A Framework for IT Project Development in a Large Company

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Abstract

IT project development is a crucial point for the success of any IT organization however delays and increasing costs jeopardize the fulfillment of the business goals. Different research studies on IT project development process confirm that one individual framework is not appropriate for all types of applications. However, reality shows that many companies choose frameworks to run their IT projects based on project type and face dissimilar problems during the execution. In this research we are presenting a framework for IT project development in a large company. The framework has been developed to improve the project IT development due to the fact that many projects have failed to deliver within defined time, cost and quality. In the large company part of our study (entitled in the paper company A) the results of IT projects success rate was significantly low. Therefore, an analysis has been done to investigate the causes for not meeting the requirements. To develop the framework we have used design science research and we have evaluated this framework within company A with project managers. The novelty in this research is that the developed framework for IT project development is based on generic Capability Maturity Model and adapted to the specific needs. The result could be applied to other large companies with similar IT needs and environment.

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1. Introduction

IT (Information Technology) project management and the delivery processes are the vital points to complete a project within agreed time, budget and quality. This statement is supported by all project management organizations according to National Institute of Building Science [1]. PM Solution of Project Management Institute Inc. illustrates that on average 37% of projects failed each year [2]. They also mention five reasons for why projects failed which are related to poor requirements, managing resources, impractical schedules, weak planning and unrevealed risks. To become successful in IT project development, it’s important to have a clear idea on these five failure issues and to take necessary steps to overcome it. In today’s business world it is important for every organization to have a well defined project management process and to follow that process strictly to achieve the best result [3-4]. It is also very significant to pursue a well recognized method to run IT projects successfully. Moreover, a well-organized IT project development framework helps a company to improve its productivity as well as the business competitiveness and provide better services for their customers [5]. But it is impossible to have one process for all type of IT projects like ERP (Enterprise Resource Planning), sourcing, HR (Human Resources) and so on. Depending on project size and others criteria, organizations choose agile, waterfall or other models to complete their projects [6]. Experienced project teams adopt waterfall model while their clients knows accurately what they desire and nothing changes other than fixing problems. On the other hand when project scope is not fixed and the feedback requires from the client to proceed on, the next steps are the selection of an agile model that can provide the best results [7-8]. Therefore the project manager needs to have a clear idea about the differences between project lifecycle and system development lifecycle. Project models are important for system development whereas time, cost and quality issues are mainly related with project lifecycles [9]. Often requirements are not possible to be defined at the beginning of the project, which makes the project development more complicated. Nowadays, many companies have decided to follow an outsourcing strategy for their IT projects [10]. Depending on different situations, project managers faced different complexities that require vast knowledge and experience to overcome that situation. That’s why an IT project framework is so important to run projects successfully within a defined time, cost and quality. A project framework is an organized approach to present clarity the project’s objectives with a sequence of check points at which advancement and consequence is possible to review and check. Moreover it provides a set of procedures for daily management of project group including roles and responsibilities of key project members [11]. The development of the IT project framework has done in Company A (due to confidentiality it is not possible to mention the company name) has one major business objective, which is to be the best in service and project delivery process. In fact Company A is a large European company and it’s running their business successfully for a long time. According to European Commission classification, Company A is a large company because is having more than 250 employees and has annual turnover more than 50 million EUR [12]. Our research has been performed in company A where we have analyzed all the IT projects from the year 2010 run by the project management group. This group is responsible to continually improve the quality, efficiency and effectiveness of the operations and its deliverables. They perform this development through management of scorecard, performance measurements and continuous improvement activities within processes. As we have noticed many research papers have focused on the problems on project management process, development of project models and methods, project management organizations culture and so on [13]. On the other hand researchers like Jianbin et al. [14] have developed a heavyweight IT project management framework based on agile method that is focusing on complexity product system of an IT project. Moreover Ulusoy and Özdamar [15] have proposed a framework that is suitable for interactive project scheduling system with limited resource while Andersson [16] has proposed a framework that is focusing on project result improvement. All these frameworks are suitable more or less for specific type of projects. More exactly it is possible to say that these
frameworks work for a specific purpose. But in order to address the problem regarding the project failures in company A, none of these frameworks for IT project development can support the specific needs of this research. Therefore in this paper we will present a framework for IT projects development by addressing the critical aspects for successful project development in Company A. On the other hand the IT project framework is based on generic Capability Maturity Model (CMM) and is adapted to the specific needs but the result could be replicated to other companies with similar IT needs and environment. The next sections of the paper start with the research background regarding IT project development, capability maturity model and the IT project framework currently used in company A. Furthermore, we have presented the research methodology used in this study and the design of framework for IT projects development in company A. Finally last section presents a discussion of the results and the conclusions.

2. Research Background

2.1. IT Project Development

Accomplishment of IT projects highly depends on exact alignment of IT and business strategy that need to be clear, coherent, and flexible [17]. According to Cadle and Yeates [9], before start a project, a detailed business case is important to be prepared which can provide a clear picture of projects’ scopes and values. There are many types of IT projects like development, implementation, and infrastructure etc. but the general principles of managing any IT project are basically almost the same. Project development process includes a set of structured procedure to accomplish the exact and unique result within a predefined and limited amount of time period. The project manager always needs to remember that there are some distinctions in structure of each type of IT project work. Meredith and Mantel [18] mentioned that, for a successful IT project, it is important to have a clear understanding about project organization and about the role of each participant including customer, major decision maker, steering group and so on. Big organization that runs many projects at a time needs to have a program and project management office to present senior managements with an independent overview of projects that is different from the projects’ own organization [19]. Project initiation mainly starts with requirement identification, project planning, and risk management preparation and by allocation of resources. Main project delivery task includes reporting, time recording, documentation, configuration management, monitoring and control, stakeholder management, change control, procurement, training and so on based on specific project type. Moreover, reviews of the project and benefits realization are also important activities after project completion [20-21]. Project Management Institute [22] defines project as “a temporary endeavor undertaken to create a unique product or service”. Company A is used General PROPS (PROjektet för ProjektStyrning) as IT project framework which defines project as “a non-recurrent, time-limited and budget undertaking, for which a goal has been set”. These two definitions are pointing out that success and failure factors for IT projects depend on planned time and budget. It is also important that the project outcome is needed to be unique that will fulfill the project goal. It seems difficult to list all success factors for an IT project development as they are not ideal for all types of projects within IT. According to Kerzner [17], very few projects are completed in real life without scope changes on time, cost and quality, which mean that success, still occur without exactly fulfilling everything defined in the project plan. Moreover if customer doesn’t accept the project outcome then it turns into failure. The reason behind the failed project also shows different scenarios based on defined project scope and current situation. Project participators, communication process, collaboration and knowledge sharing mechanisms are important factors for a successful project [23]. The common success factors [9, 22, 24-25] for all type of IT projects are as follows: Clear goal of the project; Clear statement of requirement specification; End user participation; Support from top management team;
Experienced and skilled project manager; Experienced and skilled project team members; Proper planning of the project; Adequate resource allocation; and Proper communication and project tracking plan.

2.2. Capability Maturity Model (CMM)

Project management maturity model characterizes organizations standard and shows a way to reach a higher level of maturity by improving project success with organizational performance [26]. Maturity model is a tool to enhance project management practice. It covers different important areas for organizational improvement like Project Management Office (PMO), management oversight and professional development. In this research, Capability Maturity Model (CMM) [27] has been used to understand the necessary activities for IT project development. CMM is organized on five levels, which are initial, repeatable, defined, managed and optimizing. Each level of CMM consists of major project management characteristics, factors and processes with clear goals and top level activities. In this research we have also used six key process areas (KPA) of level 2 that are essential for any IT project development organization. Every KPA identify one or more goals and a couple of actions. These actions are essential to achieve the defined goals. Level two named “repeatable” have six KPA as are below mentioned: Requirement Management (RM); Project Planning (PP); Project Tracking and Oversight (PTO); Subcontract Management (SM); and Quality Assurance (QA); Configuration Management (CM).

2.3. The IT Project Framework Used by the IT Project Group in Company A

PROPS [28] is a project model managed by Semcon corporation which is a global technological company. This model is used by different companies to run their projects [28]. Company A, use ePROPS model for IT project development as a framework which is a PROPS application used for internal changes and process improvement projects [29]. Project manager and management group follow this model and use their own experience and best practice for project development, management and delivery process. In opinion of Kerzner [30] PROPS is one of the most successful methodologies that are possible to apply in all types of organization for different sizes of projects. This framework is mainly divided into three parallel responsibility areas namely project steering process and tollgates (TG), project management process, and project work model. Tollgates are formal, planned, predefined decision points that pointed out in PROPS model by TG0 – TG5 [29]. Different milestones (MS) have decided which is not fixed in number. The MS are used before and after TG’s to check the deliverables from project process in different project phases.

- Project steering group is responsible for project steering process and for all tollgates. Project sponsors take tollgate decisions as planned accordingly, and assess value for each tollgate related to the project risk. This assessment shows the project’s condition and helps to take future decision [29].

- Project management group is responsible for project management process. They confirm all mandatory activities like TG decisions, assignment specification, etc. according to project portfolio management process. This process is divided into six generic phases which are project analysis phase, project planning phase, establishment, realization, handover and project conclusion phase. Analysis and planning phase define project deliverables that are the direct inputs for project delivery precision measurements and is the basis for project exit criteria. The whole procedure of this process includes activities like project planning, quality management, risk management, cost-benefit analysis, change management, financial management, communication plan, reporting, sourcing, documentation management, etc. from project start to end [31].

- Project work model contains tools, methods and project description for specific project. This area decides how to develop project outcomes and to deliver results. All these activities steer up to a successful implementation and delivery project outcome as is mentioned in project specification and plan [29].
3. Research Method

In this research we have used design science research method in order to develop an IT project framework as an artifact that is based on empirical facts from Company A. In this method, facts and features for each critical area and its solution are gathered in the development and application of the designed artifact [32]. According to Peffers et al. [33], design science research methodology for IS research consists of six activities. These activities are in number of six and are the followings: problem identification and motivation; define the objectives for a solution; design and development; demonstration; evaluation; and communication. In this research we have as case study Company A to address the particular problem for answering the research question. Every projects and project areas have its own characteristics that could be considered as a single case. In order to collect the data from Company A, observations, document studies, a survey and interviews have been performed in this research. Both qualitative and quantitative techniques have been used to maximize the benefits and to provide the complete understanding for the analysis purpose [34]. As this research is based on improvement of IT project development, the qualitative data are mainly gathered from the analyzed projects reports and from observation processes in Company A. The discussions we had with the project related personnel like project managers and project area managers, has helped us to gather additional valuable information. Finally, to understand the priority of each KPA and to collect data about this issue a survey has been done in Company A among the project managers, as a quantitative technique.

4. Design of the framework for IT projects development in Company A

4.1. Problem Identification and Motivation

Most companies encounter problems to complete IT projects according to agreement, which is a crucial point to become successful. If projects failed to finish according to project plan that means project is not possible to complete within defined time. When project time increases, it automatically increases project cost and decreases the project quality. Company A measure project’s success rate by their defined Key Performance Indicators (KPI) that checks project’s scope, communication, proactiveness, skills, business value, time and cost. In Company A in the year 2010 a number IT projects have failed to be completed according to their KPI target level. In fact we have found that in Company A at least 75% projects should be finished according to agreement and have a successful IT project development. Therefore, the identified problem and motivation of this research work is to find out why these IT projects failed to achieve the KPI’s target levels. To identify the problem we have studied mainly the documents of the finished projects in 2010. Moreover we have analyzed the ePROPS framework, the KPI’s, project manuals, log files and other related documents in order to provide understand the IT projects development and the problem area. All of these documents are internal documents of company A. Apart from this activity we have reviewed the related research literature on project management to identify the main issues regarding IT projects success and failure. The research done in Company A has started with the analysis of failed IT projects (37% from all the IT projects) that have provided information about the reason behind not meeting the objectives and planned time and cost. From this analysis we have found that change requests, quality issues related to testing, resource problems, supplier management, and problems with configuring the projects documents, coding and product come are some of the main reasons. Moreover the information gathered from project managers’ experiences and the lessons learned have finally been mapped into the analysis to perceive the inner idea about each KPA. To understand these project documents, pilot studies have been performed on a couple of finished projects with the assigned project managers. This has helped us to understand the companies’ working processes and also their procedures, methods, and tools that are used for IT project development. This overall study phase has helped
us a lot to understand the terminologies used and the working process in IT projects development in Company A. All these internal documents have been chosen to understand the problems and also to identify the overall impact on different IT projects area like Human Resources, ERP, Finance, etc. The result of the analysis of the project documents has shown that 38% projects have missed KPI’s target level because of the requirements management problem which is related to KPA - Requirement Management (RM). This has happened due to new change requests. All the failed IT projects have missed either time plan or budget, which is related to KPA - Project Planning (PP). A number of 65% of IT projects have suffered in tracking and oversight problem that is connected with KPA - Project Tracking and Oversight (PTO). The problem with managing the subcontracts has occurred in 50% of IT projects which are linked with KPA - Subcontract Management (SM). A number of 44% IT projects have suffered in quality issue that shows connection with KPA - Quality Assurance (QA). Finally, 18% of IT projects were responsible in managing issues of configuration management and directly related to KPA - Configuration Management (CM). From these IT project documents analyses, it is obvious which KPA is more important in project delivery and how the improvement process could be done in a more efficient way. According to company A’s KPI, 75% of IT projects need to fulfill measurement levels. Therefore, if one KPA’s impact is less than 25% that KPA can be discarded from the consequence list. In that case, from the project documents analysis, the most critical factors for IT project success are PP followed by PTO, SM, QA and RM. Where CM is 18% responsible for the failed IT project, which is less than the target level of KPI.

4.2. Objective for a Solution

The objective is to develop an artifact respectively a framework that will ensure a successful IT project development. The intention behind this artifact is to decrease the project failure rate in Company A. This artifact is based on analysis of the Company A’s used IT project framework and it will be easy to be adopted by every project manager. The IT framework will provide them simple guidelines, which are important to be followed during IT project development. The framework is divided in six Key Performance Areas (KPA) and is according to level 2 of CMM model, which is the basic of IT project development. Every KPA has one or more goals and contains a couple of activities that need to be checked during IT project development. Applied technique for data collection in this activity level is a questionnaire used to perform a survey and collect the requirements for the IT project development framework. For every KPA, a numbers of questions have been developed in order to provide answers on the important activities that need to be performed for each KPA. Moreover, a survey has been done among project managers to collect their comments within a short time and also as an efficient way to collect their requirements. The survey data has consisted of 63 multiple choice questions on six different KPA on IT project development. All the questions of this survey have five options where the first two answers are positive, the last two are negative and the middle one is neutral. If in the survey data, 50% of responses are positive then this means that the quality factor is handling in a good way otherwise it needs a further investigation. The six KPA have some common quality factors like organizational policy, resource & funding, measurements, review process, training and so on. The questionnaire used in the survey has been submitted to those personnel who were directly involved within the failed IT projects, in order to get a general overview of their project handling process. With the data collected from this survey, we finally summarized which KPA is handled in a better way and which one needs further control. Also the survey has shown us the important activities that are missing and the knowledge area of IT project people. The data analysis has first been performed for six KPA separately and then all combined to prioritize the important issues. From the analysis of these six KPA, it is obvious that current project management and delivery process are needed improvements on some specific features like training and quality assurance activities. Moreover the last KPA - CM is one that needs improvements in almost all activities. This survey
analysis have also provided important information related to IT project personals knowledge area that plays an important role in project management and delivery process performance. The analysis has shown that four KPA have more than 50% activities that are missing or may be not aware by the IT project personals. Furthermore two areas like PP and PTO are more common and well known by IT project personal. So the priority list according to missing activities is CM followed by QA, SM, RM, PTO and PP.

4.3. Design & Development of Proposed Framework for IT Projects Development

The framework for IT project development will help project managers to work with complex technology that ties together a bunch of components into a more useful object. When the project team will follow the defined framework then less complexity will show up and will be possible to have a flexible application. Everyone in the project team can easily test and debug the system even when someone is completely new in that project. During the literature study and the analysis, CMM has been found very useful for the development of IT project framework. The project group in Company A, has found this framework usefully for their IT project management, development and delivery process as it follows all the stages from project initiation to end and describes the most important criteria that are needed to be checked. Moreover the IT project framework shows the importance of each area individually and also is helping to find out the gap in their current working process. The framework that has developed for IT project development in Company A, by following Paulk et al. [27] is shown in Table 1.

Table 1: IT Project Development Framework

<table>
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<tr>
<th>KPA</th>
<th>Goal</th>
<th>Activity</th>
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| RM  | • To establish a baseline  
• To keep consistent with system | • To review requirements  
• To use allocated requirements  
• To review changed requirements |
| PP  | • Documented project estimation  
• Documented activities and commitments  
• Commitments agreed by groups | • Working group participate with proposal team  
• PP initiated in early stage  
• Working group participate in the project plan  
• Management review plan made by individuals  
• Identify life cycle  
• Plan developed according to documented procedure  
• Plan documented  
• Identify work product to maintain and control project  
• Estimate size or any changes happen according to documented procedure  
• Estimate effort and cost  
• Estimate critical resources  
• Schedule derived according to plan  
• Various risk identified  
• Plan for support tools and facilities  
• Record planning data |
| PTO | Track actual result against plan  
|     | Take corrective actions  
|     | Agreed changed commitments by groups  
|     | Development plan documented to track activities and communication  
|     | Revised plan according to documented procedure  
|     | Changes reviewed with management  
|     | Approved changes to commitments  
|     | Changes track and corrective actions taken  
|     | Effort and cost tracked and corrective actions taken  
|     | Critical resources tracked and corrective actions taken  
|     | Schedule tracked and corrective actions taken  
|     | Technical activities tracked and corrective actions taken  
|     | Various risk related to project tracked  
|     | Measurement data and preplanning data recorded  
|     | Occur periodic internal review to track progress and issues  
|     | Formal reviews occur according to milestones  

| SM | Subcontractors selected by prime contractor  
|    | Commitments agreed by both contractors  
|    | Maintain ongoing communications  
|    | Track subcontractors performance by prime contractor  
|    | Documented procedure followed to define the work  
|    | Subcontractors selected based on ability listed in documents  
|    | Contractual agreement used to manage subcontract  
|    | Subcontractor’s plan reviewed by prime contractor  
|    | Track activities and communicating status by using documented plan  
|    | Changes occur according to documented procedure  
|    | Prime contactor’s review subcontractors status  
|    | Periodic reviews and interchanges held with subcontractors  
|    | Milestone selected to formal reviews  
|    | Prime contractor’s SQA group check subcontractors work quality  
|    | Prime contractor’s CM group check subcontractors activities  
|    | Prime contractor perform acceptance testing of subcontractors delivery product  
|    | Subcontractors performance evaluated periodically  

| QA | Planned activities  
|    | Verify products and activities by adherence  
|    | Inform activities and result to groups  
|    | Inform management about noncompliance issues  
|    | Prepare plan according to documented procedure  
|    | Perform activities according to plan  
|    | Participate SQA group in project plan  
|    | Review activities to verify compliance  
|    | SQA group audits selected to verify compliance  
|    | Send report and activities to project group  
|    | Identify deviations and documented  
|    | Perform periodic reviews  

| CM | Planned activities  
|    | Identify and control products  
|    | Identify and control changed products  
|    | Inform status to group  
|    | Prepare plan  
|    | Documented and approve plan  
|    | Establish repository for baseline  
|    | Place work product under CM and identify  
|    | Changes occur according to documented procedure  
|    | Control baseline changes according to documents  
|    | Control release  
|    | Record status  
|    | Baseline contents and report present to group  
|    | Baseline audits follow documented procedure  

### 4.4. Demonstration of the Framework

We have found that it is possible to use this framework in Company A in IT projects development. Based on projects areas, projects managers can decide which activities are more important and then they can take the necessary actions. Detailed discussion of how every KPA, goals and activities are useful for project development process has been done with the project personnel and also with those managers involved in the project steering and management process.
4.5. Evaluation of the Framework

The developed IT project framework has been evaluated by holding 14 interviews with project managers. The interviewees have agreed about the usefulness of developed framework to improve IT project development. For this purpose face to face interviews have been performed to provide interviewee with the opportunity to discuss and comment the framework. The main intention of these interviews was to gather project managers’ opinion about selected KPA and its impact on project development process. During this interview sessions, questions have been selected from their survey responses and also from their project documents. The interviewees have answered about the reasons behind the missed KPI’s on their projects and the possible way to overcome those problems in future IT projects. They also have mentioned about ongoing activities and process about each KPA associated to their IT project area. Based on these discussions, finally they have provided valuable information about the required effort to improve the KPA from current state, and the value that will be possible to achieve from that improvement. In this way all the gathered data from fourteen interviews are merged together to find out the average effort required versus the value achieved for each KPA. If a high value is possible to be achieved through a low effort then that KPA deserve higher priority than others. The interviews have shown the need of improvement on PP, QA, SM and CM, KPA that will bring more value than the others two areas PTO and RM.

4.6. Communication of the Framework

In the design of the framework the last activity we have performed was done through the publication of this paper.

5. Discussion and Conclusions

The proposed framework for IT project development in Company A is based on the analyzed project group’s working process, on their project framework (ePROPS), and the CMM model. The framework has enabled the project managers to find the project problems that are linked to their working process. The proposed framework is divided into six KPA because all IT projects that failed had serious issues with these six areas. In the framework every KPA identify a couple of goals that are important to IT project success. Related to those goals and number of activities mentioned in the framework these will help project managers to accomplish these goals. In this way, the framework shows that it is useful for improving the actual IT projects development in Company A. A generalization of this result must be first tested in different development environments that are recommended as further work. The design science research method has been used to develop the framework that identify the reasons behind KPI’s of the failed IT projects and shows a possible way of improvement. The utility of the framework has been demonstrated and accepted by the project managers in Company A. The research work disclose some key characteristics of the troubles faced by IT project management in Company A and has came up with a IT project development framework. The developed framework can be usefully for other IT projects development in other large companies with a similar IT project development environment, requirements and skills, and used with the necessary adoptions.

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