

Project Management Maturity and Project Success in IT Companies of India

Dr. (Mrs) Babita Kumar

Professor
School of Business Studies,
Punjab Agricultural University,
Ludhiana, Punjab

Mrs Gagandeep Banga

Professor
School of Business Studies,
Punjab Agricultural University,
Ludhiana, Punjab

Ms. Gurinderjeet Kaur

MBA student,
School of Business Studies,
Punjab Agricultural University,
Ludhiana.

Abstract

The present paper analyses the project management maturity, project success, project challenges and the association between project management maturity and project success in IT industry. The survey conducted from large, medium and small firms combined the nine knowledge areas of the Project Management Body of Knowledge (PMBOK® Guide) with a Project Management Maturity Model (PMMM). Results indicate that, integration, cost and communication processes are matured as they are at level 4 in maturity which depicts that processes are managed and regularly measured. Scope, time, quality and procurement processes indicated less maturity as compared to other processes. Least maturity was found in HR and risk management among nine knowledge core areas. Key areas that required special attention are project control processes, informal communication and risk management. Lack of communication between project team members, lack of executive support, unclear business objectives, incorrect auditing of processes, inappropriate formal methodologies and others factors contributed to project being challenged. Quadruple constraint, system use and user satisfaction are important factor for project success. Project management maturity and project success were found to be highly correlated.

Keywords: Project management, Maturity, Project success, IT companies, Project challenges.

Introduction

Over the past decade, organisations have been turning from operations to project management as part of their competitive advantage strategy. The most successful organisations employ project management as a strategic tool to drive change and achieve their business objectives (Rodriguez and Evrard, 2004)

Project Management

As a discipline, project management has grown significantly, with standards, methodologies, international best practice and bodies of knowledge in place to inform practitioners. It is widely believed to have been used firstly developed as a management science by the military during the Second World War. Since then, it has been developed further through a number of stages which includes:

1. Critical Path Planning and Network Planning techniques (1950's and 60's)
2. Planning and tracking integrated time, cost and quality, using integrated computer systems (1970'S)
3. Matrix Management and training in the role of the Project Manager (1980'S)
4. The Project Management competencies (1980's and 90's)
5. Project Management Bodies of Knowledge (1980'S)
6. The other Project Management roles of Sponsor and User (1990's)
7. The measurement of project success for each role (1990's)
8. Management by Project and its use in the management of change (1990's)
9. Programme Management and Project Benefits Management (1990's and 2000's)
10. Maturity Modelling (2000 and beyond)

Good project management is often considered the make or break of any project. The popularity of project management is growing at an increasing rate during the last decade in every field like engineering and construction, manufacturing industries, computer software development, etc. Without a developed project management system, organizations cannot profit fully from the techniques of project management. Now-a-days IT industry is following the project management tools and techniques for all their assignments which are taken up as projects. Information technology projects are planned, monitored and controlled as per project management discipline. In IT industry project management has matured over the years because of its constant usage.

Project Management Maturity

Project management maturity refers to maturity of processes, documentation, management and metrics of the projects undertaken by organisations. Many models have been developed to understand the maturity of project management in various industries. All the fundamentals of project management are very well applied in IT industry. IT project management maturity can be mapped by the nine knowledge areas given in Project Management Body of Knowledge (PMBOK® institute 2000) which is further applied onto a project management maturity model (PMMM). Project management maturity model was developed to study the level of maturity in industries using project management processes. Many organizations have turned to the Software Engineering Institute's (SEI) Capability Maturity Model (CMM) to improve their software engineering processes by setting goals to achieve

higher SEI levels (Beset, 2007).

Need of the study

Many researchers have conducted studies to understand IT project management maturity and project successes in South Africa and US. A number of interviews were conducted with IT project managers, group leaders, business analyst, IT managers, project coordinators representing several industries, to determine the most common reasons for failure and success of IT projects. In India only few studies like Degree of openness and project success have been conducted (Krishnan, 2012). Maturity studies could be undertaken in industries like Information and Communications Technology (ICT), finance and banking, Government & public sector (National, Provincial or Local), construction and civil engineering, manufacturing, transport, wholesaler & retailer and others where project management processes are being followed. No study had been done on the project management maturity and project success in IT industry of India. So it became important to undertake this research in IT industry. IT industry occupies a very important place in Indian economy contributing 7.5% to India's GDP in 2012. IT industry consisting of two major components-[IT services](#) and [business process outsourcing](#) (BPO) exports most of its products. Exports constitute 77% of the total industry revenue. Hence, the specific objectives of the present study were:

1. To study the project management maturity of IT companies in India.
2. To study the project success, challenges and failure in IT companies of India.
3. To study the association between IT Project Management Maturity and IT project success.

Conceptual Framework

Project management is the art of managing the project and its deliverables with a view to produce finished products or service. Project management includes: identifying requirements, establishing clear and achievable objectives, balancing the competing demands from the different stakeholders and ensuring that a commonality of purpose is achieved. As early as 1981, the Project Management Institute (PMI®) started to produce a set of ethics and standards for the project management. Over the years, this set of standards gradually evolved to become what is known today as the PMBoK®. The PMBoK® is an inclusive term that describes the sum of knowledge within the profession of project management. There are nine knowledge areas that are divided into two main categories, namely core functions (scope, time, cost and quality) and facilitating functions (human resource, communication, risk and procurement) with integration management tying it all together. These knowledge areas are subdivided into processes, these can be

mapped onto five process groups, which are initiating, planning, executing, controlling and closing as shown in the table no 1 (Sonnekus and Labuschagne, 2003). These are further applied onto a Project Management Maturity Model (PMMM). Maturity models are frameworks for helping organizations improve their processes and systems. Project Management Maturity refers to processes, documentation, management and metrics. The maturity models define five level of maturity, ranging from 1 (initial process) to 5 (optimized processes). Maturity level 1 is (lowest) - Initial process (no or little formal and /or documented processes being used), Maturity level 2 - Structured processes and standards (Basic processes are in place and used most of the time), Maturity level 3 - Organizational standards and institutionalized processes (majority of project management processes are in place and are used by the majority of people), Maturity Level 4 - Managed processes (All project

management processes are in place and these are regularly measured) and Maturity level 5 - Optimized processes (All project management processes are in place, measured and continually improved upon) (Marnewick, 2012). Today, we find this maturity concept being used increasingly to map out logical ways to measure project management maturity and improve an organization's services-particularly across the software industry. This concept has evolved in IT industry and this is of interest to project management profession.

This study had been conducted to determine the maturity of IT Project Management by mapping the nine knowledge areas of the Project Management Body of Knowledge (PMBok® Guide 2000 Edition) onto a Project Management Maturity Model (PMMM) based on various other maturity models.

Table 1: Mapping of project management processes to process groups and knowledge areas.

| Process Groups → | Initiating | Planning | Executing | Controlling | Closing |
|----------------------------------|-------------------|--|--------------------------|---------------------------|------------------------|
| Knowledge Areas ↓ | | | | | |
| Project integration management | | Project plan management | Project plan execution | Integrated change control | |
| Project scope management | Initiation | Scope planning Scope definition | | Scope verification | |
| Project time management | | Activity definition Activity sequencing Activity duration estimating Schedule development | | Schedule development | |
| Project cost management | | Resource planning Cost budgeting Cost estimating | | Cost control | |
| Project quality management | | Quality planning | Quality assurance | Quality control | |
| Project HR management | | Organization planning Staff acquisition | Team development | | |
| Project communication management | | Communication planning | Information distribution | Performance reporting | Administrative control |

| | | | | | |
|--------------------------------|--|--|-------------------------------|-----------------------------|--------------------|
| Risk project management | | Risk management planning Risk identification Qualitative risk analysis Quantitative risk analysis Risk response planning | | Risk monitoring and control | |
| Project procurement management | | Procurement planning Solicitation planning | Solicitation Source selection | | Contract close out |

(Sonnekus and Labuschagne, 2003)

Project Success

Successful project is a project that is delivered on time, within budget, within scope and complies with the quality requirements. It delivers strong values, the expected value. A challenged project is a project that is completed, but is either late, over-budget or does not meet all the requirements. It delivers moderate value, less than what was anticipated. A failed project is a project that is never completed or does not meet customer requirements. It delivers very little value or no value at all. The factors which contribute towards the project success are: 1. The project manager 2. Project team 3. Project 4. Organization 5. External environment 6. Establishing quantitative and measureable Key Performance Indicators (KPIs) on priority basis 7. Aligning KPIs with business objectives 8. Setting realistic and achievable targets. The project's quality should not be compromised under any circumstances as this will drive away potential customers.

This study helped in understanding the maturity of project management in IT industry of India with the help of PMMM and whether there is any association between project management maturity and project success.

Review Of Literature

Studies conducted by Kwak and Ibbs in 2000 (a&b), 2002 and Kwak in 2001 focused on development of a project management maturity model (popularly called Berkeley project management process maturity model) and an analysis methodology to assess the maturity of project management processes (covering 8 knowledge areas and 6 project phases) across 38 different companies and government agencies in 4 different industries using benchmarking. Berkeley model helped the organization and its people accomplish higher and more sophisticated project management by systematic and incremental approach.

Further Reginato and Ibbs (2002) found that companies with

high project management maturity benefit from a high return on their project management investment (PM/ROISM) and garner a unique advantage in the marketplace due to their superior project management practices. Brooks and Clark (2009) and Kerzner, 2002 evaluated the role of Project Management Maturity Models (PMMM) in improving practice and perform strategic planning for project management. PMMM were typically used reactively and not proactively and that they did not have sufficiently rigorous protocols in the evaluation of project management maturity. For example Kloppenborg and Smith (1999) assessed the project management practices of a project organization in a large pharmaceutical and found that improvement in their practices enabled the organization to carry out their mission more efficiently and effectively. Burns and Crawford (2002) provided a real-life application of a project management maturity model to the New York Times Company.

Major (2002) concluded that with the formation of joint ventures and alliances, projects involving multi-partners have different project management cultures and project management maturity levels. These differences could be handled by introducing project management processes that were simple, pragmatic and applicable to all participants.

Rodriguez and Evrard (2004) determined that successful organization employs project management as a strategic tool to respond to this changing environment and to outperform those that do not adapt. Jugdev and Thomas (2002) determined that project management maturity models are important assessment tools for the professionals. Maturity model identify organizational strengths and weaknesses, provide benchmarking information and in strategy domain context maturity models (MMs) can lead to temporary competitive advantage but not a sustained one.

Jain (2000) made attempt in his paper to achieve six levels of project management maturity at corporate level and for

each level of maturity 20 major attributes had been identified to see the inter and intra relationship between the different levels of maturity. Andersen and Jessen (2003) researched level of project maturity in 13 organizations with a hypothesis that project maturity develops through a maturity ladder where the ladder steps were proposed to be project management, program management and portfolio management. Polley and Clark (2003) presented the strategy and experiences in introducing a comprehensive project management methodology into the Queensland (Australia) Department of Health in order to improve the project management maturity of the organization. Hoard and Craig (2003) found that organizations were currently assessing their project management maturity in an effort to improve project delivery capabilities. Pennypacker and Grant (2003) in a paper addressed the question of how an organization should pursue the development of project management capabilities purposefully over time. They explained how project management maturity models provided a systematic approach to benchmarking, enabling an organization to compare its delivery with best practice or against its competitors.

Sonnekus and Labuschagne (2003) in a survey based on Project Management Body of Knowledge and PMMM undertaken to investigate the state of IT projects in South Africa and comparing it with IT Project Management in USA highlighted three key areas that needed special attention and suggestions were made to improve each.

Sukhoo et al (2003) based their paper on surveys and discussions with software professionals in Mauritius and a methodology for software project management called Evolutionary Software Project Management Maturity Model (ESPM3) was proposed which had three maturity levels and a continuous process improvement group of Key Process Areas (KPAs). So far, few organizations in Mauritius had been found to be using software project management methodologies developed in Western/European countries.

Niazi et al (2003) suggested that different advances have been made in the development of software process improvement (SPI) standards and models, e.g. Capability Maturity Model (CMM), more recently CMMI, and ISO's SPICE. This maturity model had three dimensions--maturity stage dimension, CSF dimension and assessment dimension. It provided a very practical structure with which to assess and improve SPI implementation processes.

Cooke and Arzymanow (2003) highlighted the results of an investigation into the nature and extent of variations between project management practices in 21 organisations drawn from six industries on the basis of 10 domains which were identified using qualitative methods. Differences between companies and industries were found to exist in each domain. Project management models / project maturity

was found to be more developed in the petrochemical and defence industries as compared to industries like pharmaceutical, R&D, construction, telecommunications, financial services. Bay and Skitmore (2006) presented the results of a pilot survey aimed at ascertaining the level of project management maturity in Indonesian companies which were not using project management methodologies. Kerzner's Level 2 assessment tool was used to assess maturity levels throughout the various phases of an organization's project management life cycle (i.e., its embryonic phases, executive management acceptance phases, line management support, growth phases and maturity phases.

A 5 leveled project management maturity model was developed to assess architectural design offices' current Project Management Maturity level by Beset in 2007. Project integration and scope management was highly mature among the other function areas. The least matured function area was the project risk management. Guangshe et al in 2008 analysed the feasibility and limitation of the organizational project management maturity model (OPM3) applied to large construction projects in China like Shanghai Pudong International Airport construction project. One major problem that construction industry was facing in China was its high investment and large scale but low benefit and inferior management. The results showed that OPM3 evaluated the maturity level and also proposed some key points to improve the project management level. Helled (2010) aimed to compare project teams from two organizations where the projects had similar objectives even though they were not competing with each other by benchmarking their organizations against project management maturity criteria.

Project management maturity and project success are correlated as highlighted by the various studies conducted through out the world in various industries using the PMMMs. But no reference of such research has been found in India. Hence the study was undertaken in IT industry to fill the present research gap.

Research Methodology

The research design for this study was exploratory in approach. The study aimed at studying the project management maturity and project success of IT companies in India. Population of the study consisted of all the IT companies (National, MNCs) in India undertaking software development for different companies as projects. IT companies were further classified into three categories for the purpose of the study.

Large IT companies -IT companies that work for large number of different industries or domains and provide them solutions with employees more than 50,000

Medium IT companies - IT companies that work for few

limited industries or domains and provide solution to them in the form of software, projects, internet etc with employees ranging from 25000 to 50,000.

Small IT companies - IT companies that work for very few industries with employees less than 20,000.

Sample size consisted of ten IT companies i.e. 5 large, 3 medium, 2 small size IT companies. Five projects in different industries from each of 5 large-scale companies had been chosen. Hence 25 projects in all had been chosen from large companies. Three projects in different industries from each of the 3 medium-scale IT companies had been chosen. Hence 9 projects had been chosen from medium companies. Two projects in different industries from each of the 2 small-scale IT companies had been chosen. Hence 4 projects in all had been chosen from small IT companies and in all about 38-40 projects had been chosen. Large companies provide projects in many domains and small to one or two domains only.

Companies and projects had been chosen on the basis of convenience and willingness to respond. Primary data had been collected from project managers, project coordinators, group leaders, business analyst, IT managers etc of these companies. Hence in all 38-40 respondents were contacted through mail or face to face interview. The companies had been chosen from Mohali and Pune which are the IT hubs of two states i.e. Punjab and Maharashtra.

To fulfill the objectives, a questionnaire was designed which was divided into two subsections in which questions regarding project maturity and project success were asked. Questionnaire was based on 5-point scale showing the five

maturity levels. Association was tested between the project success and project maturity. The questionnaire was based on the questionnaire developed for a study on IT industry project management maturity and success in RAU Standard Bank Academy for Informational Technology Johannesburg South Africa. Permission was obtained to modify the questionnaires for surveying IT industry in India. Pre- test of questionnaire was conducted in two companies.

Data Analysis

Data had been analyzed by using statistical techniques like mean scores, S.D., single mean t-test, z-test, correlation, regression etc. The relationship between project management maturity and project success was observed through correlation and regression.

Findings of The Study

Findings have been divided into three sections :(1) Project management maturity in nine different core areas (2) Project success and challenges (3) Association between project management maturity and project success.

Project Management Maturity

The maturity of processes undertaken in the nine knowledge areas in IT industry out of which eight are scope, time, cost, quality, human resource, communication, risk, procurement and integration management were understood. Here maturity is checked at the level these companies deliver projects. Respondents were asked to rate the processes in nine core areas on a 5 point scale ranging from 1 (maturity level - initial level) to 5 (maturity level - optimized level).

Table 2: Project management Processes in Large, medium and Small IT companies

| Processes related to the project integration management | Large companies (n=25) | | Medium companies (n=9) | | Small companies (n=4) | | Average of a ll companies (n=38) | |
|--|------------------------|---------|------------------------|---------|-----------------------|---------|----------------------------------|---------|
| | Mean | t-value | Mean | t-value | Mean | t-value | Mean | z-value |
| Working with stakeholders in the development of the project | 3.88 | 6.06* | 4.44 | 8.22* | 4.00 | 2.45 | 4.10 | 22.58* |
| Behavior planning efforts to create a project management plan are coordinated | 4.20 | 7.34* | 4.11 | 5.55* | 3.50 | 1.73 | 3.93 | 15.07* |
| Coordinating changes that affect the project's deliverables | 3.96 | 5.71* | 4.33 | 5.66* | 3.75 | 1.57 | 4.01 | 20.75* |
| Overall | 4.01 | | 4.29 | | 3.75 | | 4.01 | |
| Processes related to project scope management | | | | | | | | |
| Defining and documenting the features and functions of projects. | 4.04 | 6.59* | 4.11 | 4.26* | 4.50 | 3.00 | 4.21 | 29.81* |
| Working with stakeholders in the creation of a project scope statements and definition | 4.00 | 7.07* | 3.89 | 3.41* | 4.25 | 5.00* | 4.04 | 35.59* |

| | | | | | | | | |
|--|-------------|--------|-------------|--------|-------------|-------|-------------|---------|
| Subdividing major project deliverables | 3.36 | 3.16* | 3.89 | 4.44* | 3.25 | 1.00 | 3.5 | 9.05* |
| Controlling changes of project scope | 4.16 | 7.77* | 4.22 | 4.4* | 4.25 | 2.61 | 4.21 | 165.53* |
| Overall | 3.89 | | 4.02 | | 4.06 | | 3.99 | |
| Processes related to project time management | | | | | | | | |
| Defining specific activities that team members and stakeholder perform | 4.12 | 7.72* | 4.12 | 7.72* | 4.00 | 2.44 | 4.08 | 96.41* |
| Estimating resources and duration of work period to complete activities | 4.28 | 9.44* | 4.28 | 9.44* | 2.50 | -1.73 | 3.68 | 5.61* |
| Analyzing activity sequencing for project schedule | 3.64 | 4.23* | 3.64 | 4.23* | 3.25 | 1.00 | 3.51 | 13.65* |
| Controlling and managing changes to project schedule | 3.92 | 7.18* | 3.92 | 7.18* | 3.50 | 1.73 | 3.78 | 20.89* |
| Overall | 3.99 | | 3.99 | | 3.31 | | 3.76 | |
| Processes related to project quality management | | | | | | | | |
| Planning for quality standard and quality assurance for project | 4.04 | 7.07* | 4.00 | 4.24* | 3.75 | 3.00 | 3.93 | 35.80* |
| Controlling specific project results to ensure quality standards | 4.00 | 7.74* | 3.67 | 4.03* | 4.25 | 2.61 | 3.97 | 20.60* |
| Overall | 4.02 | | 3.83 | | 4.00 | | 3.95 | |
| Processes related to project human resource management | | | | | | | | |
| Identifying and documenting project roles and responsibilities | 3.96 | 7.10* | 4.33 | 5.65* | 3.75 | 3.00 | 4.01 | 21.45* |
| Building individual and group skills to enhance project performance | 3.56 | 3.64* | 3.89 | 3.41* | 4.00 | -- | 3.81 | 21.69* |
| Tracking team member performance and development | 2.48 | -3.38* | 4.13 | 3.81* | 3.75 | 1.56 | 3.45 | 3.18* |
| Providing timely feedback | 4.36 | 9.71* | 1.89 | -4.26* | 4.00 | 2.45 | 3.41 | 1.89* |
| Overall | 3.59 | | 3.56 | | 3.87 | | 3.66 | |
| Processes related to project communication management | | | | | | | | |
| Communication plan and defined information distribution path | 4.40 | 9.16* | 4.11 | 4.26* | 4.50 | 5.19* | 4.33 | 40.96* |
| Collecting and disseminating information related to project, forecasting | 4.04 | 7.07* | 3.67 | 4.00* | 4.00 | -- | 3.90 | 27.72* |
| Overall | 4.22 | | 3.89 | | 4.25 | | 4.12 | |
| Processes related to project risk management | | | | | | | | |
| Risk management planning | 3.04 | 0.27 | 4.44 | 5.96* | 3.25 | 1.00 | 3.57 | 4.68* |

| | | | | | | | | |
|---|-------------|-------|-------------|-------|-------------|-------|-------------|---------|
| Risk identification mitigation strategies and risk response and control processes | 3.40 | 3.09* | 3.67 | 4.00* | 4.00 | 2.45 | 3.69 | 14.68* |
| Overall | 3.22 | | 4.05 | | 3.65 | | 3.63 | |
| Processes related to the project cost management | | | | | | | | |
| Estimating of the costs of the resources needed to complete a project | 4.28 | 8.68* | 4.33 | 8.00* | 4.50 | 5.19* | 4.37 | 70.32* |
| Allocating the overall cost estimate to individual work items of project | 3.96 | 6.53* | 4.00 | 4.24* | 4.50 | 5.19* | 4.15 | 23.62* |
| Controlling changes to the project budget | 3.64 | 4.57* | 3.78 | 3.50* | 3.25 | 1.00 | 3.5 | 11.40 * |
| Overall | 3.96 | | 4.03 | | 4.08 | | 4.02 | |
| Processes related to project procurement management | | | | | | | | |
| Planning and identification of supplier and contractor | 3.92 | 7.18* | 3.44 | 2.53* | 3.75 | 3.00 | 3.70 | 17.96* |
| Monitoring contract performance | 4.04 | 7.07* | 3.89 | 3.42* | 4.00 | 2.45 | 3.97 | 76.60* |
| Overall | 3.98 | | 3.66 | | 3.87 | | 3.84 | |
| Overall average | 3.87 | | 3.92 | | 3.87 | | 3.88 | |

$\mu=3*$ At 5% level of significance (t table values for df 24, 8 and 4 = 2.06, 2.30 and 3.18) Ztable value =1.645

Table 2 indicates that maturity level for project integration management is about 4.00 for all companies indicating that project planning is done with the stakeholders and behavior planning efforts to create a project management plan are in place. Planning, execution and control of projects are coordinated across different knowledge areas and across the projects. Project control processes are also integrated to minimize the risk of scope, cost, schedule, and quality management. Coordination of changes that affect the project deliverables is done. In smaller companies behavior planning (3.50) and control of the projects (3.75) is slightly weak as compared to large and medium companies.

Maturity level of the project scope management is 3.99 showing that the product and scope management are integrated to ensure project success. Also, scope-change-control and verification process are documented and integrated. Smaller companies are better in defining the scope, features and functions of project (4.50) and controlling the changes in the project scope (4.25) i.e., planning and controlling of projects.

Completion of projects on time is one of the major challenges for the project managers. Level of maturity in time management for projects has been found to be 3.76 in IT industry showing that the variety of scheduling tools and techniques are available for effective schedule control and formal schedule control processes and practices are integrated. Time management had been better in the large and medium sized companies (3.99) than small companies (3.31).

Project quality means that the project will meet or exceed the quality standard, find and measure variation and improve the quality. Project quality management is at 3.95 indicating that the objectives to achieve high quality project management processes and project quality are integrated. Also, project progress toward accomplishing project quality are quantified, implemented, and integrated. Planning for quality standard and quality assurance is better in large (4.04) and medium (4.00) sized companies whereas control of project results to ensure quality standards is better in small scale companies (4.25).

People work in teams on projects in IT companies. Human resource management ensures effective use of people involved with the projects. Project HR management is at 3.66 maturity level indicating that identification and documentation of project roles and responsibilities is done, both individual and group skills are improved to enhance project performance, team members are tracked for performance and development and timely feedback is provided. Organization is rewarded and recognized by project-oriented teams. But tracking of the team members for performance and development and identification of variances is informally done in large companies (2.48) and feedback is not provided timely or provided informally in case of medium sized companies (1.89)

Open and clear communication among project planners and implementers ensures project success. Project communication management is at maturity level 4.12 showing that communication plans are made and

information on project scope, schedule, cost, risk, quality, human resource, and procurement is collected and disseminated for project performance reporting. Well defined information distribution path is there. Also, communication management processes and techniques are integrated with an organizational structure leading to better administrative control. Planning regarding communication process is strong in small companies (4.50) while collection and dissemination of information is weak in medium sized (3.67) companies as compared to large (4.04) and small organizations (4.00).

Project risk needs proper identification, quantification, formulating risk mitigation strategies and appropriate risk response and control processes. Risk management for projects in IT industry has a maturity level of 3.63 indicating that the organizations use its past experiences for risk identification, response, and control. Potential risk sources are prepared and reviewed for use of other Project Management knowledge areas. Also, risk identification, quantification, and response plans are integrated across multiple projects to minimize the risk. Though large (3.22) and the small scale (3.65) organizations are conscious of the risk associated with projects, but medium scale (4.05) organizations manage risk in a better way.

Projects must be completed within the budgeted resources because cost overruns lead to projects becoming unviable. Cost management of projects is at maturity level 4.02 in IT firms. This means that formal resource planning, cost estimating, and budgeting processes are integrated. Also, project stakeholders have wide perspectives of different project cost metrics. Costing being the mainstay of firms is focused at sharply by all types of firms (Large firms-3.96, medium firms-4.03 and small firms-4.08).

Goods and services required for the project completion require contracting, negotiating the contracts, contract specifications and termination. Procurement management is at maturity level 3.84 for overall industry. This maturity level shows that long term relationships are established between the company and suppliers for delivering consistent project quality, planning and identification of suppliers and contractors and monitoring of contracts is well integrated into the at multiple levels as well as each phase of project management. All the types of organizations show the same maturity for procurement management (Large firms-3.98, medium firms-3.66 and small firms-3.87).

Standard deviation for most of the parameters in large and medium scale industries and overall for IT industry had been found to be significant at 5% level of significance while most of the parameters had been found to be non significant for small scale industry.

Overall maturity level of IT industry is at 3.88 indicating that all project processes are in place, well managed, controlled and regularly measured but not optimized. Less maturity has been found in HR and risk management among nine knowledge core areas. Level of project management maturity showed high chances of project success.

Project Success and Project Challenges

This section discusses the factors affecting the project success and the reasons why projects fail or become challenged.

Factors affecting Project Success

Various factors help in project success. Sometimes one or more factors contribute to the project being successful. Respondents chose multiple options that contributed towards project success.

Table 3: Project success factors in IT companies

| Factors contribute to project success | Large companies (n=25) | | (n=9) | | (n=4) | | (n=38) | |
|--|------------------------|----|-------------------------|-------|------------------------|-----|--------------------|-------|
| | No. of respondents | % | No. of respondents | % | No. of respondents | % | No. of respondents | % |
| Triple constraint (cost, time and scope) | 14 | 56 | 6 | 66.66 | 2 | 50 | 22 | 57.89 |
| Quadruple constraint (cost, time, scope and quality) | 23 | 92 | 8 | 88.88 | 4 | 100 | 35 | 92.11 |
| Delivery of business benefits | 1 | 4 | - | - | 1 | 25 | 2 | 5.26 |
| Meet project requirements | 13 | 52 | 5 | 55.55 | 0 | 0 | 18 | 47.37 |
| User satisfaction | 12 | 48 | 4 | 44.44 | 4 | 100 | 20 | 52.63 |
| Sponsor satisfaction | 10 | 40 | 4 | 44.44 | 2 | 50 | 16 | 42.10 |
| Steering group satisfaction | 10 | 20 | 4 | 44.44 | - | - | 14 | 36.84 |
| | | | Medium companies | | Small companies | | Overall | |

| | | | | | | | | |
|--------------------------|----|----|---|-------|---|----|----|-------|
| Stakeholder satisfaction | 5 | 20 | 2 | 22.22 | 1 | 25 | 8 | 21.05 |
| System implementation | 2 | 8 | 0 | 0 | 2 | 50 | 4 | 10.53 |
| System use | 23 | 92 | 9 | 100 | 2 | 50 | 33 | 86.84 |

*Multiple responses

According to the project managers (Table 3) factors that affect the project success are quadruple constraint (92%) and system use (92%), meeting project requirements (52%) and triple constraints (56%) in large scale companies. In medium scale companies, system use (100%) was the most important factor and adequate handling of triple (66.66%) and quadruple constraints (88.88%) are other important factors. In small scale companies user satisfaction (100%) and adequate handling of quadruple constraint (100%) are most important factors followed by adequate handling of triple constraint and sponsor satisfaction (50%).

Overall, factors that led to project success in IT companies were quadruple constraint (92.11%), system use (86.84%), triple constraint (57.89%), User satisfaction (52.63%), meeting project requirements (47.37%) and sponsor satisfaction (42.10).

Factors challenging project success

Projects face various challenges in all the types of companies and the reasons or factors leading to project being challenged have been identified as follows:

Table 4: Factors challenging project success in IT companies

| Factors leading to project being challenged | Large companies (n=25) | | Medium companies (n=9) | | Small companies (n=4) | | All companies average(n=38) | |
|--|------------------------|---------|------------------------|---------|-----------------------|---------|-----------------------------|---------|
| | Mean | t-value | Mean | t-value | Mean | t-value | Mean | z-value |
| Inadequate handling of change | 2.56 | -3.77* | 3.22 | 1.51 | 2.25 | -3.00* | 2.67 | 4.14* |
| Lack of communication between team and customers | 3.20 | 1.73 | 3.78 | 5.29* | 2.75 | -1.00 | 3.24 | 2.84* |
| Lack of communication between project team members | 2.52 | -4.09* | 2.33 | -4.00* | 3.25 | 1.00 | 2.70 | 3.85* |
| Minimal support of innovative technology | 3.64 | 6.53* | 1.67 | -8.00* | 3.00 | -- | 2.77 | 1.41 |
| Inadequate user understanding of technology | 3.68 | 7.14* | 1.89 | -10.0* | 2.25 | -3.00* | 2.60 | 2.62* |
| Lack of executive support | 2.36 | -6.53* | 3.78 | 5.29* | 3.75 | 3.00* | 3.29 | 2.20* |
| Unclear business objective | 4.00 | 10.00* | 2.33 | -4.00* | 4.00 | -- | 3.44 | 2.82* |
| Misunderstanding of user needs | 3.20 | 1.73 | 2.33 | -4.00* | 2.75 | -1.00 | 2.76 | 3.43* |
| Unclear requirement definition | 2.44 | -4.80* | 3.22 | 1.51 | 2.25 | -3.00* | 2.63 | 4.46* |
| Lack of user involvement | 3.36 | 3.67* | 3.78 | 5.29* | 3.00 | -- | 3.38 | 6.00* |
| Inadequate change control processes | 4.16 | 9.29* | 1.78 | -5.50* | 3.25 | 1.00 | 3.06 | 3.69* |
| Inappropriate formal methodologies | 4.04 | 8.51* | 3.78 | 5.29* | 3.75 | 3.00* | 3.85 | 34.60* |
| Incorrect auditing of processes | 2.36 | -6.53* | 3.33 | 2.00 | 3.25 | 1.00 | 2.98 | 0.23 |
| Other factors | 3.04 | 0.44 | 4.33 | 5.66* | 4.25 | 2.61* | 3.87 | 7.44* |

*At 5% level of significance, $\mu=3$, (t table values for df 24, 8 and 4 = 2.06, 2.30 and 3.18) z value =1.64

Table 4 shows that in large scale companies inadequate change control process (mean score 4.16), inappropriate formal methodologies (4.04) and unclear business objectives (4.00), are the main factors that leads to project being challenged. All factors except lack of communication between team and customers and misunderstanding of user needs were found to be significant at 5% level of significance.

In medium scale companies factors like lack of communication between team and customers (3.78), lack of user involvement (3.78) and lack of executive support (3.7) affected the project efficiency. All the factors except inadequate handling of change (1.51) and unclear requirement definition (1.51) were found to be significant at 5% level of significance.

In small scale companies important factors that challenged a project were lack of communication between project team members (3.25), lack of executive support (3.75), unclear

business objective (4.00), incorrect auditing of processes (3.25) and inappropriate formal methodologies (3.75). All factors except incorrect auditing of processes in small scale companies were found to be significant at 5% level of significance.

Inappropriate formal methodologies (3.85), unclear business objective (3.44), lack of user involvement (3.38), lack of executive support (3.29), Lack of communication between team and customers (3.24) and inadequate change control processes (3.06) that led to project being challenged in IT industry

Association between IT Project Management Maturity and project success

The association between project management maturity and project success was checked using Regression equation. The linear equation obtained was $y = 6.4x - 20.978$. At horizontal axis project management maturity is taken and at vertical axis project success.

Figure 1: Scatter diagram showing relation between project management maturity and project success

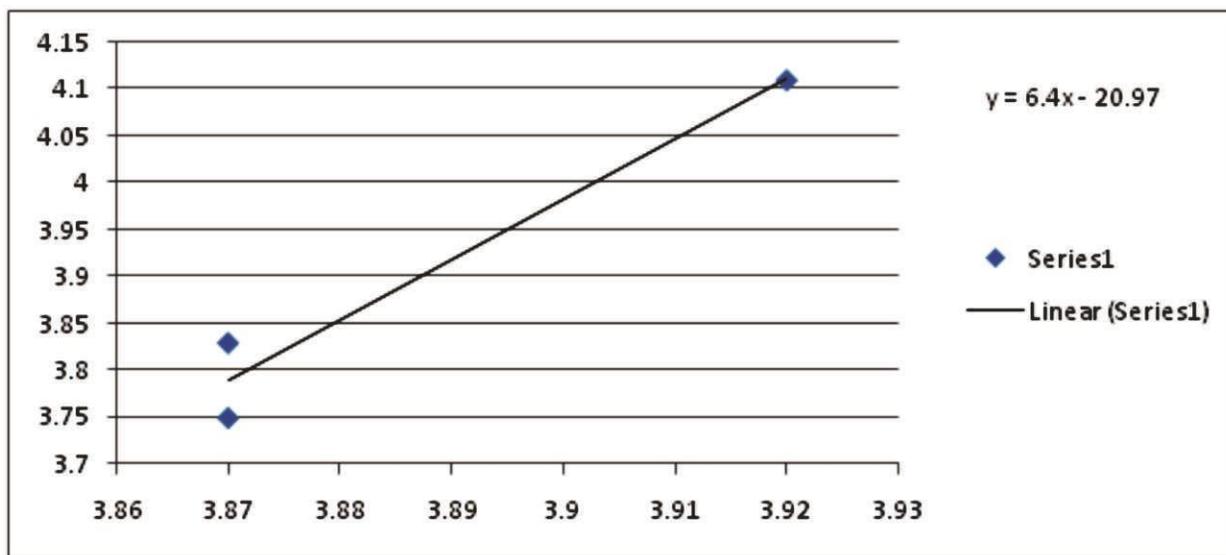


Figure 1 shows that there was a linear relationship between project management maturity and project success i.e, high maturity of project management in IT companies led to project success.

Table 5: Relation between project management maturity and project success

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .977 ^a | .955 | .910 | .0565685 |

a. Predictors: (Constant), PMM

b. Dependent Variable: PS

From Table5 it is shown that R i.e. correlation among project management maturity and project success is 0.977 which indicates that two variables are perfectly related in a positive linear relationship. R2 = 0.955 and the Adjusted R2 =0.910. These values are very close, anticipating minimal shrinkage based on this indicator.

Conclusion

IT industry is project based. IT companies based in Mohali and Pune showed maturity level of 4 indicating that processes are managed i.e, all project management processes are in place and these are regularly measured but not optimized. Project integration management, cost and communication processes are more mature as compared to the rest of the processes. Less maturity has been found in HR

and risk management among nine knowledge core areas. Control processes in the nine areas were lacking the maturity and need to be addressed. It is not enough to plan a project and not control it properly. All the aspects of a project need to be evaluated and controlled at every phase of the project life cycle.

Communication is responsible for the most of the challenges and successes. Since formal communication processes and procedures are matured but problem can only lie on with informal communication. Face to face interviews and other forms of informal communication need attention. Project teams need to bridge gap between technical staff and business staff, thereby giving them a better understanding of the needs of customers, and to deliver better products and services. Risk management also needs attention. Most projects challenges can be avoided and identified and managed before they impact the project. Correlation among project management maturity and project success is high showing the high success rate of projects in this industry and the continuous growth of industry. This study can be further conducted in Benguluru also where most of the IT companies of India are concentrated. Industry needs to take the final step of optimizing processess to be the best in the world.

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