ISTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

FACTORS CAUSING TIME SLIPPAGES AND BUDGET OVERRUNS IN IT PROJECTS

M.Sc. Thesis by

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ABBREVIATIONS

APM: Association of Project Management

CPM: Critical Path Method

DMV: Department of Motor Vehicles

EDI: Electronic Data Interchange

GIS: Geographic Information Systems

GPS: Geographic Positioning Systems

HISS: Hospital Information Support System

IRIS: Integrated Requisitioning Information System

IS: Information System

IT: Information Technology

NAO: National Audit Office

PDP: Professional Development Program

PMJ: Project Management Journal

PMI: Project Management Institute

PMQ: Project Management Quarterly

PMP: Project Management Professional

PMBOK: Project Management Body of Knowledge

UK: United Kingdom

US: United States

WBS: Work Breakdown Structure

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ÖZET

Değişimin gittikçe önem kazandığı bir dünyada bilgi teknolojileri projeleri firmaların bu değişimi etkili bir şekilde kullanabilmeleri için faydalı bir fırsat olabilir. Bilgi teknolojileri projeleri firmalara bilgi teknolojisinin sunduğu fırsatları kullanarak daha etkili, verimli ve hızlı çalışma imkanı sağlar. Bu faktörler firmaların dünya pazarında lider olmaları ve bu liderliği devam ettirebilmeleri açısından çok önemlidir. Bununla birlikte bu projelerin bazıları iptal edilmekte bazıları ise birçok problemle karşılaşarak bitirilebilmektedir. Bu çalışmanın amacı bilgi teknolojileri projelerinin başarısını etkileyen faktörleri geniş bir perspektiften analiz etmektir. Bunun yanında projelerde kullanılan anlaşmazlık yönetim tarzları ile bilgi teknolojileri projelerinin performansı arasındaki ilişkiyi inceleyen ilk araştırma olduğu için de bu çalışmanın sonuçları önem kazanmaktadır.

Bu açıdan zaman ve bütçe aşımına yol açan faktörler ve proje yöneticilerinin anlaşmazlıklarda kullandıkları yönetim tarzları literatür taraması ile belirlendi. Literatür taramasının sonucunda çalışma anketi hazırlandı. Bu anket 145 proje yöneticisine uygulandı. Bu anketin sonuçları analiz edildiğinde tüm projelerin aynı anda hem zaman aşımına hem de bütçe aşımına uğramadıkları, projelerinin bazılarında sadece zaman aşımı bazılarında ise sadece bütçe aşımı olduğu bazılarında ise her iki kriterin de aşıldığı görülmüştür. Bu yüzden, toplanan veriler zaman ve bütçe aşımı gerçekleşen projeler olmak üzere iki gruba ayrıldı.

En fazla karşılaşılan sorunlar, bu sorunların performans üzerindeki etkisi ve sorunların giderilmesinde en sık kullanılan yönetim tarzı belirlendi. Bütçe performansı ile ilgili sonuçlar ortaya çıkardı ki en sık karşılaşılan sorunlar önceliklerdeki değişim, başlangıçta yapılan planlamanın yetersizliği ve proje büyüklüğünün doğru tahmin edilememesidir. Bütçe performansı üzerindeki en etkili problemler ise başlangıçta yapılan planlamanın yetersizliği ve proje büyüklüğünün doğru tahmin edilememesidir. Proje yöneticileri tarafından en sık kullanılan yönetim tarzı ise projenin diğer üyeleri ile işbirliği yapılmasıdır.

Zaman performansı ile ilgili sonuçlar incelendiğinde, en sık karşılaşılan sorun önceliklerdeki değişimdir. En etkili problem ise başlangıçta yapılan planlamanın yetersizliğidir. En sık kullanılan yönetim şekli ise projenin diğer üyeleri ile işbirliği yapılmasıdır.

Elde edilen verilerdeki faktörler temel bileşenler analizi kullanılarak istatistiksel olarak daha az sayıdaki yeni bileşenlere dönüştürülmüştür. Regresyon analizi sonucunda elde edilen regresyon fonksiyonunda bütçe aşımı oranı bağımlı değişken, yeni bileşenler, firma ve proje yöneticilerinin demografik bilgileri ve yönetim tarzları bağımsız değişken olarak kullanılmıştır. İkinci regresyon analizinde zaman aşımı oranı bağımlı değişken ve diğer değişkenler bağımsız değişken alınarak aynı analiz yapıldı.

Bu çalışma ile bütçe ve zaman aşımına yol açan faktörlerin, firma ve proje yöneticilerinin demografik özelliklerinin ve problem çözmede kullanılan yönetim tarzlarının proje performansı ile arasındaki ilişki belirlendi. Sonuçlara göre işbirlikçi yönetim tarzı kullanıldıkça, planlama problemlerinin ortaya çıkma sıklığı arttıkça,

planlanan zaman ve teknik / personel/ kontrol problemlerinin görülme sıklığı arttıkça zaman aşımı oranı azalmaktadır, personel ve takım problemlerinin etkisi arttıkça da zaman aşımı oranı azalmaktadır. Bunun yanında personel/ takım problemleri arttıkça, zaman performansı düşmektedir. Bütçe performansı açısından zaman aşımı arttıkça bütçe aşımı da aynı şekilde artmaktadır. Diğer taraftan proje yöneticileri ağırlıklı olarak uzlaşmacı yönetim stili kullandıkça, bütçe aşımı azalmaktadır. Aynı zamanda projedeki ortalama personel sayısı ve proje yöneticisinin deneyimi arttıkça bütçe aşımı oranı azalmaktadır.

ABSTRACT

In a world, where change is becoming increasingly vital, Information Technology projects can provide a useful way for businesses to manage that change effectively. Information Technology (IT) projects provide businesses with ways to be more effective, efficient and speedy. These factors are very important for the business to be and sustain the leadership in the world market. However some of the projects have been cancelled or completed with experiencing many problems. The main objective of this study is to analyse factors affecting IT project performance from a broad perspective. Furthermore, the findings of the study are important because it is the first research to examine relationships between conflict management styles and IT project performance.

From this perspective, the factors, which may cause time slippages and budget overruns, and conflict management styles, are searched through a literature review. A survey questionnaire is prepared with the results of the literature survey. The questionnaire is conducted with 145 project managers. It was found that not all projects have time slippages and budget at the same time. Some projects have only time slippage, some have only budget overruns and some have both of. That is why, the collected data was divided into two groups according to the time and budget performance.

The most frequently encountered problems, their effect on the performance and the most frequently used management style were determined. The results on budget performance reveal that, the most frequently encountered problems are priority shifts and insufficient front-end planning. The most effective problems on the budget performance are insufficient front-end planning and underestimating project scope. The most frequently used management style is the collaboration.

The results on time performance reveal that, the most encountered problem that may cause time and budget overruns is priority shifts, the most effective problem is insufficient front-end planning and the most frequently used style by the project managers is also collaboration.

With the survey data, the factors are reduced to a few numbers of new components, by using Principle Component Analysis. With the result of regression analysis, regression function was obtained. In this function new components, firm and project managers' demographic characteristics and conflict management style were used as independent variables and the proportion of budget overrun used as a dependent variable. Same analysis is repeated by taking the proportion of time slippage as a dependent variable and the others as independent variables.

With this study, a relationship among project performance and factors causing time slippages and budget overruns, firm and project manager demographics and conflict management style is established. The outcomes show that, as the management style of collaboration, frequency of planning problems, planned time, frequency of technical/ staffing/ controlling problems increase, time slippage will decrease. Also as the effect of personnel /team problems increase, time performance decrease. From the budget performance perspective, as the time-overrun increase, budget overrun also increases. On the other hand, as the project manager relies heavily on accommodation, budget

overrun decreases. Also, while the average number of project personnel and the project manager's experience increase, budget overrun will decrease.

1. INTRODUCTION

In a world, where change is becoming increasingly vital, Information Technology (IT) projects can provide a useful way for businesses to manage that change effectively. Information Technology projects provide businesses to be more effective, efficient and speedy by using the opportunities of Information Technology. However some IT projects have been cancelled or completed after experiencing many problems. But in project-based business, it is vital to complete the project on time and budget, to meet the functional requirements to sustain the firm reputation and customer loyalty. Due to the importance of time and budget performance, the main idea of this study is helping project managers by providing hints to prevent the budget and time overruns. Also the relationship between conflict management styles and IT project performance will be examined. From this perspective, the definition of a project, information technology projects and project success will be mentioned in the introduction part of the study. In the following sections, project management and its progress, the differences between standard and information technology projects, the factors that may cause time slippages and budget overruns it will be mentioned. The features of project managers and their conflict management styles will be mentioned in the following sections. In the last part, the analyses for determining the causes of time slippages and budget overruns and their outcomes will be explained.

1.1.Definition of a Project

Different resources give different definitions about what a project is. Each of these definitions provides understanding the different aspects of project.

The first one is in the book of "Breakthrough Technology Project Management" written by Bennet P. LIENTZ and Kathryn P. REA. In their definition, a project consists of work that is focused on specific purposes within the boundaries of a defined scope. Projects can be of any size or type. A purpose for a project can be a narrow goal related to a specific system or technology, or it can be more extensive to include improvements in a business process.

Cleland (1999) gave different definitions about what a project is. Project has definite, final objectives representing specified values to be used in the satisfaction of some need or desire.

The results of a project can be in the form of a new product, service or organizational process capability. The organizational entity can be within an industrial, military, educational or social environment. For example:

- Industrial entity: a new factory
- Military entity: a new weapon system, a military campaign
- Social entity: a new highway
- Political entity: discovery of new lands and resources
- Educational entity: a new university

Each of the above examples provides the entity with something new or improved, which enhances that organization's ability to meet its operational (short-term) or strategic (long-term) responsibilities.

A project consists of a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies. Projects have a distinct life cycle, starting with an idea and progressing through design, engineering, and manufacturing or construction, through use by a project owner.

Four key considerations always are involved in a project:

1. What will it cost?
2. What time is required?
3. What technical performance capability will it provide?
4. How will the project results fit into the design and execution of organizational strategies?

The questions noted above must be answered on an ongoing basis for each project in the enterprise that is being considered, or on projects on which organizational resources are being used. The answers to these questions must also be evaluated in the context of the

project's fit into the organization's operational (short-term) or strategic (long-term) strategies (Cleland, 1999).

The interrelationships of project objectives and organizational fit can be seen in the following in Figure 1.1 (Cleland, 1999).

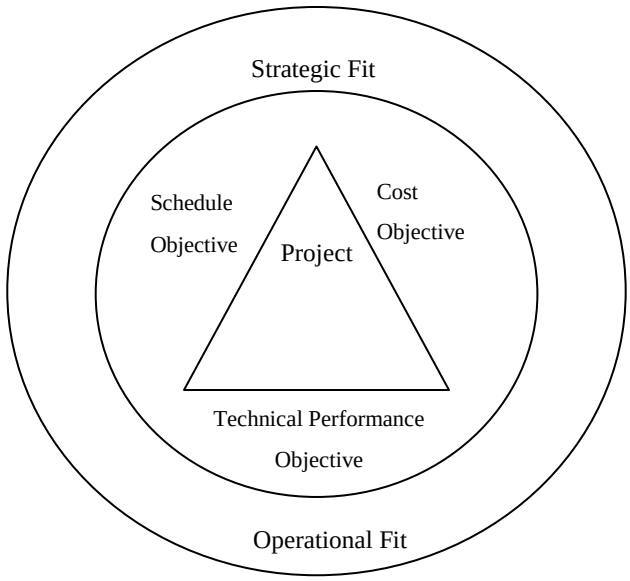


Figure 1.1:The interrelationships of project objectives and organizational fit.

Burke R. (1992) defined project in his book of Project Management. Any of the following examples may be considered to be a project:

- The transition period during which a change occurs.
- Designing and constructing a house.
- Designing and testing a new prototype (car).
- The launch of a new product.
- Implementing a new system, which could be information and control system, or a new organizational structure.
- Improving productivity within a target period.

Other features of a project include:

- A life cycle.
- A start and finish date.
- A budget.

- Activities that is essentially unique and non-repetitive.
- Consumption of resources, which may be from different departments and need co-coordinating.
- A single point of responsibility.
- Team roles and relationships that are subject to change and need to be developed, defined and established (Burke, 1992).

Having identified some of the main components of a project, definition of a project is:

A group of activities, that have to be performed in a logical sequence, to meet present objectives outlined by the client (Burke, 1992).

1.2. Definition of Information Technology Projects

Information Technology projects are the projects that are related with information technology. Back and Moreau (2001) defined Information Technology as the hardware, software, and computerized systems that process information and are typically developed to simplify or enhance specific tasks within the business cycle. A technology is one tool that may be used as part of the information management process.

1.3. Definition of Project Success and Failure

Although all IT projects have been started to accomplish, some of them have been cancelled or completed with experiencing many problems. So how can we end an IT project successfully? Project success can be achieved by understanding the problems and working to eliminate them. By doing this it may be possible to improve the success of the project.

Different definitions have been given in the literature about project success and failure of a project.

Linberg (1999) defined project success as a project that meets its budget, delivery and business objectives. Project failure is defined as a project that has been cancelled or a project that does not meet its budget, delivery and business objectives. Cannon (1994) defined IT failure in the study. IT failure is usually in terms of projects that are late or over budget and an inability to fully support of users and management.

Lewis (1995) supported the results of Standish Study by defining the software project success as meeting budget, delivery and business objectives. Ford and McLaughlin (1992) defined software project success as meeting or exceeding expectations. Taylor (2000) defined IT success as delivering to the sponsor everything specified to the quality agreed on or within the time and costs laid out at the start.

2. PROJECT MANAGEMENT

2.1. Definition of Project Management

A project is generally deemed successful if it meets pre-determined targets set by the client, performs the job it was intended to do, or solves an identified problem within predetermined time, cost and quality constraints. To meet these targets the project manager uses project management systems to effectively plan and control the project (Burke, 1992).

Many have attempted to define project management. Atkinson (1999) defined project management referencing Oisen (1971). Project management is the application of a collection of tools and techniques (such as the CPM and matrix organization) to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost quality constraints.

Atkinson stated that The UK Association of Project Management (APM) have produced a UK Body of Knowledge UK (BoK) which also provides a definition for project management as:

The planning, organization, monitoring and control of all aspects of a project and the motivation of all involved achieving the project objectives safely and within agreed time, cost and performance criteria. The project manager is the single point of responsibility for achieving the purpose.

Atkinson (1999) defined project management in the study with respect to the British Standard. The British Standard (1996) defined project management as the planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project management objectives on time and to the specified cost quality and performance.

The Project Management Institute defines project management as the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participant satisfaction (Cleland, 1999).

2.2. The History of Project Management

Formal project management emerged in a quite manner in the late 1950s. Its emergence was stimulated by the need to develop and implement a management philosophy for the management of large military and support systems. Much of the early theory of project management was developed by military organizations working with defence contractors who were involved in supplying large complex systems to military services (Cleland, 1999).

No one can claim to have invented project management. Its beginnings are found in the construction industry and in the engineering discipline. The use of task forces and other organizational teams contributed to the emergence of project management as an emerging management philosophy and process for the integration of ad hoc activities in organizations (Cleland, 1999).

The Manhattan project, developing the first atomic bomb, is often cited as the first modern project management was used. But there are many examples drawn from ancient history where project management techniques were used (Cleland, 1999). The history of large projects is often referred back as far as the construction of the Egyptian Pyramids and Great Wall of China. They were certainly large and complex structures, built with high standards, which must have liquidated vast amounts of resources (Burke, 1990).

The building of the pyramids of Egypt was a project of awesome proportions, completed at what must have been an enormous cost in human resources. Historians believe that it took over 30 years to complete the pyramids using upward of 100,000 workers. The Great Wall of China took major periods of time to complete. Throughout history there have been many improvements in the infrastructure of various societies. The building of the Roman aqueducts, roads and major buildings of that society utilized a type of project management (Cleland, 1999).

In the United States the building of Pennsylvania provided the opportunity to use an early process of project management. The Pennsylvania Turnpike was America's first superhighway. It was started by August 1939 and finished by the end of 1940. This project was completed on time and within budget, and attained the expected technical performance objective. In those years no modern project techniques such as cost and schedule software, PERT scheduling but it concluded successfully. First the project had

a high priority in the U.S. Defense initiative. Second, unemployment was high and the project was the opportunity to work on the project, so they work with high motivation. Finally, There was an extraordinary support from the project's stakeholders (Cleland, 1999).

2.3.Key People in Early- Project Management

The classical approach to management emerged at the beginning of the 1900s with three branches: Scientific management (its best known contributor, Frederick Taylor), administrative principles (Henri Fayol) and bureaucratic organization (Max Weber).

Frederick Taylor (1856-1915) was an American industrialist and an early pioneer of management techniques. On his gravestone in Pennsylvania is inscribed the epitaph the "father of Management". In 1911, Taylor published a landmark book, Principles of Management, in which he proposed work methods designed to increase worker productivity significantly (Murch, 2001).

The Taylor is an important milestone in the evolution of management theory. Before this, the only way to obtain productivity increases was to demand more workers or to get people to work longer and harder. Taylor's principles gave rise to dramatic productivity increases. He was the first person to encourage management and employees to "work smarter" (Murch, 2001).

Taylor's management principles included:

- Analyse each job to specify optimal procedures.
- Match skills with tasks to be accomplished.
- Understand worker characteristics that are important for increased productivity.
- Train workers to be more productive.
- Set a "fair day's work" standard for productivity expectations.
- Document worker performance
- Reward performance with incentives and bonuses.
- Compute management and reporting of all work (Murch, 2001).

The other key person is Henri Fayol. The basic key concepts of Henri Fayol are; division of labour, unity of command, unity of direction, scalar chain, centralization, authority and responsibility, subordination. Max Weber examined the basic key concepts of management. These are organizational structure, hierarchy of authority, description of duties and responsibilities, rules and procedures, personnel selection and professional manager (Thamhain, 1992).

The other key person is Henry Gantt (1861-1919). He became famous for the Gantt chart that is used today in project management. Gantt studied the construction of U.S. Navy ships during World War I and found that he could understand the complexities of construction much better by drawing charts. Gantt invented techniques such as milestone deliverables, task duration and estimates. He began project management by asking some fundamental questions, then expressing them in graphical format. He asked questions such as:

- How long will the project take?
- What are the critical tasks that must be completed?
- How long will each task take?
- When must each task start and end?
- Who will be responsible for each task?
- How will delayed tasks affect the project?
- What is the total cost of the project?
- What is the cost of each task?
- Is the project on schedule?
- How can slippage problems be corrected?
- Is there a way to speed up the project? (Murch, 2001).

2.4. Project Management Institute

The Project Management Institute (PMI) is the world's leading not-for-profit project management professional association, with over 95,000 members worldwide. It is established in 1969 and headquartered outside Philadelphia, Pennsylvania USA. It

promotes project management standards, provides seminars and informative programs and professional certification for individuals within organization (Murch, 2001).

The Project Management Institute is an international organization working to improve project and program performance by serving its members application areas and cultures.

As part of this purpose, its guiding principles are as follows:

- PMI shall strive for effective communication, cooperation and collaboration.
- PMI shall conduct its business in a fair manner.
- PMI shall be accountable to its members to advance the profession.
- PMI shall provide quality products and programs.
- PMI shall be member driven and shall address needs responsibly and honestly (Murch, 2001).

2.4.1. Objectives of PMI

Cleland (1999) explained the objectives of PMI in his book of Project Management: Strategic Design and Implementation. The objectives of PMI are:

- Foster professionalism in the management of projects.
- Advance the quality and range of project management.
- Identify and promote the fundamentals of project management and advance the body of knowledge for managing projects successfully.
- Provide a recognized forum for free exchange of ideas, applications, and solutions to project management challenges.
- Stimulate the application of project management to the benefit of industry and the public.
- Provide an interface between users and suppliers of hardware and software project management systems.
- Collaborate with universities and other educational institutions to encourage appropriate education and career development at all levels in project management.
- Encourage academic and industrial research in the field of project management.

- Foster contacts internationally with other public and private organizations, which relate to project management and cooperate in matters of common interest.

2.4.2. History of PMI

Five volunteers founded the Project Management Institute in 1969. The Commonwealth of Pennsylvania USA issued Articles of Incorporation for PMI, which signified the official inception of the organization. During that same year, the first PMI Seminars & Symposium was held in Atlanta, Georgia USA and had an attendance of 83 people.

In the 1970s the first issue of Project Management Quarterly (PMQ) was published and later renamed Project Management Journal® (PMJ). The first Annual Seminars & Symposium was held outside of the USA, the first PMI Chapter was chartered and the PMI Professional Awards Program was established. By the end of the decade PMI membership totalled over 2,000 individuals worldwide.

During the 1980s, PMI's membership, programs and services continued to grow. A Code of Ethics was adopted for the profession and the first Project Management Professional (PMP®) Certification examination was administered. The first PMI project management standard was published as the PMQ Special Report on Ethics Standards and Accreditation. PMI's publishing products and services also grew rapidly during this decade. The first PMI book was co-published and PM Network®, PMI's monthly magazine was born. Due to this growth, the PMI Publishing Division was established in North Carolina USA.

By 1990, PMI's membership totalled over 8,500 and by 1993 the annual membership growth rate rose to over 20 percent per year. During the 1990s, Specific Interest Groups and Colleges were formed and Seminars USA, a series of educational programs on project management was initiated (later renamed Seminars Worlds). PMI also established a presence on the World Wide Web and published the project management standard, A Guide to the Project Management Body of Knowledge (PMBOK® Guide)[1] . It describes the concepts, processes and techniques required for the management of a project. PMBOK describes the sum of knowledge, skills, and attitudes within the profession of project management. PMBOK provides a basis reference document for

[1] http://www.pmi.org/info/AP_IntroOverview.asp?nav=0201

professional standards for anyone interested in the profession of project management (Cleland, 1999).

This includes but certainly is not limited to:

- Project managers and other team members.
- Managers of project managers.
- Functional managers who provide people and other resources to support the project.
- Project customers and other stakeholders.
- Educators and trainers who teach project management and related subjects.
- Consultants who provide guidance to project stakeholders.
- Senior managers who use projects as building blocks in the design and execution of enterprise strategies (Cleland, 1999).

A model of the project management knowledge areas and the project management processes are in Figure2.1.

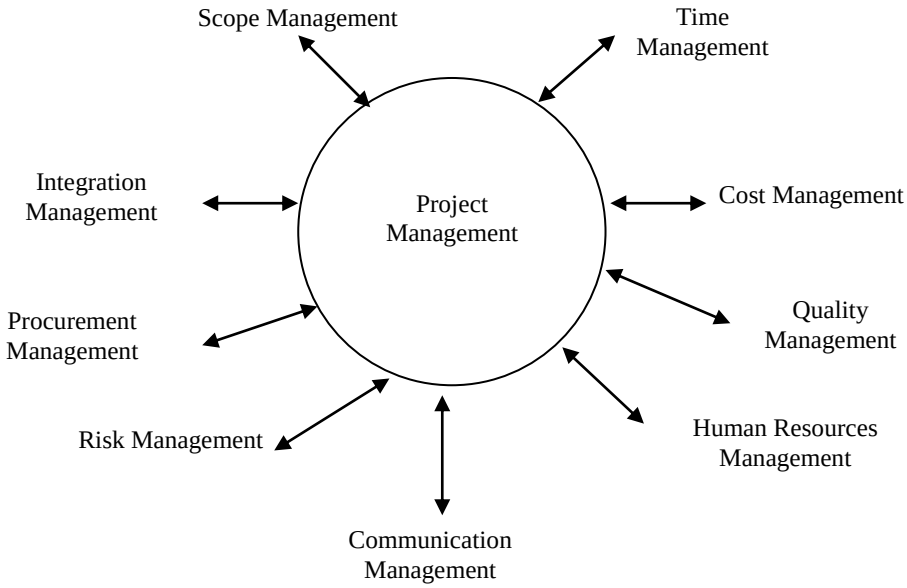


Figure 2.1: Project management knowledge areas

PMI Today®, PMI's monthly newsletter was printed for the first time and the Professional Development Program (PDP) was established for PMP certificate holders to maintain their credential. By the beginning of the 21st century, PMI had over 50,000

members, over 10,000 certified Project Management Professionals and over 270,000 copies of the PMBOK® Guide in circulation[2].

2.4.3. Today for PMI

Currently, PMI supports over 95,000 members in 125 countries worldwide. PMI members are individuals practicing and studying project management in many different industry areas, including aerospace, automotive, business management, construction, engineering, financial services, information technology, pharmaceuticals and telecommunications.

Over time, PMI has become, and continues to be, the leading professional association in project management. Members and project management stakeholders can take advantage of the extensive products and services offered through PMI[2].

2.5. Project Management Software

Project management software is a set of software functions and tools specially targeted at supporting the management of projects. As such, the software attempts to provide planning, tracking analysis, and output support. People often use project management software to meet some very specific needs. The software must be able to rapidly produce project reports. Project management software takes as input the structure of the project and the tasks, resources, costs and other input and then updates the schedules (Lientz and Rea, 1998).

Using project management software has advantages and disadvantages.

2.5.1. Benefits of Using Project Management Software

A revolution is taking place in the field of information processing, up until recently all data processing was performed by either large mainframe computers or by hand. Now with the introduction of powerful but inexpensive microcomputer hardware and computer software are offering full information and control system. From this perspective, Burke (1992) defined the benefits of project management software in the book of "Project Management".

[2] http://www.pmi.org/info/AP_IntroOverview.asp?nav=0201

- Project management software offers fast calculations. This software offers immediate changes, however by hand the calculations would take much longer.
- The calculations are always correct, the accuracy of the output is directly dependent on the accuracy of the data input.
- Editing is very quick once the database has been established.
- The application packages offer a well thought out information structure, which, will help standardize methods and enforce a disciplined approach.
- The software has the capacity to process large projects with 10000+ activities.
- Select and sort functions enable the operator to present the information in a structured format.
- Management by exception and variance reports are easily obtained.
- Once the database has been established, what-if analysis can be performed quickly.
- The project database can be linked to the corporate database.
- The software can offer centralized or distributed reporting which is flexible to suit the organization structure.
- Better quality reporting, the documents and graphics can be customized to facilitate dissemination of information within the project team. Most packages offer a large number of standardized and customized reports.
- Quicker calculation can lead to a shorter reporting period, which gives greater control and more accurate trend analysis. It will also be quicker to respond to a changing situation.
- The Work Breakdown Structure (WBS) or Organization Breakdown Structure (OBS) can structure reports.
- The software release the manager from processing large amounts of data manually, which should give him to concentrate on managing the project and the people involved on it.
- It is relatively simple to make back-ups and safe copies of the project data.
- Managers can type their own reports and faxes.

2.5.2. Disadvantages of Using Project Management Software

Burke (1992) defined the disadvantages of project management software in the book of "Project Management".

- There will be additional costs associated with education and training, hardware and software procurement and loss of production while implementing the new system.
- The additional cost of maintenance and up grading.
- The new system may cause a resistance to change, which could affect company morale and productivity.
- If the computer goes down this could stop the company's operation, especially if effective back-up systems have not been established.
- If data safety precautions are not taken it is possible to lose vast amount of data.

3. INFORMATION TECHNOLOGY PROJECTS

Information technology projects are the projects that are related with information technology. Back and Moreau (2001) defined information technology as the hardware, software, and computerized systems that process information and are typically developed to simplify or enhance specific tasks within the business cycle. A technology is one tool that may be used as part of the information management process.

3.1. Differences Between Standard and Information Technology Projects

There are some general differences between standard projects and information technology projects. These differences can be analysed in terms of purpose, scope, parallel work, interfacing projects, technology dependence, management expectations, understanding the technology and technology gaps (Lientz and Rea, 1999).

- Purpose: The goals of a system and technology project are often not as clearly defined as those in engineering or other projects. The goals may not be well defined at the start of the systems project.
- Scope: Systems projects sometimes lack clear boundaries. The scope can creep and expand.
- Parallel work: While a new system is being created or installed, work can continue on the current system, creating changing requirements. This is not as true in standard projects.
- Interfacing projects: Systems projects are more likely to have complex interfaces.
- Technology dependence: It seems that only in systems and technology projects do people attempt to use new technology or technology with which they have no or only limited experience, raising the level of risk.
- Management expectations: Upper-level managers attend seminars and read about the promise of new technologies. Their expectations can impact the systems project.

- Understanding the technology: Although no systems projects can involve technology, it is normally simpler to apply because the technology can be handled separately. In systems, it is the reverse. The only way modern systems can be successful is by integrating multiple technologies. This requires a deeper and more thorough understanding of the technology.
- Technology gaps: Systems and technology projects are also affected by gaps between the newest technology and the older technologies.

3.2. Trends that can affect Information Technology

Trends in business, technology, system and project management can affect information technology.

3.2.1. Trends in Business

Certain business trends have emerged, affecting IT projects. These trends can be analysed in terms of accountability, downsizing / rightsizing, importance of business processes, reengineering and process change, global competition, outsourcing / supplier-customer links and thirst for information (Lientz and Rea, 1999).

- Accountability: Business has become more sensitive to accountability and has a greater drive for results. These results can impact funds of projects and their schedules.
- Downsizing / rightsizing: Information technology has been hit by this trend, as have the business units. The impact is that many organizations have to make up for the decline in staff with automation by putting more pressure on systems projects.
- Importance of business processes: Where as in the past, the focus was on the business organization, attention has shifted to the basic business processes. This new focus impacts the scope and focus of systems projects.
- Reengineering and process change: Changes in business processes are almost always linked to changes in systems and technology.
- Global competition: Companies faced with competing in multiple, diverse markets. This requires flexibility on the part of the technology and systems.

- Outsourcing / supplier-customer links: With electronic commerce and electronic data interchange (EDI), firms seek to tighten their links with suppliers and customers. In addition, more functions are being outsourced in some cases to suppliers and customers.
- Thirst for information: Firms desire to get the information for management, strategic, and tactical / operational purposes. Data warehousing and the spread of data base management systems have created new projects that pull information form multiple sources for analysis in support of knowledge management.

These factors lead to the creation of more projects that are of increased complexity compared to traditional systems work (Lientz and Rea, 1999).

3.2.2. Trends in Technology

Some of the key technology trends such as network expansion, declining cost and increased performance of microcomputers, embedded technology and cumulative impacts can affect project management (Lientz and Rea, 1999).

- Network expansion: The internet, local area networks and wide area networks have made communications and networking more affordable and easier to implement than was previously the case. This means that more companies have implemented networks. The software to handle electronic mail, videoconferencing, and voice communications over networks has improved and become cheaper and less complex to install. Most information technology projects today involve a networking component. Network expansion can be seen in two ways: internal and external. Internally, wide area networks and on-line, client-server applications have fuelled network expansion. Externally, the use of electronic commerce, EDI, extranets and links to suppliers and customers has grown.
- Declining cost and increased performance of microcomputers: As a result of this trend, companies have been encouraged to deploy more microcomputers with increased functions to more employees. This makes the information projects larger because more staff must be trained.
- Embedded technology: Technology has become embedded in physical devices as never before. The growth of geographic information systems (GIS) and

geographic positioning systems (GPS) are two examples of technology embedded in vehicles, facilities and equipment.

- Cumulative impacts: With a growing dependence on technology, companies need to manage the cumulative efforts and cross-impacts of the technology (Lientz and Rea, 1999).

3.2.3. Trends in Systems

The impacts of moving from the raw technology to information technology is evident in the following trends:

- Systems replacement: Whether preparing for the year 2000 problem or just replacing ancient legacy systems, systems groups are moving to install new software packages. This is not a simple replacement project. The new software offers different features and capabilities.
- System integration: There is a trend toward more integration of systems and data. What used to be a series of single projects has been replaced by larger, integrated projects.
- Improvements in tools: More tools are available to assist in development and systems management. Object-oriented programming and design tools are emerging in addition to improvements in database and fourth-generation languages as well as data warehousing tools. The approach using Java and other similar tools for intranets makes information technology management easier.
- Stability of vendor software: As in the old days when there was one dominant hardware vendor, the emergence of a major dominant software vendor has lent stability and more predictability to systems. The counter-weight is that the pace of technology advance may be slower, but it is still substantial.
- Client-server, extranet and intranet development: Where these projects were once rare, they are now becoming much more common and the focus of most of the new development. Such work results in large, complex projects to reduce risk.
- Changes in staffing mixes: The dominant programming language among staff was once COBOL. Although COBOL is still substantial use, other technologies

have become popular, such as C++, Visual Basic, Java, and fourth-generation languages. Students and people entering the programming field are far more likely to know these newer languages than they are to know COBOL. This influences what IT projects are undertaken and how they are carried out. With a greater variety of skills needed, project teams have to be larger. However, with an increased number of projects, the staff must be spread across multiple projects (Lientz and Rea, 1999).

3.2.4. Trends in Project Management:

These trends further influence the nature of information technology projects. Overall, the trends have the following impacts:

- Projects involve more business aspects due to reengineering.
- Projects are more complex in general in terms of technology.
- Projects are more integrated with each other and with current work.
- Staff members have to be assigned to multiple projects due to limited budgets and resources.

More tools are used for project management than were available 15 years ago. Some highlights are the following:

- Project management software is now network based to support sharing of project information among project teams and with others outside of project.
- Groupware allows for project teams to share information on issues, project status, action items, and other project information.
- Electronic mail, voice mail, and videoconferencing support the dissemination and sharing of information more rapidly.
- Databases support the storage and organization of information related to projects (Lientz and Rea, 1999).

3.3. Myths of Project Management

Trends in project management help to explode some of the myths that have arisen around project management over the years. There are eight myths mentioned in the book of "Breakthrough Technology Project Management" of Lientz, B.P. and Rea, K.P., (1999).

- Myth 1: To be successful, projects require dedicated resources.

This was true 20 years ago. It is now no longer the case. Systems projects require a variety of different skills from different people over the life the project. For most companies, having any substantial number of full time staff dedicated full time to the length of the project is not possible.

- Myth 2: Project leaders must be allowed a great deal of autonomy to get work done.

This myth is based on the idea that projects have a stand-alone nature and that project leaders are fully responsible for the project. Today, this is not realistic. Projects are interdependent; resources are shared. Project leaders may even be shared and split among multiple projects.

- Myth 3: Success in a project is to achieve the implementation of the system or technology.

This is the traditional narrow definition of success. It is why many systems people think that a project was a success, while the business managers view it is a failure. It is a matter of perspective. Many systems people think that the job ends when the software runs; however, business managers think that the project ends when the business processes are improved with the implementation of the systems. Much of the costs of a project occur in the systems aspect, the benefits largely are realized in the changes and improvements to the business. Thus if a project stops with the completion of the system, there may be no project benefits. If the business processes and organization do not change when the new system is implemented then there are likely to be few benefits, making the project a waste of time.

- Myth 4: Projects depend on stable, defined requirements and technology.

The traditional system life cycle emphasized getting the requirements right. If this were done, then the design and development are more likely to be successful because they met the requirements. This is nice in theory and terribly wrong in practice. The business managers may not know what is needed until they see something. As they see and experience the information technology, their requirements naturally evolve and change. It is part of life. It is also true that you must plan for technology improvement and change in any long-running project.

- Myth 5: You can measure a project in terms of percentage complete and budgeted versus actual results.

Unfortunately, in information technology projects it is difficult, if not possible to clearly identify the percentage complete. In addition, much of the expense in an information technology project is in fixed costs associated with networks, hardware and software. The variable that mostly indicates problems is staff time. Thus, budget is a trailing indicator. There are better measures for a project in terms of assessing outstanding issues and problems.

- Myth 6: Each information technology project is unique.

This is a seemingly innocent statement. However, if you accept it, then you tend to manage projects independently and fail to gain from lessons learned. Projects have unique attributes, but underneath the veneer of the new technology they have much in common.

- Myth 7: You can throw resources and money at information technology projects to good effect.

In some business projects this is true. It is seldom the case in information technology management. People's skills and knowledge are not interchangeable. Throwing people into an information technology projects often just slows the project down due to coordination and bringing people up to speed.

- Myth 8: Things will work out all right if you use the magic tool or software.

Any tool requires a substantial learning curve. A tool expert should be identified and on board. People not only must gain familiarity with the tool, but also expertise. Were this not enough, many tools are not complete. Staff members are forced to deal with multiple tools from different suppliers making the job worse.

3.4. Differences Between Traditional and Modern Project Process

Lientz, B.P. and Rea, K.P., (1999) examined the traditional project process and modern project process. They mentioned that the project management methods can be divided into ideas and proposals for projects, project approval, project kick-off and start, project monitoring, reporting and management, project end or termination.

3.4.1. Traditional Project Process

- ❖ Ideas and proposals for projects:

In most organizations ideas for projects are often expected to come from the upper management. The assumption here is that business units know their needs and so will formulate their requirements. These will then go to the systems organization for review and estimate of effort and schedule.

- ❖ Project approval:

Several approaches are employed for approval. One is to use a steering committee that meets to approve or change priorities recommended by information systems. Although it may appear to be a slate of related projects, this is often a list of individual projects. Another approach is to negotiate and approve, defer, or reject requests individually. This is the "let's make a deal" approach.

- ❖ Project kick-off and start:

Because the elapsed time between initial request and start of the project can be long, the project may get off a very slow start. Generally an extensive planning effort is launched to develop a detailed project plan. Then this plan must be approved. Individuals must be signed up to be on the team. After considering the initial idea for the project, the idea is often found to be incomplete and more work must be done to define the scope of the project and end products. The project leader and team are often dedicated to the project. They have not been told to interface with other projects. The project leaders are left to define their own tasks and milestones for each project, resulting in little or no uniformity across projects.

- ❖ Project monitoring, reporting and management:

Many people make a big deal out of the size of the project in terms of project monitoring and reporting. Larger projects get more attention; smaller projects get less.

Project managers are often trained to focus on administrative matters such as tracking, reporting and estimating for the project. Historically, several factors contributed to this. Project teams were larger. The software and other project management tools were primitive so that much of the project manager's time was consumed gathering status and using the software. Even today, there is usually no organized approach to deal with problems. As a problem appears, the project leader uses his or her own experience and knowledge to address the problems one at a time. When it comes to review, managers consider the projects one at a time. They do the same with the problems and issues. More attention is given to projects that are over budget or behind schedule.

- ❖ Project end or termination:

The project progresses toward its milestones. At the end of the project, the business unit that wanted the project is asked to sign off. This can be a rushed affair. Both the business unit and the systems unit do not want the project to appear as a failure, which would reflect badly on them both. After sign-off, it is too seldom the case that management insists on determining the benefits of the system. If asked, the response is often in terms of soft, fuzzy benefits. Normally no effort is made to extract lessons learned from the project. The business unit goes back to its normal work. The system staff moves on to another project.

3.4.2. Modern Project Management Process

- ❖ Ideas and proposals for projects:

Although departments can still submit project ideas, information systems works with departments to assess the current state of key business processes and their supporting systems and technology. The result is a process plan that leads to projects that involve process improvement as well as systems work. A complete project concept is developed that identifies business roles, purpose, scope, general costs, benefits, general schedule and issues to be addressed in the project. The current processes are measured to assess the problems and to support the determination of benefits.

The information systems function plans haw to manage resources across multiple projects. The objective is to form project teams that are as small and flexible as possible. Analysis is also performed to identify and analyse the interdependencies between projects. Improvements to the architecture and technology base are identified and related to the business processes.

- Project approval:

A slate of projects is reviewed and approved by management with an emphasis on interrelationships among projects. Project approval is tentative and subject to review at three-to-four month intervals.

- Project kick-off and start:

Projects are initiated by developing detailed project plans based on standard templates. A template includes standardized high-level tasks, resources, resources assigned to tasks, and dependencies. This is more than a work breakdown structure (WBS), which is a general list of tasks. It paves the way for increased standardization and the ability to analyse data from multiple projects. Team members are placed on teams in a just-in-time mode. The core team for any project is no more than three or four people. Other team members are on the projects part time for performing specific tasks.

- Project monitoring, reporting and management:

Standardized electronic reporting is employed for all projects. A project coordinator analyses the data from all projects. This person also reviews the active issues across the projects and presents the results of the analysis to the project leaders as well as to management. The project coordinator facilitates the release of resources from projects and their redeployment to other projects.

Project leaders share their schedules with each other in a network environment. They work together in joint meetings chaired by the project coordinator to resolve conflicts for resources.

Project leaders do work on the projects. They also work on all active issues and support the gathering and dissemination of lessons learned. Project updating is done by team members through the network, releasing some of the project leader's time from administration.

Measurement of the project is based on open issues and their impacts on the projects. Percentage complete and budget status are still important but are considered secondarily.

- Project end or termination:

Although a project can end, it is usually just the end of a phase to support the business processes. Making large-scale improvements in major systems involves creating and managing multiple projects.

3.5. Project Success and Failure

3.5.1. . Why Projects succeed

Based on experience from many projects, there are other ingredients to project success.

- Requirements: Requirements in the modern setting come from the changes to the business processes. Business processes tend to be more stable than requirements created in the old manner. Requirements are often tied to business transactions. The requirements have less change and more stability. Moreover, any changes to requirements can be evaluated and justified based on an assessment of their effect and impact on business processes.
- Team building: By having team members more active in project a management they have a greater sense of commitment. The same is true for business units. Project leaders are encouraged to work together in a cooperative mode.
- Issue oriented: This process makes management more issue oriented rather than status oriented. Management considers issues, which cannot be resolved by individual or multiple project managers.
- Overall focus of projects: Because the projects are based on major business processes that cross multiple departments, the projects will consume most of the available resources. This means that many of the smaller, enhancement type projects will fall by the wayside due to a lower priority.
- Impact on information systems: With this new project focus, information systems become a key supporter, if not owner, of processes that involve multiple departments.

3.5.2. Why Engineering Programs Fail

Few engineering managers argue with the need for controlling their projects according to established plans. The challenge is to apply the available tools and techniques effectively, that is, to manage the effort by leading the multifunctional personnel toward the agreed on objectives within the given time and resource constraints. Even the most experienced practitioners often find it difficult to control engineering activities in spite of apparent detail in the plan and personnel involvement or even commitment. Effective engineering management is a function of properly defining the work, budgets and

schedules and then monitoring progress. Equally important, control is related to the ability of keeping personnel involvement and interested in the work, obtaining and refuelling commitment from the team as well as from upper management, and to resolving some of the enormous complexities on the technical, human and organizational side (Thamhain, 1986).

4. CAUSES OF PROJECT MANAGEMENT FAILURE

4.1.The Challenges of Project Management

Many managers argue that engineering work should not be more difficult to control than any other work. Others claim that the technical complexities, the multidisciplinary nature of most engineering programs, and the multitude of superimposed regulations and restrictions make it indeed more challenging to control engineering work according to original plans. Especially those managers involved in the research, development, and design phases of engineering work echo this argument (Thamhain, 1986).

Thamhain made a research by collecting data from engineering managers during interviews. The results of this study are in the journal of Project Management Journal, Criteria for Controlling Projects According to Plan. He explained the challenges and reasons for overruns in the book of Engineering Management. A survey of 300 engineering managers indicated that, regardless of their functional responsibility, 70% of these managers feel their work is more difficult to control according to plan than other business activities. Table 4.1 summarizes the specific challenges as seen by the engineering managers, and Table 4.2 lists reasons for over runs. The perception is further supported by statistics showing that almost every engineering program requires more time and resources than originally were estimated (Thamhain, 1986).

Table 4.1: Challenges of Managing Projects

Rank Order	Challenge	Frequency
1	Coping with end-date-driven schedules	85 %
2	Coping with resource limitations	83%
3	Communicating effectively among task groups	80%
4	Gaining commitment from team members	74%
5	Establishing measurable milestones	70%
6	Coping with changes	60%
7	Working out project plan agreement with team	57%
8	Gaining commitment from management	45%
9	Dealing with conflict	42%
10	Managing vendors and subcontractors	38%
11	Other challenges	35%

Table 4.2: Potential Problems Leading to Schedule Slips and Budget Overruns

1	Difficulty of defining work in sufficient detail
2	Little involvement of support personnel during planning
3	Problems with organizing and building project team
4	No firm agreement to protect plan by functional support groups
5	No clear charter for key engineering personnel
6	Insufficiently defined project team organization
7	No clear responsibility definition with team
8	Rush into project kick-off
9	Project perceived as not important or exciting
10	No contingency provisions
11	Inability to measure true project performance
12	Poor communications with upper management
13	Poor communications with customer or sponsor
14	Poor understanding of organizational interfaces
15	Difficulty in working across functional lines
16	No ties between job performance and reward system
17	Poor leadership
18	Weak assistance and help from upper management
19	Engineering leader not involved with team
20	Ignorance of clearly warning signals and feedback
21	Poor ability to manage conflict
22	Credibility problems with task leaders
23	Difficulties in assessing risks
24	Insensitivity to organizational culture/value system
25	Insufficient formal procedural guidelines
26	Apathy or indifference by team or management
27	No mutual trust among team members
28	Too much unresolved/dysfunctional conflict
29	Power struggles
30	Too much reliance on cost accounting system

First, it was analysed the reasons for poor project management control as they related to budget overruns and schedule slips. Second the less tangible criteria for these control problems were discussed. It was found that many of the reasons blamed for poor project performance, such as insufficient front-end planning and underestimating the complexities and scope were really rooted in some less obvious organizational, managerial and interpersonal problems (Thamhain, 1986).

In Table 4.3, directly observed reasons for schedule slips and budget overrun is given.

Table 4.3: Directly observed reasons for schedule slippages and budget overruns

1	Insufficient front-end planning
2	Unrealistic project plan
3	Project scope underestimated
4	Customer / management changes
5	Insufficient contingency planning
6	Inability to track progress
7	Inability to detect problems early
8	Insufficient number of checkpoints
9	Staffing problems
10	Technical complexities
11	Priority shifts
12	No commitment by personnel to plan
13	Sinking team spirit
14	Unqualified project personnel

It was found that engineering managers perceive these problem areas in a somewhat different order than their superiors (general managers).

Engineering managers most frequently blame the following reasons for poor project performance:

1. Customer and management changes
2. Technical complexities
3. Unrealistic project plans
4. Staffing problems
5. Inability to detect problems early

General managers, however, most frequently cites the following:

1. Insufficient front-end planning
2. Unrealistic project plans
3. Underestimation of project's scope
4. Customer and management changes
5. Insufficient contingency planning

It can be understood from their different perspective, engineering managers are more concerned with external influences such as changes, complexities, staffing and priorities, while senior managers focus on what should and can be done to avoid problems.

4.2. Less Obvious Reasons for Poor Performance

Managers at all levels had long lists of the real reasons why the problems identified. They pointed out, for instance, while insufficient front-end planning eventually got the project into trouble, the real culprits were much less obvious and visible. These subtle reasons, summarized in Table 4.2 have a common theme. They relate strongly to organizational, managerial, and human aspects. In fact the most frequently mentioned reasons for poor project performance can be classified in five categories:

1. Problems with organizing project team
2. Weak project leadership
3. Communication problems
4. Conflict and confusion
5. Insufficient upper-management involvement

Most of the problems in Table 4.2 relate to a manager's challenge to foster a work environment conductive to multidisciplinary teamwork, rich in professionally stimulating and interesting activities, involvement and mutual trust. The ability to foster a high performance project environment requires sophisticated skills in the leadership, technical, interpersonal and administrative areas. To be effective, project managers must consider the task, the people, the tools, and the organization. The days of the manager who gets by with technical expertise or purely administrative skills alone are gone. Today the engineering manager must relate socially as well as technically. He or she must understand the culture and value system of the organization. Research and experience show that effective project management is directly related to the level of proficiency at which these skills are mastered. Furthermore, there is a strong correlation between the potential problems (Table 4.2) and the directly observed reasons for schedule slips and budget overruns Table 4.3. These correlations were measured by using Kendall's tau rank-order statistics as a strength of approximately t =+.50 and a confidence level of 99%. This indicates that the more potential problems a project leader or engineering manager experiences, the more actual performance problems are observed. These factors seem to be strongly related.

5. FACTORS THAT CAUSE POOR PROJECT PERFORMANCE

5.1. Insufficient front-end planning:

Effective engineering planning is related to properly defining the objectives, the work, the budgets, the schedules, and their monitoring process (Thamhain, 1992).

Many researchers have analysed this factor so far. Rotham (2000) analysed the causes of project failures in the improving economies. He stated that, excessive desires for the project might cause beginning the project with insufficient front-end planning. He gave examples for this type of problems. One of the examples is related with the draft project. In this project, the need was determined at the beginning of the project, but their long-term usage or their alternatives were not determined at the beginning. This deficiency effect flexibility of the project phases in a negative way. Thamhain (1992) stated the importance of flexibility in the book of "Engineering Management". In a dynamic and changing environment we try to catch our targets in a moving environment. The planning process must acknowledge dynamics and must have flexibility to respond to the unpredictable changes.

Another example of this study is related with the construction project. In this project, the location of the project was not appraised sufficiently from the logistic side and different alternative for the location was not determined. When the project was started, it was understood that, the location has some disadvantages from the logistic side. So, the project was ended and started in the different place. Both of these examples finished below the optimum profit. These examples show that, to be successful in the projects, big emphasis must be given on front-end planning and defining alternatives.

Another study about poor planning is KPMG Canada Survey in 1997. This study searched the causes of project failure. It was found that the main causes of project failure that were identified were poor project planning, weak business case and lack of top management involvement and support.

Verner et al. (1999) made a research with 20 senior software development professionals from a number of different organizations in United States. This study was made to find

out the factors leading to success or failure of software development projects. They organized their discussion into seven headings. One of them is planning, monitoring and control. For the failed projects respondents mentioned that projects suffered from insufficient planning, and abandonment of planning under pressure.

5.2. Unrealistic project plan

Personnel must be involved at the project formation for the realistic project plans. Active participation during project definition and requirement analysis leads to personnel involvement and interest in the work itself and helps to build the team spirit. This involvement leads to an understanding of the requirements and more realistic assessment of the resources needed to perform (Thamhain, 1992).

Paul (1997) mentioned an example about unrealistic project planning. He stated the failures of an IS (Information Systems) project that is related with IRS (Internal Revenue Service). In this example, it is stated how the project personnel can progress in a wrong direction if measurable milestones and delivery times of the outputs are not determined in the plan. Also the projects must be broken up into manageable parts. In this study, it is stated that, project managers must know the signals of the failure. The causes of this project failure are; insufficient formation of project portfolio, no evident sponsors, unqualified project personnel, wrong technology choices and unrealistic project scope.

Paul stated the absence of controllable and measurable outputs as the basic cause of IS project failure in the study. But determination of the outputs is related with separation of the project into manageable parts. These parts have to own measurable outputs and these outputs should give a signal to the managers. IRS did not determine these parts and signals at the beginning of the planning and could not understand the bad progress of the project. The realistic plans done at the beginning of the project is very important for separating the project into measurable parts and determining the signals of the project failure. Paul stated seven signals in this study:

- Forcing for the unrealistic delivery times.
- Designating unqualified personnel to the complicated works.
- Not forming evident sponsors.
- Not separating the project into parts.

- Not forming good project architectural.
- Not forming comprehensive project purse.
- Understanding the applicable project basic idea incorrectly.

5.3. Project scope underestimated

A project consists of work that is focused on specific purposes within the boundaries of a defined scope. The scope of the project defines what is included in and excluded from the project.

A systems and technology project idea can be viewed in a number of dimensions: underlying technology, business unit involvement, extent of business process impact, extent of interfaces to existing systems, existing technology interfaces, impact on business policies, and impact on the business unit organization. These dimensions allow comparing different scopes.

The first action in working with scope is to define alternatives and graph them. The second action is to determine the impact of different scope alternatives. The third action is to employ the table and develop alternative project ideas (Lientz and Rea, 1999).

Scope management manages the scope of the project. Effective scope management is one of the key factors determining project success. Failure to accurately interpret the client's needs or problems will produce a misleading definition of the scope of the work. If this causes rework and additional effort, there may be project cost and time implications. Therefore project success will be self-limiting if the scope of work is inadequately defined. Scope management will also outline how the project will be managed, progress monitored, reported and controlled (Burke, 1990).

Bicnell (1995) mentioned about the importance of estimation of the scope. In 1987, the California Department of Motor Vehicles (DMV) launched a major project to revitalize their driver's license and registration application process. By 1993, after $45 million dollars had already been spent, the project was cancelled. According to the report, DMV technical committee never believed that the project becomes fact. The president of Standish, Jim Johnson said that, the main causes of the failure for DMV are, no monetary gain in this project, lack of executive management support, poor project planning and project scope was underestimated.

Another study about project scope is in Stapleton's (1993) study. Stepleton examined the America's biggest national infrastructure project, Los Angles Subway System. These kinds of big projects are very difficult to complete without conflicts, because these projects generally have technical complexities, difficulties about reconciliation of project groups and difficulties of defining the needs of the projects. One of the members of management committee of project, Laurance Weldon, mentioned about the importance of defining the needs of the project. Weldon said that for this, project scope must be defined properly.

5.4. Customer / management changes

Projects can be affected from the customer and management changes. Customers can change their expectations and obligations and managers can change their priorities and approach. There are many examples about these changes in the studies.

One example about management change is in the study of Vowler (1997). Mercury is the second biggest telecommunication company in England. The director of IT, Uwe Natha, was appointed for putting in order the confusion in Mercury. The aim of the Mercury was to increase the percentage of success rates of projects with the management changes. The first aim for Natha is increasing the morale of the department personnel. Natha educated the personnel by increasing the knowledge about the work and improving the communication skills. Then he focused on the success of the project completion. He increased the performance from %20-%30 to %65. In this example, management approach was also changed with management changes, these two factors were very important for the success of the projects.

Another example about the management change is in the study of Margollis (1992). This example is related with the New York Life Insurance Co. This firm uses the latest technology and especially focuses on the customer services. In this firm, management team, IT personnel also participated, was occurred between functions. This new team approach caused new traditions in the firm. Sustainability of the system is also a very important project. New management approach was very important for the achievement of the project.

5.5. Insufficient contingency planning

It has been assumed that normal working conditions and practices will prevail. Unfortunately the real world does not work that way and allowances should be made for the risks and uncertainties. The size of the contingency will depend on many factors:

- Type of project
- General efficiency and competence of the company
- Degree of risk and uncertainty (Burke, 1990).

Contingency planning to projects is one of the important issues that can carry of the project to success. In today, the fast technological changing indicates that there can be fast changes about work needs. Firms have to be at least in harmony with the changes in environment to become successful. This needs flexibility in firm movements and plans. This need has to be taken into consideration in the planning phase and contingency plans have to be prepared.

McCury (1999) examined IT projects that suffer difficulties in his study. McCury mentioned about two books, which were "Stop Project Failures through Risk Management" and "IT Investments-Making A Business Case " written by Dr. Don Remenyi. These books were aimed to identify the ways for the success of the projects. The first book mentioned about the causes of project failures and the elements of risk and risk management. In the second book, the value of investment was explained with examples.

Risk and risk management are very important for the contingency planning. Risks are very important either in the first phase of the projects and in the following life cycles. Unfortunately, most of the firms become irrelevant to this subject and suffer for the under performed systems or wholly unsuccessful projects.

When the fast and high cost of the changes in technology are taken into consideration, IT projects incur risks. These projects can be applied after many years due to their complexities and the changes in the needs of the firms. Remenyi mentioned the high risk factor associated with IT projects. To be successful, management and the project staff must pay attention to the risks and probable different situations. The risks are grouped into three groups:

Work risks: The working system's needs can be changed according to work in the improving phase.

Improvement risks: The estimates of the necessary work can be unrealistic, project staff can abandon the work, and the software and hardware can be insufficient for the work.

Structural risks: The chosen organization can be insufficient to use the technology, the inappropriate hardware and software can be used.

For Remenyi, the most harmful risk is work risks. Because, any study can be cancelled due to not meeting the needs of the work.

Project managers must be proactive by looking ahead to the future and identifying and addressing issues that raise the risk of the associated tasks. A primary duty of the project manager is to identify, analyse and resolve project issues. An issue can be a problem or opportunity. If the issues can be addressed, risk can be reduced and the chance of project success can be increased (Lientz and Rea, 1999).

5.6. Inability to track progress

The ability to measure the status of an engineering project is crucial for assessing engineering performance. It is also crucial for moving the project toward its established objectives. The ability to measure is often determinant of a project's success or failure.

One of the examples about inability to track progress is in the study of Cannon (1994). The accounting system of an airline was aimed to change in this project. This project was lasted two years later and it was running over time and budget. These overruns are due to the fact that, in this complex project, tracking the project was difficult and estimating the time required to achieve certain milestones was highly variable.

Levine (1989) examined the inappropriate tracking methods of the projects in the study. In this way, Levine touched on a study, which was published by business Week in 11/7/88, in his study. In this study, the software project that has time slippages or budget overruns was examined. For the experts' opinions, the causes of the failures are not only insufficient project management or system plan, but also management staff was underestimated the complexity and the cost of the project. Another two important causes are staffing and sponsor problems. Project sponsor did not control the project in

the application phase. Also, this project was tried to be accomplished by unqualified personnel, so the project was lasted longer than planned.

Projects must be controlled whether they fit to the planned budget and timetables. Today, software was used to measure the performance. But, it is very important to remember that, traditional project control systems track and report the problems of the project instead of removing. A good control system must track the application phase and make risk analysis (Levine, 1989).

5.7. Inability to detect problems early

In order to complete the project successfully, it is very important to detect the problems at the early stages of the projects.

Rotham (2000) examined this subject in his study. Many firms give the responsibility of buying new equipment or choosing the process control specifications to the counsellor firms. These counsellor firms usually set up a factory with many unnecessary sophisticated instruments. The level of the personnel knowledge was not sufficient for the instruments and the cost of the factory increases accordingly. As seen in this example, firms do not search for the needs of the factory at the beginning and can not identify the probable problems early. In the end, an unusable system was set up with high cost.

Another study about IT projects' early problem detecting is in the study of Gentle (1994). The main problem for project failures is not identifying the problems properly. Generally, in these projects, the needs were identified on the basis of interviews between analyst and user. But the errors in the description of the needs cause project improvement in a wrong way and in the end user will not satisfy with the results of the project. To resolve these kinds of projects, the needs must be identified properly at the beginning of the project.

Oluafa and Keith (1992) mentioned about the importance of detecting the problems early. In this study, they aimed to identify the feedback mechanism for operational simulation of construction projects. They benefited from a simulation example for identifying the related concepts and identified this simulation. This simulation program, which is used for great excavation processes, includes simulation module and also defines the needs for all simulation phases. With this program, the problems can be

identified. This simulation program can be used in planning or different phases of the project, the personnel can identify possible problems early and precautions can be taken to prevent the problems.

5.8. Insufficient number of checkpoints

A project plan must have measurable milestones, each of which has specific deliverables items or results defined. This will make it possible to measure project status and performance and provide the crucial inputs for controlling the project to achieve the desired results (Thamhain, 1992).

Verner et al. (1999) studied about a research with 20 senior software development professionals from a number of different organizations in United States. This study was made to find out the factors leading to success or failure of software development projects. They organized their discussion into seven headings. One of them is development process and methodology. The respondents mentioned that the major problems were in two main areas, the lifecycle model used and monitoring and control of the process.

Another example about insufficient number of checkpoints is in the study of Solomon (2000). Solomon mentioned about the experienced project manager, Dennis B. Lynch. Lynch thinks that something can be learned from every failure. The important point is searching the causes of the failure and not repeating the same failures again. One of the important consequences of Lynch's experience is identifying the success factors of the project and evaluating these factors periodically.

5.9. Staffing Problems

Project leaders often make the mistake of assuming that certain team members have specific levels of technical knowledge or that they have extensive knowledge of the business process. Then the leader is surprised to find out that the knowledge is lacking. This has become more commonplace due to the wide range of technical and business knowledge that a project requires today. One of the reason is that, projects require high level of personnel knowledge. Another factor is that people naturally do not like to reveal what they do not know. This is especially true for individuals who are hired into a company to work on a specific project. They may overstate the extent of their

experience. If the project leader cannot assess the skills and knowledge of the team members in advance, there may be many unpleasant surprises in terms of knowledge gaps (Lientz, and Rea, 1999).

Levine (1989) mentioned that project must be done with the qualified personnel. He also mentioned about the effects of the unqualified personnel on the time slippages. The required standard times are computed assuming to be worked with tame and qualified people in the projects. But in the application phase, the specified times takes more than determined with the unqualified personnel. This causes time slippages and budget overruns.

5.10. Technical complexities

New technology requires training. But training in the organizations is usually limited and there is a lack of expertise. When a new technology is started to be used, such as software or network, personnel must gain the knowledge at the proficiency level. One of the reasons for the failure of early client-server projects was an unexpectedly long learning curve. Learning a technology also may require forgetting old habits, which were useful in the past (Lientz and Rea, 1999).

Technical complexities caused a failure in the Bank of America in February 1988[3]. Hardware problems caused the Bank of America to lose control of several billon dollars in trust accounts. All the money was eventually found in the system but the entire Trust Department of 255 people was fired as all the depositors withdrew their trust money. The first night where the US Fed's new system went life, it lost control over 28 billion dollars in transfers and awarded interest to the wrong member banks. The member banks only reported 24 billion dollars loss in the next day.

Another study about project scope is Stapleton (1993) study. Stapleton examined the America's biggest national infrastructure project, Los Angeles Subway System. These kinds of big projects are very difficult to complete without conflicts, because these projects generally have technical complexities, difficulties about reconciliation of project groups and difficulties of defining the needs of the projects. The key factor for overcoming the conflicts is good communication channels between project groups and the management.

[3] Anonymous, "Failure examples of IT projects", www.it-cortex.com

5.11. Priority shifts

Priority shift is a very important factor for accomplishing a project successfully. All projects are aimed for reaching the determined goals, but while reaching to the goals, organizational values must not have been forgotten. The values and project goals determine the priorities.

One of the examples about this factor is encountered in the United States. The Pennsylvania Turnpike was America's first superhighway. This project was completed on time and within budget, and attained the expected technical performance objective. The Pennsylvania Turnpike was accomplished successfully, because firstly the project had a high priority in the U.S. Defence initiative. Second, unemployment was high and the project was the opportunity to work on the project, so they work with high motivation. Finally, There was an extraordinary support from the project's stakeholders (Cleland, 2000).

Another study about this subject is in the study of Rotham (2000). Rotham examined the priority shift factor from political perspective. Rotham mentioned that political effects have some negative consequences on projects. Additional cost and high main costs are some of the consequences and these costs are caused by parties during project planning and application. In these kinds of projects, the total cost increase %15 or %20.Another effect of politics on projects are delays in the project-planning phase, the required agreements are done with political groups instead of qualified groups.

These approaches not only increase the cost of project but also cause indefinites about sufficiency and the power of competition. Many projects are affected negatively due to the high cost agreements and delays in the applications negatively.

Most of the projects mentioned in this study are related with the governmental projects. But the same partisan attitude or grouping of different staffs causes the same problem in the private sector also. In conclusion, the level of political effects has to be controlled and these effects must be kept under the acceptance limit for the accomplishment of the project successfully.

Rotham demonstrated how project sponsors shift their priorities. The priorities for the projects are conforming to the specifications, the acceptable cost level and finishing the project in the predetermined time limits. But, in these examples, these priorities are

surrounded with political benefits and beneficial relations. This approach cause time slippages and budget overruns in the projects.

Another example about this subject is in the study of Lattig (1999). In this study, Lattig mentioned the opinion of Mark Boase who is the information systems management expert of Lockheed Martin Aircraft Systems. Boase mentioned that in some of the information systems projects, the improved analytical approaches are not understood completely by the users, so these projects become solutions only for some part of the people. So in these kinds of projects, the needs of work cannot be met completely. In this example as understood, the priority is not only occurring solutions, but also the system has to be understood and used by all users.

5.12. No commitment by personnel to plan

Involvement and participation of all project team members and their managers is usually necessary for the development of a realistic plan, one which is operationally feasible and will eventually obtain the acceptance and commitment of all key project personnel (Thamhain, 1992).

Kirby (1996) illustrated the idea that the same event from different perspectives can ascribe different meaning. Acme, which is a large international food producer set out to design an information system called IRIS (Integrated Requisitioning Information System). IRIS was to be an integrated system designed to reengineer the requisitioning, purchasing, receiving, disbursement and employee expense reporting processes at Acme. It was decided in the design meetings that the system was to be developed in three stages. Although phase 1 was scheduled for release to headquarters in November 1992, it was not going to be ready for its scheduled November 1992 launch. The programmers were having difficulty meeting the functional specifications, development of the training program was being delayed and there was a growing turnover rate among the personnel working on the project. IRIS failed because personnel hold different perceptions for the events from an entirely different perspective. So the support for the project weakened and resistance increased for the project. For Kirby, resolving this conflict can be accomplished by understanding the user's concerns. This requires spending time, talking to the people involve, finding out what they think and seeing events from their perspective.

5.13. Sinking team spirit

Team spirit can be defined as people on the teamwork together on their own without direction from the project leader. At the start of a project, the project leader must build team spirit. The project leader must set the stage by discussing the following aspects of the project with each person individually:

a. The purpose of the project and why the person's role is important
b. The scope of the project and how the individual will fit within it.
c. Why the person is on the team
d. What you expect of the individual
e. What he or she will get out of being on the project
f. How you will support the individual and provide for training and tools
g. How you want team members to work together; give examples
h. The individual's role in project management with respect to status and issues
i. What you want to do for the individual (Lientz and Rea, 1999).

Love (1997) mentioned the importance of the team spirit in the study. The relations between subcontractor and contractor affect the team spirit. If team members do not obey the rules and have negative attitude of each other, then this negative influence can be one of the most important failure causes of the projects. In this respect, the success of the projects is related to the sub contractors. So, subcontractors have to know that they are the part of the team and they have to be in a good relation with the contractor or employer.

5.14. Unqualified project personnel

Project leaders often make the mistake of assuming that certain team members have specific levels of technical knowledge or that they have extensive knowledge about the business process. Then the project leader is surprised when the knowledge of personnel is lacking. The lack of knowledge may occur due to the different reasons. One of the reasons is that projects need high-qualified personnel due to the complexity of the projects. Another factor is that people naturally do not like to reveal what they do not know. This is especially true for individuals who are hired into a company to work on a specific project. They may overstate the extent of their experiences. If the project leader

fails to assess the skills and knowledge of the team members in advance, they are likely to be many unpleasant surprises in terms of knowledge gaps (Lientz and Rea, 1999).

Lack of knowledge often does not surface until the project and tasks start. Individuals may try to hide the gap or work around it. The first impact is the slippage of the tasks involves. If the knowledge is critical, the project leader may have to find new resources to fill in by adding to both expense and duration. There are also social impacts. The other members of the team may no longer trust to the team member. Conflict among the project team can be created. The person may feel depressed from finally having to admit that he or she lacked the necessary skills. It can be prevented by carefully defining what skills are needed (Lientz and Rea, 1999).

One of the examples about unqualified project personnel is in the study of Cannon (1994). In his study, a retailer decided to upgrade its systems and redesign its distribution and stock management systems. It employed consultants, established an experience project team, had a clear, user-defined system design and utilized project management techniques to control it. In the end, the first phase of the system was abandoned after almost 50 percent more time than planned had been taken. There were three reasons for its failure. The first ones is, the project of the project was far greater than anyone had completed before and estimates of the time taken to analyze activities and come to sensible system solutions were inaccurate. There was little real experience of a system of this type project. The last one is, the end result was thought to be well defined, but it became clear that the detail was only hazily understood as the project progress, so time estimates were incorrect.

Another example related with unqualified project personnel is in the study of Rotham (2000). In this study, it is mentioned about a project, which was lasted unsuccessfully due to the lack of qualified workers. Also these workers did not take sufficient training for their work. The international corporate did not realize the fact that subcontractors should be educated in some issues. Also project owners did not accept the need of training of maintenance personnel and operational group. Unqualified personnel cause so many problems. There were big delays in completing the order and production in the plant. In addition, there were big budget overruns. The products, which were not provide the required specifications, did not satisfy the customers and in the end sales decrease accordingly.

The consequence of this example is that project owner must be sure of the qualifications of the contracted firm for the success of the project. In this direction, project owner and the contracted firm should identify the required level of training for project personnel and supply the trainings for increasing the qualifications of the personnel.

In the same study, Rotham (2000) mentioned about a project, which was cancelled. The problem of the project was analysed by a firm and then reported. According to this report:

- Project was planned badly and in the end the consumer country could not consume the predefined production level of the project.
- Project was finished with high cost.
- The maintenance of the institution was done by the personnel who do not have required knowledge and material.

Especially, the third one is related with the unqualified personnel. Project was cancelled in the end and all equipment and material became a scrap.

In the same study, another example is related with the choice of subcontractor. The subcontractor who had sufficient qualifications was found, but the price for this project was found to be high. So agreement was made with another subcontractor who wanted fewer prices than the previous one. But this subcontractor was far away from the knowledge and experience that the work needs. In the end, the project was finished with high cost and time slippages by the second contractor. When the cost of the project was analysed, the total cost was nearly equal to the subcontractor who knows the work well.

Another example about unqualified project personnel is in the study of Collins (1996). In this study, it is mentioned about an IT project, which was named HISS (Hospital Information Support Systems). This project had millions of pound loss. NAO (National Audit Office) prepared a report and explained the lessons that can be taken from this unsuccessful project. The most interesting parts of this project is that the project was put in the application very quickly with the request of prime minister, but the personnel were not trained for the required specifications. This important deficiency caused the loss of millions pounds of English Government.

5.15. Lack of executive support

Executive support influences the process and progress of a project. Senior level management direction, involvement, interest, and support are usually necessary to create proper visibility of the project. Executive support stimulates involvement and interest among team members. It builds the desire for success, a pervasive reach for excellence that unifies the team and leads to commitment (Thamhain, 1992).

Bicnell (1995) mentioned about the importance of the top management support for the project in his study. In 1987, the California Department of Motor Vehicles (DMV) launched a major project to revitalize their driver's license and registration application process. By 1993, after $45 million dollars had already been spent, the project was canceled. According to the report, DMV technical committee never believed that the project becomes fact. The president of Standish said that, the main causes of the failure for DMV are, no monetary gain in this project, poor project planning and lack of executive management support.

6. PROJECT MANAGERS

6.1. What does a Project Manager Do?

Technology project managers fulfil the following requirements:

- Define and review the business case and requirements by regular reviews and controls to ensure that the client receives the system that he or she wants and needs.
- Initiate and plan the project by establishing its format, direction and base lines that allow for any variance measurements and change control.
- Partner with the end users, work with project sponsors and other management to establish progress and direction of the project by achieving goals, reaching targets, solving problems, mitigating risks.
- Manage the technology, people and change in order to achieve goals, reach targets, and deliver the project on time and within budget.
- Manage the project staff by creating an environment conductive to the delivery of the new application in the most cost-effective manner.
- Be able to manage uncertainty, rapid change, ambiguity, surprises and a less defined environment.
- Manage the client relationship by using an adequate direct yet complete and formal reporting format that compliments a respected and productive relationship.
- Drive the project by leading by example, and motivating all concerned until the project accomplishes its goal (Murch, 2001).

6.2. Necessary Skills for Engineering Management

Engineering function requires specific skills in leadership, technical, interpersonal, and administrative areas.

6.2.1. Leadership Skills

Effective engineering involves a whole spectrum of interpersonal skills and abilities. These are:

- Ability to manage in unstructured work environment
- Clarity of management direction
- Defining clear objectives
- Understanding of the organization
- Motivating people
- Managing conflict
- Understanding of professional needs
- Creating personnel involvement at all levels.
- Communicating, in written and oral mode
- Assisting in problem-solving
- Aiding group decision making
- Building multidisciplinary teams
- Credibility
- Visibility
- Gaining upper management support and commitment
- Action-orientation, self-starter (Thamhain, 1992).

Crawford (2001) states that, effective leaders do two things: establish a compelling vision for the future, and motivate and direct others to take effective action in realizing the vision. In the world of information technology, the leader presents a compelling technical solution to an important business problem or opportunity, and effectively recruits and coordinates the activities of other business and technical experts to develop and implement the solution.

Crawford stated the symptoms of ineffective leadership within an IT project are:

- Many different interpretations of what the purpose and intended result of the project is.
- Frequent changes in project staff assignments.
- Frequent changes in completing deliverables (for example, planning documents, requirements, design deliverables).

- Vague statements from the project manager about what the project will produce.
- Staff completing technical deliverables, which are frequently rejected or sent back for significant re-work.
- Vague statements from staff about when work will be completed and what completed components will include.

He stated the techniques for effective leaders in IT projects include:

- Develop a deep knowledge of the business problem or opportunity to be addressed through the project.
- Communicate to the technical team both the technical and business results desired from the project. Project leaders must do this often, so every project team member breathes the "business vision" for the project.
- When needing project staff to do something, make a clear and specific request.
- Before promising delivery date, cost scope to the project's sponsors or stakeholders, project leader must check with the analysts and programmers who will be doing the work.
- Make sure staff needs for time, appropriate materials and equipment, and other resources are addressed.
- Read and respond to staff progress reports.
- Give and receive honest and constructive assessment of work completed.

6.2.2. Technical Skills

The engineering manager understands the technologies and trends, the markets, and the business environment in order to participate effectively in the search for integrated solutions and technological innovations. The necessary skills are:

- Ability to manage technology
- Understanding of technology and trends
- Communicating with technical personnel
- Understanding of market and product applications
- Fostering innovative environment
- Unifying the technical team

- Aiding problem solving
- Facilitating tradeoffs
- System perspective
- Technical credibility
- Integrating technical, business and human objectives
- Understanding engineering tools and support methods (Thamhain, 1992).

6.2.3. Administrative Skills

The engineering manager must be experienced in planning, staffing, budgeting, scheduling and other control techniques. Administrative skills of the project managers are:

- Planning and organizing multifunctional programs
- Attracting and holding quality people
- Estimating and negotiating resources
- Working with other organizations
- Measuring work status, progress, and performance
- Scheduling multidisciplinary activities
- Understanding of policies and operating procedures
- Delegating effectively
- Communicating effectively, orally and in writing
- Managing changes (Thamhain, 1992).

To have an understanding of the importance of the skills, Zimmerer and Yasin (1998) made a research about the characteristics of the project managers. They reported the results of a 76 usable responses of senior project managers. These characteristics were ranked from the most important to the least important, these were leadership by example, visionary, technically competent, decisive, a good communicator, a good motivator, stands up to upper management when necessary, supportive team members, encourages new ideas in the rank. The basic understanding from this outcome shows that effectiveness is directly related to the ability of the project manager to lead and manage more than simply possess exceptional technical skills.

In their study, they shed light to characteristics of effective project managers. While being the team leader and communicator were found to be the most important

characteristics for effectiveness, lack of upper management commitment and support was found to be the most important organizational factor in making a project manager ineffective. The effective project leader profile reveals a personality, which recognizes necessity to build a project team, reinforces positive behaviour, communicates effectively, demonstrates trust and respect, empowers team members to perform and set goals while being flexible to respond to inevitable changes.

6.3. Successful Project Managers

Lientz and Rea (1999) examined the most common characteristics of successful project managers in the book of "Project Management: Planning and Implementation". These are:

- They know what is going on in the project at any time.
- They work on communications with line managers.
- They are aware of the trade-off between the needs of the organization and the needs of the project.
- They can address resource allocation among multiple projects dynamically.
- They are able to evaluate and criticize themselves.
- They work with project team members one-on-one to understand their needs and frustrations.
- They are always on the lookout for ways to improve the project and the environment of the project.
- They become adept at the methods and tools.
- They practice project fire drills in the planning.

6.4. Project Management Styles

Posner (1986) says that project managers' effectiveness is their ability to both recognizes the sources of conflict and to manage the dynamics of conflict. Five styles for handling conflicts were analysed that are: collaborating, compromising, avoiding, accommodating and dominating.

- Collaborating: involves an approach where all affected parties are involved and work toward an "optimal" solution to their disagreements.

- Compromising: is characterized by a give-and-take approach where bargaining is used to find solutions that bring some sense of satisfaction to the affected parties.
- Avoiding: finds “solutions” to conflicts by one or both of the affected parties retreating, postponing or ignoring the potential or actual disagreement.
- Accommodating: involves a “going-along” perspective where areas of conflict are not emphasized and differences are resolved when one party adjusts to the other’s desires.
- Dominating: involves a competitive (win-lose orientation) where one party’s position is exerted at the potential expense of the other.

7. RELATED STUDIES

In a world, where change is becoming increasingly vital, Information Technology projects can provide a useful way for businesses to manage that change effectively. Information Technology projects provide businesses to be more effective, efficient and speedy by using the opportunities of Information Technology. These results are very important for the businesses to stay and sustain the leadership in the world market. However some IT projects have been cancelled or completed after experiencing many problems. In the end, the success of the project is affected negatively. The factors that may cause project failure are mentioned in the part of factors that may cause project failure previously. In the literature, these factors, their effects on the time and budget performance and statistical outcomes of the project failure and success, conflict management styles are examined by several researchers.

In 1998, the French computer manufacturer and systems integrator, BULL, requested an independent research company, Spikes Cavell to conduct a survey in the UK to identify the major causes of IT project failure in the finance sector. A total of 203 telephone interviews were conducted with IT project managers. All the managers interviewed had previously taken the lead in integrating large systems within organizations in the Times Top 100. In the project evaluation phase, the main IT project failure criteria searched were:

- Meeting milestones (51%)
- Maintaining the required quality levels (32%)
- Meeting the budget (17%) (Anonymous, 1998).

Another study is Chaos Report (1995). This study has been conducted among 365 IT managers from companies of various size and various economic sectors. In this report, the main IT project failure criteria considered were:

- Cost overruns
- Time overruns
- Content deficiencies (Anonymous, 1995).

Another study on the importance of time and budget overruns is reported by Ford and McLaughlin (1992). In this study, 492 MIS managers were asked to indicate the degree of satisfaction with MIS project teams and the factors associated with successful teams. In the first part of questionnaire, performance criteria were identified. These were: the ability of MIS project teams to meet cost expectations, to meet time deadlines, to utilize technical expertise, to work effectively with other parts of the organization and to meet expectations in overall or global sense. With respect to the performance criteria, it was concluded that, there is widespread satisfaction with the use of MIS project teams. For the most part, managers believe that their project teams have either met or exceeded expectations across all performance measures. Any disappointment that exists is limited to meeting time and cost expectations.

Standish Group International (1994) reported that 31,1% of all corporate software development projects are cancelled before they get completed and 52,7% are costing 189% of their original estimates. The average software project success rate in Standish Study was only 16,2%.

Taylor (2000) defined IT success as delivering to the sponsor everything specified to the quality agreed on or within the time and costs laid out at the start. In his study, he stated that out of 1027 projects covered only 130, or 12,7% were successful. These findings compared well with the results of the Standish Group, which found a success rate of around 16,2% in a 1994 study.

Johnson (2003) presented overall results of CHAOS reports including the latest report of 2000, which makes his work different. A substantial progress was noted in IT project performance according to CHAOS reports. Time overruns have significantly decreased from 222% over the original time estimates in 1994 down to 63% in this latest study. Cost overruns have gone from 189% over the original cost estimates in 1994 down to 45% in the 2000 study. According to 1994 results, only 28000 application development projects met the criteria for success- completed on time, on budget and with all the features and functions originally specified. 2000 year's results show that 78000 projects were successful. Table 7.1 depicts the resolution of the 30000 applications projects in large, medium or small cross-industry U.S. companies tested by the Standish Group since 1994. The Standish Group categorizes projects into three resolution types:

- Successful: The project is completed on time and on budget, with all features and functions originally specified.
- Challenged: The project is completed and operational, but over budget, over the time estimate, and with fewer features and functions than initially specified.
- Failed: The project is cancelled before completion or is never implemented (Johnson, 2003).

Table 7.1: Project Success Rates

	1994	1996	1998	2000
Succeeded	16%	27%	26%	28%
Failed	31%	40%	28%	23%
Challenged	53%	33%	46%	49%

In 1994, only 16,2 % of application development projects met the criteria for success; completed on time, on budget and with all the features / functions originally specified. In 2000, 28 % of projects were successful.

Atkinson (1999) provides some thoughts about success criteria for IS / IT project management. In his paper in addition to cost, time and quality, other factor took into account such as stakeholder benefits. He proposed a new framework to consider success criteria, The Square Root. An argument has been provided which demonstrates that two types of error can exist within project management. Type I errors when something is done wrong, while a Type II error is when something has not been done as well as it could have been or something was missed. In trying to prevent a Type II error of project management, this paper suggests the Iron Triangle could be developed to become the Square-Route of success criteria. Atkinson proposed the Square Root with the four success criteria, which are; the iron triangle, the information system, organizational benefits and stakeholder community benefits. It is generally known as the success criteria cost quality and time. From the information system viewpoint maintainability, reliability, validity, information quality use are evaluated as success criteria. Benefits for organization are classified as improved efficiency, improved effectiveness, increased profits, strategic goals, organizational learning and reduced waste. Benefits of stakeholder community can be classified as satisfied users, social and environmental impact, personal development, professional learning, capital suppliers, content project team, economic impact to surrounding community.

Yeo (2002) describes to create a systematic framework that is broad enough to represent a wide range of possible factors that may impact systems performance; and secondly to use the framework to assess the impact of different classes of influencing factors. The proposed framework is a triple-systems (S) model containing a set of three sub-systems of strategic project planning and delivery process, the organizational contexts and a formalized-technology enabled information system. Yeo describes an information system as a failure if any of these following situation occurs: (1) when the system as a whole does not operate as expected and its overall performance is sub optimal. (2) if, on implementation, it does not perform as originally intended or if it is so user-hostile that it is rejected by users. (3) if the cost of development exceeds any benefits, the system may bring throughout its useful life. (4) due to problems with the complexity of the system.

Might and Fischer (1985) examined the factors affecting project success. These are organizational structure, the level of authority delegated to the project manager and the size of the project. They found that the level of authority of project managers related to the success of meeting budget, time and technical requirements.

The study on Chaos Report (1995) indicated that incomplete requirements, lack of user involvement, lack of resources, unrealistic expectations, lack of executive support, changing requirements and specifications, lack of planning, lack of IT management and technology illiteracy are the causes of project failure (Anonymous, 1995).

Jiang and Klein (1999) tried to identify the relationship between risk and system success. System success is related to many risks associated with information system (IS) development. In this article four IS success measures were found to relate to different risk factors. The success measures are: satisfaction with the development process, satisfaction with system use, satisfaction with the system quality, and impact of the system on the organization. The project risk items were categorized as: technological newness, project size, lack of team's expertise with the task, lack of team's development expertise, lack of user input, insufficient resources, lack of clarity of role definition, application complexity, lack of user experience. Based on the analyses of the 10 project risk variables on the overall system success, they found that the various project risk items are not equally important in influencing system success. The results of this study indicated that: the lack of team's general expertise, application complexity and the lack of user experience were the most important factors for system development process

satisfaction. On the other hand, technological newness was the single most important factor for determining satisfaction with the system quality. The lack of user support was most important to the impact of the system on the organization. Finally, the level of the user experience on the application and the clarity of role definitions significantly influenced system use satisfaction.

Slevin and Pinto (1986) studied the major factors believed to contribute to the success of project implementation. These are clearly defined goals, top management support, a competent project team members, sufficient resource allocation, adequate control mechanisms, adequate communication channels with feedback capabilities and responsiveness to client's needs.

Thamhain (1992) searched the challenges of managing projects according to plan and reasons for schedule slips and budget overruns. The questionnaire method was applied to 400 engineering and general managers. The results suggest that end-date driven schedules and resource limitations are the most encountered challenges. This study also revealed the differences between engineering and general managers' perceptions in identifying the reasons for budget over runs and time slippages. It was found that, engineering managers are more concerned with external influences such as customer and management changes, technical complexities, unrealistic project plans, staffing problems and inability to detect problems early more than general managers. On the other hand general managers are concerned with internal factors such as insufficient front-end planning, unrealistic project plans, underestimation of project's scope, customer and management changes, insufficient contingency planning more than engineering managers.

The Standish Group (1994) surveyed IT executive managers for their opinions about why projects succeed. The three major reasons that a project will succeed are user involvement, executive management support and a clear statement of requirements. Standish Group also examined the project challenged factors: lack of user input, incomplete requirements and specifications, changing requirements and specifications. It also searched the reasons for cancellation that are incomplete requirements and lack of user involvement.

Dvir et al. (1998) examined the natural way to classify projects and the specific factors that influence the success of various kinds of projects. The research is made up with a sample of 110 projects. For each project they collected data on more than 400

managerial variables on the success of projects, where project is represented by 11 variables grouped into two dimensions. One dimension is meeting design goals with variables: functional variables, technical specifications, schedule goals, budget goals. The other one is benefits to the customer with variables: meeting acquisition goals, meeting the operational requirements, product entered into service, reached the end-user on time, product used over a substantial period of time, product yields substantial improvement in user's operational level, user is satisfied with product. Their result suggests that project success factors are not universal for all projects.

Linberg (1999) identified the success factors of a successful software projects These are; effective leadership, conductive organizational climate, technologically realistic requirements, realistic schedule and effort estimates, sufficient software personnel and other necessary resources, and a diverse and synergistic team.

Wateridge (1998) analysed the success criteria appropriate to all IS/IT projects. He concluded that not all the criteria will be appropriate to be used on all projects. Project managers must agree with the stakeholder according to the criteria and factors that meet the project requirements that generally mentioned on time, budget and to expected specifications. He stated the success factors for a project; meets user requirements, achieves purpose, meets time scale, meets budget, happy users, meets quality, happy team, happy sponsor, and commercial success. He concluded that project managers view the commercial success of a project and meeting quality as more important criteria than do users. Furthermore, cost and time are still extremely important criteria for success as perceived by project managers.

Verner et al. (1999) made a research with 20 senior software development professionals from a number of different organizations in United States. This study was made to find out the factors leading to success or failure of software development projects. The success factors are: high level management support, involved stakeholders, negotiated, well defined requirements, experienced project manager, accurate developer-driven estimates, appropriate lifecycle models, managed risk, high intra-team communication and low staff turnover. The failure factors are vice versa of the project success factors. Their observations are compared with the points raised by Brooks in his seminal work. They concluded that although Brooks warned about the factors of the successful projects so many years ago, there are still factors completely beyond the project manager's control.

Posner (1986) argued that effective performance is the ability to successfully manage conflicts and disagreements that invariably arise in the course of task accomplishment. Organizing work by project teams inevitably involves conflict. The team is usually composed of people with different professional affiliations and with different orientation toward work. The ability is just managing the project team successfully. Five management styles are mentioned in this study: collaborating, compromising, avoiding, accommodating and dominating.

Larson (1997) examined the relationship between specific elements of partnering and project success. Partnering is a method of transforming contractual relationships into a cohesive, project team with a single set of goals and established procedures for resolving disputes in a timely and effective manner. This study is based on the 291 respondents who answered a series of questions concerning a recently completed project that they had work on. The results suggest that different elements of the partnering process (meeting schedule, controlling cost, technical performance, customer needs) do contribute to project success and that they affect different aspects of project success.

It should be noted that the literature provides several studies on factors affecting project success. However, no previous study attempts to analyse factors affecting IT project performance from a broad perspective. Furthermore, the findings of the study are important because it is the first research to examine relationships between conflict management styles and IT project performance.

7.1. The Methodology

In this study, the questionnaire method was used for gathering data. Questionnaire (App.A) was prepared on the basis of literature survey. Thamhain's and Posner's studies were the main references for preparing the questionnaire (Thamhain, 1992 and Posner, 1986). For this project, 145 project managers from 110 different firms were interviewed. The data was gathered during the fall of 2002. The questionnaire is composed of six main parts. The first part was designated as demographic characteristics of the firm. The distribution of the sectors and demographic characteristics of the firms can be seen in Table 7.2. In the second part, project managers were asked to answer the questions thinking the Information Technology projects, which were ended in the last six months. From this perspective, a short definition of the project, project duration and budget agreed upon prior to project start,

the average number of project personnel, the ratio of budget overrun and time slippage were asked to the project managers in the second part. In the third part, 15 problems that were thought to be the causes of budget overruns and time slippages were given and asked the frequency of the problems. In the fourth part, the opinion of the project managers for the effect of these 15 problems on the time performance of the IT project was asked. In the fifth part, the effect of 15 problems on the budget performance was asked to the project managers. In the last part, 15 different project manager's conflict style preferences were prepared and the level of agreement on the given situations was asked to the project managers.

Table 7.2: Demographic characteristics of the firms

The Distribution of Sectors		
Information Technology	Distribution	Telecommunication
22 (15,17 %)	1 (0,69 %)	10 (6,9 %)
Iron-Steel	Electronic	Machine-Production
0 (0 %)	4 (2,76 %)	1 (0,69 %)
Service	Transportation	Paper and Paper-made
4 (2,76 %)	2 (1,38)	0 (0 %)
Food	Automobile	Health
10 (6,9 %)	9 (6,21 %)	3 (2,07 %)
Packaging	Petrol-chemical	Banking and Finance
0 (0 %)	2 (1,38 %)	36 (24,83 %)
Textile	Metal Goods	Chemical
5 (3,45 %)	3 (2,07 %)	2 (1,38 %)
Glass	Construction	Other (……)
0 (0 %)	4 (2,76 %)	27 (18,62 %)
The number of different firms= 110		
The average number of white-colored workers= 311		
The average number of blue-colored workers= 711		

In the second part of the questionnaire, it was asked to the project managers whether they experienced time slippages and budget overruns in their IT project. It was analysed that not all projects have time and budget overruns at the same time. Some projects have

only time slippage, some have only budget overruns and some have both. The statistical outcome on overruns can be seen in the Table 7.3.

Table 7.3: The statistical outcomes of the overruns

	Number	Percentage
Budget overruns	76	52,4 %
Time slippages	97	66,9 %
Budget overruns and time slippages	65	44,8 %

These statistical outcomes showed that project managers face budget overruns in 52,4 % of Information Technology projects. Time overrun percentage increases for the IT projects, which is 66,9 %. Project managers encounter budget and time overruns at the same project less than the other two criteria. It has a percentage value of 44,8 %.

In the third part of the questionnaire, the frequency of 15 factors that may cause budget and time overruns was asked to the project managers. Project managers indicated the frequency of conflicts on a five point Likert scale. "1" indicates very low frequency which means that project managers never encountered these kinds of problems in their projects and "5" indicates very high frequency which means that they always encountered these kinds of problems in their IT projects.

In the fourth part of the questionnaire, the effects of 15 factors on the time performance were asked to the project managers. Project managers indicated the effect of these conflicts on a five point Likert scale. "1" indicates very low effect, which means that these problems have no effect on time performance and "5" indicates very high effect which means that these factors have high effect on the time performance of the IT projects.

In the fifth part, the effect of 15 factors on the budget performance was asked to the project managers. Project managers indicated the effects of these conflicts on a five point Likert scale. "1" indicates very low effect, which means that these problems have no effect on budget performance and "5" indicates very high effect which means that these factors have high effect on the IT projects' budget performance.

In the last part of the study, the conflict management styles utilized by project managers were analysed. The main reference point of this part is Posner's study (Posner, 1986).

Five styles for handling conflicts were analysed that are: collaborating, compromising, avoiding, accommodating and dominating.

- Collaborating: involves an approach where all affected parties are involved and work toward an "optimal" solution to their disagreements.
- Compromising: is characterized by a give-and-take approach where bargaining is used to find solutions that bring some sense of satisfaction to the affected parties.
- Avoiding: finds "solutions" to conflicts by one or both of the affected parties retreating, postponing or ignoring the potential or actual disagreement.
- Accommodating: involves a "going-along" perspective where areas of conflict are not emphasized and differences are resolved when one party adjusts to the other's desires.
- Dominating: involves a competitive (win-lose orientation) where one party's position is exerted at the potential expense of the other.

A short form of the Rahim Organization Conflict Inventory-II (Rahim, 1983) was utilized to measure project manager's conflict style preferences. The styles for the conflict management can be seen in Table 7.4.

In this part, different types of project manager's conflict style preferences were prepared and project managers' level of agreement on these 15 different project manager's conflict styles was asked. Project managers indicated their agreement on a five point Likert scale. "1" indicates very low agreement which means that project managers do not agree the given conflict styles and "5" indicates very high agreement which means that project managers very agree to the given conflict styles.

Table 7.4: Conflict Management Styles

Conflict Management Styles	Rank	Styles
Collaborating	1	I try to integrate my ideas with those of my team members to come up with a decision jointly.
	2	I try to work with my team members for a proper understanding of a problem.
	3	I try to find a middle course to resolve an impasse.
Compromising	4	I give some to get some.
	5	I use "give and take" so that a compromise can be reached.
	6	I win some and I lose some.
Avoiding	7	I try to avoid unpleasant exchanges with my team members.
	8	I try to stay away from disagreement with my team members.
	9	I generally avoid an argument with my team members.
Accommodating	10	I generally try to satisfy the needs of my team members.
	11	I usually accommodate the wishes of my team members.
	12	I sometimes help my team members to make a decision in his favor.
Dominating	13	I use my expertise to make a decision in my favor.
	14	I sometimes use my power to win a competitive situation.
	15	I usually hold on to my solution to a problem.

In this study, the collected data was divided into two groups according to the time slippages and budget overruns. So statistical analyses will be made on the basis of time and budget performance independently. In the first part, the budget performance criteria will be analysed on the basis of 76 questionnaires. In the second part time performance will be analysed on the basis of 97 questionnaires. So the study will be divided into two main parts, budget and time respectively.

It will be helpful to give the general approach applied to have a general perspective of the methodology applied. The methods applied to the both parts will be similar. The first section will be called demographic characteristics of firms and project managers, the second part will be called information about the project, and the third part will be called frequency of the problems. Fourth part will be analysed in the time part, because

the effect of the problems on the time performance was asked. The fifth part will be analysed in the budget performance part, because the effect of the problems on the budget overruns was asked. The last part will be called conflict management styles.

The frequency of the problems will be ranged according to the average scores from high to low and the most frequently encountered problems will be determined. The effect of the problems will be ranged according to the average scores from high to low and the most effective problem will be determined on budget and time performance independently. The factors, in the third, fourth, fifth part, will be analysed by Principal Component Analysis independently. With this approach, 15 factors will be turned into new meaningful components for each part. These new components will be used as independent variables for the regression analyses. In addition to these independent factors, demographic characteristics of the firms and project managers and conflict management styles will be used as independent variables of the regression function.

7.1.1. BUDGET PERFORMANCE

7.1.1.1.Methodology for the Budget Criteria

Statistical outcomes of the questionnaire showed that, project managers encounter budget overruns in 52,4 % of the projects. In this study, 76 questionnaires will be used for analysing the data, since budget overruns occurred with 76 project managers from 64 different firms.

7.1.1.2. Demographic Features of Firms and Project Managers

The distribution of the sectors and demographic characteristics of the firms can be seen in Table 7.5. As seen from the table, the sectors that have budget overruns mostly in IT projects are Information Technology and Banking & Finance.

Table 7.5: Demographic characteristics of the firms that experienced budget overruns

The Distribution of Sectors			
Information Technology	14 (18,42 %)	Telecommunication	5 (6,58 %)
Electronic	1 (1,32 %)	Machine-Production	1 (1,32 %)
Service	4 (5,26 %)	Metal Goods	3 (3,95 %)
Food	7 (9,21 %)	Health	1 (1,32 %)
Automobile	2 (2,63 %)	Banking and Finance	16 (21,05 %)
Textile	4 (5,26 %)	Chemical	2 (2,63 %)
Construction	2 (2,63 %)	Other (……)	14 (18,42 %)
The number of different firms= 64			
The average number of white-colored workers= 237			
The average number of blue-colored workers= 570			
Project management experience (month)			
Max= 240	Min= 2	Ave= 46	
Work experience at the current position (month)			
Max= 240	Min= 1	Ave= 28	

7.1.1.3. Features of the Projects

In the second part, the features of the IT projects, which were ended in the last six month and have budget overruns, were analysed. The information on these projects will be given in Table 7.6.

The data shows that, the average project duration agreed upon prior to project starts is 6,68 months. The average number of project budget counted to be $180.692. The maximum and minimum IT projects' budget is $4.000.000 and $1.000 respectively. The average number of project personnel was asked in the questionnaire to the project

managers and the statistics shows that there are 300 personnel in max, 1 personnel in min and 12 personnel on the average. The deviation from the originally scheduled due date was asked to the project managers, the maximum deviation is 36 months and the average time slippage is 2,3 months. The statistics shows that, the projects were ended 12 months earlier than the planned duration on average. It is shown that projects have 19,6 % budget overruns on average. Among 76 projects, one project had a 200 % overrun in max and 1 % overrun in min.

Table 7.6: The information about projects that experienced budget overruns

The number of projects= 76		
Estimated time for project completion (month)		
Max= 36	Min= 1	Ave=6,68
Original estimates for project budget ($)		
Max= 4.000.000	Min= 1.000	Ave=180.692
Number of project team members		
Max= 300	Min= 1	Ave= 12
The deviation from the originally scheduled due date (month)		
Max= 36	Min= -12	Ave= 2,3
The deviation from the original budget (%)		
Max= 200	Min= 1	Ave= 19,6

7.1.1.4.The Conclusion for Budget Performance

7.1.1.4.1.The Frequency of the Problems

The frequency of the problems, which may cause budget overruns and time slippages, were ranged according to their average values (Table 7.7). Cronbach's α test was applied to determine the reliability of the data. Reliability analysis was applied for the part, which determines the frequency of the 15 problems (Cronbach, 1984). Cronbach's α was found to be 0,77. This value is sufficient for the reliability of the data.

The most encountered problem that may cause time and budget overruns is "priority shifts" with 2.86 average. The least encountered problem is "sinking team spirit" with 1.93 average. It is very important to understand whether the averages are really different from each other to determine the most encountered and least encountered problems. For this Tukey-B test was applied on 15 problems. In Table 7.7, the same letter indicates that there is no statistical difference between the averages of the problems. Tukey-B test statistics showed that, the first two problems, which are "priority shifts" and

"insufficient front-end planning", are the most frequently encountered problems. The problems after the rank 5 are the least frequently encountered problems.

Table 7.7: The statistics for the frequencies of the problems

Rank	Problems	Tukey-B Test	Mean	SD
1	Priority shifts	A	2,86	1,23
2	Insufficient front-end planning	A	2,84	1,22
3	Technical complexities	B	2,64	1,04
4	Insufficient contingency planning	B	2,55	1,14
5	Project scope underestimated	B	2,51	1,16
6	Unrealistic project plan	C	2,21	1,25
7	Unqualified project personnel	C	2,16	1,29
8	Staffing problems	C	2,14	1,24
9	Lack of executive support	C	2,14	1,14
10	Inability to detect problems early	C	2,13	1,06
11	Customer / management changes	C	2,05	1,25
12	No commitment by personnel to plan	C	2,04	1,20
13	Insufficient number of checkpoints	C	2,01	0,99
14	Inability to track progress	C	1,96	0,89
15	Sinking team spirit	C	1,93	1,20

Note: Means with the same letter are not significantly different at p=0,05

The Principal Component Analyses was applied for the problems that may cause time slippages and budget overruns. The Eigen value statistics shows in Table 7.8. Eigen values, which were greater than "1" was taken as a component. This criterion allows having six factors for defining the factors. The statistics show that these six components explained the 70,22 of the variance. In this analysis, the loadings greater than 0,4 are taken to have a meaningful explanation of the components. The outcomes of the Principal Component Analyses for the related factors can be seen in Table 7.9. 15 problems were reduced to six components by this approach. These factors were named on the basis of loadings, which were seen in the columns of the components. The components were named as follows:

The first component (C1): Team and personnel problems
The second component (C2): Planning problems
The third component (C3): Controlling and tracking problems
The fourth component (C4): Changes and managerial problems
The fifth component (C5): Staffing problems

The sixth component (C6): Technical problems

Table 7.8: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,04	26,96	26,96	2,189	14,59	14,59
2	1,85	12,36	39,32	1,97	13,12	27,71
3	1,37	9,12	48,44	1,94	12,92	40,63
4	1,13	7,55	55,99	1,75	11,63	52,26
5	1,12	7,47	63,46	1,53	10,17	62,43
6	1,01	6,76	70,22	1,17	7,79	**70,22**
7	0,80	5,36	75,58			
8	0,75	4,97	80,55			
9	0,65	4,34	84,89			
10	0,54	3,59	88,48			
11	0,50	3,34	91,82			
12	0,43	2,89	94,71			
13	0,36	2,42	97,13			
14	0,23	1,54	98,67			
15	0,20	1,34	100,000			

Table 7.9: Principal component loading matrix for the frequency of budget related problems

	Component					
	C1	C2	C3	C4	C5	C6
Unqualified project personnel	0,87					
Sinking team spirit	0,79					
No commitment by personnel to plan	0,73					
Unrealistic project plan		0,80				
Insufficient front-end planning		0,70	0,44			
Project scope underestimated		0,69				
Inability to detect problems early			0,77			
Inability to track progress			0,68			
Insufficient number of checkpoints			0,54		0,47	
Customer / management changes				0,82		
Priority shifts				0,62		
Lack of executive support				0,50		
Staffing problems					0,64	
Technical complexities						0,92
Percentage variance explained	14,59	13,12	12,92	11,63	10,17	7,79
Percentage cumulative variance explained	14,59	27,71	40,63	52,26	62,43	70,22

7.1.1.4.2.The Effects of the Problems on the Budget Performance

The effects of the problems on the budget performance are in the fifth part of the questionnaire. The reliability of the 15 problems was measured on the basis of Cronbach's α. The Cronbach's α was measured as 0,87. This value is sufficient for the reliability of the data.

The effects of the problems, which may cause budget overruns, were ranged according to their average values from high to low in Table 7.10. The most effective problem that may cause budget overruns is "insufficient front-end planning" with 3,08 average. " Insufficient front-end planning" is in the second rank of the frequency analyses. This shows that the factor, insufficient front-end planning, is seen very frequently and this factor is very effective on the project budget performance. The least effective problem is "sinking team spirit" with 1,87 average.

But before making comments on the outcomes, t-value statistics will be very helpful to determine whether the level of the effects are different from the medium level. The 95 % confidence interval of the t-test is applied. The test value is chosen as "3" for the comparing test; this value also indicates the medium value of the Likert scale. The statistics shows that "insufficient front-end planning" and "project scope underestimated" are not statistically different with the mean value 3. These two problems are very effective on the budget performance.

Table 7.10: Perceived effects of potential problems on the budget performance

Rank	Problems	Mean	SD	*t*-value
1	Insufficient front-end planning	3,08	1,26	0,545
2	Project scope underestimated	3,04	1,24	0,278
3	Technical complexities	2,68	1,01	-2,73*
4	Insufficient contingency planning	2,61	1,07	-3,21*
5	Priority shifts	2,57	1,15	-3,30*
6	Unrealistic project plan	2,54	1,29	-3,11*
7	Unqualified project personnel	2,36	1,32	-4,25*
8	Inability to detect problems early	2,34	1,14	-5,04*
9	Insufficient number of checkpoints	2,32	1,20	-4,96*
10	Inability to track progress	2,22	1,01	-6,67*
11	Lack of executive support	2,18	1,19	-5,99*
12	Customer / management changes	2,13	1,21	-6,23*
13	Staffing problems	2,11	1,14	-6,85*
14	No commitment by personnel to plan	2,00	1,13	-7,71*
15	Sinking team spirit	1,87	1,01	-9,76*

* p<0,01

The Principal Component Analyses was applied for the effects of the problems. The Eigen value statistics is in Table 7.11. Eigen values, which were greater than "1" was taken as a component. This criterion allows having four factors for defining the factors. The statistics shows that these four components explained the 62,97 of the variance. The outcomes of the Principal Component Analyses for the related factors can be seen in Table 7.12. Four factors were extracted by using Rotated Component Analyses. These factors were named on the basis of component loadings, which were seen in the columns of the Table 7.12. The components were named as follows:

The first component (C7): Personnel/ team and project tracking problems.

The second component (C8): Insufficient planning and shifts in priorities

The third component (C9): Unrealistic project planning

The fourth component (C10): Customer and management problems

The first component explained 27,02 % of the variance and this component contributes highest in the explanation of the variance.

Table 7.11: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,62	37,44	37,4	4,053	27,02	27,02
2	1,76	11,70	49,14	2,568	17,12	44,24
3	1,06	7,09	56,23	1,543	10,29	54,53
4	1,01	6,75	62,98	1,282	8,54	**63,07**
5	0,90	6,03	69,01			
6	0,75	4,99	74,00			
7	0,69	4,63	78,63			
8	0,58	3,85	82,48			
9	0,54	3,62	86,1			
10	0,52	3,48	89,58			
11	0,49	3,23	92,81			
12	0,36	2,37	95,18			
13	0,29	1,92	97,10			
14	0,27	1,81	98,91			
15	0,17	1,10	100,000			

Table 7.12: Principal Component Loading Matrix for perceived effects of potential problems on the budget performance

	Components			
	C7	C8	C9	C10
Sinking team spirit	0,77			
No commitment by personnel to plan	0,77			
Insufficient number of checkpoints	0,74			
Staffing problems	0,74			
Unqualified project personnel	0,67			
Inability to track progress	0,65			
Lack of executive support	0,62			0,52
Insufficient contingency planning		0,72		
Insufficient front-end planning		0,68		
Priority shifts		0,66		
Inability to detect problems early		0,58		
Technical complexities		0,52		
Project scope underestimated			0,80	
Unrealistic project plan			0,62	
Customer / management changes				0,70
Percentage variance explained	27,02	17,12	10,29	8,54
Percentage cumulative variance explained	27,02	44,24	54,53	63,07

7.1.1.4.3. Management Styles on the Budget Performance

In this study, there are three-project manager's conflict style preferences for each management style. Firstly, the reliability of each group is analysed. Internal reliabilities of the data were calculated by taking different pairs of styles and the most reliable style is chosen among the choices. Table 7.13 shows internal reliabilities, means and standard deviations. Internal reliabilities ranged from 0,487 to 0,71. The style most frequently used by the project managers is the collaboration, followed by the accommodating. The difference between collaborating and accommodating is 0,001 and it is a significant value for the statistical differences of management styles. Avoiding is ranked fifth for managing conflicts. Compromising and dominating are not significantly different from each other. The differences between each of these pairs except compromising and dominating are statistically significant ($p<0,001$ or $p<0,05$). In other words, project managers were significantly more likely to use collaboration as a conflict management style than they were accommodate and to use accommodate as a conflict management style more than compromise or dominating. The least used management style is avoiding for project managers.

Table 7.13: Means and standard deviations of conflict management styles

Management Styles	Internal Reliability	Mean	SD
Collaborating	0,71	8,46	1,52
Accommodating	0,54	7,97	1,38
Compromising	0,489	7,18	1,55
Dominating	0,487	6,83	1,60
Avoiding	0,55	5,32	1,95

7.1.1.4.4. Regression Analysis for the Budget Overruns

As noted earlier, Principal Component Analysis's outcomes will be used in the regression analyses. Principal Component Analyses for the frequency of the problems prevail six components, which will be used as a component for the regression analyses. In a similar way, four components for the effectiveness of the problems on the budget performance prevailed. Because of these ten components will be used in the regression analyses, component scores were obtained.

In addition to these independent factors, demographic features of the firms and the project managers and management styles will be used as independent factors. The

demographic characteristics used in the regression analyses are the proportion of white colour personnel, experience of the project managers as a project manager, working time in the defined position, project duration agreed upon prior to project starts, average number of project personnel, time overruns. So the proportion of budget overrun is the dependent variable of the regression analyses and the other factors are independent variables of this analysis.

In this analysis, the relation among the budget overrun and the demographic characteristics, the frequency of the problems, effectiveness of the problems and conflict management styles will be analysed.

The stepwise analysis was used for the regression analyses. The outcomes of the analyses can be seen in Table 7.14 and 7.15. The outcomes show that four variables entered the regression function. The R^2 value was calculated as 0,71. The variables are "time overrun", "accommodation", "average personnel of the project" and "project manager's experience". The outcomes of the analyses will be evaluated in the following section.

Table 7.14: ANOVA for the budget overruns

	Sum of Squares	*DF*	Mean Square	*F*	Prob>*F*
Regression	30848,901	4	7712,225	46,923	0,000
Residual	11669,454	71	164,359		
Total	42518,355	75			

Predictors: Constant, time overrun, accommodation, personnel, experience

Dependent Variable: the deviation from the original budget

Table 7.15:Regression on the deviation from the original budget

Independent variables	Beta	Std. Beta	*Model* R^2	Adjusted R^2	*F*	Prob>*F*
Constant	43,66					
Time overrun	4,09	0,82	0,65	0,64	134,29	0,000
Accommodation	-3,64	-0,21	0,68	0,67	7,71	0,007
Personnel	-0,12	-0,18	0,71	0,69	7,81	0,007
Experience	-6,69E-02	-0,12	0,73	0,71	3,99	0,050

7.1.1.5. Discussion on Budget Performance

In this part of the study, the frequency of the problems that may cause budget and time overruns in IT projects and their effect on the budget performance was analysed. The

relationship among the budget overruns and the frequency of the problems, their effect on the budget performance, the demographic features of the firms and project managers and conflict management styles were analysed by using regression analyses.

This study attempts to analyse factors affecting IT budget performance from a broad perspective. Furthermore, the findings of the study are important because it is the first research to examine relationships between conflict management styles and IT project budget performance.

In this study, 76 questionnaires was used for analysing the data, since budget overruns occurred with 76 project managers from 64 different firms. The frequency of the problems was ranged from high to low in Table 7.7. The most encountered problems are "priority shifts" and "insufficient front-end planning". These findings are consistent with those of Verner et al. (1999). In their study, they attempted to find out factors leading to success or failure of software development projects. For the failed projects senior software development professionals mentioned that projects suffered from insufficient planning and abandonment of planning under pressure.

The effects of the problems on budget overruns are given in Table 7.10. It was found that the greatest effects on budget performance are when "insufficient front-end planning" and "project scope underestimated " are exhibited. Project managers perceive "insufficient front end planning" and "underestimating project scope" as the worst influential problems on budget overruns. It should be noted that "insufficient front end planning" is also the worst frequently observed problem.

The outcomes of the regression analyses show that, four variables entered the regression function. The variables are "time overrun", "accommodation", "average personnel of the project" and "project manager's experience".

The β coefficient of time overrun is positive, this means that while time overrun increases, budget overrun will increase. When the projects are not completed at the predetermined time, the cost of the project may increase due to the salaries and the other requirements of the personnel. In this analysis, the highest β coefficient of the regression analysis shows that, the contribution belongs to the time overrun. It indicates the fact that time overrun is very critical factor for budget-overrun analyses. This seems to be a commonly observed relationship all around the world. For example, Spikes Cavell (1998), an independent research company, conducted a survey in the UK to

identify the project failure criteria in the French computer and systems integrator, BULL. Meeting milestones has the highest ratio in the project failure criteria among the other criterion with 51% percent. This shows that project managers must give importance to the time performance, because it also affects project budget performance.

On the other hand, the coefficients of the accommodation, average personnel of the project and project manager's experience are negative, this means that when the values of the variables increase, budget overrun will decrease. Similar findings were reported by Jiang and Klein (1999), Mandell (1999) and Linberg (1999). Jiang and Klein (1999) identified the factors that affect the system development process satisfaction, these are the lack of team's general expertise, application complexity and the lack of user experience. Mandell (1999) proposed an approach to make the project personnel to learn from their experiences, especially in IT projects. The mentioned approach is:

- Analyse how and why the project failed
- Cite causes/reasons for project failure
- Distribute these lessons learned to senior management project management and project implementers
- Create new guidelines on system development practices and procedures (for future projects).

Linberg (1999) found that sufficient software personnel and necessary resources are one of the success factors.

Thamhain (1986) also made a research similar to the current study in United States. However he did not focus on only on IT projects. So this study may prevail the comparison of IT projects with all types of projects. Thamhain made this research with 400 project managers to determine the frequency of the problems that may cause budget and time overruns. The rank of the problems can be seen in Table 7.16. In the present study, there are 15 problems that may cause budget and time slippages, but in Thamhain's study, there are 14 factors. The only difference is the lack of executive support. To have a comprehensive understanding of the difference between Turkey and United States, these two statistics is given in Table 7.16.

The huge differences between the two countries are obtained for " customer / management changes", "sinking team spirit", "insufficient front-end planning" and "insufficient contingency planning".

Table 7.16: The comparison of United States and Turkey about the factors that may cause time slippages and budget overruns

Ranking in the US	Problems	Ranking in Turkey
1	Customer / management changes	11
2	Technical complexities	3
3	Unrealistic project plan	6
4	Staffing problems	8
5	Inability to detect problems early	10
6	Priority shifts	1
7	Sinking team spirit	15
8	Project scope underestimated	5
9	Insufficient number of checkpoints	13
10	No commitment by personnel to plan	12
11	Insufficient front-end planning	2
12	Inability to track progress	14
13	Insufficient contingency planning	4
14	Unqualified project personnel	7
	Lack of executive support	9

In Figure 2, the frequency of the problems, which may cause time and budget overruns, can be seen. As seen in the figure, the most encountered problem is "priority shifts" and the least encountered problem is "sinking team spirit".

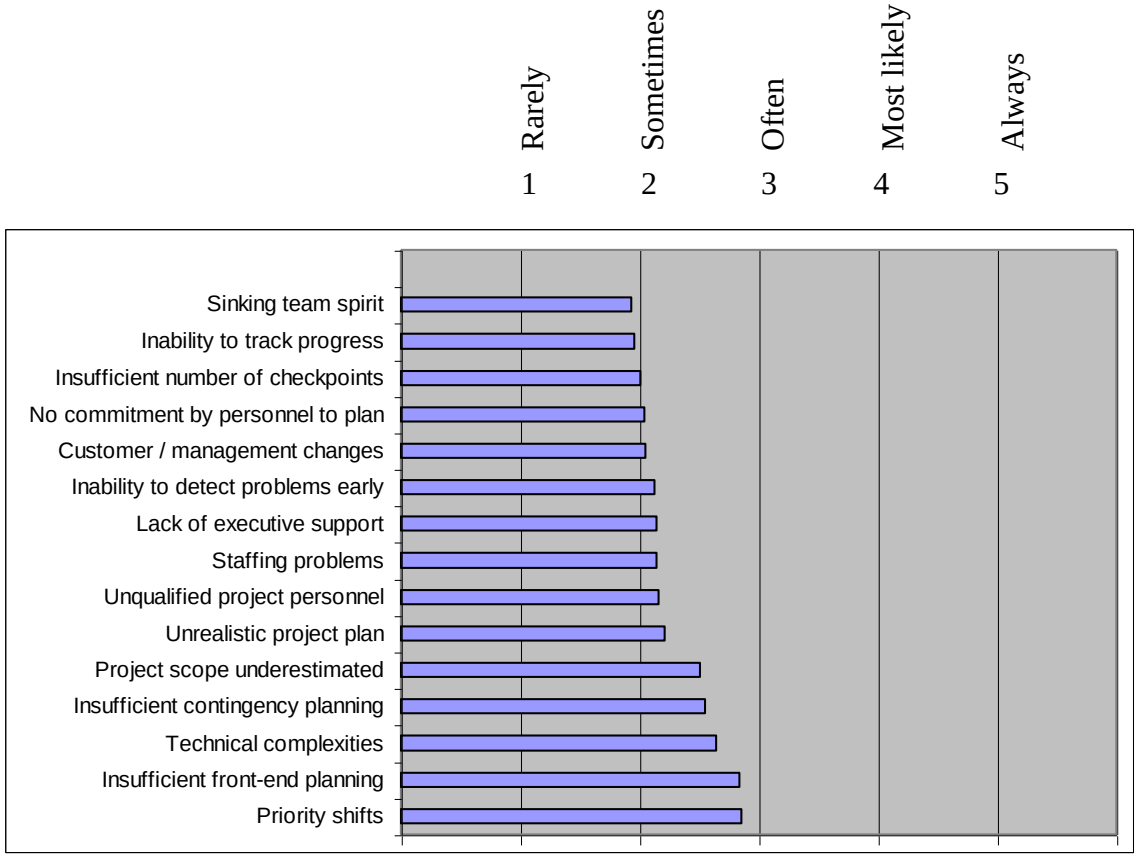


Figure 7.1: The frequency of the problems on the budget performance

If project managers have a going along perspective where areas of conflict are not emphasized and differences are resolved when one party adjusts to the other's desires in IT projects, the proportion of budget overrun will decrease. Collaboration is also used as a method by project managers all over the world (Posner, B. Z, 1986). In this analysis, if the average number of project personnel increases, budget overrun will decrease. This may be the result of the fact that the distribution of work components to the project personnel decreases the workload per person and the given work can be finished on time and on the budget. Another possible reason for this finding might be the fact that IT project groups have less than required number of workers, so an increase towards the required number might increase IT projects' budget performance. If the experience of the project personnel increases, budget overrun will decrease. Because when the experience of the project managers increases, project managers can gain the ability to detect problems and to resolve the problems fast and correctly. The outcomes show that, Turkish project managers learn lessons from their past experiences.

Conflict management styles used by project managers were the second issue investigated in this study. Collaboration was the most frequently used management style and avoidance is the style least favoured by project managers in handling conflicts. These five styles were ranked in nearly same order as the Posner's study. The ranking is shown in Table 7.17.

Table 7.17: Comparison between Turkey and Posner's study

Management Styles	Ranking in Turkey	Ranking in the Posner's study
Collaborating	1	1
Compromising	3	2
Accommodating	2	3
Dominating	4	4
Avoiding	5	5

This ranking of conflict management styles appears to be consistent with the nature of project management work. Because project managers' responsibilities cut across various functional areas it is necessary to employ a problem solving (collaborative) approach to managing differences between people and departments. Dominating or forcing is generally not a strategic option available to project managers since they rarely have the necessary position power to command compliance with their requests. Finally given the stress of schedules and deadlines not dealing with differences (avoidance) is a luxury project managers can seldom afford (Posner, B., Z., 1986).

7.1.1.6. Conclusion and Recommendations

This study attempts to analyse the factors affecting IT project budget performance. Furthermore, the relationship between conflict management styles and IT project performance was analysed. Frequency and effects of the problems, demographic features of the firms and project managers and conflict management styles were used as the independent variables in the regression analyses. The outcomes of the regression analysis showed that, four variables entered the regression function. The factors are time slippages, accommodation, average project personnel and project manager's experience.

Although the findings of the study contribute to a better understanding of the factors that affect IT project budget performance, there are several limitations to this study. First, regardless of the significance of the relationships between factors in the regression model, we can not ignore the fact that these relationships may not apply to all

businesses since the data came from IT projects. Therefore, future research should attempt to understand the relationships analysed in this study for other industries.

Second, the results of this study are far from reaching implications for other countries. A similar study examining this subject in an even broader sample of IT projects located in a variety of different countries could serve to further extend and enhance these findings.

Finally, a longitudinal research design is essential to confirm the linkages among the study variables.

7.1.2. TIME PERFORMANCE

7.1.2.1. Methodology for Time Slippages

Project managers encounter time slippages in 66.9 % of the IT projects. In this study, 97 questionnaires will be used for analysing the data, since time overruns occurred with 97 project managers from 78 different firms.

7.1.2.2. Demographic Features of Firms and Project Managers

The questionnaire is composed of five main parts, which includes the questions for the demographic characteristics of the firms in the first part. The distribution of the sectors and demographic characteristics of the firms can be seen in Table 7.18. The first two most interviewed sectors of this study are: banking and finance and information technology. Project managers' working duration is 47,8 months and their experience in their position is 32,6 months on average.

Table 7.18: Demographic characteristics of the firms that experienced time slippages

The Distribution of Sectors		
Information Technology 15 (15,46 %)	Distribution 1 (1,03 %)	Telecommunication 8 (8,25 %)
Iron-Steel 0 (0,00 %)	Electronic 3 (3,09 %)	Machine-Production 1 (1,03 %)
Service 4 (4,12 %)	Transportation 2 (2,06 %)	Paper and Paper-made 0 (0,00 %)
Food 9 (9,28 %)	Automobile 2 (2,06 %)	Health 2 (2,06 %)
Packaging 0 (0,00 %)	Petrol-chemical 0 (0,00 %)	Banking and Finance 22 (22,68 %)
Textile 4 (4,12 %)	Metal Goods 3 (3,09 %)	Chemical 2 (2,06 %)
Glass 0 (0,00 %)	Construction 4 (4,12 %)	Other (…….) 15 (15,46 %)
The number of firms= 78		
The average number of white-colored workers= 272		
The average number of blue-colored workers= 688		
Project management experience (month)		
Max= 240	Min= 0	Ave= 47,8
Work experience at the current position (month)		
Max= 240	Min=1	Ave= 32,6

7.1.2.3. Features of the Projects

In the second part, the features of the IT projects, which were ended in the last six month and have time slippages, will be analysed. The information on these projects will be given in Table 7.19.

There are 97 projects that will be analysed for the time performance. The data shows that, the average project planned duration is 6,5 months, the planned duration in max is 24 months and 1 month in min. The average number of project personnel in the project was asked to the project managers in the questionnaire and the statistics shows that there

are 300 personnel in max, 1 personnel in min and 11 personnel on the average. The deviation from the planned time in terms of month was asked to the project managers, the maximum time deviation is 300 months and the average time is 11 months. It is shown that projects have 50.09 % time slippages from the planned time in average. From 97 projects, one project has a 200 % budget overrun in max and 11.34% budget overrun on average. One project was finished with 40% budget saving.

Table 7.19: The features of the projects that have time slippages

The number of projects= 97		
Estimated time for project completion (month)		
Max= 24	Min= 1	Ave= 6,5
Number of project team members		
Max= 300	Min= 1	Ave= 11
The deviation from the originally scheduled due date (%)		
Max= 300	Min= 1	Ave=50,09
The deviation from the original budget (%)		
Max= 200	Min= -40	Ave= 11,34

7.1.2.4. The Conclusion of the Study from the Time Perspective

7.1.2.4.1. The Frequency of the Problems

The frequency of the problems, which may cause budget overruns and time slippages, were ranged according to their average values (Table 7.19). Cronbach's α test was applied to determine the reliability of the data (Cronbach, 1984). Cronbach's α was found to be 0,83 for the frequency of the 15 problems. This value is sufficient for the reliability of the data.

The most frequently encountered problem that may cause time and budget overruns and project managers face is "priority shifts" with 2,96 average. The least encountered problem is "sinking team spirit" with 1,94 average. It is very important to understand whether the averages are really different with each other. Tukey-B test is applied to the data to reveal the difference. With this approach, the most and least encountered problems can be determined. Tukey-B test was applied for 15 problems. In Table 7.20, the same letter indicates that there is no statistical difference between their averages.

Tukey-B test statistics showed that, the first two problems, which are "priority shifts" and "insufficient front-end planning", are the most frequently encountered problems. After the rank of "insufficient contingency planning" are the least encountered problems.

Table 7.20: The frequencies of the problems from the time perspective

Rank	Problems	Tukey-B Test	Mean	SD
1	Priority shifts	A	2,96	1,27
2	Insufficient front-end planning	A	2,95	1,31
3	Technical complexities	B	2,72	1,12
4	Project scope underestimated	B	2,64	1,20
5	Insufficient contingency planning	B	2,51	1,12
6	Unrealistic project plan	C	2,40	1,33
7	Lack of executive support	C	2,34	1,22
8	Inability to detect problems early	C	2,26	1,11
9	Staffing problems	C	2,26	1,27
10	Insufficient number of checkpoints	C	2,16	1,07
11	Unqualified project personnel	C	2,15	1,24
12	Customer / management changes	C	2,12	1,24
13	Inability to track progress	C	2,07	1,03
14	No commitment by personnel to plan	C	2,03	1,15
15	Sinking team spirit	C	1,94	1,16

Note: Means with the same letter are not significantly different at p=0,05

The Principal Component Analyses was applied for the problems that may cause time and budget overruns. The Eigen value statistics is in Table 7.21. Eigen values, which were greater than "1" was taken as a component. This criterion allows having five factors for defining the factors. Five factors represent the 15 problems of the analysis. The statistics show that these five components explained the 66,41 of the variance.

The outcomes of the Principal Component Analyses for the related factors can be seen in Table 7.22. In this analysis, the loadings greater than 0,4 are taken to have a meaningful explanation of the components. Five factors were extracted by using Rotated Component Analyses. These factors were named on the basis of loadings, which were seen in the columns of the components. The components were named as follows:

The first component (Ct1): Personnel / team problems

The second component (Ct2): Planning problems

The third component (Ct3): Customer / management / shifts problems

The fourth component (Ct4): Technical/ staffing/ control problems

The fifth component (Ct5): Contingency planning and controlling problems

Table 7.21: Total Variance Explained

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,76	31,72	31,72	2,575	17,17	17,17
2	1,76	11,75	43,47	2,199	14,66	31,83
3	1,35	8,98	52,45	1,828	12,19	44,02
4	1,08	7,20	59,65	1,752	11,68	55,70
5	1,01	6,75	66,40	1,607	10,71	**66,41**
6	0,89	5,95	72,35			
7	0,75	4,97	77,32			
8	0,67	4,47	81,79			
9	0,64	4,28	86,07			
10	0,58	3,88	89,95			
11	0,39	2,63	92,58			
12	0,39	2,57	95,15			
13	0,29	1,90	97,05			
14	0,23	1,55	98,60			
15	0,21	1,40	100,000			

Table 7.22: Principal component loading matrix for the frequency of time related problems

	Component				
	Ct1	Ct2	Ct3	Ct4	Ct5
Sinking team spirit	0,85				
Unqualified project personnel	0,80				
No commitment by personnel to plan	0,75				
Unrealistic project plan		0,83			
Project scope underestimated		0,77			
Insufficient front-end planning		0,72			
Priority shifts			0,69		
Customer / management changes			0,62		
Lack of executive support			0,59		
Technical complexities				0,65	
Insufficient number of checkpoints			0,42	0,59	
Staffing problems				0,57	
Inability to detect problems early				0,55	0,50
Insufficient contingency planning					0,86
Inability to track progress					0,48
Percentage variance explained	17,17	14,66	12,19	11,68	10,71
Percentage cumulative variance explained	17,17	31,83	44,02	55,70	66,41

7.1.2.4.2. The Effects of the Problems on the Time Performance

The effects of the problems on the time performance are in the fourth part of the questionnaire. The reliability of the 15 problems was measured on the basis of Cronbach's α. The Cronbach's α was measured as 0,83, which is sufficient for the reliability of the data.

The effects of the problems, which may cause time slippages, were ranged according to their average values from high to low in Table 7.23. The most effective problem that may cause budget overruns is "insufficient front-end planning" with 3,09 average. "Insufficient front-end planning" is in the second rank of the frequency analyses. This shows that the factor that may cause budget overrun is seen very frequently and this factor is very effective on the project time performance. The least effective problem is "no commitment by personnel to plan" with 2,1 average.

But before making comments on the outcomes, t-value statistics will be very helpful to determine whether the level of the effects are different from the medium level. The 95 % confidence interval of the t-test is applied. The test value is chosen as "3" for the comparing test; this value also indicates the medium value of the Likert scale. The statistics shows that the first four problems are not statistically different with the mean value 3. This means that "insufficient front-end planning", "priority shifts", "technical complexities" and "project scope underestimated" are effective as the mean effect. The other problems have less effect than the mean value.

Table 7.23: Perceived effects of potential problems on the time performance

Rank	Problems	Mean	SD	*t*-value
1	Insufficient front-end planning	3,09	1,33	0,69
2	Priority shifts	2,94	1,29	- 0,47
3	Technical complexities	2,93	1,27	- 0,56
4	Project scope underestimated	2,92	1,20	- 0,67
5	Insufficient contingency planning	2,73	1,10	- 2,39*
6	Unrealistic project plan	2,61	1,30	- 2,98**
7	Lack of executive support	2,53	2,32	- 2,01*
8	Inability to detect problems early	2,46	1,21	- 4,37**
9	Staffing problems	2,38	1,29	- 4, 74**
10	Unqualified project personnel	2,34	1,35	- 4,83**
11	Inability to track progress	2,30	1,08	- 6,38**
12	Customer / management changes	2,27	1,36	- 5,31**
13	Insufficient number of checkpoints	2,21	1,03	- 7,59**
14	Sinking team spirit	2,14	1,27	- 6, 65**
15	No commitment by personnel to plan	2,10	1,19	- 7,40**

** $p<0,01$

* $p<0,05$

The Principal Component Analyses was applied for the effects of the problems on the time performance. The Eigen value statistics is in Table 7.24. Eigen values, which were greater than "1" was taken as a component. This criterion allows having four factors for defining the factors.

The statistics show that these four components explained the 63,12 of the variance. The outcomes of the Principal Component Analyses for the related factors can be seen in Table 7.25. The loading greater than 0,4 is taken as meaningful for defining the components. Four factors were extracted by using Rotated Component Analyses. These factors were named on the basis of loadings, which were seen in the columns of the components. The components were named as follows:

The first component (Ct6): Controlling/ contingency planning/ management problems
The second component (Ct7): Personnel /team problems
The third component (Ct8): Planning problems
The fourth component (Ct9): Technical/ priority shifts problems

The first component explained 19,16 % of the variance and this component contributes highest in the explanation of the variance.

Table 7.24: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,36	35,75	35,75	2,87	19,16	19,16
2	1,64	10,96	46,71	2,55	16,97	36,13
3	1,27	8,43	55,14	2,37	15,78	51,91
4	1,20	7,97	63,11	1,68	11,21	**63,12**
5	0,97	6,46	69,57			
6	0,76	5,06	74,63			
7	0,71	4,72	79,35			
8	0,67	4,47	83,82			
9	0,54	3,58	87,40			
10	0,45	2,99	90,39			
11	0,38	2,52	92,91			
12	0,34	2,29	95,20			
13	0,33	2,19	97,39			
14	0,24	1,59	98,98			
15	0,15	1,02	100,00			

Table 7.25: Principal component loading matrix for perceived effects of potential problems on the time performance

	Component			
	Ct6	Ct7	Ct8	Ct9
Inability to track progress	0,78			
Insufficient number of checkpoints	0,74			
Insufficient contingency planning	0,68			
Inability to detect problems early	0,66			
Customer / management changes	0,58			
Unqualified project personnel		0,79		
Sinking team spirit		0,79		
No commitment by personnel to plan		0,78		
Lack of executive support		0,45		
Insufficient front-end planning			0,84	
Project scope underestimated			0,82	
Unrealistic project plan			0,74	
Technical complexities				0,74
Priority shifts				0,68
Staffing problems		0,43		0,52
Percentage variance explained	19,16	16,97	15,78	11,21
Percentage cumulative variance explained	19,16	36,13	51,91	63,12

7.1.2.4.3. Management Styles on the Time Performance

Table 7.26 shows internal reliabilities, means and standard deviations. Internal reliabilities ranged from 0,30 to 0,71. The style most frequently used by the project managers is the collaboration, followed by the accommodating. The difference between collaborating and accommodating is statistically significant ($p<0,01$). Compromising as a conflict management style is ranked third in terms of frequency. Dominating is ranked fourth and avoidance is ranked fifth as a style for managing conflicts. The differences between accommodating and compromising and between compromising and dominating are statistically significant at the 0,05 significant level ($p<0,05$). The differences between each of the other conflict styles are statistically significant ($p<0,001$). In other words, project managers were significantly more likely to use collaboration as a conflict management style than they were accommodate and to use accommodate as a conflict management style more than compromise. The least used management style is avoiding for project managers.

Table 7.26: Means and standard deviations for conflict management styles

Management Styles	Internal Reliability	Mean	SD
Collaborating	0,63	8,41	1,58
Accommodating	0,30	8,00	1,28
Compromising	0,55	7,47	1,91
Dominating	0,31	6,93	1,70
Avoiding	0,71	5,69	2,75

7.1.2.4.4.Regression Analyses for the Time Slippages

Principal Component Analysis's outcomes will be used in the regression analyses. Principal Component Analyses for the frequency of the problems prevail five components, which will be used as a component for the regression analyses. In a similar way, four components for the effectiveness of the problems on the time performance prevailed. Because of these nine components will be used in the regression analyses, component scores were obtained.

In addition to these independent factors, demographic characteristics of the firms and the project managers will be used as independent factors. The demographic features used in the regression analyses are the proportion of white coloured personnel to blue-coloured personnel, project managers' experience as a project manager, project

managers' working duration in the their position, project duration planned at the beginning of the project, average number of project personnel. So the proportion of time slippages is the dependent variable of the regression analyses and the other factors are independent variables of this analysis.

In this analysis, the relation between the time slippages and the demographic characteristics, the frequency of the problems, effectiveness of the problems and management styles will be analysed.

The stepwise analysis was used for the regression analyses. The outcomes of the analyses can be seen in Table 7.27 and Table 7.28. The outcomes show that four variables entered the regression function. The R^2 value was calculated as 0,265. The variables are collaboration, frequency of planning problems, planned time, frequency of technical/ staffing/ control problems, effect of personnel /team problems. The outcomes of the analyses will be evaluated in the following section.

Table 7.27: ANAVO for time slippages

	Sum of Squares	*DF*	Mean Square	*F*	Prob>*F*
Regression	95498,412	5	19099,682	7,905	0,000
Residual	219855,972	91	2416,000		
Total	315354,384	96			

Predictors: Constant, collaboration, Ct2, planned time, Ct4, Ct7

Dependent Variable: The deviation from the originally scheduled due date

Table 7.28: Regression on the deviation from the originally scheduled due date

Independent variables	Beta	Std error	Model R^2	Adjusted R^2	*F*	Prob>*F*
Constant	159,36					
Collaboration	-10,53	-0,290	0,116	0,107	12,46	0,001
Ct2	-13,90	-0,242	0,176	0,158	6,84	0,010
Planned duration	-3,19	-0,283	0,230	0,205	6,55	0,012
Ct4	-10,76	-0,188	0,268	0,237	4,83	0,031
Ct7	10,98	0,192	0,303	0,265	4,48	0,037

7.1.2.5. Discussion on Time Performance

In the second part of the study, the main objective was to find the influences of problem's observed frequency, their perceived effect and conflict management styles on IT projects' time performance.

A total number of 97 questionnaires were returned by project managers from 78 different firms. The frequently observed problems were ordered from high to low frequency in Table 23. The most frequently encountered problems turned out to be "priority shifts", "insufficient front-end planning" and "technical complexities".

Also, the most effective problems on time performance were determined. According to the results, IT project managers perceive "insufficient front end planning", "priority shifts", "technical complexities" and "underestimating project scope " as the most influential problems on time slippages. It should be noted that "insufficient front end planning", "priority shifts" and "technical complexities" are also the most frequently observed problems. Similar findings were reported by several researchers. For example Rotham, 2000; Stapleton, 1993; Bicknell, 1995.

Rotham (2000) examined the priority shift factor from the political perspective. Rotham asserted that, priority shifts might cause cost increases by % 15 to % 20. Rotham also suggested that to be successful in the projects, the main focus must be placed upon front-end planning and defining alternatives.

Stapleton (1993) examined the United States' biggest national infrastructure project, Los Angeles Subway Systems. This type of large scale projects have technical complexities, difficulties about reconciliation of project groups and difficulties defining the requirements of the project. According to Stapleton, the key factor for overcoming the conflicts is to create good communication channels between project groups and the management.

As stated by Bicknell (1995) an IT project in the California Department of Motor Vehicles was cancelled after $45 million had already been spent. The president of Standish Group, Jim Johnson argued that, the main causes of this failure are no monetary gain in the project, lack of executive support, poor project planning, and underestimation of project scope.

In this study, regression analysis was employed to determine the factors that affect IT projects' time performance. Five variables entered the regression function. The variables are collaboration, frequency of planning problems, planned duration prior to the beginning of the project, frequency of technical/ staffing/ controlling problems, effect of personnel /team problems. It should be noted that all β coefficients are

negative except the coefficient of effect of personnel / team problems. This means that while the effect of personnel / team problems increases, time slippage will increase.

The results indicate that time slippages can be reduced if project managers apply the management style of collaboration. In this management style, project managers and team members are involved and work toward an optimal solution to their disagreements. This finding supports the conclusion of Posner (1986). That is revealed, collaboration conflict management style appears to be consistent with the nature of project management work. Because project managers' responsibilities cut across various functional areas it is necessary to employ collaborative approach to managing differences between people and departments.

These results indicate that when the frequency of the problems increases, time slippages will decrease. It seems likely that, when project managers encounter the problems very frequently, then they gain experience while solving these early problems. So if the solutions are pre-determined, the slippages might be reduced.

Among the factors, frequency of planning problems was found to be the most frequently observed one in IT projects. As the frequency of the "unrealistic project plan", "underestimating project scope" and "insufficient front-end planning" increase, the ratio of time slippages will decrease. These findings are consistent with the Vandersluis' findings (1997). Vandersluis suggests possible actions to be performed to increase the chance of an organization for implementing an IT project successfully. These actions are:

1. Get a plan: Before a single code is written, create a schedule, which matches the scope of the project. If uncertainty about areas of functionality exist, divide the project into phases, which isolate the risk and authorize each phase individually.
2. Track the progress of the plan: Set up weekly or monthly review of the schedule where the progress for each task is outlined and the impact on the rest of the project is identified.
3. Close the loop: Once the project is complete, learn from it. Ensure the lessons learned and any inconsistencies between the plan and the results are used to improve the planning and project control process.

The results also indicate that another factor that affects time performance is technical/ staffing/ controlling problems. Project managers perceive "technical complexities",

"insufficient number of checkpoints", "staffing problems" and "inability to detect problems early" as the most frequently encountered problems. If project managers encounter these problems very frequently, time slippages will reduce. The finding is in consonance with James (1997), who found that software projects are most likely to be successful if they are highly focused and built on well-understood technology. Furthermore, the high focus and building on well understood technology will facilitate dealing with the complexities in the applications and increase the chance of completing the project on time, within predefined budget and with the required functionality.

The results also show that the smallest β coefficient in the regression function belongs to the planned duration. When the planned duration for projects increases, it is more likely to finish the project on time. One possible reason might be the originality of the IT sector. IT sector differs from other sectors because in this sector technology changes also faster than other sectors. That makes the technology complexity higher when compared with the other sectors. But the personnel and project manager may not realize the complexity of the projects and do not plan the time duration adequately. At the end, time slippages may occur.

Lastly, the effect of personnel / team problems has an impact on the time performance of IT projects. As the effects of the problems increase, the ratio of time slippages will increase. It should be noted that personnel/ team problems component was determined mainly by "unqualified project personnel", "sinking team spirit", and "no commitment by personnel to plan" (Table 7.23). Similar findings were reported by Covey (1992), Deming (1986), McConnell (1996) and Linberg (1999). Personnel problems can be overcome with motivation. Motivation is a very special topic, which can be achieved by an effective leadership. Effective leaders within organizations must strive to inspire and motivate (Covey, 1992; Deming, 1986). McConnell (1996) says: "Study after study has found that motivation probably has a larger impact on productivity and quality than any other factor". Linberg (1999) argues that, when there is a perception that the project will not be getting additional personnel or additional resources, software developers may become demotivated and not fully commit to the goals of the project. Taking that into account, to fulfil the commitment to the plan, the personnel must be satisfied with the amount of resources supplied.

As noted in the budget performance analysis part, Thamhain (1986) came up with a research similar to the current study in the United States. To have a comprehensive

understanding of the differences between Turkey and the United States, the rank order of the problems in both countries are given in Table 7.29.

The huge differences between the two countries are obtained for "customer/ management changes", "inability to detect problems early", "sinking team spirit", "insufficient front-end planning" and "insufficient contingency planning".

Table 7.29: Comparison between the United States and Turkey about the frequencies of the problems

Ranking in the United States	Problems	Ranking in the Turkey
1	Customer / management changes	12
2	Technical complexities	3
3	Unrealistic project plan	6
4	Staffing problems	9
5	Inability to detect problems early	13
6	Priority shifts	1
7	Sinking team spirit	15
8	Project scope underestimated	4
9	Insufficient number of checkpoints	10
10	No commitment by personnel to plan	14
11	Insufficient front-end planning	2
12	Inability to track progress	14
13	Insufficient contingency planning	5
14	Unqualified project personnel	11
	Lack of executive support	7

In Figure 3, the frequency of the problems, which may cause time and budget overruns, can be seen. As seen in the figure, the most frequently encountered problem is "priority shifts" and the least encountered problem is "sinking team spirit".

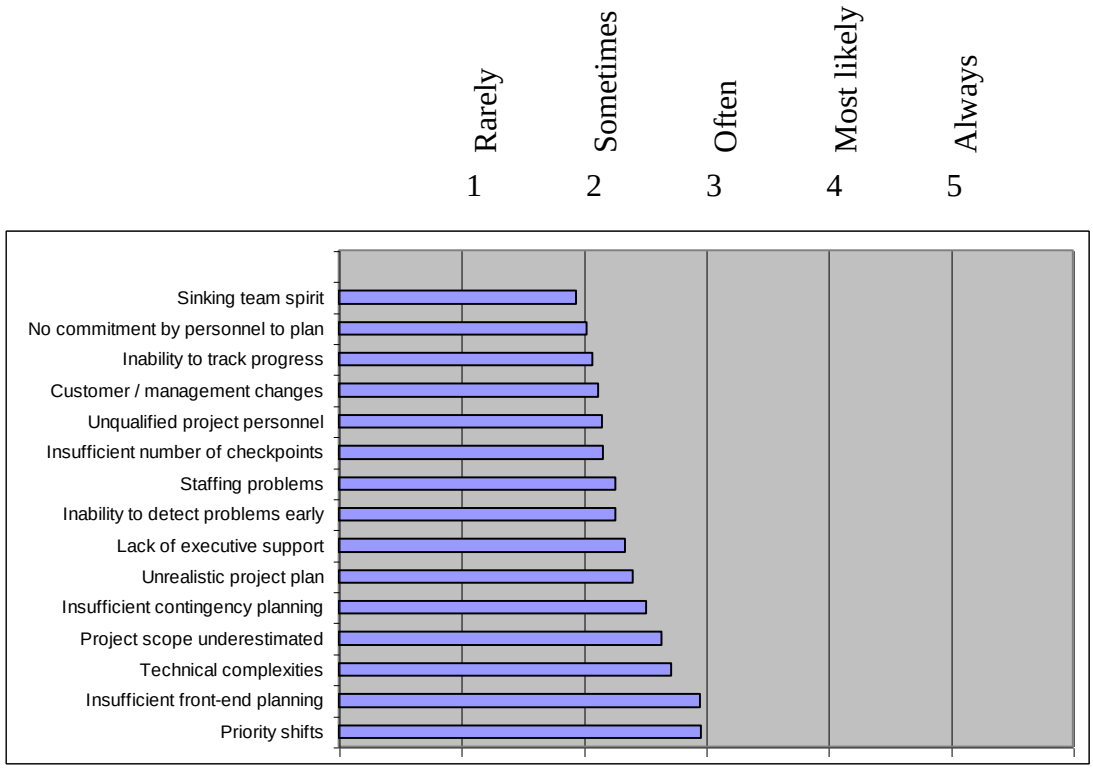


Figure 7.2: The frequency of the problems on the time performance

Conflict management styles used by project managers were the second issue investigated in this study. Collaboration was the style most frequently utilized while avoidance was the least favoured conflict management style. It should be noted that the order of the conflict management styles were quite similar in both studies.

Table 7.30: The comparison between Turkey and Posner's study

Management Styles	Ranking in Turkey	Ranking in the Posner's study
Collaborating	1	1
Compromising	3	2
Accommodating	2	3
Dominating	4	4
Avoiding	5	5

7.1.2.6. Conclusion and Recommendations

This study attempts to reveal the factors affecting IT project budget performance. Furthermore, the relationship between conflict management styles and IT project performance was analysed. Frequency and effects of the problems, demographic

characteristics of the firms and project managers and conflict management styles were used as the independent variables in the regression analysis. The outcomes of the regression analysis showed that, five variables entered the regression equation. These factors are collaboration, frequency of planning problems, planned duration agreed upon prior to project starts, frequency of technical/ staffing/ controlling problems, and effect of personnel/ team problems.

Although the findings of the study contribute to a better understanding of the factors that affect IT project budget performance, there are several limitations to this study. First, regardless of the significance of the relationships between factors in the regression model, we can not ignore the fact that these relationships may not apply to all businesses since the data came from IT projects. Therefore, future research should attempt to understand the relationships analysed in this study for other industries.

Second, it should be noted that the model variables explained 26% of the variance on time slippages. That a large percentage of the dependent variable remains unexplained suggests the need for additional research incorporating potential unmeasured variables in the current study.

Third, the results of this study are far from reaching implications for other countries. A similar study examining this subject in an even broader sample of IT projects located in a variety of different countries could serve to further extend and enhance these findings.

Finally, a longitudinal research design is essential to confirm the linkages among the study variables.

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APPENDIX

App.A

İSTANBUL TEKNIK ÜNIVERSITESI

İşletme Fakültesi

Endüstri Mühendisliği Bölümü

Sayın İlgili,

Size sunulan bu anket proje yöneticilerinin bilgi teknolojileri projelerinde zaman ve bütçe aşımına sebep olabilecek problemler, bu problemlerin etkileri ve problemlerin çözümünde uygulanan yönetim şekillerini ortaya çıkarmak için yaptığımız bilimsel çalışmada kullanacağımız ana veri kaynağımız olacaktır. Bu noktanın anketin doldurulması sırasında tarafınızdan dikkate alınacağına inanmaktayız.

İTÜ İşletme Fakültesi Endüstri Mühendisliği Bölümü'nde yürütmekte olduğumuz bu çalışmamıza gösterdiğiniz ilgi ve ayırdığınız değerli vaktiniz için çok teşekkür ederiz.

Saygılarımızla,

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Adı- Soyadı:

Telefon no:

Faks:

E-Posta:

Çalıştığınız firmanın adı:

Adresi:

Firmanız hangi sektör içinde yer almaktadır?

Bilgi Teknolojisi	☐	Otomotiv	☐
Demir-Çelik	☐	Petro-kimya	☐
Servis	☐	Metal Eşya ve Makina	☐
Gıda	☐	İnşaat	☐
Paketleme	☐	Telekomünikasyon	☐
Tekstil	☐	Makina-İmalat	☐
Cam	☐	Kağıt ve kağıt ürünleri	☐
Dağıtım	☐	Sağlık	☐
Elektronik	☐	Bankacılık ve Finans	☐
Ulaşım	☐	Diğer.....(Lütfen belirtiniz)	☐

Firmadaki beyaz yakalı çalışan sayısı: .....

Firmadaki mavi yakalı çalışan sayısı:.....

Proje yöneticilik tecrübeniz: ..... Ay

Şu andaki pozisyonunuzda çalışma süreniz: ..... Ay

Son 6 ay içinde sonuçlandırdığınız zaman ve bütçe aşımına uğramış bir bilgi teknolojileri projesini düşünerek anket sorularını cevaplandırınız.

I. Projenin kısa tanımı:.

Projenin başlangıçta planlanan süresi: ..... Ay

Proje ekibi ortalama eleman sayısı: .....

Sonuçlandırdığınız projede, planlanan teslim tarihinden itibaren ne kadarlık bir gecikme olmuştur?

..... Ay

Gerçekleştirdiğiniz projede, planlanan bütçeden, ne kadarlık bir sapma olmuştur?

II. Aşağıda listelenen, proje planında öngörülen teslim zamanı ve bütçe rakamının aşılmasına sebep olabilecek problemlerin, belirttiğiniz proje çalışmasında ortaya çıkma sıklıklarını işaretleyiniz.

	Çok düşük	Düşük	Orta	Yüksek	Çok yüksek
Proje başlamadan önceki dönemde yapılan planlamanın yetersizliği	☐	☐	☐	☐	☐
Gerçekçi olmayan proje planı	☐	☐	☐	☐	☐
Proje büyüklüğünün doğru tahmin edilememesi	☐	☐	☐	☐	☐
Müşteri veya yönetim değişikliği	☐	☐	☐	☐	☐
Beklenmeyen durum planlamasında yetersizlik	☐	☐	☐	☐	☐
Proje gelişimini izlemekte yetersizlik	☐	☐	☐	☐	☐
Problemlerin erken fark edilememesi	☐	☐	☐	☐	☐
Proje değerlendirme/ kontrol nokta sayısının yetersizliği	☐	☐	☐	☐	☐
Eleman bulmada problemler	☐	☐	☐	☐	☐
Teknik problemler	☐	☐	☐	☐	☐
Önceliklerdeki değişim	☐	☐	☐	☐	☐
Personelin planlama sürecinde isteksiz davranması	☐	☐	☐	☐	☐
Ekip ruhunun oluşturulamaması	☐	☐	☐	☐	☐
Kalifiye olmayan proje elemanları ile çalışmak zorunda kalmak	☐	☐	☐	☐	☐
Üst yönetim desteğinin yetersizliği	☐	☐	☐	☐	☐

III.Aşağıda listelenen problemlerin, belirttiğiniz projenin teslim zaman performansını hangi düzeyde etkilediğini düşünmektesiniz?

	Çok düşük	Düşük	Orta	Yüksek	Çok yüksek
Proje başlamadan önceki dönemde yapılan planlamanın yetersizliği	☐	☐	☐	☐	☐
Gerçekçi olmayan proje planı	☐	☐	☐	☐	☐
Proje büyüklüğünün doğru tahmin edilememesi	☐	☐	☐	☐	☐
Müşteri veya yönetim değişikliği	☐	☐	☐	☐	☐
Beklenmeyen durum planlamasında yetersizlik	☐	☐	☐	☐	☐
Proje gelişimini izlemekte yetersizlik	☐	☐	☐	☐	☐
Problemlerin erken fark edilememesi	☐	☐	☐	☐	☐
Proje değerlendirme/ kontrol nokta sayısının yetersizliği	☐	☐	☐	☐	☐
Eleman bulmada problemler	☐	☐	☐	☐	☐
Teknik problemler	☐	☐	☐	☐	☐
Önceliklerdeki değişim	☐	☐	☐	☐	☐
Personelin planlama sürecinde isteksiz davranması	☐	☐	☐	☐	☐
Ekip ruhunun oluşturulamaması	☐	☐	☐	☐	☐
Kalifiye olmayan proje elemanları ile çalışmak zorunda kalmak	☐	☐	☐	☐	☐
Üst yönetim desteğinin yetersizliği	☐	☐	☐	☐	☐

IV.Aşağıda listelenen problemlerin, belirttiğiniz projenin bütçe performansını hangi düzeyde etkilediğini düşünmektesiniz?

	Çok düşük	Düşük	Orta	Yüksek	Çok yüksek
Proje başlamadan önceki dönemde yapılan planlamanın yetersizliği	☐	☐	☐	☐	☐
Gerçekçi olmayan proje planı	☐	☐	☐	☐	☐
Proje büyüklüğünün doğru tahmin edilememesi	☐	☐	☐	☐	☐
Müşteri veya yönetim değişikliği	☐	☐	☐	☐	☐
Beklenmeyen durum planlamasında yetersizlik	☐	☐	☐	☐	☐
Proje gelişimini izlemekte yetersizlik	☐	☐	☐	☐	☐
Problemlerin erken fark edilememesi	☐	☐	☐	☐	☐
Proje değerlendirme/ kontrol nokta sayısının yetersizliği	☐	☐	☐	☐	☐
Eleman bulmada problemler	☐	☐	☐	☐	☐
Teknik problemler	☐	☐	☐	☐	☐
Önceliklerdeki değişim	☐	☐	☐	☐	☐
Personelin planlama sürecinde isteksiz davranması	☐	☐	☐	☐	☐
Ekip ruhunun oluşturulamaması	☐	☐	☐	☐	☐
Kalifiye olmayan proje elemanları ile çalışmak zorunda kalmak	☐	☐	☐	☐	☐
Üst yönetim desteğinin yetersizliği	☐	☐	☐	☐	☐

V.Aşağıda belirtilen cümlelere katılım derecenizi ilgili şıkkı işaretleyerek belirtiniz.

	Kesinlikle katılmıyorum	Katılmıyorum	Fikrim yok	Katılıyorum	Kesinlikle katılıyorum
Bir problemin daha iyi anlaşılması için çalışanlarımla beraber çaba gösteririm.	☐	☐	☐	☐	☐
Çalışanlarımla hoş olmayan fikir alışverişlerinde bulunmaktan kaçınmaya çalışırım.	☐	☐	☐	☐	☐
Bazen çalışanlarımın kendi istedikleri doğrultuda karar vermelerine yardım ederim.	☐	☐	☐	☐	☐
Kördüğüm gibi gözüken durumlarda orta yol bulmaya çalışırım.	☐	☐	☐	☐	☐
Ortak bir karar alabilmek için kendi fikirlerimle çalışanlarımın fikirlerini birleştirmeye çalışırım.	☐	☐	☐	☐	☐
Bazen istediğimi elde etmek için gücümü kullanırım.	☐	☐	☐	☐	☐
Genellikle çalışanlarımın ihtiyaçlarını karşılamaya çaba gösteririm.	☐	☐	☐	☐	☐
Bazen benim dediğim olur bazen çalışanlarımın.	☐	☐	☐	☐	☐
Çalışanlarımla pazarlık yaparak anlaşırım.	☐	☐	☐	☐	☐
Genellikle problemlerin çözümünde kendi önerdiğim yönteme sadık kalırım.	☐	☐	☐	☐	☐
Genellikle çalışanlarımla tartışmaktan kaçınırım.	☐	☐	☐	☐	☐
Belli kazanımlar için belli fedakarlıklarda bulunurum.	☐	☐	☐	☐	☐
İstediğim kararı alabilmek için uzmanlığımı kullanırım.	☐	☐	☐	☐	☐
Çalışanlarımla anlaşmazlığa düşeceğim konulardan uzak durmaya çalışırım.	☐	☐	☐	☐	☐
Çalışanlarımın isteklerine uyarım.	☐	☐	☐	☐	☐

CURRICULUM VITAE

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