



CENTERIS 2012 - Conference on ENTERprise Information Systems / HCIST 2012 - International
Conference on Health and Social Care Information Systems and Technologies

The 7 key factors to get successful results in the IT Development projects

Germán Arias^{a,*}, Diego Vilches^a, Claudia Banchoff^a, Ivana Harari^a, Viviana
Harari^a, Pablo Iuliano^a

^aUniversidad Nacional Arturo Jaureche, Instituto de Ingeniería, Av San Martín 2002, Florencio Varela (CP1888) Pcia de Buenos Aires,
Argentina

Abstract

This paper explores the key factors in which a project manager should focus on Software development projects in order to increase the probability of getting successful results. To define and rank these factors, we have analyzed the root causes of why these projects fail; we have also reviewed the software continuous improvement model CMMI and gathered the experience of different project managers throughout their professional career. For each ranked factor, the author describes the main aspects to take into account in order to guide the project managers in the best way to implement it

© 2012 Published by Elsevier Ltd. Selection and/or peer review under responsibility of CENTERIS/SCIKA -
Association for Promotion and Dissemination of Scientific Knowledge

Keywords: software development projects; software successful factors; CMMI; software project management

1. Introduction

The software engineering projects have a substantial difference from those related with other engineering areas (e.g: civil, industrial, etc.). This is so due to the intangible nature of software that creates a non-stable

* Corresponding author.

E-mail address: german.arias09@gmail.com

context during project execution which generates a typical set of problems and reduces the probability of success.

According to the latest report published by the Standish Group [1], 83.8% of software development projects fail. The report distinguishes two types of failures in these projects:

- The project is completed and operational, but over-budget, over the time estimate, and offers less features and functions than originally specified.: 52.7%
- The project is cancelled at some point during the development cycle: 31.1%

The report also provides the causes of the project's failure. Refer to the list of causes provided by relevance:

1. Incomplete Requirements 13.1%
2. Lack of User Involvement 12.4%
3. Lack of Resources 10.6%
4. Unrealistic Expectations 9.9%
5. Lack of Executive Support 9.3%
6. Changing Requirements & Specifications 8.7%
7. Lack of Planning 8.1%
8. No longer required 7.5%
9. Lack of IT Management 6.2%
10. Technology Illiteracy 4.3%
11. Other 9.9%

Analyzing above causes, we have realized that there are relationships among them. In addition, some of these causes are clearly symptoms of other included in the same list. To understand this concept better we include the following examples:

- a) If there is a lack of user's involvement, probably, the requirements will be no clear and incomplete.
- b) Having inaccurate estimations, it may result in poor or inadequate planning as well as in unrealistic expectations.
- c) Lack of executive support, it may result in issues during the assignation of project resources.

These symptoms just mentioned do not allow us to clearly understand the real reasons of the problem.

To prioritize the success factors, we have also analyzed the CMMI process areas that this model [2] aims to focus in initial maturity levels. These areas allow the IT companies to achieve the first level of maturity: the Level 2. This level is mainly focused on administrative areas (rather than in technology areas); since this first maturity model has the objective of generate a managed process [3]. It is focused on project planning and project execution aligned with policy; to employ people with right skills to produce controlled outputs; to involve relevant stakeholders; to monitor, control, and review the process as well as to evaluate the adherence to process descriptions. All these imply to generate a stable environment for the project execution.

Another aspect to consider is how the companies work, and the influence of the organizations hierarchical structure. In some cases, the changes in companies emerge from the base of the organizational pyramid but usually are promoted by the senior management and impact the whole company.

In order to give a practical approach to the article in how to implement these factors, we have interviewed some project managers from several companies with large and proven experience managing software development projects in different business areas and project sizes.

Besides that and with the objective to help to the project managers to implement these factors, we have included in this article the best practices from the PMI framework and the Rational Unified Process.

The article purpose is to provide to IT projects managers with guidelines to focus their time and effort on key factors that will ensure a stable project to increase the chances of project success.

Finally, the article covers these factors in order of importance, analyzing the main concepts of each one and keeping pragmatic point of view in the implementation of the best practices related to these factors.

2. Data collection

We interviewed Project Managers that work in different country across LATAM region (Argentina, Uruguay, Chile and Colombia), every one of them have more than 5 years of experiences as Project Managers.

We asked them wich is the key successful factor they focus on during a software a medium (+1000 work hours) or large (+5000 work hours) development project, and to justify why.

The results of the first question of these interviews are included in table 1.

Table 1. Interviews results.

Key factors	% Indicated by PMs
Senior Management support	32,20%
Qualified project managers	23,50%
Adequate Planning	17,60%
key users Involvement	13,70%
Requirement's management	6,30%
Monitor and control the project execution	4,20%
Development team management	2,50%

Regarding the reasons of the answers, we used it as input in the above description of each key factor.

3. Analyzing the 7 key successful factors

Aligned with the concepts described in the introduction, the 7 key successful factors will be described and analyzed:

3.1. Senior Management support.

Project managers should keep in mind that IT development projects exist to support a particular business. In most of the cases, the business manager of a specific business unit decides to create a business case. This business case is presented to the Company Board that will decide if the investment is justified. The business unit manager is known as “project sponsor” and in some cases project sponsor could be more than one manager. The sponsor, who has an influence position within the company, should be committed to mitigate risks and solve issues that project team cannot resolve by their own. The sponsor acts as a project protector and helps to get financial resources and the necessary human resources for the project [4]. He is an evangelist in the company that promotes the benefits of the application being developed and also ensures the right conditions and changes required in the impacted business areas to deploy the new software. The sponsor pushes the key users to ensure their active participation in the project and to be the change agents to promote the use of the new application.

During the project execution the project manager should generate a good and fluent communication with the sponsor. It is critical to conduct periodical meetings, usually known as executive committee meetings, in which the project manager reports the project status and also request the support needed to mitigate risks and solve issues that are outside the project team scope. Therefore, the sponsor must have the empowerment due to his/her role in the company, as well as the personal capability to take decisions.

On the other hand, the sponsor should participate in the change request approvals based on business needs

and also should manage the budget extension as required.

The project manager has to work aligned with company goals and must understand the sponsor's responsibilities within the company. By doing this the project manager will keep the project sponsor integrated along the project life cycle. The project manager must pay attention and should identify if the project lose the sponsor's support. That negative scenario could be as a result of other critical project sponsor activities; due to a change on the business context or just due to the sponsor is no longer interested in the project success. Once detected this negative context, the project manager should take corrective action at earliest, which could be a meeting with the sponsor or the company executives. It is important to highlight that the project manager should have the required empowerment within the company to make this type of decisions. A project without top management support may result in a project not aligned with company objectives and it is destined to failure. We can assume that project has failed from the beginning.

3.2. Qualified project managers.

According to the Standish Group's annual report [1], 97% of successful IT projects had a project manager assigned. This does not imply the project manager assignment ensures the project success. The same entity ensures that 76% of projects that were canceled had a project manager assigned. These numbers shows the importance of having a project manager with appropriate knowledge and skills to manage an IT project.

There are many companies that have not a formal project manager role in their IT areas. The "Project managers" emerge informally from the development teams without adequate project management skills and training. Usually they do not have the enough knowledge and tools to manage an IT project context, which is generally unstable. This scenario increases the number of issues of a common software development project. Therefore, one of the most important decisions that a company must take is to create a position or a department responsible for managing IT projects. Once this decision is taken, it should be very clear the responsibilities of this role (or area) as well as the skills and capabilities that a project manager should have.

According to the PMBOK[5], the project manager is the person that applies knowledge, skills, tools and techniques to the project activities in order to meet or exceed the expectations of the people involved in the project.

Is essential projects managers have knowledge in project management tools, such as PMI project management framework (PMP certified if possible), quality software development models (like CMMI) and software development processes (Unified Process, SCRUM, etc).

In addition, the project manager integrates all the project parts. Project integration can be described as the process that ensures that all elements (people, task, organizational units, etc.) fit together as an integrated whole [6].

But this knowledge is not enough. The company must promote the project manager interpersonal skills development, not only within the team, but also with different project stakeholders. It is essential that the project manager has a business vision and convey this vision to his/her team, understanding that the company decides to invest in a software development project to support the business. The manager should always take project decisions keeping in mind the business. Another skill the project manager has to develop is the ability to understand how the project affects (negatively or positively) each project stakeholder and should be able to get the required support to drive successful results. The project manager must have a strong communication skill, both oral and written, since 90% of his/her time is dedicated to communicate. The role also has an important political component in the company and must have adequate support from senior management to drive the changes mentioned above. Also the project manager should have financial management skills.

Finally, it is desired that the project manager has experience in different project roles. Although the project manager will get the required support from his/her team in decision-making, the previous experience in different software development roles will help him/her to better integrate the team, to understand how to solve the problems that arise in the team and give coaching to some team members.

3.3. Adequate Planning.

Project planning is much more than building an schedule. Planning is the strategy that the project team will follow to achieve the project objectives. Planning is a creative activity that implies to imagine the future as well as to define the project strategy based on that. Planning is also to analyze the actions required to change that future.

It is important for software development projects, which need to manage a high degree of uncertainty and is not easy to build a detailed plan for the entire project, to manage two different planning levels. The first level is the high-level project planning and include the estimates results, requirements management plan, identification of project stakeholders, the phases and iterations plan [7], etc.). This information is consolidated in a unique document named the unified project plan. The second level includes the phase or iteration planning, which includes detailed plan of the activities to be performed. During the project, near to the end of the current phase or iteration (which generally must have a duration of less than one month), the next phase is planned in detail, taking into account the present context and getting lessons learnt of previous phases or iterations.

One of the main steps of planning is the effort, time and resources estimate. These estimates are the foundations of planning. Most of unrealistic expectations mentioned by the Standish Group report is because non accurate project estimations. The effort estimate process must have as an input a clear scope. The scope definition is one of the most important challenges in the software development life cycle and it will be further explained in this paper as it is a very complex activity. According to the selected effort estimation method, the scope (size) can be estimated in several ways: List of use cases by complexity, function points, etc. PM should be aware that during initial estimates, the scope/size is also estimated and we have a low level of precision. It is recommended to move through a first exploratory phase of the project, called inception [8]. During this phase, we start to gather the requirements and, at the end of this phase, the requirements are more clear to make a new estimate with a higher degree of accuracy. The historical information available and the project team experience in similar development projects is a valuable input to consider during estimations. If it is not possible, we must use formal methods such as COCOMO2, based on function points or use cases [9].

Another important aspect to take into account during project strategy phase is the software development cycle to be used. Due to the intangible nature of the software it is highly recommended an iterative cycle, split it into phases and iterations with clearly objectives defined in each phase. These objectives are planned to mitigate the risks with huge impact and with high occurrence probability during the early phase of the project. It is not possible to move from one phase to another until we have assurance that the objectives of the previous phase were achieved. Therefore we need to have clearly defined the phase end acceptance criteria. If the phases are too large in duration, it is recommended to split them into iterations no longer than one month and. It is also recommended that each iteration result in a software work product release in which new software functionalities are included [8], note that this is not applicable for initial iterations. By doing this, the progress of the software functionalities can be showed to end users and we could get feedback from them, helping to solve part of the problem of software intangibility.

This planning with monthly delivery targets, also helps to the development team to have a short-term objective and they don't need to wait until several months to see their software working. It has a positive effect regarding team motivation.

The governance model is also a critical activity during planning phase. We need to identify the project authorities, their responsibilities and how they will interact across different layers.

It is important to keep in mind that planning is an iterative work and should be reviewed periodically. It is highly recommended to get project planned reviewed and updated each time a phase finishes.

The project plan should be approved by all the stakeholders (project team, sponsors, key users, and suppliers). This will ensure that all project stakeholders agree on responsibilities and dates defined.

3.4. *key users Involvement*

The first step to achieve the user's involvement is to identify them and define their responsibilities [10]. This identification process may be simple or could require a major effort. This will depend on the knowledge that the project manager has related with the company culture and will also depend on the number of users and business processes that the application being developed must support. Often the identification activity involves several meetings with the project sponsor and the nominated key users. Keep in mind that part of the project's success depends on proper selection of these key users. During these interviews, we also must have a good understanding on the business processes that each user knows to assign the right responsibilities in the project. All this information must be registered formally in the project plan. Usually, organizations have a functional structure and the key users are assigned to operational activities much of their time. The project manager's responsibility is to estimate the key user's participation (effort and duration) along the project life cycle. This activity is critical in order to communicate when and how much time these users should be allocated to the project. Once the Project Manager has the estimated effort of key users, a project commitment of these users and their supervisors should be ensured as the project activities may compete with the operational activities mentioned above. Therefore, it is important to obtain the user's supervisor assignment approval, so they can plan with time in advance how to solve the assignment of operational activities.

Communication to key users should be clear: when they will participate in the project, the effort planned and tasks/responsibilities to be assigned during the project life cycle. Probably, the project manager may get some restrictions on availability of the users, so the project plan should be reviewed taking into consideration these new restrictions. After this revision the plan should be shared again with project stakeholders for approval.

User assignment commitment is not easy, since we may also find the lack of commitment of key users' supervisors. In these cases it is the sponsor who should help project manager to gain the assignment needed for the proper project execution.

This commitment must be maintained along the project life cycle [14]. It is suggested to keep key users informed about project progress to achieve this.

Finally, it is critical to be aware that key user's participation is not only limited to requirements definition phase. They should participate in each software delivery acceptance test and must be involved in the cultural change management process.

3.5. *Requirement's management*

Requirements management is one of the biggest problems in IT development projects. Usually, the users do not clearly know what they need from the application to be developed. In addition it is difficult to generate a correct communication synergy between users and functional analysts, who are responsible of getting the software requirement specifications.

As in all disciplines of a software development, the first activity to have a successful requirement's management is to plan this activity [11]. The planning must focus on gathering requirements techniques that will be used (interviews, workshops, focus groups, etc.), to identify who are the key users, where these requirements will be registered, which documents the users will receive and the approval flow details.

On the other hand, we have to define the change management process [12] and who will be responsible for approving them. Generally the projects define a Change Control Board who has the final authority for the change approval or rejection. Company executives involved in the project and the sponsor are part of this board.

The functional analyst role is critical to guide users to provide the necessary requirements to support the business. This role is the link between key users and development team, so the functional analyst must understand both languages: business and technical. It is highly recommended to assign analysts that know the

business and/or has previously taken a developer role.

The requirements generally are documented in a document called SRS (software requirements specification). We must register for each requirement who is the user that has requested it in order to have traceability between requirements and users. In this document should be also recorded non-functional requirements, scope & out of scope details, and integration with other systems (if any).

As we said before, the entry for the effort estimate is the project scope. If these requirements are not stable, the estimate will not be accurate, and we will not have and accurate planning.

Once requirements gathering processes finish, we should create a baseline of them [13]. The baseline concept is similar to a photograph taken to the requirements and we will work on that picture in the estimation and project planning. In an iterative process, this initial baseline is created based on requirements gathered during inception. Any requirements that are not included in this baseline should be managed as a change request and we need to launch the planned change management process. If the request is approved, after analyze its impact, the project planning should be updated and a new baseline of the requirements should be prepared. To manage these updates consistently and manage this baseline document is recommended to use a configuration management tool (e.g: SVN, CVS, VSS, SharePoint, etc.). Note that are different configuration management tools recommended based also in the technology used.

3.6. Monitor and control the project execution

If we have defined planning as future projection, monitoring and controlling activities involves comparing reality with the planned future and manage the differences. As the same way that planning, monitoring and controlling projects should be managed in more than one level, according to the governance model defined in the project plan. The first level is associated to the status review that the project manager carry out with the project responsible from the business unit involved (it could be more than one). In the follow-up meetings [15] the participants review the detailed planning execution, the completion of the activities committed in the reviewed period, the commitments made for the near future, the identified risks, the issues detected and metrics defined.

It is important that prior to this meeting, the project manager write a status report that describes all these aspects. This report will guide the follow up meeting to have a more effective meeting. This status report has two additional benefits: the first one is the formal communication of project status. This formal communication gain greater commitment with the project stakeholders. The second implication is that it allows to the project manager to generate a time to do the intellectual exercise of to review project status in an orderly and clearly enough way to can write it in a report. During the writing of this report, the project manager launches corrective actions detected in the detailed project status review.

The other level of monitoring to be performed is the executive follow up. Projects (usually medium or large) build a project executive committee. This committee integrated by the project sponsor, project manager and others executive stakeholders with appropriate decision power in the company (responsible for the IT area, executive of the supplier company providing development services, etc.). During the executive committee meeting it is important to scale issues that cannot be resolved in the context of the project team: resource allocation, budget slippage, key user's involvement, etc.

3.7. Development team management.

When we review software development team management aspects, is when the software engineering becomes a social science. Team management requires formal training, inherent values to the people and experience. The human factor is so important the in software industry that CMMI developed a human capabilities maturity model for software development: People CMM [16].

According to the software engineers current labor market context, the resources demand is growing

constantly and graduates of engineering careers keep stable or even decrease [17]. Therefore, the focus on teams management is not only a project key success factor, but it is a very important aspect to stay competitive in a job market struggling to attract these resources.

The unstable characteristics of software development we have described throughout this article impact directly on the development team motivation and morale. Unclear objectives, inaccurately estimates, poorly defined requirements and annoying key users is an usual context in software development projects, resulting in a irritating work environment that generate resistance to collaborate, frustration without limits and endless overtime to try to achieve a feat.

The project manager should be the pressure filter between the company and the development team and create a collaborative environment and a nice atmosphere to keep the team motivated. There is not any other factor that can increase the productivity levels like motivation [18] . This does not imply the project team will not have demand required to achieve project objectives. In times where pressure start to increase in the project where time and cost slippage appear, is when the project manager must trust in his/her team and avoid apply micromanagement with team members, the usual reaction when project managers are in project chaotic situations.

The manager must delegate decisions to the team as much as possible to those team members with the capability to do that. This will generate a greater sense of membership to the project.

One of the most important aspects to achieve an integrated functionality and high productivity team is the selection of each project members. The project manager must have the capability and to dedicate adequate time to select the people, covering the necessary project knowledge. These members must have the integration perspective among them to be not just a set of people working together, but a really well integrated a team.

4. Conclusion

Due the intangible software nature, the software development projects begin in unstable contexts (lack of user's involvement, incomplete requirements or requirements changing every time, difficulty to have resources availability, difficulty to have an accurate estimate etc.). The project manager must manage these problems to change this initial context and stabilize it. So the project manager drives the change. There is not a formula to apply to every project to be sure it will be successfully, but to underestimate any of these factors mentioned, put entire project in risky situation. Every interviewed manager agreed the project can not finish successfully if they do not invest the enough time to manage the selected key factor.

References

- [1] THE STANDISH GROUP REPORT Chaos Report (1995)
- [2] CMMI® for Development, Version 1.2 - Your Approach to Process Improvement, pp 14
- [3] CMMI® for Development, Version 1.2 - Capability Level 2: Managed, pp 33
- [4] PMP Exam Prep, 6th Edition (Aligned with the PMBOK Guide, 4th Edition). Rita Mulcahy (RMC Publications, 2009), The role of the project Sponsor, pp 306
- [5] Integration: The Essential Function of Project Management - Linn C. Stuckenbruck.
- [6] Project planning best practices. Rational Edge (2003) – Eric Lopes Cardozo, DJ de Villiers
- [7] Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development (3rd Edition) – Craig Larman
- [8] Estimacion del esfuerzo basada en casos de uso - Mario Peralta
- [9] CMMI® for Development, Version - SP 2.6 Plan Stakeholder Involvement 1.2, pp 342
- [10] Project Management Body of Knowledge - PMBOK (PMI, 4th ed, 2008) – 5.2 Scope Planning , pp 51
- [11] Project Management Body of Knowledge - PMBOK (PMI, 4th ed, 2008) – 5.2.3 Output of Scope planning, pp 52
- [12] CMMI® for Development, Version - SP 1.3 Create or Release Baselines, pp 120
- [13] CMMI® for Development, Version - SP 1.5 Monitor Stakeholder Involvement, pp 314
- [14] CMMI® for Development, Version - SG 1 Monitor Project Against Plan, pp 314

[15] <http://www.sei.cmu.edu/library/abstracts/reports/01mm001.cfm>

[16] Information Technology magazine – N° 173, 2012 (focused on Argentinean labor market)

[17] <http://www.westminstercollege.edu/myriad/index.cfm?parent=2514&detail=4475&content=4798>