

Chapter 6.4

Computer–Aided Management of Software Development in Small Companies

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ABSTRACT

This chapter focuses on the principles of management in software development projects and optimization tools for managerial decision making, especially in the environment of small IT companies. The management of software projects is specific by high requirements on qualified labor force, large importance of the human capital, low level of fixed costs, and highly fluctuating product demand. This yields a dynamic combinatorial problem for the management involving considerable risk factors. The key aspects addressed here are structuring of the project team, cost estimation, and error avoidance in the implementation phase of the project. Special emphasis is put on human resource and fault-tolerant management of the project cycle. Discrete faults and continuous stochastic inputs are used to test and evaluate project

variants. We have developed an online simulation tool for this purpose that facilitates findings of optimal resource structures and creation of optimal network from task relations. General principles of software project management are presented along with the analysis of the software project simulation tool in a brief case study.

INTRODUCTION

The history of modern project management in general dates back to the 5th decade of the last century in connection with large military projects. About 1 or 2 decades ago, a close attention started to be paid to risk assessment and coordination of mammoth software projects (MS Windows development, etc.). Although it is fully recognized that the way of management of software projects

often matters more than financial resources (and a frequent success of small software companies sold at astronomic profits to giant SW development companies demonstrates this point), relatively little is known what are the crucial factors for success. A project can be defined as a temporary endeavor undertaken to create a unique product or service (i.e., in the present case, software) or another product by using software at a large scale. It is noteworthy that a complexity limit was empirically discovered in the software development, which is as low as about 10 software engineers working on one project. Therefore, an appropriate management is crucial since most of the software projects exceed this number.

Software development and its successful management is a key issue for a number of small IT companies and, with increasing importance, also for their clients. The project management (PM) common fundamentals are integration, scope, time, cost, quality, human resource, communications, risk, procurement, delivery and service to customers. Software project management (SPM) is, in addition, characterized by unique success factors derived from the unique components of IT projects. There are specific requirements on the applicability of standards, fault-tolerance, risk management, project scheduling, code development and testing techniques. Further important issues are selection and use of third-party software and also the intellectual property rights.

It has been noted in recent surveys that most software projects suffer from inadequate management techniques that ignore the unique characteristics of this field (cf. Northwest Center for Emerging Technologies, 1999; US Government Accounting Office, 1979, 2000). The most cited reasons are poor strategic management and underestimation of human factors in particular. It is known that about one half of software projects was delayed in completion and one third was over budgeted in 1997-1999, similar to the first study conducted in 1979 on this problem by the US Government Accounting Office. This

remarkably persistent problem has been gaining increasing attention in scientific literatures for about a decade (cf. Abdel-Hamid & Madnick 1991; Humprey & Kellner, 1989). Since then, books and practice guides (e.g. Bennatan, 1995; Jalote, 2002) have appeared with different levels of rigor, but the number of detailed investigations in scientific journals has been rather limited (cf. Drappa & Ludewig, 1999; Rodrigues & Bowers, 1996). There is also a nuance to be noted: Traditional PM aims to solve certain types of *problems*, while SPM is rather a *process* than a solution of a problem, and therefore it requires a different approach.

Major authorities among the professional organizations in the field of SPM are Project Management Institute (PMI), Software Engineering Institute (SEI) and IEEE Software Engineering Group. These recognize the following important factors for a successful project:

- Leadership,
- Communication,
- Negotiating,
- Problem-solving methodology,
- Information sharing and training, and
- Relevant technical expertise.

Coordination and cooperation are the key factors; this is within the responsibility of the administrative hierarchy that typically includes a coordinator, assistant project manager, program manager, and a software development coordinator. Each project typically involves a team, targets certain customers and relies on contractors, and must be backed by sponsors, executives, and functional managers.

The first principle of project management is that there exists no universal principle at all. Attention has to be paid to project size, project type, culture of the project team and other factors. Software projects, in addition, require a special emphasis on the communication of *technical* experts in order to guarantee code portability

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