# The Art of Project Management: Key Adjustments Factors using Dynamic Techniques

Antonio Folgueras Marcos, Ángel García Crespo, Belén Ruiz Mezcua

Carlos III University, Department of Computing Engineering
Madrid, Spain
afolguer@ inf.uc3m.es, acrespo@ia.uc3m.es, bruiz@inf.uc3m.es

**Abstract.** This paper considers the most important aspects for an effective and efficient implementation of an Information Technology (IT) project. In the search for a good implementation of a project, it is necessary to perform multidisciplinary tasks as well as to consider non-technological issues such as management skills and human aspects. This paper presents a list of simple recommendations which summarize the main abilities and skills to put into practice in IT implementations. These considerations are divided into five groups but by size reasons in this paper are summarized in two: people & project psychology and organization & planning. Both of them are used to calculate adjustment factors in the Function Point counting method using dynamic models.

**Keywords:** Software project management, team building, software dynamics, risk management, function point method.

## 1 Introduction

Effective and efficient project development in time, cost and benefits are difficult to obtain in Information Technology (IT) projects. Throughout its history, the development of software has been marked by cost overruns, late deliveries, customers discontent and poor reliability. Management software projects are different from management hardware projects. Software projects are a “brain product”. A company’s requirements include processes, administration, product development, usability and many other activities that have to be supported by the software.

There are many papers which address complicated tools for controlling projects and extending methodologies when the real problems of the projects are found more in the field of human and management proficiency. This paper presents five aspects which assure that a project is both well-executed and does not produce deviations : people, organization and style of management, plan and risk management, psychology and business considerations (every aspect has a dynamic diagram and an adjustment factor). By size reasons in this paper is summarized in two: people & project psychology and organization & planning.

To support this research we draw on the experience gained in thirty large projects in different sectors (the sector is a critical variable): Telecom (five projects), industry

(six projects), process industry (five projects), distribution industry (five projects), food industry (four projects), aerospace industry (two projects), insurance (two projects) and public sector (one project).

## 2 The project management field of knowledge

There are interesting documents reviewing the main references in project management research. James Themis gives an introduction of different methods of code estimation and speaks about the estimation techniques in the present and gives future considerations [Themis, unknown]. The software Engineering Institute gives information about the different curricular topics of software project management and a list of the main references [Tomayko, 1989].

Several studies and theories can be found which focus on the area of code estimation. Basically these are studies that try to have an approach to the theory of determining cost variables and estimate efforts. The main methods are: lines of Code (LOC), CoCoMo (Constructive Cost Model) by Larry Boehm in 1981 and 1988, Function Points and Feature Points by Jones Albrecht in 1979, Revised Intermediate CoCoMo (REVIC), Effort Prediction Objects Model (F-PROM) by Laranjeira in 1990, Object–Oriented Decomposition and Function Bang Metric by DeMarco.

There are different studies and theories regarding the best methodologies, standards and approaches for dealing with project management. The most recognised guide and standard is provided by the Project Management Institute (PMI) in the Project Management Body of Knowledge. Other examples of professional project management associations that develop standards are: UK Association for Project Management and Standards Association of Australia. In addition, there are dozens of books that give a complete and up to date view of software project management techniques, among them: Information Project Management by Gary R. Heerkens [Heerkens, 2002], Modern Project Management by Norman R. Howes [Howes, 2001] and Harvey A. Levine [Levine, 2002].

## 3 People & Project Psychology considerations

People are the most important variable for the success of a project. It is good to keep track of the competences existing and needed in an organization with a tool of competence management. It is necessary to match the characteristic of the job with the characteristic of the people [Probert, 1997]. For example, an imaginative person should not be assigned a detailed and repetitive job. Furthermore, routine work for controlling and obtaining objectives is far better for a person who is more detailed, thoughtful and structured.

Software development involves more scheduled creativity than most other business areas. Allowing people to be creative and innovative is important. Without innovation however, you never obtain a sustainable competitive advantage; you can only photocopy old functional requirements with new technology.

Everyone working on the project has to take charge of their own job according to their experience. For example, people with four years of experience should be ready to design, solve problems and lead a small team. People who need a detailed course of action and continuous help from others in order to carry out their activities, do not have enough capabilities to be part of a team project. Trust and commitment ("push") are two of the most important characteristics of the member of a team.

There are many studies in psychology (individual and group) about how we can characterize people. Utilizing this information helps us to accurately select who we want to incorporate into our project in terms of: intellectual capabilities, honesty, degree of commitment and ability to work in a group. The project team works as a whole, but at a higher level every project leader must consider: "common sense" (a mix of experience and maturity) and commercial abilities.

A project needs different kinds of people and there are a variety of aspects to consider: functional expertise, management expertise and technical expertise.

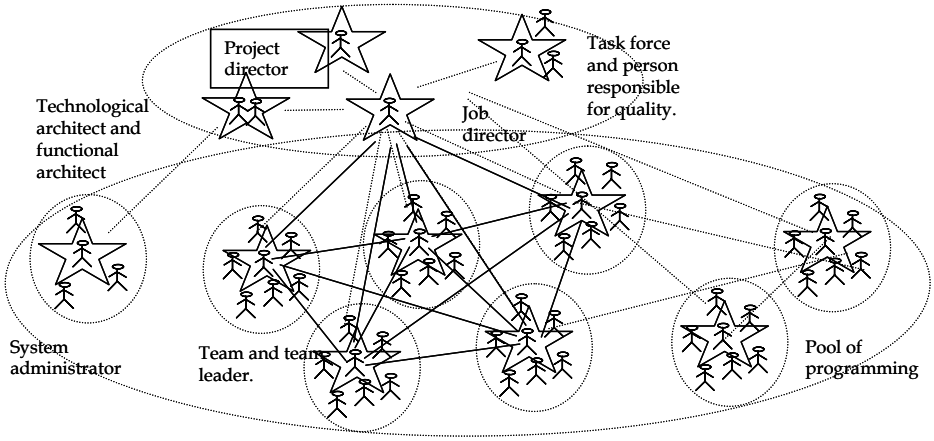


Figure I: Network organization is the most efficient for developing projects.

It is important to consider motivation when you are going to hire a person for a project. To understand motivation you have to analyze two things: Is his motivation in line with the necessities of the project? (Intrinsic motivation); How can I improve the motivation of this person in my project? (Extrinsic motivation).

At the beginning of the project, the different teams have to understand some facts of IT design characteristics, for example:

1. A customized implementation project management is not the same as a packaged solution project management (i.e. ERP´s).
2. Customized developments should only be carried out when the businesses' requirements are very different and there are no solutions in the market to meet those needs [Laudon, 1998] [Nelson, 1996].
3. It is better to have a high-quality technical package which covers 90% of the functional requirements than to have a package which covers 100% of those requirements but is not good in the technical considerations (for example reliability problems).
4. Never forget the scalability of the software (future requirements) [Lee, 2000].

Another important part of the project leader's job is to explain that a pre-configured solution allows, through the software configuration, millions of possible business solutions some of which are extremely different from others.

Depending on the area, combining different packaged solutions is not a problem (for example: SAP in ERP with Siebel in CRM, etc). Such as in the car industry operation, the future will be packaged solutions but with freedom to combine (this solutions incorporate pre-configured interfaces with other software).

It is necessary to control and to manage the formal and informal communications within the project using efficient communication tools [Kerzner, 2003]. One of the most important problems in software engineering is the coordination to insure low levels of rework. Rework is not always due to mistakes in the design, but rather a result of a misunderstanding of the users' needs (poor communication) or because of a misunderstanding of the design between members of the project (again, poor communication).

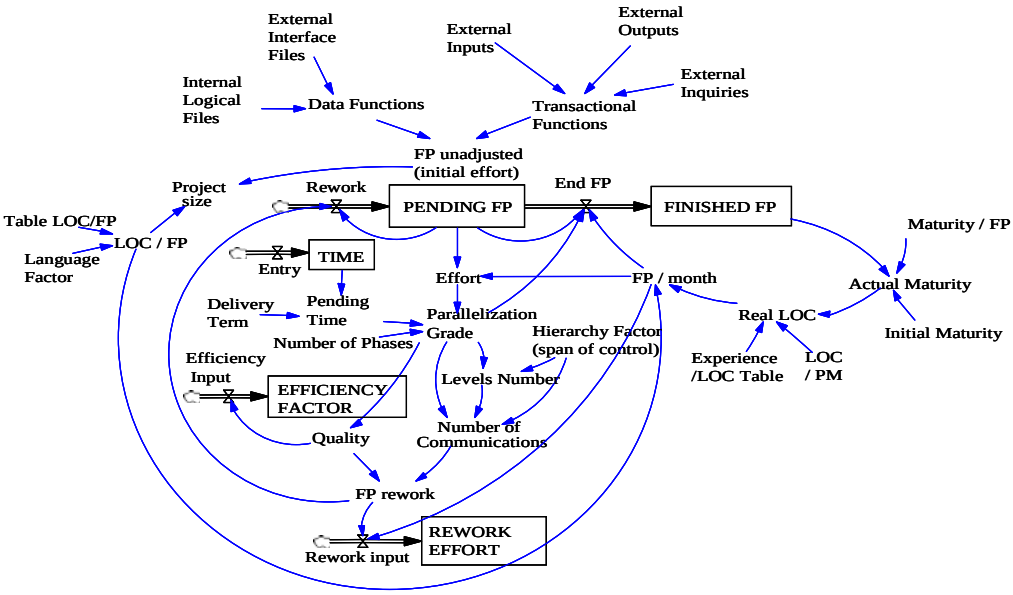


Figure II: Dynamic model to calculate the size effect in the adjustment factor.

## 4. Organization and planning considerations

A project cannot be managed like the department of a company. The project management has to be more agile and autonomous, to work faster and more efficiently than is the case in the usual company structure.

The network organization (with fewer than three levels) is the best way to organize environments that require innovation and flexibility (figure I). An informal organization requires people with sufficient experience and training if you want to work with effectiveness.

You can gain the customers/users trust but you must remember that the real issue is the business relationship. After every milestone, you must have a formal approval

from the customer including a complete list of the things that the customer does not feel have been completed with the necessary quality [Pham, 1995].

Never do the project estimation by thinking about another project and copying the estimations. These kinds of estimations are like a lottery and demonstrate that the manager in charge does not have enough experience. The best way is a zero-base budget; budgeting only the real tasks but considering the whole tasks (you need previous experience).

It is essential that the design and management of a project be simple [Curtis, 1988]. However, simplicity is not the same as easiness because a company, by definition, is complicated. The difficulty of a project increases exponentially with the difficulty of the design [Boehm, 1981 and 1988] [Brooks, 1995] [Brown, 1996]. There are two essential rules for minimizing these risks (figure II): modularize the project, split the different tasks. Do not forget that an increase of 10% in the size of the project can raise the complexity of the project 30%.

The following are the five principal execution problems in an IT project [Searle, 2000]:

1. Over-simplify the difficulties of the project.
2. Delay the beginning of the new tasks.
3. Not considering the differences between things that we plan to do, things that we have resources to do and things that we really need to do.
4. Carefully manage the interrelationships with external parts or departments in the project because they always suffer delays.
5. Consider the difficulty and extra-effort of the last details of the project. A project which advances 95% is never a project at 95%.

When planning a project, it must be kept in mind that it is like a chain and the bottlenecks must be controlled. In all the projects, there are circumstances that provoke bottlenecks. It is a statistical reason that depending on the dimension of the project and the different uncertainness you have, there is a probability of failure. Because of that, you have to count on extra resources in the project: extra time security and extra people.

The other aspect is to count on extra resources. New people are required in the training period and they are very helpful as a “taskforce” when you detect a risk of bottlenecks in the chain. It is essential to study and apply the Theory of Constraints (TOC) in project management [Goldratt, 1997 and 2004]. One hour of deviation in a bottleneck will cause more than hundred of hours of deviation in the project (multiplication effect).

Another thing which is necessary to avoid is multitasking. It is not true that three tasks at 33% added together are 100%. The reason is clear: the preparation time when passing from one task to another. Furthermore, there is a loss of concentration and quality [Abdel-Hamid, 1983 and 1989].

## 5. Conclusions

The modern IT technologies increase the functional requirements and the integration between tools, departments and companies. Projects are increasingly more

complex and require management skills and human behavior knowledge if you do not want them to fail. To manage IT projects it is always more difficult to possess good skills than good knowledge. To manage IT projects it is more important to understand human behavior and the functional necessities than to count on a sophisticated estimation tool.

This paper, presents a group of recommendations based on the experience of the authors to insure a well-executed project: people, organization and style of management, plan and risk management, psychology and business considerations. These five aspects are analyzing by dynamic models to define more accurately the value adjustment factors in the function point method. By size reason is only explained two models: to calculate the adjustment factor by logistic reasons (organization & planning) and by human reasons (people & organization).

## References

[1] Abdel-Hamid, T. and Madnick, S.E. (December 1989) Lessons learned from modelling the dynamics of software development. Communications of the ACM. Vol.32. No.12.
[2] Boehm, B.W. (May 1988) A spiral model of software development and enhancement. IEEE Computer.
[3] Brooks, F.P. (1995) The mythical man-month. Essays on software engineering. Anniversary edition. Addison-Wesley.
[4] Brown, N. (July 1996) Industrial strength management strategies. IEEE.
[5] Curtis, B.; Krasner, H. and Iscoe, N. (November 1988) A field study of the software design process for large systems. Communications of the ACM. Volume 31 Number 11.
[6] DeMarco, T. (1982) Controlling Software Projects: Management, measurement & Estimation. Yourdon Press Computing Series.
[7] Goldratt, E.M. (April 1997) Critical Chain. North River Press.
[8] Heerkens, G.R. (2002) Project Management. BriefcaseBooks. Mc Graw Hill. Professional.
[9] Howes, N.R. (2001) Modern Project Management. Successfully Integrating Project Management Knowledge Areas and Processes. Amacom.
[10] Kerzner, H. (2001). Strategic Planning for Project Management using a Project Management Maturity Model. John Wiley & Sons, Inc.
[11] Kerzner, H. (2003) Project Management. Eighth edition. Wiley.
[12] Laranjeira, L. (May 1990). Software Size Estimations of Object-Orientated Systems. IEEE Transactions Software Engineering, Vol. 16.
[13] Laudon, K.C. and Laudon, J. P. (1998) Management Information Systems. New Approaches to organization & Technology. Fifth edition. Prentice Hall International, Inc.
[14] Lee, Kenny K.F.. (2000) The five disciplines of ERP software implementation. IEEE.
[15] Levine, H.A. (2002) Practical Project Management. Tips, Tactics and Tools. John Wiley & Sons, Inc., New York.

[16] Nelson, P.; Richmond, W. and Seidmann, A. (July 1996) Two Dimensions of software acquisition. Communications of the ACM. Vol.39. No.7.
[17] Pham, Mitchell K.D. (1995) Total quality management in software engineering. IEEE.
[18] Phillips, J. (2004) IT Project Management. Second edition. McGrawHill Osborne.
[19] PMBOOK Guide. (2004). A Guide to the Project Management Body of Knowledge. Third Edition. Four Campus Boulevard. Newtown Square, Pennsylvania. USA.
[20] Probert, G. (June 1997) Projects, people and practices. Engineering Management Journal.
[21] Rowen, R.B. (IEEE. 1990) Software project management under incomplete and ambiguous specifications.
[22] Searle, J.R. (2000) Razones para actuar. Una teoría de libre albedrío. Ediciones Nobel.
[23] Themis, J. (Unknown) Methods and Models for Estimating a Software Project: An Analytical Approach. Source and date unknown.
[24] Tomayko, J.E. and Hallman, H.K. (July 1989) Software Project Management. SEI Curriculum module SEI-CM-21-1.0. Carnegie Mellon University. Software Engineering Institute.