Some perceive monitoring stage as critical, while others consider corrective action stage to be important. Also, the importance of skills required for each stage varies accordingly. There appears to be a change in perception in terms of creativity required for project controls.

5.2. Other Aspects

When it comes to formal meetings to discuss and evaluate options during control process, more than 60% of the respondents mentioned that they meet every week and remaining are in the opinion of fortnightly and monthly. But considered the majority opinion, weekly meetings to evaluate options would be suggested for a healthy project control process. This also results in updating data collection and documentation for weekly meetings in order to understand the current situation of the evaluation process. Also when it comes to taking decisions or corrective actions, all most all the respondents have mentioned that it was the responsibility of the ‘Project Manager in consultations with other functional heads. 80% of the respondents mentioned that there is a ‘High involvement of people only for key decisions’ in their respective organizations. Also the respondents are divided on period of meeting required to be held for taking decisions. Few have mentioned that they meet weekly, some say they meet fortnightly and other monthly and one said they meet quarterly. So it can seen that there is no periodic meeting for coming together to discuss on control issues. So, it can also be said that as and when it was felt necessary depending upon the maturity and size of the organization, project managers, functional heads and control team meet to discuss project related issues. Many respondents have mentioned that ‘Project manager’ to be the best replacement for a Project Controller. This is also an industry practice where project controllers shall be made as project managers and project managers are made as controllers. Also 70% respondents mentioned they engage experts during control process to derive additional inputs for quality control. In view of acute shortage of manpower, project managers can also take the responsibility of dual role with monitoring and evaluation from his site resources. This can be best suitable for smaller and less complex projects.

5.3. Summary

The above presented data analysis and results have been discussed for arriving at primary objective of the research i.e. threshold factors required for effective implementation of project controls in construction projects. Also, the key characteristics derived from monitoring, evaluation and corrective actions are presented. The next chapter will present the conclusions for the research along with the limitations.
Chapter 6
Conclusion

The aims and objectives for the research were discussed in chapter 1, along with the rationale for choosing the research topic. Chapter 2 provided the background research/literature review with an aim to identify a gap in the literature. Also, this identified literature has been employed in the analysis section. Chapter 3 discusses the research methodology employed where the research strategy, data collection methods and limitations along with research ethics were presented. Chapter 4 discusses the background of organizations chosen for data collection and analysis. Chapter 5 presents the data analysis discussing the results briefly with an aim to answer the research objectives. Finally, this chapter will provide the conclusions for the research where the research aims and objectives will be answered based on the analysis and results from the previous chapter. Also, the research is completed by providing recommendations for future and limitations completing the research requirements.

6.1. Conclusions

The primary aim for this section is to able to answer the research aims, hence, the section is divided into two parts each one corresponding to the research aims identified in chapter 1.

6.1.1. What are the influencing/threshold factors for effective implementation of ‘Project control’ in construction projects?

The aim is identify the threshold factors for effective implementation of ‘Project controls’, from literature the authors have identified that ‘Project controls’ mechanism is implemented in stages as: Monitoring, Evaluation and Corrective actions. Hence, for this objective the authors have identified the threshold/ influencing factors for Monitoring, Evaluation and Corrective actions which will ultimately lead to factors (threshold/influencing) for effective implementation of ‘Project controls’ in construction projects. Looking at the identified influencing/threshold factors for each stage of project controls:

Monitoring stage

From the data analysis chapter, some of the identified influencing/threshold factors for the monitoring stage can be listed as:

- Project Monitoring starts from ‘conception stage’
- Project Monitoring is both a site and centralized set-up in most organizations
- Team effort is required for monitoring
- Time being spent on data collection is on average 25%
- There is a chance of producing over documentation during monitoring process.
• Junior cadre engineers should be employed for data collections
• Primavera P3 is still a preferred choice as appropriate monitoring and control tool.
• Use of information technology is increasing and necessary for monitoring purpose.
• Use of Trend forecasting is also can be implemented for control process.
• High degree of Analytical, Relationship, Leadership, Computer Operational’ are four important skills required during monitoring process.

Evaluation stage:

• Project Evaluation set-up is same as monitoring set-up.
• Team effort is required for Evaluation also.
• An average of 36% is being spent by control engineers during evaluation.
• Weekly meetings are suggested for evaluation purpose.
• Same tools and techniques used for monitoring aspects are being used for evaluation stage also.
• High degree of Analytical, Computer Operational, Technical, and Risk assessment are the four important skills required during evaluation stage.

Corrective action stage:

• Project Manager in consultation with other, is responsible for taking corrective actions
• People or Executives of the contracting companies are interested and involved in taking key decisions
• No tools are being used during this process and it is a highly ability driven process.
• High to very High degree of Leadership, Technical, Presentation and Negotiating skills are four important skills required for taking corrective actions.

The above brings out two aspects which do not agree with literature. One is that project monitoring and evaluation as two separate stages of controlling process. The data collected from responsible project controllers showed that the two stages are unique and similar in many aspects. Also the team responsible for doing project monitoring also does the project evaluation. Also, the skills required for data collection is similar to data evaluation to large extent. So, in contrast to PMI view, monitoring and evaluation stages in construction projects has many common features. The responses given by practitioners working as responsible ‘Project Controllers & Project Managers’ indicate that they recognize the two stages as One. From the Chapter – 5, it can bee seen that respondents agree that similar tools and techniques are being used in both these stages, Also both the stages involve team effort. Also many times, the same team be seen working in monitoring stage and also evaluation stage. Also both the stages requires ‘analytical skills & computer operational skills’ which indicate that people of similar skills are required for both stages. These arguments leads us to the fact that the two stages are identical.
However further research is required on other type of projects, which can provide us evidence of similar results.

From the above, the threshold factors for effective implementation of ‘control process in contracting companies’ shall be as follows.

1. Start Control Process from ‘conception stage’
2. Establish control process both at site and centralized for a group of projects. This helps in utilizing control engineers effectively.
3. Cultivate Team Effort.
4. Employ junior cadre persons for data collection
5. Use Information technology in sharing reports across departments in order to reduce over documentation.
6. Implement ‘Primavera P3’ and if possible implement ‘Trend Forecasting’.
8. Initiate weekly meetings for discussing control issues.
9. Involve Project Managers in Control process.
10. Suggest key issues to be discussed as a team for quality decisions.

The above factors can be listed as the identified influencing/threshold factors for monitoring, evaluation and corrective action stages and hence, for effective implementation of project controls for construction projects

6.1.2. What are the key characteristics of the ‘Control Process’ in construction projects from the perspective of contracting companies?

This objective tries to identify key characteristics which can derived by the study of the three critical aspects of project controls (monitoring, evaluation and corrective actions) in the construction industry.

Project Controls – A Process driven system.

Project Controls is a sensitive area of a project where there is not much literature to inform the best practices. This study is an effort towards that. From the literature and also from the data collected, it can be seen that there is a reduction of process dependency during monitoring and evaluation stages. At the same time an increase of creativity and ability prominently being highlighted during corrective actions stages.

The other aspect which needs to be discussed is the strategic importance of project controls in a contracting organization. As mentioned in the literature, contracting organizations impose controls on budget and resources. This many times brings conflict of views between corporate management and site management. Project Controls is a process which keeps a track of the project and helps in informing the appropriate functional heads in managing the deviations. So, every effort should be made to see that
the Control process to be Neutral and not bent towards the interest of corporate management nor the site management. The data collected showed that 80% of the respondents mentioned a neutral practice in their organizations. However 10% mentioned that their ‘control process’ is in between Neutral and Corporate Management and another 10% mentioned that their ‘control process’ is in between Neutral and Project Site Management. This indicates that biased practices are observed in contracting organizations and needs an urgent attention to maintain a balanced project management practices.

Project controls is perceived as indulgence of IT, analytical and systematic process. Also the literature mentioned the usage of many tools and techniques. Again as mentioned by Lewis(1998: 43) that important aspect about success is perception. It can be a process driven, or creative effort by an individual / group of people. In order to ascertain this, the responses are analyzed in detail vide chapter 5. Broadly the factors can be classified as process driven factors and ability driven factors. The process driven factors are the tools and techniques, set up, responsibility. Where as, the creativity aspects are type of skills, complexity involving the control process. When we do scrutiny and dissection of the questionnaire sent by respondents the following can be featured as below.

The process driven factors are predominantly based on the use of IT and tools and techniques. It can be seen from the data collected that monitoring and evaluation involve Information technology and advanced tools and techniques. But corrective action stage involves zero tools and in addition mentions the importance of ability in taking corrective actions. Considering an importance scale of 10, the minimum threshold during monitoring and evaluation stage can be established as 8 for comparative purpose and zero for corrective actions stage. So the graph shall be as below.
Based on the analysis made in the discussion on the creativity scale. The creativity index shall be as below.

From the above two figures, it can be seen that there is inverse relationship between the process driven factors and creative factors in all the three stages. This indicates that there is a shift from process to creative roles of people in control process. From the discussion chapter, it can be see that there is a shift from team effort during initial monitoring stage to more relationship efforts during evaluation stage and problem solving issues during corrective action stage. Again there is a shift from Team work to Individual Responsibility from monitoring to corrective action stages. This theory augment the importance of Project Manager in construction projects. Also the theory brings out an important aspect that the Project Manager should predominantly exhibit Logical, Negotiating, Risk Assessment Skills in order to find solutions at every stage of the project. This theory brings out one more important aspect for practitioners, is the team employed for project controls should be directed towards monitoring and evaluating purpose. The research indicated that the inputs from the monitoring and evaluation team is further analyzed for corrective actions by ‘Project Manager’. So, contracting organizations should make an effort to bring energetic and analytical persons for monitoring and evaluations purpose and employee project manager who can able to take responsible actions.

From the above discussion and details mentioned in Chapter 5, it can be established that the 4 key characteristics of a control process can be as below.
1. The control process starts from with team efforts and ends with individual decision making style.
2. Control process is an un-biased process with TRUST among participants as key ingredient.
3. The people involved in initial control process have analytical and computer operational skills.
4. Project Manager role in control process is eminent and important attaching creativity and logic in resolving issues at every stage of the project.

The above brings out the key characteristics based on the inputs provided by the respondents and the ability of the authors knowledge of the control process. However the same can be made much better with more responses and also with the help of structured interviews.

6.2. Limitations:

Some of the limitations for this research can listed as:

- The research is based on multiple case analysis of contracting companies (9 to be specific). Since, the research was based on a limited number of contracting organizations the generalization of the findings can be considered as a limitation for the research.

- Few responses could not be comprehended for a thorough analysis.

- Method of establishing the ‘Creative Scale’ is not supported by literature and is only meant for a guide line to understand the concepts.

6.3. Recommendations for future:

Given that one of the reasons questionnaires have been employed is due to time, the research could be conducted employing an action research strategy, where the authors would be able to participate and be more involved.

One other improvement could be to make a large survey of different organizations (sample size > 70) in order to generalize findings and make a contribution to the existing literature.

Further Research can be made for other kind of projects, such as technology projects, research projects and compare the results with the findings from this research. The results thus gained from combined efforts, has potential to provide inputs for improving PMI’s approach of ‘Project Controls’ as a three step process of monitoring, evaluation and corrective actions. Also further research is needed to establish the 4 key characteristics more appropriately.
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Accessed: 2007-11-23
### General Information - 1

1. Please indicate approximate turnover of your organization during last financial year?
   - a) € 1-100 million
   - b) € 101-200 million
   - c) € 201 – 300 million
   - d) € 301 million and above

2. What is your functional role? *(e.g. project manager, control engineer, contracts manager etc.)*

   Answer

3. Please state the number of years of work experience.
   - a) 1 to 3 years
   - b) 3-6 years
   - c) 6 – 10 years
   - d) 10 years and above

4. Please state the type of projects your organization undertake
   - a) Roads and Bridges
   - b) Residential and Commercial Buildings & Structures
   - c) Power
   - d) Oil & Gas project
   - e) Other works

5. Is your Control Procedures same for all types of projects? *(Yes/No)*

### Project Monitoring

1. Who generally is assigned the responsibility for project monitoring in your organisation *(please mark in the adjacent column)*
   - a) Individual person
   - b) Project Control Team

2. What is the Project Monitoring set up in your organisation? *(please mark in the adjacent column)*
   - a) Centralised set up for a group of projects
   - b) Project specific located at project site
   - c) Both centralised and Project based
   - d) Any other (please state)
3. From what stages does ‘Project Monitoring’ begins in your practice?
   a) Conception stage  
   b) Design stage  
   c) Execution stage  

4. What tools and techniques are you currently using for ‘project monitoring’
   (e.g MS project, Primivera3, Web based Project management Systems, ASP Cost efficiency, trend forecasting, etc)
   Answer here  

5. How much time do you spend on data collection? (in percentage terms compared with total time)
   Answer here  

6. Do you think that you are producing more documentation than required? (yes/no)  

7. What according to you would be the most important skill/s for the project monitoring? (Please rank the below - 1 is Highest and 10 is Lowest)
   a) Analytical Skills  
   b) Relationship Skills  
   c) Leadership skills  
   d) Computer Operational skills  
   e) Presentation skills  
   f) Technical (incl. engineering & contractual) Skills  
   g) Liaison skills  
   h) Negotiating Skills  
   i) Risk assessment & Forecasting  
   j) Political and Maneuvering  

8. What according to you would be the Level of skill required by people working in project monitoring?
   a) Low  
   b) Moderate  
   c) High  
   d) Very High  

9. What are the sources of inputs for ‘Project Monitoring’
To what functional departments does monitoring reports be distributed.

Answer here

### Project Evaluation

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Who is generally assigned the responsibility for project evaluation in your organisation <em>(please mark in the adjacent column and If individual, please state the functional person responsible.)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Individual person</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Control Team</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Is Project Evaluation Set-up is same as Monitoring Set up? <em>(Yes/No)</em></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Do you use any Separate tools and techniques for ‘Evaluating Project performance’ other than the tools used for Monitoring? <em>(yes/no).</em> If Yes, kindly mention few of them.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Answer here</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>How much time do you spend on Evaluation i.e. (Data Analysis)? <em>(Compared with data collection in percentage terms)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Answer here</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>How often do you meet to evaluate options on control issues of any given project? <em>(please mark in the adjacent column)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Weekly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Fortnightly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Monthly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Quarterly</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>How often do you generate reports on ‘Project control’? <em>(please mark in the adjacent column)</em></td>
<td></td>
</tr>
</tbody>
</table>
7. What according to you would be the most important skill/s for the project Evaluation? (Please rank the below - 1 is Highest and 10 is Lowest)

- Analytical Skills
- Relationship Skills
- Leadership skills
- Computer Operational skills
- Presentation skills
- Technical (incl. engineering & contractual) Skills
- Liaison skills
- Negotiating Skills
- Risk assessment & Forecasting
- Political and Maneuvering

8. What according to you would be the Level of skill required by people working in project evaluation?

- Low
- Moderate
- High
- Very High

9. To what functional departments does Project Evaluation Reports are distributed?

Answer here

- Corrective actions

1. Who is generally assigned the responsibility for ‘corrective actions’ in your organisation (please mark in the adjacent column and if individual, please state the function person responsible)

- Project Controller
- Project Manager
- Other Managers or Directors

2. How do you take ‘Corrective actions’ in your organisation? (please mark in the adjacent column)

- Conscientiousness
- Individually, based on the functional requirement
c) Project Manager (in consultation with other functional heads)

d) Project Controller (in consultation with project manager and others)

3. What is the level of interest of people in your organisation when taking ‘corrective actions’ *(please mark in the adjacent column)*

   a) High Involvement for almost all decisions
   b) High Involvement only for key decisions
   c) Medium involvement and only when required.

4. Do you use any separate tools and techniques for ‘Corrective Actions’ such as decision tree, mind mapping etc.?

   *Answer here*

5. How often do you meet to discuss on Corrective actions pertaining to any given project? *(please mark in the adjacent column)*

   a) Weekly
   b) Fortnightly
   c) Monthly
   d) Quarterly

6. What according to you would be the most important skill/s of a person involving to take corrective actions.? *(Please rank the below - 1 is Highest and 10 is Lowest)*

   a) Analytical Skills
   b) Relationship Skills
   c) Leadership skills
   d) Computer Operational skills
   e) Presentation skills
   f) Technical (*incl. engineering & contractual*) Skills
   g) Liaison skills
   h) Negotiating Skills
   i) Risk assessment & Forecasting
   j) Political and Maneuvering

7. What according to you would be the Level of skill required by people working in Corrective Actions?

   a) Low
   b) Moderate
   c) High
   d) Very High
<table>
<thead>
<tr>
<th>8</th>
<th>Name few functional departments who involve in taking corrective actions?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Answer here</strong></td>
</tr>
</tbody>
</table>

**General Information – II**

<table>
<thead>
<tr>
<th>1</th>
<th>What Relationship can best be explained between - Project Controlling, Corporate Management and Site Management? <em>(please mark in the adjacent column)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Project Control is closer to Corporate</td>
</tr>
<tr>
<td></td>
<td>b) Project Control is between Corporate &amp; Neutral</td>
</tr>
<tr>
<td></td>
<td>c) Project Control is Neutral</td>
</tr>
<tr>
<td></td>
<td>d) Project Control is between neutral and Site</td>
</tr>
<tr>
<td></td>
<td>e) Project Control is closer to site</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>From your experience and knowledge who would you recommend as the best replacement for a Project Controller? <em>(Please rank the below - 1 is Highest and 4 is Lowest)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Technical Expert</td>
</tr>
<tr>
<td></td>
<td>b) Project Manager</td>
</tr>
<tr>
<td></td>
<td>c) Contract Manager</td>
</tr>
<tr>
<td></td>
<td>d) Finance Manager</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Do you engage engineering experts for consultation (or) advice exclusively for controlling process? <em>(Yes / No)</em></th>
</tr>
</thead>
</table>

**Company:**

**Telephone:**

**Email address:**

Thank you very much for taking your time to participate in this survey. Please should you require a copy of our findings, feel free to request or leave any comments in the space provided below:
Appendix 2:

1. Factors for effective monitoring

Based on the questionnaire responses, the data collected is compared by having all the responses for each factor in a tabular form:

**Note:** Company ‘C’ is not a contracting company, but, has been included for comparison as response has been received from the organization (this company responses have been highlighted in red). Also, company B has provided the authors with responses from two respondents as shown (B1 and B2).

1. Responsibility

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

All the respondents have mentioned that ‘project controls’ is a team effort during monitoring process.

2. Project Monitoring Set-up

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Project specific</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Out of 8 respondents, 6 mentioned that the monitoring set –up is both project based and centralized. And 2 respondents mentioned that it is project specific only.

3. Stage from which monitoring starts.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conception stage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>Designs Stage</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Execution</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
4. Tools and techniques currently being used for ‘project monitoring’:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Project</td>
<td></td>
<td>X</td>
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<td></td>
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<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>P3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>Web based</td>
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<td></td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>systems</td>
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<td></td>
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<tr>
<td>ASP Cost</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Trend</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>forecasting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-House softwares</td>
<td>Depends on the controller</td>
<td>Agresso webinfo and company specific documentation system (ISO 9001-certified)</td>
<td>Quantities database, JD Edwards</td>
<td>In-house management planning and control systems</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

5. Time spent on data collection (in percentage terms compared with total time):

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage out of total time</td>
<td>40%</td>
<td>40%</td>
<td>30%</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
<td>N/A</td>
<td>10-15%</td>
<td>15%</td>
</tr>
</tbody>
</table>

6. Is there more documentation being produced than required:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes/No</td>
<td>Yes</td>
<td>Depends on project phase and progress,</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
7. Most important skill for project monitoring:

<table>
<thead>
<tr>
<th>Skills</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Relationship</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Leadership</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Computer operational</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>9</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liaison</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negotiating</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk assessment and forecasting</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Political and Maneuvering</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Level of skill required by people working in project monitoring:

<table>
<thead>
<tr>
<th>Skill level</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Very high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

9. Sources of inputs for ‘Project Monitoring’:

<table>
<thead>
<tr>
<th>Company</th>
<th>Sources:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Delivery teams</td>
</tr>
<tr>
<td>B1</td>
<td>Technical reports, financial estimation, execution/construction reports, accounting, contracts/procurements</td>
</tr>
<tr>
<td>B2</td>
<td>Technical departments, procurement and construction, project management and control</td>
</tr>
<tr>
<td>C</td>
<td>Preliminary reports, prior knowledge</td>
</tr>
<tr>
<td>D</td>
<td>YIT’s project systems</td>
</tr>
<tr>
<td>E</td>
<td>Safety updates, schedule updates, cost updates, risk updates</td>
</tr>
<tr>
<td>F</td>
<td>Project site planning, execution, purchase, finance,</td>
</tr>
<tr>
<td>G</td>
<td>Primary data from the project, external market elements in terms of procurement leads, price data etc</td>
</tr>
<tr>
<td>H</td>
<td>Budget and estimated final cost</td>
</tr>
</tbody>
</table>
10. To what functional departments does monitoring reports be distributed:

<table>
<thead>
<tr>
<th>Company</th>
<th>Functional department:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All functional departments</td>
</tr>
<tr>
<td>B1</td>
<td>Project level functional management, Project management, client, Corporate management</td>
</tr>
<tr>
<td>B2</td>
<td>Technical departments, project monitoring department, procurement</td>
</tr>
<tr>
<td>C</td>
<td>To the departments that ordered the project</td>
</tr>
<tr>
<td>D</td>
<td>Economy and local production unit</td>
</tr>
<tr>
<td>E</td>
<td>Project management, Contract Management, Client</td>
</tr>
<tr>
<td>F</td>
<td>Business head, Project head, Finance head, Purchasing, Project manager</td>
</tr>
<tr>
<td>G</td>
<td>Project control, finance and cost control</td>
</tr>
<tr>
<td>H</td>
<td>Operations and Project Controls</td>
</tr>
</tbody>
</table>

Factors for effective Project evaluation:

1. Responsibility

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>Yes</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

2. Is the project evaluation set-up same as the monitoring set-up:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes/No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3. Do you use any separate tools and techniques for ‘project evaluation’ other than the tools used for monitoring?

<table>
<thead>
<tr>
<th>Company:</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes/No</td>
<td>No</td>
<td>No</td>
<td>No idea</td>
<td>No idea</td>
<td>No</td>
<td>Yes, Risk assessment tools</td>
<td>RTLC tools and ERP</td>
<td>Internal management planning and control system</td>
<td>No</td>
</tr>
</tbody>
</table>
### 4. Time spent on evaluation (data analysis) compared with data collection in percentage terms:

<table>
<thead>
<tr>
<th>Company:</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>20%</td>
<td>40%</td>
<td>70% on</td>
<td>50%</td>
<td>40%</td>
<td>N/A</td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>analysis 30% on</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>data collection</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>40% (double that of data collection)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### 5. How often do you meet to evaluate options on control issues of any given project:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fortnightly</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Monthly</td>
<td></td>
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<td>X</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### 6. How often do you generate reports on ‘Project Controls’:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fortnightly</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7. What is the most important skill/s for project evaluation:

<table>
<thead>
<tr>
<th>Skills</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Relationship</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Computer operational</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Presentation</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td></td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Technical</td>
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<td>7</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Liaison</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negotiating</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>4</td>
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</tr>
<tr>
<td>Risk assessment and forecasting</td>
<td>7</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Political and Maneuvering</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. What would be the level of skill required by people working in project evaluation:

<table>
<thead>
<tr>
<th>Skill level</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Very high</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. To what functional departments are project evaluation reports distributed:

<table>
<thead>
<tr>
<th>Company</th>
<th>Functional department:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All functional departments</td>
</tr>
<tr>
<td>B1</td>
<td>Project controls, Project management, client, Corporate management</td>
</tr>
<tr>
<td>B2</td>
<td>Technical department, and project control, project management</td>
</tr>
<tr>
<td>C</td>
<td>To the department that ordered the project</td>
</tr>
<tr>
<td>D</td>
<td>Economy and local production unit</td>
</tr>
<tr>
<td>E</td>
<td>Not often</td>
</tr>
<tr>
<td>F</td>
<td>Business head, Project head, Finance head, Purchasing, Project manager</td>
</tr>
<tr>
<td>G</td>
<td>Project control</td>
</tr>
<tr>
<td>H</td>
<td>Operations</td>
</tr>
</tbody>
</table>

Corrective Actions:

1. Who is generally assigned the responsibility for ‘corrective actions’:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Other managers or directors</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. How are corrective actions taken:

<table>
<thead>
<tr>
<th>A B1 B2 C D E F G H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
</tr>
<tr>
<td>Individually, based on the functional requirement</td>
</tr>
<tr>
<td>Project manager (in consultation with other functional heads)</td>
</tr>
<tr>
<td>Project Controller (in consultation with project manager and others)</td>
</tr>
</tbody>
</table>

3. What is the level of interest of people in your organization when taking ‘corrective actions’:

<table>
<thead>
<tr>
<th>A B1 B2 C D E F G H</th>
</tr>
</thead>
<tbody>
<tr>
<td>High involvement for almost all decisions</td>
</tr>
<tr>
<td>High involvement for only key decisions</td>
</tr>
<tr>
<td>Medium involvement and only when required</td>
</tr>
</tbody>
</table>

4. Do you use any separate tools and techniques for ‘corrective actions’ such as decision tree, mind mapping etc:

<table>
<thead>
<tr>
<th>Company</th>
<th>Tools and techniques:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sometimes</td>
</tr>
<tr>
<td>B1</td>
<td>Six sigma</td>
</tr>
<tr>
<td>B2</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>Don’t know</td>
</tr>
<tr>
<td>D</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>No</td>
</tr>
<tr>
<td>H</td>
<td>Decision tree</td>
</tr>
</tbody>
</table>
5. How often do you meet to discuss on corrective actions pertaining to any given project:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fortnightly</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarterly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. What would be the most important skill/s for people involved in taking corrective actions:

<table>
<thead>
<tr>
<th>Skills</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Relationship</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Computer operational</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Liaison</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negotiating</td>
<td>6</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk assessment and forecasting</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Political and Maneuvering</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

7. What is the level of skill required by people working in corrective actions:

<table>
<thead>
<tr>
<th>Skill level</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>High</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Very high</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. Name few functional departments who involve in taking corrective actions:

<table>
<thead>
<tr>
<th>Company</th>
<th>Functional department:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All functional departments</td>
</tr>
<tr>
<td>B1</td>
<td>Depending on what the corrective actions are, it is usually the project management which is responsible for enforcing the corrective action</td>
</tr>
<tr>
<td>B2</td>
<td>Technical departments</td>
</tr>
<tr>
<td>C</td>
<td>Controllers and independent reviewers</td>
</tr>
<tr>
<td>D</td>
<td>Economy and technical department</td>
</tr>
<tr>
<td>E</td>
<td>Project management, Project controls, Procurement</td>
</tr>
<tr>
<td>F</td>
<td>All concerned departments</td>
</tr>
<tr>
<td>G</td>
<td>Project control, Finance</td>
</tr>
<tr>
<td>H</td>
<td>Project controls and Operations</td>
</tr>
</tbody>
</table>

*General information regarding organizations:*

1. Turnover of the organization during the last financial year:

<table>
<thead>
<tr>
<th>Turn over in million</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>€ 1-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>€ 101-200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>€ 201-300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>€ 301 and above</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Functional role of the respondent:

<table>
<thead>
<tr>
<th>Company</th>
<th>Role of the respondent (project manager, control engineer, contracts manager etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Project controls manager</td>
</tr>
<tr>
<td>B1</td>
<td>Project controls engineer (cost)</td>
</tr>
<tr>
<td>B2</td>
<td>Planner</td>
</tr>
<tr>
<td>C</td>
<td>Dam safety and risk and civil structural engineer</td>
</tr>
<tr>
<td>D</td>
<td>Branch manager</td>
</tr>
<tr>
<td>E</td>
<td>Sr. Project controls engineer</td>
</tr>
<tr>
<td>F</td>
<td>Head SBU</td>
</tr>
<tr>
<td>G</td>
<td>Project manager</td>
</tr>
<tr>
<td>H</td>
<td>Contracts manager</td>
</tr>
</tbody>
</table>
3. Years of work experience of the respondent:

<table>
<thead>
<tr>
<th>Years</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 and above</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

4. Type of projects undertaken by the organization:

<table>
<thead>
<tr>
<th>Type of projects</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads and bridges</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Residential and commercial buildings and structures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and gas projects</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other works</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Is the control process same for all types of projects:

<table>
<thead>
<tr>
<th>Company</th>
<th>Response:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes and No</td>
</tr>
<tr>
<td>B1</td>
<td>Yes</td>
</tr>
<tr>
<td>B2</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Almost yes</td>
</tr>
<tr>
<td>F</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Yes</td>
</tr>
<tr>
<td>H</td>
<td>Yes</td>
</tr>
</tbody>
</table>
6. What relationship can best be explained between project controlling, corporate management and site management:

<table>
<thead>
<tr>
<th>Relationship</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project control is closer to corporate management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project control is in-between corporate and neutral</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project control is neutral</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Project control is between neutral and site</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project control is closer to site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. From the respondents experience recommendation for the best replacement for a project controller:

<table>
<thead>
<tr>
<th>Replacement</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical expert</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project manager</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X3</td>
<td>X1</td>
<td>X</td>
<td>X1</td>
<td></td>
</tr>
<tr>
<td>Contract manager</td>
<td></td>
<td>X1</td>
<td>X2</td>
<td>X2</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance manager</td>
<td></td>
<td>X2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Does the respondent’s organization engage an engineering expert for consultation/advice exclusively for controlling process:

<table>
<thead>
<tr>
<th>Company</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>B1</td>
<td>No</td>
</tr>
<tr>
<td>B2</td>
<td>Yes</td>
</tr>
<tr>
<td>C</td>
<td>Yes</td>
</tr>
<tr>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Yes</td>
</tr>
<tr>
<td>F</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>Yes</td>
</tr>
<tr>
<td>H</td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix 3

Access to Data from respondents (E-mails):

---------- Forwarded message ----------
From: "vara burela" <varaburela@googlemail.com>
To: bharath_dunn@yahoo.com
Date: Mon, 7 Jan 2008 21:14:06 +0530
Subject: Re: Fw: questionaire
the mail from Ramgopal with filled questionnaire

On 11/29/07, vara burela <varaburela@googlemail.com> wrote:
---------- Forwarded message ----------
From: Maruboyina Ramgopal < Ramgopal.Maruboyina@networkrail.co.uk >
Date: Nov 27, 2007 6:41 PM
Subject: Fw: questionaire
To: varaburela@googlemail.com

Fyi

-----Original Message-----
From: Maruboyina Ramgopal
To: ’vara burela’ <varaburela@googlemail.com >
Sent: Tue Nov 27 15:30:58 2007
Subject: FW: questionaire

c <<Research Questionnaire.doc>> ompleted

________________________________
From: vara burela [ mailto:varaburela@googlemail.com ]
Sent: 27 November 2007 12:12
To: Maruboyina Ramgopal
Subject: Re: questionaire

Dear Ramgopal.

I had just sent you the questionnaire on your bechtel ID.

I am also enclosing another copy for your immediate reference.

Thank You

vara prasad
On Nov 27, 2007 8:36 AM, Maruboyina Ramgopal <Ramgopal.Maruboyina@networkrail.co.uk> wrote:

Bava – Can you resend me the latest questionnaire?

On Nov 19, 2007 8:56 PM, Maruboyina Ramgopal <Ramgopal.Maruboyina@networkrail.co.uk> wrote:

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The content of this email (and any attachment) is confidential. It may also be legally privileged or otherwise protected from disclosure.

This email should not be used by anyone who is not an original intended recipient, nor may it be copied or disclosed to anyone who is not an original intended recipient. If you have received this email by mistake please notify us by emailing the sender, and then delete the email and any copies from your system.

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Network Rail Infrastructure Limited registered in England and Wales No. 2904587, registered office 40 Melton Street London NW1 2EE

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Subject: RE: Research Questionnaire  
From: "Dirisina, Siv" <DirisinaS@BANTREL.COM>  
Date: Fri, November 23, 2007 01:21  
To: "vara prasad" <vapr0002@student.umu.se>  
Options: View Full Header | View Printable Version

Answers marked red in the attached.

Good Luck!
Dear Respondent,

We request your participation and support our research on 'Construction Project Controls' undertaken as part of Masters Thesis at Umea University.

As per PMBOK(2000), controlling is a three step process i.e. Measuring progress, Evaluating what remains to be done, and Corrective action to achieve or exceed the objectives. Today, there has been increasing importance to improve processes and productivity in construction Industry.

So, we intend to identify factors for effective implementation of project controls with-in the construction industry. This research is being conducted by Vara Burela and Bharadwaj Dunna as part of the requirement for completion of Maters in Strategic Project Management course (December 2007) under the guidance of Prof. Anders Soderholm.

The identity of the respondent shall be kept confidential and shall not be disclosed at any circumstances. The responses will only be used for the academic research and for no other purpose.

So, we request the respondent to kindly take time from his/her hectic work schedule and answer the enclosed questionnaire as early as possible.

If you require clarifications regarding the questionnaire, please call Vara Burela, at +46-730981483 (or) send an email and we shall
immediately respond.

Sincerely

Vara Burela & Dunna Bharadwaj

This e-mail and any attachments may contain confidential and privileged information. If you are not the intended recipient, please notify the sender immediately by return e-mail, delete this e-mail and destroy any copies.

Any dissemination or use of this information by a person other than the intended recipient is unauthorized and may be illegal.

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Subject: FW: Research Questionnaire.doc
From: "Dirisina, Siv" <DirisinaS@BANTREL.COM>
Date: Tue, December 11, 2007 22:56
To: vapr0002@student.umu.se (more)
Options: View Full Header | View Printable Version

thanks David

________________________________
From: Deng, Junxiong
Sent: December 11, 2007 2:55 PM
To: Dirisina, Siv
Subject: Research Questionnaire.doc

Siv,

Done.

Cheers

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Any dissemination or use of this information by a person other than the intended recipient is unauthorized and may be illegal.
Subject: Answer to Research Questionnaire
From: birgit.nilsson@yit.se
Date: Fri, December 7, 2007 13:31
To: vapr0002@student.umu.se
Options: View Full Header | View Printable Version

Hello!

I am sending you Mr Sjölanders answer to your research questionnaire.

With Kind Regards

Birgit Nilsson
Controller Region Nord
Division Rörsystem
YIT Sverige AB

PS. Please send my regards to Prof. Anders Södergren. I was a student in Umeå when he also was a student, and we used to play in the same team at the "Brännbollsturnering". DS
Thanks Alex.

-----Original Message-----
From: Arulprakassam, Aananth (Alex)
Sent: December 10, 2007 5:17 PM
To: 'vapr0002@student.umu.se'
Cc: Dirisina, Siv
Subject: RE: Research Questionnaire

Hi Vara,

Please find attached reference questionnaire completed. As I pointed out at the end of questionnaire, my feedback is based on my experience in previous company. Good luck with your project.

Thanks & Regards
Alex Arul (Aananth ArulPrakassam)
Lead Cost Specialist
Bantrel - RCP site - Coker Silo
Edmonton, Canada
780.410.7111

-----Original Message-----
From: Dirisina, Siv
Sent: December 3, 2007 7:36 AM
To: Arulprakassam, Aananth (Alex)
Subject: FW: Research Questionnaire

Alex,

Please see below e-mail.
Vara is my classmate in B.Tech and is currently doing his masters in construction management in Sweden. As part of his thesis he needs help in answering this questionnaire. Appreciate if you answer based on your experience with Flint. Also I will highly appreciate if you can forward to any of your friends in other companies.

Thanks
Siv

-----Original Message-----
From: vara prasad [mailto:vapr0002@student.umu.se]
Dear Respondent,

We request your participation and support our research on 'Construction Project Controls' undertaken as part of Masters Thesis at Umea University.

As per PMBOK(2000), controlling is a three step process i.e. Measuring progress, Evaluating what remains to be done, and Corrective action to achieve or exceed the objectives. Today, there has been increasing importance to improve processes and productivity in construction Industry.

So, we intend to identify factors for effective implementation of project controls within the construction industry. This research is being conducted by Vara Burela and Bharadwaj Dunna as part of the requirement for completion of Masters in Strategic Project Management course (December 2007) under the guidance of Prof. Anders Soderholm.

The identity of the respondent shall be kept confidential and shall not be disclosed at any circumstances. The responses will only be used for the academic research and for no other purpose.

So, we request the respondent to kindly take time from his/her hectic work schedule and answer the enclosed questionnaire as early as possible.

If you require clarifications regarding the questionnaire, please call Vara Burela, at +46-730981483 (or) send an email and we shall immediately respond.

Sincerely

Vara Burela & Dunna Bharadwaj

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Any dissemination or use of this information by a person other than the intended recipient is unauthorized and may be illegal.
Dear Vara Prasad,

Please find attached the filled in questionnaire.

Rgds

P Ravi Shankar

-----Original Message-----
From: vara prasad [mailto:vapr0002@student.umu.se]
Sent: Saturday, December 15, 2007 5:25 PM
To: P.Ravi Shankar
Cc: prs@ltinfocity.com
Subject: re. research questionnaire

Dear Mr. Ravi Shankar

How are you and your work. I am back to India few days back for a small holiday and need to go back to Sweden in January for a presentation.

I have an urgent request regarding my course work. I need a questionnaire to be filled by you. Request you to take a few minutes from your hectic schedule and kindly fill it.

It is about my research in Swedish University. The topic is on 'Construction Project Controls'. Today, there has been increasing importance to improve processes and productivity in construction Industry.

So, we intend to identify factors for effective implementation of project controls with-in the construction industry. This research is being conducted by Self (Vara Prasad) and Mr. Dunna, under the guidance of Prof. Anders Soderholm.

The identity of the respondent shall be kept confidential and shall not be disclosed at any circumstances. The responses will only be used for the academic research and for no other purpose.

If you require clarifications regarding the questionnaire, please call me on +91-9704197597. Kindly treat this as urgent.
Dear Mr. Vara Prasad,

I am here with sending the questionnaire duly filled.

Regards,

Rahaman

-----Original Message-----
From: vara prasad [mailto:vapr0002@student.umu.se]
Sent: Saturday, December 15, 2007 5:28 PM
To: Fazale Rahaman
Subject: re. research questionnaire

Dear Mr. Fazale Rahaman,

How are you and your work. I am back to India few days back for a small holiday and need to go back to Sweden in January for a presentation.

I have an urgent request regarding my course work. I need a questionnaire to be filled by you. Request you to take a few minutes from your hectic schedule and kindly fill it.

It is about my research in Swedish University. The topic is on 'Construction Project Controls'. Today, there has been increasing importance to improve processes and productivity in construction Industry.

So, we intend to identify factors for effective implementation of project controls within the construction industry. This research is being conducted by Self (Vara Prasad) and Mr. Dunna, under the guidance...
of Prof. Anders Soderholm.

The identity of the respondent shall be kept confidential and shall not be disclosed at any circumstances. The responses will only be used for the academic research and for no other purpose.

If you require clarifications regarding the questionnaire, please call me on +91-9704197597. Kindly treat this as urgent.

Sincerely

Vara Prasad & Dunna.