Software Project Management and Planning: The Case of the Greek IT Sector

Prodromos D. Chatzoglou
Associate Professor, Democritus University of Thrace, Dept. of Production Engineering & Management, University Library Building, Xanthi 67100, Tel./Fax: ++30 – 25410 – 79344
Email: pchatzog@pme.duth.gr

Nikolaos Theriou, Efstathios Demetriades
Associate Professor , Application Professor, TEI of Kavala, Dept. of Business Administration, Agios Loukas, 65404 Kavala, Tel. / Fax : ++30 – 2510 – 462156
Email: ntheriou@teikav.edu.gr

Vasilios Aggelides
Director, Hospital of Kavala, Dept. of Information Management
40 American Red Cross Str., 65201 Kavala
Email: ngnk@kav.forthnet.gr

ABSTRACT

There are many factors that affect the competitiveness of the companies within the IT/IS sector. Some of the most important are the use of modern management techniques as well the use of state of the art production tools. Nevertheless, no research has been conducted to study the use by and effect of similar factors on the Greek IT/IS companies.
This research attempts to investigate whether the Greek IT/IS sector is competitive within a continuously and rapidly changing international market by examining the production process adopted and the management practices used by the companies included in this sector.
A structured questionnaire was addressed to project managers and program leaders of almost all Greek IT/IS companies. The analysis of the data collected (65 questionnaires) has shown that although very experienced and highly educated people are involved in the production process, most companies are not using any formal development methodology and they do not plan neither they manage their development process in the right way.

Keywords: Information System Development, IS Development Methodologies, IS Project Management.

1. Introduction

The goal for all project managers is to bring a project to completion on time, within the budgeted costs, and to meet the planned performance or end-product goals by orchestrating all resources assigned to the project effectively and efficiently [Simpson, (1987)]. As a result, managers of software development projects increasingly recognise the importance of planning and estimation [Lederer and Prasad, (1995); Deephouse et al., (1996)] for the successful completion of their projects. However, although they have many sophisticated tools at their disposal, many systems are still delivered way behind schedule, cost far more to produce than original budget estimates, and fail to meet user requirements [Johnson, (1996); Lederer and Prasad, (1995); Simmons et al., (1993); Barki, Rivard, & Talbot, (1993)].

Thus, it is not surprising that improving software product quality and performance and development team productivity has become a primary priority for almost every organisation that is involved in the development of computer systems [Moller and Paulish, (1993)]. Nevertheless, surveys in the UK [KPMG, (1990); Fairbrain, (1989)] report that there are still major quality problems with commercial systems. While computer hardware performance has been doubling approximately every three years, improvements in software productivity have been increasing at a modest 4% annual rate [Putnam, (1991)].

The problem caused by this phenomenon, often referred to as the "software crisis" [Glass, (1994)], can be attributed not only to the non-application of principles and methods, but also to inadequate project management caused by a lack of recognising and understanding what the real problems are in carrying out software development [Ratcliff (1987)].

Unfortunately, the main strategies adopted for planning the development process are various 'rules of thumb' developed by project managers which are based only on their personal experience. "Effort estimates are, therefore, usually best guesses based on a series of best guesses about the project and staff resources" [Jordan and Machesky, (1990)]. Another strategy is to follow the old adage, "estimate the cost and then double it". However, it is most likely that cost will still be underestimated [Bowen and Hinchey, (1995)].

A number of studies focusing on the efficiency of software development have been presented in the literature [Mahmood, Pettingell, & Shaskevich, (1996)]. Many attempts have also been made to examine the scale effect on the software production process [Banker & Kemerer, (1989); Byrnes, Frazier, & Gulledge, (1993)]. Recently, Banker, Chang, and Kemerer (1994) reported the existence of both economies and diseconomies of scale in software development.

Finally, it is recognised [Lauer, (1996); Bubenko, (1995); Keil, (1995); Boehm, (1991)] that most of the problems still have their roots not only in the technical (software) issues but also in managerial, organisational, economical and social issues.

The last decade was for the Greek IT/IS sector a period of rapid growth and expansion. This can be attributed to the fact that the market became more mature (after its initial steps in the early 80's), the introduction of many companies in the Athens Stock Exchange, and finally, the EU funding of many IT/IS projects. This research attempts to provide a snapshot of the Greek IT industry today. The main aim is to understand how Greek IT/IS companies organise and manage their development process.

This paper is structured as follows: Section 2 provides a brief literature review, while Section 3 describes the research methodology adopted. Section 4 presents the results and finally, Section 5 summarises the findings and highlights some of the limitations of this research.

2. Literature Review and Underlying Theoretical Framework

Planning is an iterative process because there are a large number of interacting variables and first assumptions can be proved incorrect [Youl, (1990)]. Project managers usually have to make early estimates without knowing the detailed requirements. The project team members and their abilities may also be unknown. However, no one can afford to wait until the end of the requirements capture and analysis stage to start planning for the rest of the project.

Planning and managing the system development process depends on a method of estimating the resources (cost, effort, timescale) required for the completion of different stages of the development process. In addition, the estimating method must be able to take into account the sensitivity of the development resources to various product, project and environmental factors. Resource estimation must also be able to take past experience into account, particularly the relevant experience of the department or business in the development of similar systems [Rook and Wingrove, (1990)].

Studies have shown [Locke and Latham, (1990); Rasch and Tosi, (1992), Constantine, (1993); Nidumolu, (1995); Lauer, (1996)] that some of the most important factors that affect the software development process are a) Human Factors, b) Technical Factors and c) Management Factors [Ali and Seiford, (1993); Constantine, (1993)]. Nevertheless, studies have pointed out that the project manager's expertise is not captured by the existing models [Mukhopadhyay et al., (1992); Subramanian and Breslawski, (1995)]. Instead, software

community pays too much attention to the technical factors at the expense of these other contexts. One often cited reason is the difficulty of quantitatively measuring human factors [Perry et al., (1994)]. Nevertheless, the need to improve IS human resources is quickly emerging as a high priority in the 1990s among IS executives [Neiderman et al. (1991)]. Information systems development is not considered any more just as a technical process of building an information system, but also as a social process involving stakeholders from multiple organizational units [Kirsch, (1997)]. Successfully building systems, therefore, requires effective management of relationships among these stakeholders to elicit their contributions and cooperation, while at the same time, maintaining progress toward the project's goals [Beath & Orlikowski, (1994); Walz, et al., (1993)].

Human factors must include factors concerning both developers [Rasch & Tosi, (1992); Macala, Stuckey, & Gross, (1996)] and users. The degree and effectiveness of participation depends on the relative ability of users and developers to exert influence, their relative power positions and the ability and willingness of each party to communicate [Markus and Bjorn-Anderson, (1987)]. A model on how users participate in system development is presented by Newman and Robey (1992) and a comprehensive review of the latest research on users' participation is given by Cavaye (1995). Nevertheless, the argumentation for user participation has been largely uncorroborated by research evidence plagued, however, with inconclusive and sometimes contradictory results [Hartwick & Barki, (1994); Hunton & Price, (1997); Lawrence and Low, (1993); DeLone and McLean, (1992); McKeen et al, (1994); McKeen & Guimaraes, (1997)].

Furthermore, not only tools and methods, but also personnel experience and skills are important. The latter are indicated as key variables that influence overall software development effort [Wrigley & Dexter, (1991)] as well as software development management and productivity [Subramanian & Zarnich, (1996)]. Above all, software development is a collaborative effort that relies on effective communication and interaction between various stakeholder groups: managers, end-user groups and systems development professionals [Newman & Robey, (1992)].

Additionally, other studies have shown that some of the most important factors that influence the productivity within the software development process are :

i) size of project team [Banker et al, (1994); Jordan and Machesky, (1990); Youl, (1990); Banker and Kemerer, (1989)],
ii) product complexity, requirements volatility, schedule constraints and software tools that are used [Rasch and Tosi, (1992)],
iii) team cross functionality and team independence [Carmel, (1995)],
iv) learning, training, and communication overheads [Rodrigues and Williams, (1997)].

3. Research Methodology

The data collection process took place from June till September 2000. More than four improved version of the research instrument (questionnaire) were designed and tested. The questionnaire was divided into six sections, each one dealing with a different aspect of the development process. It must be stressed that most of the questions referred to the last project each respondent was involved in.

Despite the fact that all the formal data collection procedures were adopted (very big sample list, search of the right people within each company that the questionnaire should be addressed to, an introductory letter explaining the questionnaire and why/how it should be answered was also included, a follow up call was made a week after they had received the questionnaire etc), no more than 65 correctly completed were received. A possible reason why a relatively low response rate was obtained is probably the time the data collection process took place (summer - holiday season). The SPSS statistical software was used to analyse the data.

4. Analysis of Findings

The people who have participated in the survey completing the questionnaires were mainly Project Managers or Program Leaders (81,5%). It is important that they are quite experienced since they have participated in 8, on average, similar projects. Most of the projects are software projects (77%) that are developed for external customers (91%). The majority of them are for Generic use (73%) and tackle well defined problems (70%).

Most developing organisations (81,5%) have a formal system development procedure. However, and in accordance to what is happening in other countries (……) it is found that a relatively small percentage of the Greek IT/IS companies (54%) are using formal development methodologies during the system development process. Nevertheless, nearly all of these methodologies are structured ones and compatible with other methodologies/methods/tools used by the companies. Only a few of them covered the Requirements Capture and Analysis (RCA) stage of the development process, and no tool or technique was in use to ensure that enough requirements were captured. Furthermore, 66% of the methodologies were supported by a tool, which was responsible for automating the process, while 54% of the methodologies included a project management tool. It is encouraging though that the main reasons these specific methodologies were chosen are first, the quality of the outcomes produced by their use, and second, the compatibility and suitability level of each methodology with the characteristics of each specific project.

To continue, it was reported that the main size metric used for the requirements document is the "number of pages" metric (anything from 4 to 500 pages, with average size 85 pages), while for the whole project the metric used the number of code lines used to complete the project (anything from 2.200 to 400.000 LOC, with average size 92.000 LOC). The main programming languages used are C++ and Java.

Furthermore, one of the most interesting finding is the resource allocation pattern used by the Greek IT/IS companies and the effectiveness of this pattern. More specifically it is found that, in 64% of the projects, the development team was consisting of less than six people. In detail, only one or two persons were responsible for the development of the Feasibility Study (in 54% of the projects), one to three persons were involved in the Requirements Capture and Analysis process (72% of the projects), one or two persons had undertaken the Analysis and Design task (63%), up to four people were responsible for the writing of the actual code (72%), and finally, up to five persons were involved in the testing and implementation process (in 54% of the projects).

As far as the elapsed time and effort allocated to each stage of the system life cycle are concerned, it is found that projects are developed within 2 to 36 months (23 months on average) and the effort needed for their completion is from 1 to 600 man-months (240 man months on average) respectively. However, it is shown that the stage where the highest percentage (33%) of the total elapsed time and effort was allocated to is the Coding stage. On the other hand, only 13% of the total elapsed time and effort was allocated to the Requirements Capture and Analysis stage (Figure 1). Similarly, while the total cost of project development is from 60.000 euros up to 600.000 euros (185.000 euros on average), Coding is the single stage of the development process with the highest cost (37% of the total cost). The Requirements Capture and Analysis stage accounts only for 11% of the total development cost. Despite this resource distribution pattern, most of the requirements (46%) are captured within the RCA process, while there is a volume (20%) of the requirements that are captured during the Coding and Testing stages. This can explain why although 25% of the respondents were not satisfied with the amount of requirements captured during the RCA process, 82% of them reported that more than 85% of the requirements captured during all the stages of the development process had finally been used. This resource allocation pattern indicates that Greek IT/IS firms put emphasis mainly on the Coding stage of the system development process.

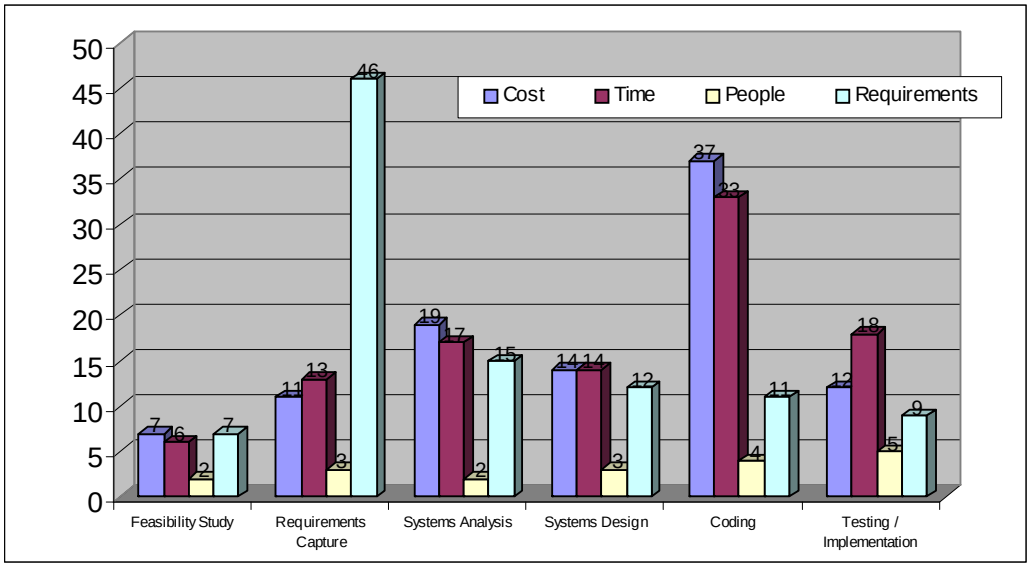

Figure 1: Resources allocated and Requirements captured within each stage of the development process

Furthermore, to support what was found by other researchers [Youl, (1990)], the development process used by Greek IT/IS companies is an iterative process. However, the number of iterations is different for each separate stage of the development process. Additionally, different, as well, is the reason why the targets within each stage had not been accomplished and, therefore, one more iteration had to be performed. For instance, only two iterations were performed of the Feasibility Study (in 54% of the projects) and the Design stages (in 63% of the projects) and the main reason for not accomplishing their targets was "lack of time". On the other hand, three iterations of the RCA process occurred mainly because there was a communication problem between the developers and the "sources of information". The last iteration of this stage is usually performed for validation and verification purposes. Finally, cost seems to be the main reason why the Analysis stage is performed only once in most of the projects.

Moreover, the way some important factors (human, technical etc) affect the previously mentioned project management parameters (time, effort, cost) was examined. The majority of the respondents consider as very significant the following factors: team members' experience, team members-users communication, team management, and resources available and their coordination. It should be stressed though, that the same people reported than the significance of the factors does not determine the actual level of each of the factors. More specifically, it is found that the level of the following factors is high to very high: team members experience, team members knowledge, customers dedication to the project, management commitment, project management style, development tools/techniques used and finally, resources available (Table 1). In the majority of the projects included in this survey, the effect of these factors on time, effort, cost and outcomes was positive. The most important factors found to be: a)team members experience, b)team members knowledge, and c)team members persistence and commitment. On the other hand, it is reported that the factors project managers should work on in order to improve both the quality of the project outcomes and the economic parameters of the projects are: a) users' involvement, and b) team members-users communication. As for project management, respondents suggested that improvement is necessary especially in planning and organising the project management process.

Table 1: Level of Factors and their Impact on Resources (Time, Effort, Cost) and Outcomes

	FACTORS	LEVEL (VALUE)	IMPACT ON RESOURCES & OUTCOMES
1	Team members Experience	Very High	High
2	Team members Knowledge	High	High
3	Team members Commitment and Persistence	High	High
4	Team Size	Satisfactory	Medium
5	Users' Involvement	Satisfactory	Medium
6	Users' Communication with team members	Satisfactory	High
7	Users' Motivation	Satisfactory	Medium
8	Users' Abilities	Low	Low
9	Conflict between users	Low	High
10	Users' understanding of the system under development	Satisfactory	Medium
11	Customers Persistence and Commitment to the Project	High	Medium
12	Developing Organization's Commitment	High	High
13	Project Management	High	High
14	Tools and Techniques available	High	High
15	Resources available	High	High
16	Resource Coordination	High	High

5. Summary, Conclusions and Research Limitations.

The main findings of the research presented in this paper indicates that Greek IT industry focuses mainly on the development of small size, generic software, solving medium or well-defined problems and targeting small to medium size customers. The experience of the people who are participating in the development process is satisfactory and, this also, partly explains their good knowledge on and understanding of the problems they are facing during the development process. It comes as a surprise that a rather large number of developing organisations do not use a development methodology; it seems that they are heavily relying on the experience and knowledge of the people who participate in the development team. However, since there are not many experts in this field in Greece, companies are always facing the threat of loosing their most experienced personnel. On the other hand, it is quite promising, that those companies that are using a development methodology are doing so for specific reasons (compatible with other methods used, suitable to the characteristics of the specific project etc.).

The fact that "lack of time" was reported as the main obstacle for not delivering what was promised to is a strong indication that mainly planning but also management are not performed in a proper way. To support this argument, it is shown that the iteration process of some of the stages did not produced the expected results mainly because there was not enough time allocated to these stages.

Finally, it becomes obvious from both the literature review but also from the presentation of the findings of this research that the successful completion of the IT/IS projects very much relies upon the knowledge, experience, and commitment of both team members and users but mainly upon the communication between these two parties. However, it seems that Greek companies do not pay the appropriate attention to some of these important human factors, but neither to technical factors (e.g. use of methodologies).

This research has some major limitations. First of all, mainly software houses were included in the sample and, as a consequence, the findings refer only to this IT/IS sub-sector. Second, although the size of the sample could be considered as satisfactory, it might not be a good representative of the population, because some of the biggest and well-known companies refused to participate. Last, the data collection process took place 30 months ago and things might have changed since. For the above three reasons it was decided to repeat the same survey (using an improved version of the same instrument) in order to be able to draw some more reliable conclusions about the Greek IT sector.

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