

## **Chapter 3**

### **Survey Of Software Engineering Project Management Problems In Malaysia**

#### **3.1 Survey Objectives**

Incompleteness and delays are the major issue in software project management and it has been reported that the failure of most software projects was due to problems in software management [IAN92], [RED90]. Moreover, the main objective in this research is to develop a tool to reduce problems and insure quality. Therefore, it is very important to search for the problems and difficulties causing incompleteness and delays. The following are the main survey objective.

- (a) Investigate the types of software project management problems companies are facing.
- (b) Discuss critical project management problems.
- (c) Evaluate the need for development tools to solve/minimize problems in a project.

#### **3.2 Prior Studies**

Over the past ten years, most of the studies investigated software development problems and risks that led to schedule slippage and cost overruns. Most of these studies found that the problem areas in software development are in the requirements definition and design phases [RAM84]. Gregory T. Daich reported that 70% of the defects in most systems are caused during the analysis and design phase and 30% are introduced during coding [GRE96].

Raymond, Pamela, and Alex found that the major factor causing difficulty in maintaining large software system is the lack of attention to requirements analysis and specification [RAY84]. Studies show that 95% of software had to be rewritten after delivery because of mismatches with user requirements. In addition, there are many examples of total cancellation of projects due to the lack of appropriate requirements and feasibility analysis [RAY84]. Reference to an article on IT project success in the US gave startling statistics. According to the article from Application Development Trends, 31% of IT projects are cancelled before completion. This represented approximately 80,000 cancelled projects in 1995 which is worth a staggering \$8 billion. 61% of business functionality expected from the project actually makes it to the final version. Only 13% of IT systems projects are considered successful by the executives who sponsored them. More than half of all system projects have cost overruns of at least 189% [CHR97]. Up to 30% of the cost of software quality can be reduced if the defects are detected and avoided early through reviews and audits [SIE97].

Pareto principle states that 80% of the defects can be traced to 20% of all possible causes. Identifying and isolating the vital 20% will help in correcting most of the defects [ROG97]. CHM & Co. Project Management Consulting in Western Australia noticed after years of extensive work in South East Asia, Australia and Europe, that almost everyone is able to make reasonably good planning, scheduling, and budgeting. However, good tracking is still lacking [CHM97]. After years of pursuing fragments of a solution to the challenges of software engineering, including the development of methods, tools, and the like, the software engineering community has come to realize that over emphasizing any one of these areas to the exclusion of others is incorrect.

The community recognizes that well defined and well supported process are the critical issue in producing high quality software system on time and within budget [BRI95]. In addition, Redmill addressed the reasons for the failure to meet budget, timescale, and specification as: 1) incomplete requirements and imprecise specification, 2) difficulties in modeling systems, 3) cost and resources estimation are uncertain, 4) lack of visibility, 5) difficulty in monitoring the progress, 6) complicated error and change control, 7) lack of agreed metrics, 8) difficulty to control maintenance, 9) lack of common terminology, 10) software/hardware apportionment is uncertain, 11) rapid changes in technology, 12) determining the suitability of languages, 13) measuring reliability, 14) interfacing problems, and 15) integration problems [RED90].

A study reported that the number of defects that occur in software delivered to the field is not a linear function of size, the defects increase exponentially. This study also revealed that there were many projects which failed and many more are failing because of counterproductive management [NOR96].

In summary, most of the studies discussed above focuses on highlighting the reasons for incompleteness and delays in software project development. The main problems in project slippage are excessively optimistic estimates, incomplete plans and requirement problems [CHM97].

### 3.3 Research Approach

The survey was done on software developing organizations in Malaysia to investigate the types of software project management problems companies are facing and to evaluate the need for additional development tools to minimize these problems. A questionnaire (Appendix B) was developed with the following question type: i) open ended questions leading to a broad set of data, such as eliciting addition problems not mentioned ii) closed ended questions such as a checklist of problems the companies are facing in each stage. The checklist approach was chosen because it is easy to understand and saves the respondent's time. The questionnaire is divided into sections representing project management phases. Each section presents a collection of problems gathered from books, published papers, the internet and expert opinion. The questionnaire was reviewed by several academics. The questionnaire was then distributed by mailing them with a cover letter which assured the respondent's confidentiality. A web version was also provided at the following address [<http://www.fsktm.um.edu.my/~hanan/survey.html>].

### 3.4 Survey Results

The survey [KHA98] was done to investigate the problems companies are facing and the limitations of the available tools. The analysis of the result was based on 31 respondents. The section below gives the compiled results in respective stages.

#### a. Planning stage.

The respondents indicated that the single most critical problem in this stage is the shortage of equipment and manpower during the implementation (71%, 22/31), as shown



in Figure 3.1 and Table1. In estimating the project attributes, most companies are facing difficulties in estimating project size, cost, and schedule (71%, 22/31), which is presented in Figure 3.2 and Table 3.2.

Table 3.1: General planning problems.

|     |                                                                                                                                  |
|-----|----------------------------------------------------------------------------------------------------------------------------------|
| P1  | Software costs and schedules are hard to prepare accurately.                                                                     |
| P2  | The methodology, standards and procedure are unclear.                                                                            |
| P3  | Losing the support of senior management due to a change in focus or change in people.                                            |
| P4  | Difficult for project managers to select the methods and/or tools to use.                                                        |
| P5  | Shortage of equipment, and manpower during implementation.                                                                       |
| P6  | Documentation such as in general plan or detail plan, is not clear and ambiguous.                                                |
| P7  | Supervisor, who is in-charge of control, monitoring of progress and correcting action plans, does not present reports regularly. |
| P8  | Software project management plan is not clearly defined.                                                                         |
| P9  | Unable to determine the completeness of the software project management plan.                                                    |
| P10 | Inadequate knowledge/training in using the plan inspection support tools.                                                        |
| P11 | Delay in planning software project management.                                                                                   |

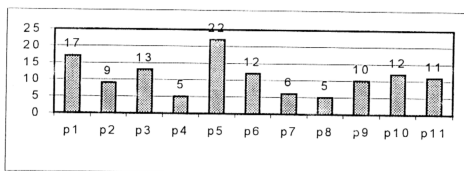


Figure 3.1: Bar chart representation of the planning problems

Table 3.2: Estimating problems

|    |                                                                             |
|----|-----------------------------------------------------------------------------|
| P1 | Difficult to estimate project size, cost, and schedule.                     |
| P2 | Do not use past experience when the project is similar to those in the past |
| P3 | Do not decompose the project into smaller tasks to estimate individually.   |

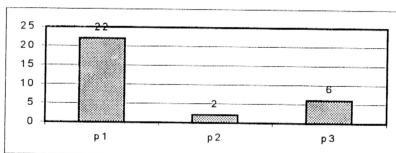


Figure 3.2: Bar chart representation of estimation problems

## b. Organizing stage.

The two major problems in this stage are lack of qualified personnel in the organization, and no documentation on decision justifications (48%, 15/31) as shown in Figure 3.3 and

Table 3.3.

Table 3.3: Major problems in the organization stage.

|    |                                                          |
|----|----------------------------------------------------------|
| P1 | Difficult to select organization program model.          |
| P2 | Lack of qualified personnel in organization.             |
| P3 | The justification for decision sometimes not documented. |
| P4 | Job descriptions and qualifications not documented.      |

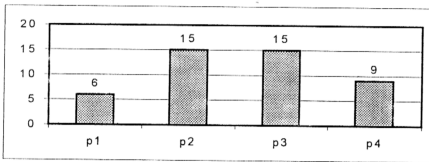


Figure 3.3: Bar chart representation of problems in organization

### c. Staffing stage

Late on assigning people causes the most problems which delays the project due to the need for people to be trained and learn the system (55%, 17/31). In addition, there seems to be insufficient qualified people (48%, 15/31) as depicted in Figure 3.4 and Table 3.4.

Table 3.4: Staffing problems

|                                                                                               |
|-----------------------------------------------------------------------------------------------|
| Insufficient qualified people.                                                                |
| The staff turnover due to (poor working conditions, low pay, competitive job market is high). |
| The staff do not know anything about the procedure or the rule planned in staffing plan.      |
| Assigning people late in the project                                                          |

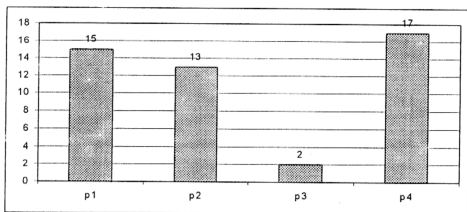


Figure 3.4: Bar chart representation of staffing problems

#### d. Directing stage.

The major problems at this stage are the project members do not report consistently (42%, 13/31) and there are incomplete or unclear documentation of important decision or managing change (39%, 12/31) as shown in Figure 3.5 and Table 3.5.

Table 3.5: Directing problems

|    |                                                                                   |
|----|-----------------------------------------------------------------------------------|
| P1 | In each stage the leadership is lacking in knowledge and experience.              |
| P2 | The staff do not report consistency day by day to supervisor/manager.             |
| P3 | Delegating authority not to a qualified person.                                   |
| P4 | Incomplete/unclear documentation of important decision or managing change         |
| P5 | Project manager uses unfamiliar tools and methods that they have not used before. |

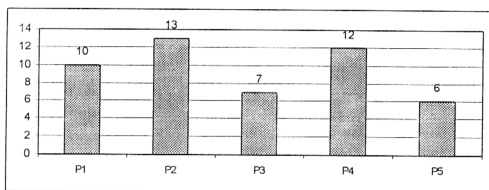


Figure 3.5: Bar chart representation of directing problems

### e. Controlling stage

In the context of controlling the projects 32% (10/31) of the companies do not have enough experienced staff in reporting processes. About 42% (13/31) of the companies have incomplete standard of performance to define the quality of products as shown in Figure 3.6 and Table 3.6.

Table 3.6: Controlling problems

|    |                                                                                          |
|----|------------------------------------------------------------------------------------------|
| P1 | The standard of performance (to describe/define the quality of a product) is incomplete. |
| P2 | The staff is not qualified/has not enough experience in reporting.                       |

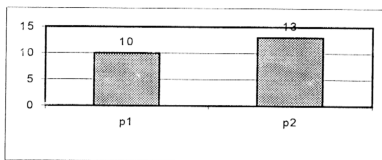


Figure 3.6: The scales of the controlling problems

## f. Requirement stage

A high percentage (77%, 24/31) of the companies are facing difficulties in understanding the problem and requirements due to the changes in the requirements and unknowledgeable customers. 43% (15/31) of the companies are facing problems through misunderstanding requirements. These problems have existed for a long time [RAY84]. There is difficulty in communication between project members and customers (52%, 16/31). The development team of some companies (39%, 12/31) lack knowledge and experience. Besides that, (35%, 11/31) the companies are not using prototypes in the requirements stage to handle the disagreement between customers and developers. These problems are presented in Figure 3.7 and Table 3.7.

Table 3.7: Requirement problems

|    |                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------|
| P1 | Difficult to understand the problem and the requirements.                                                           |
| P2 | There is misunderstanding in requirement when specialists try to define the specification to meet that requirement. |

Table3.7: (Continue)

|    |                                                                                  |
|----|----------------------------------------------------------------------------------|
| P3 | Analysis team member lack of knowledge/experience in specification requirements. |
| P4 | Software requirements are difficult to write correctly and ambiguously.          |
| P5 | The tools used in this stage are not enough to detect the faults/defects.        |
| P6 | Prototyping not used in the requirement analysis.                                |
| P7 | Difficulty in communications between project members and the customers.          |

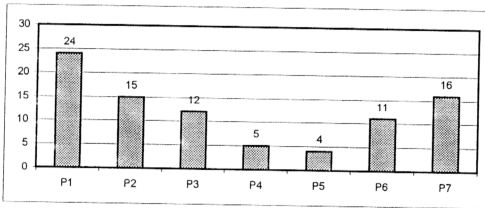


Figure 3.7: Bar chart representation on requirement problems

Generally, companies are facing problems in both software development (39%, 12/31) and project management (35%, 11/31) as seen in Figure 3.8. The problems in software development might be attributed to the problems in project management.

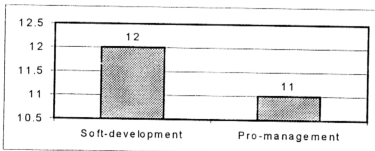


Figure 3.8: Bar chart representation of problem level

From Figure 3.9, the faults detected in the inspection process is most critical in the following phases:

- Ph1 (58%, 18/31) Design reviews.
- Ph2 (48%, 15/31) Specification review.
- Ph3 (45%, 14/31) Requirements review.
- Ph4 (26%, 8/31) Code inspections.
- Ph5 (19%, 6/31) Plan inspection.

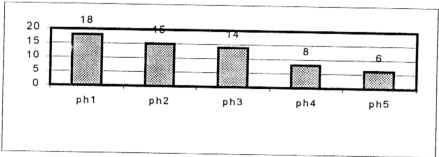


Figure 3.9: Phases where fault detected are most critical

More than 50% of respondents felt that tools are not required. However, respondents indicated the need for tools in some of the phases. 39% (12/31) of the companies believed that tools are needed during the design review. Another 35% (11/31) stated that tools are required only during the specification review stage (Figure 3.10).



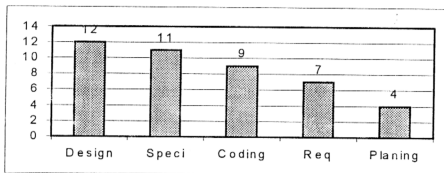


Figure 3.10: Tool requirements at various stages

This survey investigated the limitations of the available tools in the planning stage. It has been observed that most of the companies (58%, 18/31) complained about the inability of tools to determine accurate estimation (e.g. cost, & schedule). For some companies (32%, 10/31), a long training time is needed to acquire the skill of using tools. There is no specific planning tools used apart from project management approaches using milestone, WBS, PERT, CPM, and Gantt charts.

In the organizing stage, the problems can be minimized in a variety of ways. Top management involvement is critically important. Sufficient project resources should be made available. Flat organization style team should be adopted to reduce bureaucracy. Team size should be manageable and there should be less chief programming teams. Problems which exist in staffing stage can be reduced by using the latest technology. Graduates are not productive immediately and as such training must be provided with the support of the management. Skills available must be matched with requirements.

In the directing stage, less chiefs and more soldiers are needed wherever possible and responsibilities should be assigned accordingly. Existing, proprietary methodology is to be followed for efficient reliability. Leadership training should be provided to the project managers and group leaders. Proper reporting procedures should be followed to ensure controllability.

### 3.5 Discussion

This chapter presents some anticipated results to help identify problems concerning software project management. According to this survey, not many tools are being used. Current project management tools are incomplete in handling project management tasks efficiently. Furthermore, these tools do not solve current project management problems.

Development tools should be integrated together with project management tools so that proper tracking of details such as requirement changes can be done. Tools should help in spelling out the user's requirements especially in handling changes in requirements.

The software development process depends on three important parameters: time, cost, and effort. When estimated properly, timing and quality, to a certain extent, could be guaranteed. Many problems fall on the attitude of people. A computer could be used to help the manager assign people to projects, based on their qualifications, experience and performance record during development. Records on past experiences should be made available such as the defects introduced during development, causes of these defects and adopting known methodologies; and making the tools easy to learn and understand.

Project management tools must include checklists, procedures and steps to avoid common problems. An integrated on line tracking system would be useful.

### 3.6 Correlation

Correlation is a statistical method used to answer questions about relations between variables.

- ◆ **Pearson Correlation coefficient Computation;** measures the strength of the linear relationship between two variables. The following is the relationship between software project management phases and the numbers of problems in each phase, which can be identified by calculating the value of correlation coefficient. The required calculations are in the following table:

Table 3.8: Correlation coefficient calculations

| X       | Y       | Y <sup>2</sup>        | X <sup>2</sup>       | XY      |
|---------|---------|-----------------------|----------------------|---------|
| 1       | 14      | 196                   | 1                    | 14      |
| 2       | 4       | 16                    | 4                    | 8       |
| 3       | 4       | 16                    | 9                    | 12      |
| 4       | 5       | 25                    | 16                   | 20      |
| 5       | 2       | 4                     | 25                   | 10      |
| 6       | 7       | 49                    | 36                   | 42      |
| ΣX = 21 | ΣY = 36 | ΣY <sup>2</sup> = 306 | ΣX <sup>2</sup> = 91 | ΣXY=106 |

The formulae is:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

Where:

- n is the number of paired observations.
- X representing the software project management phases and the requirement phase.
- Y representing the number of problems in each phase.

$$r = \frac{6(106) - (21)(36)}{\sqrt{[6(91) - (225)][6(306) - (1296)]}} = -0.000692281$$

The value of  $r = 0.0$  indicates a scattering of points that do not have an upward or downward trend, which means there is no relationship between the software project management phases and the number of problems in each phase.

- ♦ *CHI-Square test* has been also applied to test whether there is a relationship between the problems in software development and the problems in project management. The CHI-square statistic is computed using the following formula.

$$X^2 = \sum \frac{(f_o - f_e)^2}{f_e} = 78.92$$

As a result  $X^2 = 78.92$ , which means the problems in software development and the problems in project management have dependent relationship.