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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESIS (ES)

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

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IN SEARCH OF EXCELLENCE IN SOFTWARE DEVELOPMENT PROJECT: A STUDY

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ABSTRACT

Methodologies developed for use in western countries may not be totally suitable for developing countries. The selection of appropriate software development methodologies for a given project, and tailoring the methodologies to a specific human culture have been dealt with since the establishment of software development as a discipline. Nowadays, the nature of the projects has changed to be unique, uncertain, complex and innovative. It becomes hard to plan in advance the project development, as deviations from plans and unpredictable changes occur more frequently. This can be specifically observed in the software development industry which needs to constantly meet customers' rapidly changed requirements. Therefore, it becomes important and necessary for company management to know how to select a suitable method for the new software development project to get the maximum benefits. This paper reports on how we can understand and support the software projects development, project planning based on a literature study and an industrial study. The main emphasis of the study was on how to support the management of software development projects. Contemporary literatures on software project are reviewed and presented. The objective of the paper is to improve the management practices of software development project.

KEYWORDS

software projects, project management, software engineering, software cost estimation, software development management, project success, project planning.

1. INTRODUCTION

Software Engineering is a field without too much historic background since it is less than four decades old. Software engineering covers the development of software systems. Software engineers focus on applying systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software.

Software Projects are discrete but multidimensional activities that serve as vehicles of change. However, it is not easy to develop a consistent view of the problem because of this multidimensionality. In the drive toward formalizing software project management as a distinct discipline, there has been much discussion on the nature and definition of project success, but no consensus has emerged.

In software development, testing and maintenance, as in other large scale engineering activities, effective project planning is essential. Failure to plan and/or poor planning can cause delays and costs that, given timing and budget constraints, are often unacceptable, leading to business – critical failures.

Traditional tools such as the Project Evaluation and Review Technique (PERT), the Critical Path Method (CPM), Gantt diagrams and Earned Value Analysis help to plan and track project milestones. While these tools and techniques are important, they cannot assist with the identification of optimal scheduling assignment in the presence of configurable resource allocation.

Software engineering literature like Roger, 2005 and Sommerville, 2010 focuses on project management and effort concepts, but the emphasis is on effort estimation and effort related planning (e.g., scheduling) rather than on the total management of effort. Effort has not been seen as an independent area of management like risk or quality. Literature discusses risk management, quality management and configuration management individually but effort is covered as a part of software project management.

Project planning has become of great importance for software development, which has forced the industry to make fundamental changes of the planning paradigm. Planning begins with requirements that define the product and project.

Research points out that an important factor in project success is thorough planning in the early stage of the project life-cycle(Mantel et al., 2001). Some argue that too much planning may endanger the project(Meredith and Mantel, 2009) and moreover claim it may obstruct creativity(Dvir et al., 2003). However, although planning does not guarantee success, at least a minimum degree of planning is required, since lack of planning most likely will guarantee failure.

When project managers and project teams are engaged in day-to-day project execution, they typically are not focused on the business aspects. Their focus and attention, rather, is operational, and their mindset is on "getting the job done." While this mindset may focus on doing the job efficiently, i.e., not waste time and money, it may lead on to disappointing business results and even failure. Moreover, current study aims at analyzing the software project development, planning and success. The research is based on both literature reviews and software industry studies. The objective of the paper is to improve the management practices of software development project.

2. LITERATURE REVIEW

2.1. SOFTWARE CRISIS

This term refers to the problems in the early history of software development when programs were developed following unsystematic and random methods. As the programs became more complex more programmers would be added and the results were: late delivery of software, software not meeting the intended needs, programs not adaptable to changed circumstances, and many errors were detected after product delivery, which led to difficulties in maintaining software. These problems were referred to as the software crisis, (Friedman, 1989; Van Vliet, 2003; Olerup, 1991; Yeh, 1991; Pressman, 2000; Brooks, 1987; Naur,1996;Glass, 1998; and Shemer, 1987).

The software crisis spanned over three decades from the 1960s to the 1980s during which some projects resulted in huge overspends, wasted money, unacceptably long development timeframe, caused property damage and a few projects caused loss of life, (Glass, 1998; Bryant, 2000 and Brooks, 1987). Some used the term software crisis to refer to their inability to hire qualified personnel. The software crisis was originally defined with regard to productivity, but evolved to emphasize quality, (Glass, 1998;Bryant, 2000 and Brooks, 1987). The software crisis not only refers to problems associated with approaches to developing software but also includes the broader aspects of how to maintain software. Efforts towards solving these problems led to the birth of a new discipline called Software Engineering ascribed to the 1968 NATO Software Engineering Conference held in Garmisch, Germany. The rationale behind the engineering solution was to develop a set of standards that would regulate the approach to developing software. A methodology called the Waterfall Model, also commonly known as the Classical Software Engineering Paradigm, SDLC (Software Development Life Cycle) was developed.

According to Boehm and Turner (2004) the strengths of the SDLC lie in concepts such as *process improvement, processcapability, organizational maturity, process group,* and *risk management* as explained below:

- *Process improvement* –a set of activities designed to improve the performance and maturity of the organization's processes.
- *Process capability* –the natural ability of a process to produce planned results. Process capability leads to process predictability and measurability, which results in effective elimination of causes of poor quality and productivity.
- *Process predictability* is a highly debatable concept because some in the methodology fray consider it a limitation instead of a point of strength.

- *Organizational maturity* – refers to the organization's ability to apply common standard processes across the organization.
- *Process group* – a collection of specialists that facilitate the definition, maintenance, and improvement of the processes used by an organization.
- *Risk management* – an organized, analytic process to identify uncertainties that might cause harm or loss.
- *Verification and validation* – verification is concerned with technical details of whether the product meets the specification as detailed in the functional and non–functional requirements, in other words the product has been built the right way. Validation is less technical and it aims at ensuring that the product does what the customer wants it to do, in other words the right product has been built (Sommerville, 2004). These two checking and analysis processes generally reveal product defects.

Schwaber and Beedle (2002) argue that defined and repeatable processes only work for tackling defined and repeatable problems with defined and repeatable people in defined and repeatable environments, which is not possible in today's fast changing business environments. The essence of the problem is that traditional software engineering is based on repeatability that was derived from the other engineering disciplines such as civil, electrical and mechanical where repeatable processes are not only possible but are a virtue. However, issues of software development are different in two ways:

- **Aesthetically** – in the traditional engineering fields for example a draughtsman may design and draw the diagrams for a bridge but he/she will not necessarily build the bridge. Yet in software development it does not work well if the designer is not the programmer (Beck, 1999).
- **Application area** – the requirements for building a bridge would not normally change, but the business environment for which software is built are always changing.

The limitations of the classical software engineering paradigm are rooted in sequential thinking which focuses on the activities presumed to be necessary to produce a result and assumes that one has nothing to learn so that each activity can be completed in sequence, (Larman, 2004 and Hoffer, George and Valacich, 2004).

The paradigm therefore tends to be predictive and assumes that business requirements can be accurately predicted. Therefore some techniques have been developed since the early 1980s to try and predict requirements and control their stability, (Davis, 1980). To try and solve some of these problems many methodologies emerged from the early 1970s up to this age. The emergence of methodologies led to a new challenge of finding the best methodology for a given situation, which is usually called the methodology jungle. Despite the tremendous growth in the discipline of software engineering, the irony is that the problems that led to the software crisis still remain though in relatively smaller percentages as confirmed in the CHAOS report of the Standish Group International (1994) and the subsequent reports. Details of problems that led to the software crisis are well documented in (Pressman, 2000; Brooks, 1987; Naur, 1996 and Shemer, 1987).

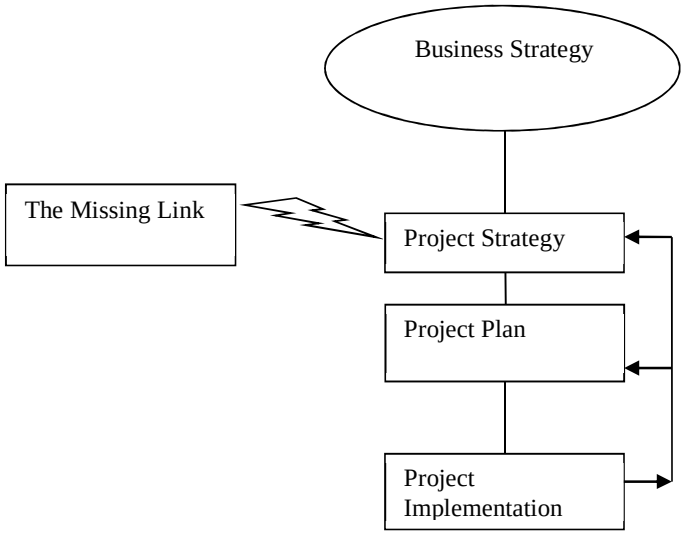
This section summarized literature on the software crisis. The general tone of published research on the software crisis is that the software crisis problems found in the nineteenth century are still the same as those of the twenty–first century. There is in fact a fundamental difference because over the past two decades or so (1980s to 2000s) a lot of maturity in terms of planning and management has been introduced into software engineering from both teaching/training and practice. This kind of growth has resulted in the delivery of high quality software which is also very complex. Therefore maintenance problems of the 1980s are different from maintenance problems of the 2000s hence the original definition of software crisis may not be relevant to the situation of the 2000s. Innovations to the existing software technologies continue to improve on the quality of software engineering.

2.2. STRATEGY IN SOFTWARE PROJECT

Projects are defined as temporary organizations and processes that have been set to achieve certain goals under the constraints of time, budget, and other resources. Projects conceive of goals, structures, processes, and of course resources. Unlike on-going operations, each project is unique, and to some extent, "first of its kind." Furthermore, projects are initiated to implement business, corporate, or organizational goals into action.

They are the vehicles with which organizations execute their strategies, things get done, and decisions are being implemented. One may ask then, do we need to deal with a concept called project strategy? Typically, most projects would start with a project plan. The plan normally includes the project goal, project scope, project deliveries, project milestones, project resources, and activities for execution. Also typically, projects are initiated as part of a grand-plan, which is consistent with business strategy and conceived at the corporate or business unit level. While some projects do better than others, conceptually, there is a missing link – between the business strategy and the project plan. We call this link the *project strategy* (Figure 1).

FIGURE 1: PROJECT STRATEGY – THE MISSING LINK



Project strategy is defined as the project perspective, direction, and guidelines on what to do and how to do it, to achieve the highest competitive advantage and the best project results. With this definition we could suggest that project strategy is a combination of elements, some of them taken from Mintzberg's five "P" framework. First, it is a perspective. The perspective creates the proper view and approach to the project. But strategy is also the direction and guidelines, which will define the path to take and will direct behavior. The perspective and guidelines are used to select the project product, the *"what to do"* part, and to decide on ways of action, namely, the "how to do." And finally, strategy is the position we wish to accomplish, namely, the "competitive advantage".

2.3. PROJECT PLANNING

A project may be defined as a planned undertaking, designed to achieve certain objectives within a given budget and within a specific time interval. The Project Management Institute (PMI) defines a project as a "temporary endeavor undertaken to create a unique product or service". The words "temporary endeavor" implies that the efforts are time limited. A project is a set of limited resources, such as time, people, knowledge, money etc. and project planning is the key element to obtain control and utilization of these recourses, in the best possible way, in order to ensure fulfillments of the project objectives. There is no single reason for

a software engineering project to have a project plan. A project plan usually contains several parts produced in order to help the project team with their project. The main objectives with a project plan are the following:

- Guide project execution
- Document project planning assumption
- Document project planning decisions regarding alternatives chosen
- Facilitate communication among stakeholders
- Define key management reviews as to content, extent, and timing
- Provide a baseline for progress measurement and project control

The project plan is generally developed in the initial phase of the project and needs to be reviewed and agreed upon by all concerned persons. However, the plan is expected to change over time and is updated each time the actual progress differs from the plan or when project conditions changes, which require new approaches (Sommerville, 2010). A carefully prepared project plan if properly followed and committed to, should lead to a successful project and eliminate many of the pitfalls inherent in the project management process. It provides leadership vision and facilitates for management to utilize available resources efficiently.

In addition to the main software project plan, different types of specific plans may be developed to support the main plan in different areas. Example of such plans may be the following(Sommerville, 2010):

- Quality plan - Includes the quality procedures and standards that concern the project.
- Validation plan - Covers approaches, resources and schedule involved in the system validation.
- Configuration management plan – Consists of the configuration management procedures and structures to support the project.
- Maintenance plan - Predicts the maintenance requirements, maintenance costs and the effort required.
- Staff development plan - Includes how available skills and experience will be developed.

The main project plan may be of various forms. Summarized below is a gist of what Project Management Institute (PMI) and Sommerville, 2010 put emphasis on:

1. Scope and Objectives - The scope and objectives of the project are generally set by extracted requirements. The scope is a statement defining the project and its deliverables and should clearly and concisely state project information such as, what it is, what it does, how much it will cost, and when it will be delivered. The project scope has strong relationships to the project schedule and involved resources. Thus, modifications of the project may also affect the project scope.

2. Work Breakdown Structure (WBS) - A WBS is a deliverable-oriented grouping of project components that organizes and defines the total project scope. Thus, the WBS divides the total scope into major work packages, which are further subdivided into manageable work items to be accomplished in order to finish the project.

3. Budget and Schedule - The budget and schedule of the project are based on established estimates [PMI]. Schedule development implies to determine start and finish dates for concerned project activities, which for example may be performed through simulations or mathematical analysis [CMMI, ver.1.1]. The schedule may be presented by Gantt charts, milestone charts, etc. and may be supplemented by supporting detail documents that include identified assumptions and constraints [CMMI, ver.1.1]. Cost budgeting implies to allocate the overall cost estimates to individual work items. The budget should be based on and supported by the WBS, project schedule, and the cost estimates [CMMI, ver.1.1].

4. Risks - Planning for project risks should address issues that could jeopardize accomplishment of critical project objectives. The planning process involves identifying project risks, quantifying the risks, and developing risk responses.

5. Monitoring and Reporting Mechanisms - The purpose of monitoring mechanisms are to provide an understanding of the project progress in order to take appropriate corrective actions if project performance deviates from established plans. Monitoring involves monitoring actual values of planning parameters, such as cost, effort, and schedule. These values are compared to the estimates and possible deviations are identified [CMMI, ver.1.1]. Reporting mechanisms are concerned with collecting and disseminate performance information in order to provide involved stakeholders with status, progress and information about how resources are used to fulfill established objectives.

6. Resources - The resources and quantities required in order to carry out the project should be identified and described [CMMI, ver.1.1]. Project resources come in various forms such as, personnel, funds, equipment, facilities, material, information etc. and the selection of these resources should be based on the established estimates. Establishing resource requirements allow for several benefits such as, identification of resource shortage, identification of feasibility problems due to resource conflicts, etc. [Mantel S, 2001].

7. Knowledge & Skills - Planning for knowledge and skills involves both training of project team and acquisition of knowledge from external sources. The knowledge and skills required to execute the project should be identified and the currently available knowledge and skills should be assessed. With this information available, the deficiency of knowledge and skills is identified and mechanisms for providing this knowledge and skills are selected.

8. Stakeholder Involvement - Stakeholders involved in the project should be identified and their functions requiring representation in the project should be defined. Furthermore, the level of interaction and the relevance of each involvement should be described. An appropriate technique to handle this effort is to develop a two-dimensional matrix with stakeholders along one axis and project activities along the other axis [CMMI, ver.1.1].

As stated above, current subjects are recommended by [CMMI, ver.1.1], Furness, 2001 and Sommerville, 2010. Obviously, a project plan may take various forms depending on the needs and purpose. The project plan is obviously developed when the developer has reached an agreement with the customer. Prior to such an agreement, the supplier must be certain that they are capable of undertaking a project. If the supplier doesn't possess the knowledge, skills or time to undertake the project, it's a waste of time to initiate negotiations with the customer. To find out whether this is the case or not, effort and time estimates must be established. When this is settled and negotiations are initiated, the supplier must come up with a reasonable price for the product. The price must be compatible, cover the development costs and furthermore generate a desirable profit. In order to achieve this balance the project costs must be estimated. With all the estimates at hand, it's possible to establish the project scope, a schedule and budget, resources required, and knowledge and skills required.

2.4. PLANNING MANAGEMENT

Project planning management is something that is involved during the entire project. Project plan, estimations, risk planning is typical things that the project manager or managers is in-charge of. Project management includes numerous important responsibilities and project planning is of course one of them. Project management is the application of knowledge, skills, tools and techniques to project activities in order to meet the stakeholders' needs and expectations from a project (Furness, 2001). To meet stakeholders' needs and expectations involves numerous demands, such as scope, time, cost, quality and integration. To give the project a strong foundation, the project manager must conduct a sufficient research in order to take care of the planning. But is it up to the project manager to solely take care of all planning? Of course not, the project manager may involve experts within the company as well external to the company. But how to deal with this is not obvious.

A project manager's overall responsibilities can be defined as bring a project completion on time, within the budget cost, and to meet the planned performance or end-product goals [Simpson WD, 1987]. The project manager has responsibilities towards his project group, top-management, sub-contractors and of course, the customer.Without a satisfied customer, the top-management will not be pleased. This chain of command is usually described in the organizational structure at software engineering companies. Modern project manager's works hard in order to reach the end-product goals in a rewarding manner, often with clear product goals well defined in advance (Dvir et al., 2003, Tzvi Raz, 2003).

A project manager has, quite naturally, the main responsible for planning the project. However, the project manager must plan enough in order to reach a successful outcome. But, how do you know, as a project manager, when it's enough? Who can say that anything is good enough planned?

According to most project managers it is impossible to know. Further, researches (Dvir et al., 2003, Tzvi Raz, 2003) state that too much planning can obstruct creativity and the quality of the product can suffer. At the same time, the lack of planning will, most definitely, guarantee failure. The success of a software project very much relies on good management and control system which allows development to satisfy the project objectives.

2.5 PROJECT ORGANIZATIONAL STRUCTURE

Since the software engineering industry has grown enormously the last two decades, the organizational structure in well-established companies has changed a great deal. From small underground projects with one or a few persons implementing rather small applications, to huge international companies with a turnover of billions of dollars. Apple and Microsoft are examples of such companies. Still, the organizational view of software companies has, quite logically, many different views. The organization in a company can be described as a system of human and physical elements interacting to achieve various goals.

Further, M. Nicholas states that there are two kinds of organizational structures. One is the formal structure, which is the official and documented structure and describes who's in charge, chains of command, divisions, groups and people and how they are supposed to relate. The informal structure on the other hand, is the structure that describes personal relationships, communication and interaction between involved stakeholders. It can also be described as how they want to relate.

However, project organizations can also be divided into internal and external structures. The internal project structure includes the interfaces among the units of the software development team. Depending on which developing model or specific process model they choose to work with, the structure looks a bit different. However, certain groups or responsibilities are rather general in all software development. Naturally, a project manager has the overall responsibility, but a project team could have several other managers. The most common are configuration manager, quality manager, test manager, security managers and architecture manager. Thus, how does the organizational structure affect project planning and is it possible for a project manager to affect the people responsible for required resources? This differs of course a lot from company to company.

However, according to Nicholas, it is very rare that project managers have anything to say about the organizational structure. However, it is possible for the project managers to come with recommendations, which the top-management should take into account. This organizational structure may help or hinder the project managers in the planning phase. Depending on the resources assigned to the project manager in the research phase the planning outcome may vary a lot. Since project planning is both considered difficult and important, we believe that it is important for the top-management to listen to the project managers demands and wishes in the initial planning phase. This influence on the resources that are being assigned to the project and with a lack, or abundance, of resources this may lead to project failure.

This is probably one of the largest problems for top-management in the software industry since it is very difficult in the initial planning stage to state what are all the activities are and how they need to be carried out in order to complete the project, and what their cost and duration parameters are.

2.6. PROJECT SUCCESS

According to De Wit, 1988, success means different things to different people. This statement is confirmed by several suggested assessment approaches, which all recommends different success factors to measure. For example, Parviz F. Rad suggests that the success attributes may be categorized into "Things Related Attributes" and "People Related Attributes". Attributes related to "things" are scope, quality, schedule, and cost whereas attributes related to "people" are team morale and client satisfaction. De Wit, 1988 suggested that the following seven dimensions should be considered when determining project success: efficiency of execution, personal growth, managerial and organizational implications (including customer satisfaction), technical performance, and manufacturer's ability and business performance.

There are several factors that contribute to a successful project. It is important to explore how success is defined, both in literatures and industry. Current section is devoted to give a brief outline of how the literatures define project success and how success is measured.Success may be defined as an achievement of something desired, planned, or attempted. Thus, success is a result of achieving known objectives in order to satisfy a certain need or want. A project is consequently considered successful when its objectives are fulfilled [M. Nicholas]. Project objectives may involve multiple dimensions, such as time, cost, quality etc. However, although this is a quite common definition of project success and moreover corresponds to the reality in some cases, there are many examples where this definition is not enough(Shenhar et al., 2001). These examples show that despite extensive delays and overruns, the project outcome may be a great business success(Shenhar et al., 2001). Usually, project management is forced to make certain trade-offs which may affect established objectives, but if these trade-offs are mutually agreed upon by involved stakeholders, the project may still be successful [M. Nicholas]. An example is the Sydney Opera House, which took three times longer than planned and cost approximately five times higher than expected(Shenhar et al., 2001). Today the Opera House is Australia's most famous landmark. Another example is the first Windows software by Microsoft, which suffered from extensive delays and required additional staff to complete (Shenhar et al., 2001). Today, 90% of all PCs use the Windows operating system.

Research has proven that if a mutual agreement among involved stakeholders exists about how to judge project success, the likelihood for success is maximized(Turner, 2008). If such agreement doesn't exist, the likelihood that different stakeholders exploit the project to achieve their own objectives is maximized(Turner, 2008).

2.7. PROJECT MANAGEMENT SUCCESS

The classic criterion from practice is a measure of the immediate performance of a project against its main design parameters—schedule (time), budget (cost), scope, and/or quality which the literature tends to call a measure of *project management success*. This definition was already established in the earliest discussion of projects in the management literature. Gaddis, 1959 defined a project as "an organization unit dedicated to the attainment of a goal—generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications". In the three-element form, this criterion is variously called the triple constraint, iron triangle, or three-legged stool of project management. Other variants include all four elements as the project diamond or four-legged stool.

Scope is less clearly defined than time or cost, referring to the extent to which the main deliverable was completed against specification or whether all intended activities and phases of the project were completed. Quality is often assessed, *post hoc*, against established industry or subjective criteria. The conventional approach is that an assessment of performance is made in a post project review based on whether the project was completed "on time, within budget and to specification". If each was achieved within anarrow range of tolerance then the project is deemed a success. This criterion is of particular interest to stakeholders with vested interests in the project vehicle itself, such as the project manager, project team, and project governance stakeholders.

This classic criterion remains the most widely used measure of project success. Its main value is in offering a simple, direct measure of performance of a project and the project management expertise applied to complete the project within the bounds of the most immediate design parameters (time, cost, and scope). However, it has major limitations. Most critically, it focuses on the *means* rather than the *ends* of the investment from the organizational perspective. It takes limited or no account (depending on how scope is defined and measured) of whether the main project deliverable fulfilled the purpose for which it was intended and whether the objectives of the project's investors were achieved. For example, it is not unusual, especially in Information System projects, for a project that is late, over budget and/or under-delivered against specifications to be declared a success, because it still delivered a benefit to the client/users and/or to the investing business.

3. RESEARCH METHOD

This paper reports on how we can understand and support the software projects development, project planning based on a literature study and an industrial study. The paper is based on both literature reviews and software industry studies. The main objective with this paper is to describe, analyze and understand the software project development practices in literature as well as software industry. The software industrial studies are based on different research data of software companies and conducted interviews among all involved stakeholders. Interviews is a quite straight-forward and non-problematic research approach in comparison to other research methods, such as observations, experiments, simulations etc. It's an appropriate research method to use when time and other resources are limited. Interviews are quite flexible in the way that it allows the interviewer to ask resulting questions, modify the line of enquiry, follow up interesting responses and explore underlying motives [Robson, Colin, 1993].

The interviews are based on two different interview styles. The first part of the interview is a so-called unstructured interview [Robson, Colin, 1993]. By this way, the risk of missing valuable information is reduced, since the interviewees are able to talk freely about the subject and are not obstructed by any pre-defined agenda.

The second part is a structured interview, which means that the interview is based on a pre-determined set of questions [Robson, Colin, 1993]. By using this approach we are able to ensure that required information is retrieved.

4. DISCUSSION AND CONCLUSION

Many projects in the computer industry have failed to achieve their objectives due to lack of managerial skills. Considering the following circumstances:

- Project objectives are poorly defined and/or understood, even by the members of project team,
- Project deadlines are dictated by external events or imposed arbitrarily by administrator.
- Project budgets are based on naive estimates given by inexperienced managers.
- Project staffing is determined more by availability than ability.

The outcome of projects launched under such circumstances is easily predicted. Managing a well-planned and well-staffed project is challenging. Many engineering managers came to management through the technical ranks. Although they may have had plenty of engineering training and mentoring, they frequently learn management skills the hard way, through trial and error. Managers have two primary jobs: to get the best work out of the people who work for you and to create an environment that enables people to get work done (so they can do their best work). It's Always the People-Help People do Their Best Work.

Software project planning is today an extensive and central component in software development. Project planning has become of great importance for software development, which has forced the industry to make fundamental changes of the planning paradigm and moreover, that thorough planning in the early stage of the project life-cycle is an important factor in project success. The result of the interviews conducted at different software companies indicated that these statements are credible. 80% of the interviewees claim that project success increase in proportion to the amount of effort invested in project planning. The most common problems in project planning are to develop accurate estimates and to handle external influences and dependencies. Project estimation is a common problem since the software developer often faces unknown domains, new technologies and other complexity issues. If the developer should produce the same product over and over again, estimation would be a lot easier. Our investigations correspond to the literatures when it comes to estimation techniques; expert judgment is without a doubt the most commonly used method to develop estimates. This is quite logical, since current method is very simple and cheap and often bases the estimates on in-house knowledge and experience.

Dvir et al., 2003 uses three different success criteria in his article. These criteria are meeting planning goals which measures success at the project manager level, end-user benefits which measures success from the end-user point of view and finally contractor benefits which measures success at the contractor's level. Shenhar et al., 2001, Dvir et al., 2003 and Levy uses 13 success measurements divided into four sections: Meeting planning goals, Benefits to the customer, Commercial success and future potential. Other interesting material within the project success area is presented by J. Drew et al. They state in their report that project managers can make more efficient and effective projects if they detect high-risk elements early.

The companies we interviewed invest in between 25% to 80% of the total project effort in project planning. Obviously, this quite large gap is a result of different environments, conditions and project characteristics, such as complexity, size, resources, assets etc. According to the interviewees, project planning gets harder and requires more effort the more complex a project is and a project obviously becomes more complex the more complicated the mission is. Thus, development of complex software is hard to plan for and require more planning efforts. When analyzing the results of the interviews, we have identified software complexity to be the source to all planning difficulties and the most critical factor in order to achieve adequate project planning.

According to the research outcome, software complexity originates from several sources. One of the reasons for complexity is that the software engineering is a quite new and immature discipline, which implies lack of experience and usage of undeveloped technologies and methodologies. This is also confirmed by several credible sources, such as SEI (Software Engineering Institute), SWEBOK (Software Engineering Body of Knowledge). The quite low age of the industry also implies little consensus and few standards. According to the interviewees, misinterpretation of requirements is quite common and may have severe consequences.

The research shown that the industry and the literatures, roughly, have the same view on the project plan. According to the interviewees, a project plan should mainly consist of the following: Project scope, Project objectives, WBS, Schedule, Budget, Possible risks, Resources required, Skills and knowledge required, Project dependencies. The literary study also includes such as Monitoring and reporting mechanisms, Stakeholder involvements. Many of the interviewees state that they put a lot of effort in the initial estimates in order to establish credible budgets and schedules and are forced to discard many of these estimates when requirements and other project characteristics are changing. Companies invest more effort to plan budget and schedule than they do in anyother planning activity. Thus, software companies put a lot of effort in an activity with a little chance of achieving its goals.

Successful project management is generally classified as accomplishing the effort on time, within budget, and at an acceptable level of quality(Kerzner, 1989). However, the process should result in continuous improvement (Oakland,1999;Kerzner, 1989) in order to reach excellence. Kerzner, 1989 argues that the excellence in project management requires first, a continuous stream of successfully managed projects and second, that decisions made on individual projects must take into account the best interest of both the project and the company as a whole. Moreover, a customer must see first, the project as having an appropriate fit with the mission, objectives, and goals of the enterprise(Cleland, 2004). Second, stakeholders are happy with the way the project was managed and the results that have been produced (Cleland, 2004).

Developers, managers, and customers usually have good reasons for making the decisions they do, and the problems have been made so often. Hence the problems can have been divided along the development-speed, dimensions of people, process, product, and technology. Failure to deal with problem personnel also threatens development speed. This is a common problem and has been well-understood at least since Weinberg, 1998 published Psychology of Computer Programming in 1971. Failure to take action to deal with a problem employee is the most common complaint that team members have about their leaders (Larson and LaFasto, 1989). It is better to make time for uninterrupted talk with each person in your group every week.

Whether you are a technical lead or a functional manager, one of your deliverables to your management is a periodic assessment of what and how your organization is doing. You also have a deliverable to your staff, of knowing enough about what they're doing and how they're doing it to give them formal and informal performance reviews. You can't meet those deliverables if you don't know what everyone is doing.

Process-related problems slow down projects because they squander people's talents and efforts. If you're working on a six-month project, and it takes you three months to meet your two-month milestone, what do you do? Many projects simply plan to catch up later, but they never do. We learn more about the product as we build it, including more about what it will take to build it.

Developers are fascinated by new technology and are sometimes anxious to try out new features of their language or environment or to create their own implementation of a slick feature they saw in another product--whether or not it's required in their product. The effort required to design, implement, test, document, and support features that are not required lengthens the schedule.If you have product goals that push the state of the art algorithms, speed, memory usage, and so on you should expect great uncertaintyin your scheduling. If you're pushing the state of the art and you have any other weaknesses in your project--personnel shortages, personnel weaknesses, vague requirements, unstable interfaces withoutside contractors, you can throw predictable scheduling out the window.Most software is so bad, in fact, that if it were a bridge, no one in his or her right mind would walk across it. If it were a house, we would be afraid to enter. The only reason software engineers get away with this scam is the general public cannot see inside of software systems. If software design were as visible as a bridge or house, we would be hiding our heads in shame.

We would not accept a new house with sloping floors, holes in the ceilings, nails sticking out of the walls, and an outrageous price even if it minimally met basic needs. Rather than crooked floors, the software manifestations of poor design are redundancy, unnecessary performance bottlenecks, intertwined bugs that cannot be fixed, impenetrable code, and other ills. Unfortunately, we often accept software in just such a state. Regularly, companies release code like this to external and internal customers. And customers accept delivery. Businesses pay billions of dollars per year for this kind of software during mergers and acquisitions.Yet again, the type of project and software company plays a vital role when forming a project plan, handling estimations, risks, resource allocating etc.

The certain steps can be taken at the time the project is launched to improve the prospects. Every project is unique in nature, however the following guidelines can be used for managing the project planning as well as minimizing the faults well:

- Hire a competent project manager whose administrative, technical, and political skills commensurate with the task. Also appoint the team members with proper mix of technical and administrative skills. Avoid, whenever possible, part-time assignments so that individuals who are working on the project can devote their full attention to it.
- Establish the appropriate communications links among all the elements of the organization and assign each task to an individual or to a specific organization so that responsibility for its completion is unambiguous. Distribute the plan, schedule and budget to all concerned and confirm their ownership of the tasks assign to them.
- Review the project schedule and budget regularly. At each review meeting, ask for reaffirmation of plans and schedules for the forthcoming period.

Of course, no project planning philosophy can guarantee the success of any project, no matter how noble its objectives are, or how diligently it is applied. It can, however, materially improve the prospects for success, provided all project participants accept the philosophy and it is administered in a consistent and disciplined manner.

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