ITMEM - INFORMATION TECHNOLOGY MANAGEMENT ENHANCEMENT MODEL: ASSESSMENT OF INFORMATION TECHNOLOGY USE IN ORGANIZATIONS

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Approval of the Graduate School of Informatics

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ABSTRACT

ITMEM- Information Technology Management Enhancement Model: Assessment of Information Technology Use in Organizations

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This study proposes a new model for the assessment of information technology (IT) use in public and private companies, which is called ITMEM- Information Technology Management Enhancement Model. This model aims to assist decision making processes in information technology management. For this purpose, a tool is developed to explore strengths and weaknesses of a company in IT use. The model was developed upon a three-folded structure including (1) academic studies in technology management, (2) best practices which are developed for control over operations and processes including COBIT, CMMI and ITIL, and (3) standards about IT management and IT security. The conceptual framework of ITMEM is based on technology management process assessment model of M.J. Gregory. Methodological triangulation approach is adopted for the model for retrieving valid and reliable results. Triangulation consists of (1) semi structured interview, (2) presented company documents and (3) questionnaire developed upon relevant academic researches, best practices and standards. ITMEM was practiced on ten domestic and experienced companies in software & development and manufacturing industries which were appraised in or in progress of being appraised in CMMI. The study revealed the benefits and deficiencies of IT use in the company. It also provided information for decision makers about IT value within companies, and demonstrated the effects of best practices and standards over IT use.

The reported findings should be valuable assets to researchers studying on IT management and IT use in organizations.

Keywords: Information technology, assessment, information technology use, technology management

ÖZ

BTYİM- Bilgi Teknolojileri Yönetimi İyileştirme Modeli: Organizasyonlarda Bilgi Teknolojileri Kullanımı Değerlendirmesi

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Bu çalışma, kamu ve özel şirketlerde bilgi teknolojileri (BT) kullanımını değerlendiren yeni geliştirilmiş bir uygulama olan ITMEM- Bilgi Teknolojileri Yönetimi İyileştirme Modeli'ni sunmaktadır. Bu çalışmanın amacı BT yönetimi kara verme süreçlerinde destek olmak ve organizasyonların BT kullanımı alanında güçlü ve zayıf yönlerini keşfedebilecekleri bir araç sağlamaktır. Model, BT alanındaki akademik çalışmaları, COBIT, CMMI ve ITIL gibi en iyi uygulamaları ve BT yönetimi ve BT güvenliği standartlarını içeren üçlü bir yapı üzerine inşa edilmiştir. Modelin ana yapısı M.J. Gregory'nin teknoloji yönetim süreci değerlendirme modeli üzerine kurulmuştur. Metodolojik üçleme yöntemi geçerli ve güvenilir sonuçlar alabilmek için ITMEM tarafından benimsenmiştir. Üçleme yarı-yapılandırılmış röportaj, sunulan dökümanlar ve akademik çalışmalar, en iyi uygulamalar ve standartlar çerçevesinde oluşturulan anket sorularından oluşmaktadır. ITMEM yazılım ve geliştirme üzerine çalışan ve CMMI tarafından derecelendirilmiş (yada hazır olan) 10 yerli firma üzerinde uygulanmıştır. Çalışma, şirketlerde BT kullanımının yararları ve eksiklerini açığa çıkarmakta, detaylı ve yol gösterici bilgiler sağlamakta ve kullanılan standartlar ve en iyi uygulamaların etkilerini sunmaktadır. Sunulan sonuçların organizasyonlarda BT yönetimi ve kullanımı üzerine çalışan araştırmacılar için değerli bilgiler sağlayacağına inanılmaktadır.

Anahtar Kelimeler: Bilişim teknolojileri, bilişim teknolojileri değerlendirme, bilişim teknolojileri kullanımı, teknoloji yönetimi

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This thesis is dedicated to my mother, Hamide Sezgin.

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CHAPTER 1

INTRODUCTION

In the global market, all companies are required to have rapid, accurate information to process and extract valuable outputs. Here, the main purpose is to keep competitive advantage and market share. Achieving the competitive advantage is vital for companies to survive in a marketplace which has especially high demand elasticity and rapidly changing requirements (Ankeny, 2009). To reach desired outputs, information technology has become a necessity for companies which is being used as a tool for business operations. After understanding the importance of IT and its applications, in these days, most companies in the market place use IT as leverage in business. Like quality practices, IT is related to every division inside and the outside of the company, and have place in short term and long term operations and plans. IT utilities vary with regards to purpose and needs of a company. But mostly, it consists of a set of tools and processes for business operations. According to the definition of Information Technology Association of America, IT is defined as "the study, design, development, implementation, support or management of computer-based information systems" (itaa.org, 2010). Deans and Kane put emphasis on importance of IT by explaining that IT has a remarkable role for success of a company under uncertain economic conditions (Deans & Keane, 1992). Thus, IT management becomes mandatory role to be capable of using IT. The definition brought by Badawy points out the need of IT management as: " Information Technology Management is concerned with exploring and understanding Information Technology as a corporate resource that determines both the strategic and operational capabilities of the firm in designing and developing products and services for maximum customer satisfaction, corporate productivity, profitability and competitiveness" (Badawy,1998). The leverage of IT brought a major burden to the management of IT. Due to its vitality, high flexibility for adapting market conditions and comprehensive applications, IT requires effective management including intradepartmental and environmental factors (Boynton, Zmud, & Jacobs, 1994)

After the emergence of IT and IT management practices, the quality and the control of the IT utilities became an issue (ITIL, 2007). To maintain effective management for keeping the quality at desired levels and for controlling of IT in competitive level, supportive tools to increase management capability are needed over time. For this purpose, standardized procedures, such as best practices and standards, are developed to help the managers to control IT utilities and measure the quality of its implementations (Tranchard, 2008; What is the purpose of COBIT?, 2010). The most popular instances of the best practices are (1) Control Objectives for Information and related Technology –COBIT (ISACA, 2010) which brings a set of measures, processes to managers, auditors, and IT users for assisting the use of information technology and appropriately developing company IT management and its control. (Stanford University, 2010); and (2) Information Technology Infrastructure Library -ITIL which is the guide for quality IT services and required facilities for supporting IT (ITIL, 2007). Another best practice is (3) Capability Maturity Model Integration-CMMI which is an approach to improve performance of a company by its processes. Purpose of CMMI is gathering separate organizational functions, setting objectives for process improvement, presenting guidance for quality processes, and for evaluating current processes, providing reference point. (What is CMMI?, 2008) The most popular standards used in IT management are (1) ISO 38500 (ISO/IEC 38500- Corporate governance of information, 2008) and (2) ISO 17799 (Information technology - Security techniques - Code of practice for information security management, 2008) which provide government and security guidelines for the IT users. Hereafter, the mentioned ISO standards refer to ISO 38500 and 17799 in the study and the best practices refer to COBIT, ITIL and CMMI.

Even though the best practices and ISO standards are popular tools in controlling and maintaining IT, they have problems and missing points in practice. Good point is that optimization process of them still goes on and new versions of them are periodically released, but there are common problems that are not easily amendable. The most important problem of best practices and standards is the lack of know-how (Morimoto, 2009). Any company, who needs to practice any of those, also needs an experienced person in the field to implement the tools or train employees. This problem reduces availability and applicability of the best practices. In addition, their aggregate cost (i.e. time, training, purchasing license of use, expert) can go beyond affordable boundaries of most of the companies. Specifically COBIT requires deep expert knowledge for implementation and its context is too generic which leads to confusion and problems in its implementation (Morimoto, 2009). Besides, COBIT addresses “what must be done” instead of “how”, which is also strongly needed aspect for guidance of practicing. (Solms B. v., 2005). In our model we tried to eliminate such obstacles encountered with current applications, which also

become the main issues in other developed practices (Karabacak & Sogukpinar, 2005; Rush, Bessant, & Hobday, 2007)

In this study, a new method is proposed and practiced. It is called ITMEM: Information technology management enhancement model which is designed to assess IT use in the companies in order to assist the IT managers in decision making. It is argued that ITMEM presents a holistic and valid scope to evaluate IT use in organizations. The model was developed upon a three-folded structure including academic studies, best practices and the standards. It was applied through 10 case studies which include practicing on 10 domestic software & development and manufacturing companies in place. Our model's conceptual framework was developed upon technology assessment management procedure framework of M.J. Gregory (Gregory, 1995). The prepared questions through academic studies, best practices and standards were allocated under the five constructs of the framework which are named as Identification, Selection, Acquisition, Exploitation, and Protection. For ensuring validity and reliability, methodological triangulation was adapted including survey, interview and documents. Thus, main research method selected survey approach with cooperation of semi-structured interview method (Lindlof & Taylor, 2002; Qualitative Interviewing, 2010). In other words, for increasing validity of results of quantitative method, qualitative approach was used.

The cases were specifically selected from a unique set of companies which are well-known and experienced in the sector of software market. The companies were appraised in CMMI level 3 and above, or they were preparing to be appraised (Published Appraisal Results, 2007-2010). The selection of companies which applied common best practices brings the ability to make comparison of benefits and the results of our model. In addition, the level 3 and above companies have a proven success in business processes and well- developed characteristics. The other common point is that selected companies are in dynamic working environment and have knowledge about common points in process management by CMMI. This conclusion is derived from company profiles in published appraisal results of CMMI (Published Appraisal Results, 2007-2010). Level of business standards enables researcher to get accurate and reliable results during the practice. Practicing ITMEM on those companies helped to comparatively analyze the results and provide additional insight about the companies including company culture, operation routines and procedures. Due to the restrictions that are based on confidential issues, the name of the companies cannot be shared in the study but the CMMI levels, size and industries might give clues about them.

The contribution of this study is primarily to bring a new aspects to assessment of IT use which is, in comparison with other practices, requires little time, money, and training. It

enables the small and medium sized companies to assess their IT use practically, and through this way, enhance IT management practices and approaches. Another contribution is to bring a different model to the literature which is based on academic framework and developed upon three-folded structure of academic studies, best practices and standards. It should be valuable asset if we consider the fact that other best practices were not academic-based studies. The other contribution to literature is about the validation of the model. Other than the best practices and standards which are only directing several questions on determined fields and seeking only the documentations, ITMEM involves use of semi-structured interview, questionnaire, and documentation. This structure establishes a triangulation for validation which enables the surveyor to retrieve proof of given information, emerging data and comprehensive insight of the companies. From the community perspective, ITMEM provides a tool for IT assessment especially for small and medium-sized enterprises (SMEs) with low budget. It can also be valuable asset for auditing.

The scope of the study includes companies in every industry which uses IT as a tool to assist their business processes and to gain competitive advantage.

The aims of this study are as follows: (1) Proposing an assessment framework to literature that is believed to define objectives in which IT use is assessed (2) Gathering information about IT use in companies to assist IT management in decision making processes, (3) Providing a framework to improve the IT structure of companies by exploring their strengths and weaknesses with regards to IT in a practical manner, (4) Providing an auditing tool to industries about IT use as well as IT awareness and knowledge.

The thesis is organized as follows: (1) Literature Review of technology management is presented. It includes literature reviews about IT management, best practices and standards, and the utilization of ITMEM (2) Overview to the process of ITMEM practice is given. (3) Methodology of the study including case study details, research approach, data collection and analysis is explained in details. (4) Results are presented. (5) Discussion of results with findings and recommendations are proposed. (5) Conclusion including limitations and future works are given.

CHAPTER 2

LITERATURE REVIEW

2.1. Technology Management

As generic definition, management is known as a set of activities which requires organizing items for fulfilling particular duties. Without deviating from origins, its business definition is the act of gathering people to fulfill specific goals in all business fields (Gomez-Mejia, Balkin, & Cardy, 2008) Management has been acted since the early years of mankind. Over the years, it became more complicated and important notion, especially after the development of industries. Even though, the concept of management stayed constant, the variables which effect the management evolved (Wren, 1994). In the early years of industrial revolution, management mainly required to maintain maximizing the efficiency in production, which means to produce the maximum output with minimum input. Relative to the known management needs, there were fewer concerns in business processes. They were mainly as followings: (1) market condition was less competitive, which means that rivalry is low, (2) input and output were limited with regards to sources and current needs, (3) customers' specific needs were ineffective in decision making process, (4) standard production provided routine set of process, (5) and there were few considerations about employee rights (Wren, 1994). Today, not only the efficiency but the effectiveness, environmental factors, employee rights and needs, customer demands, source allocation and distribution are some of the prior issues effect the management.

In contemporary definitions, management has many approaches and processes, but mainly includes 4 steps which are planning, organizing, implementing and monitoring (Gomez-Mejia, Balkin & Cardy, 2008):

- *Planning* is determining a goal and required sources to achieve it.

- *Organizing* is gathering the determined sources and illuminates the path through the goal. Organizing includes important elements like staffing, directing and controlling.
- *Implementing* is sets of actions using the sources in harmony to reach to the goal.
- *Monitoring* is looking back and evaluating the whole path went through to reach to the goal and analyzing the results.

These 4 steps were accepted as main processes in management operations by many authorities. When we look back to the history of management, it was observed that developments of basic management process roots back to the studies of many scientists such as H. Towne, F. Taylor, E. Mayo, M. Weber and W. Deming. But current management processes were basically inspired from Deming cycle: Plan-Do-Check-Act (Gomez-Mejia, Balkin & Cardy, 2008). Deming cycle is defined as a process of problem solving in four steps which is developed by William Deming in the mid 80s for business process improvement (Deming, 2000)(Figure 1). As the definition and concept, the cycle of Deming fits into management processes.

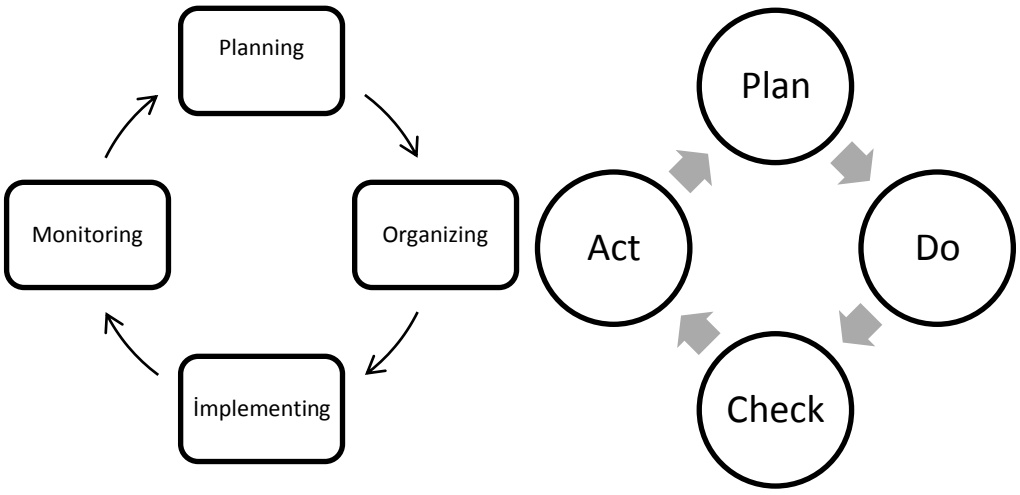


Figure 1. Management Cycle & Deming Cycle

So when technology and management met? In fact, management had always have technology as an important input or resource that was added up to the plans, intensively since after industrial revolution. It started with technology of steam and advanced dramatically with innovations (Greenwood, 1997). But lately, technology had been more than a resource, a part of business operations. Thus, managing the technology became an emerging issue that requires specialty and expertise (Wren, 1994). Even though the technology management roots date back to more than fifty years ago, the literature review

that is considered in this study begins in the 80s in which information technology gain popularity and importance (Webster & Robins, 1986).

One of the earliest and broadly accepted definitions of technology management (TM) explains it as ‘‘a process, which includes planning, directing, control and coordination of the development and implementation of technological capabilities to shape and accomplish the strategic and operational objectives of an organization’’ (NRC, 1987) . Since then, the awareness of the importance of technology management increased dramatically due to the emerging needs in the marketplace (Liao, 2005). The importance of TM in the market is also emphasized by Skilbeck et. al. as: “Technology management includes activities which cut across intra-organizational boundaries and disciplines and may also span many businesses in order to create and sustain technology-based competitive advantage in a rapidly changing marketplace” (Skilbeck & Cruickshank, 1997). This trend led to many studies searching for the answers of the questions of: What is technology management? What are its methods and techniques? What are its functions for supporting individual and organizations in managing the technology? (Liao, 2005). The Review study of Liao demonstrates that technology management framework and its applications widely used over the years and spread over different industrial fields. The followings are the chronological list of fields prepared by Liao in which technology management frameworks and applications had been used: computer integrated manufacturing (1995), project management (1996), business process reengineering (1997), product design (1999), space disaster management (2000), technology assessment (2000), process design (2002), engineering design (2002), and knowledge management (2003). In addition to that, technology management tools also gain remarkable interest for assisting technology management and creating effective solutions. Phaal et. al. categorized the tools into subgroups as followings: portfolio methods for strategy and selection, technology strategy, grids for linking technology to business, technology and management of technology, technology acquisition and sourcing , R&D management, miscellaneous (Table 1) (Phaal, Farrukh, & Propert, 2006).

Table 1. Technology Management tool catalogue of Phaal et. Al. (Phaal, Farrukh, & Propert, Technology management tools: concept, development and application, 2006).

Technology Management Sub-groups	Explanations
Portfolio methods for strategy and selection	"Management and assessment of technology/R&D portfolios or options, linking investment, risk, competence or strength to business benefit, supporting strategy, benchmarking, assessment and audit"
Technology strategy—general	"General technology and R&D strategy development and deployment, aligning technology development with business goals, in terms of markets potential or product innovation"
Grids for linking technology to the business	"Exploration and assessment of current and new technology, in terms of the linkages to markets, business areas, products, competences and goals, for supporting decision-making, strategy and management of R&D"
Technology and the management of technology	"Types, classification and structure of technology, and the management of technology, including audit, assessment and protection of the technology base (intellectual property)"
Technology acquisition and sourcing	"Technology sourcing and acquisition options, R&D collaborations and alliance types and make vs. buy decisions"
R&D management	"R&D management and decision making, including strategy and portfolio methods, linkages to product and market requirements, evolution of R&D in the business, organizational aspects and performance"
Miscellaneous	"General technology management"

In a study of 1995, M.J. Gregory designated that very few companies have systematic and comprehensive approaches to the management of technology, and specified that there were few frameworks in technology management which is an important missing link in TM (Gregory, 1995). By the way of this problem, he developed technology management process framework to provide to the companies the ability to audit and improve the technology management processes. In the study, the elements of technology management, which are generally accepted major work clusters about technology management, contribute to the main frame of the model:

- *Competence and capability*. It searches for knowledge assets of a company.
- *R&D management*. It is required for development of technology.
- *Innovation.* Studies focus on invention and entrepreneurial events.
- *Organizational Learning*. Company's ability for learning and forming its competence became a fundamental asset.
- *New product introduction.* Effective management and auditing is needed.

Additional to that, the missing links in technology management were determined not to avoid current needs in the market:

- *Technology strategy Vs. Technology management*. Successful strategic implementations rely on proper management activities.
- *Lacks of frameworks.* No comprehensive framework exists for technology management.
- *Language and integration*. There is a requirement of language to link the important dimensions of business with technology.

Considering the contributions and missing links, TM process assessment model was established. The developed framework, which is also the conceptual framework of ITMEM, consists of 5 technology management process constructs as followings:

- *Identification*: It includes "forming an awareness of all the technologies which are important to the business. It contains routines for systematic search of existing and emerging technologies".
- *Selection*: Selection involves "the preference of technologies that should be encouraged and promoted within the company".
- *Acquisition*: The acquisition is interested in "decisions about the suitable ways of selected technologies' acquisition and embedding them effectively. Technologies may be acquired internally or externally".
- *Exploitation*: Exploitation is concerned with "the realization of technologies' value or systematically converting technologies into marketable products. The link between the market, technologies and platforms is important".
- *Protection*: It is concerned with "the preservation of the knowledge and expertise that are embedded in products and systems. It also includes legal issues as patenting and licensing. Protection is matters for the operations about all other constructs".

M. J. Gregory's study led to different technology management studies. The majority of them aim to form a roadmap in technology (Phaal, Farrukh, & Probert, 2004), to create a framework for services (McDermott, Kang, & Walsh, 2001) and technological knowledge (Phaal, Farrukh, & Probert, 2004) . The main purpose in all the studies was getting better insight and understanding about technology management and auditing. In one of the further academic studies conducted by Rush et. al., Gregory's model was representing main constructs for the study and this new approach was an extended form of Gregory's model for measuring technological capability (Rush, Bessant, & Hobday, 2007) . The new model includes new dimensions as followings: awareness, search, core competence, strategy,

assessment and selection, technology acquisition, implementation and absorption, learning and exploiting external linkages. Their relations with Gregory's model are shown in Table 2.

Table 2. Relations between the main constructs and extended model of Rush et al.

5 construct of IT assessment	Phaal et al.'s Technology capability dimensions
Identification	Awareness, core competence, Strategy, Learning
Selection	Search, Assessment and selection
Acquisition	Technology acquisition, Exploiting external linkages
Exploitation	implementation and absorption
Protection	-

It is found that there is a common understanding in the studies inspired from Gregory's study. Gregory claimed that there is a remarkable need for the technology management tools, methodologies and applications to control the technology and to maintain technology management quality, and its traces were observed in other studies as well. Table 3 presents the fundamental studies which used the model of M.J. Gregory as a roadmap in technology management. Most of the studies were applied to measure technology management aspects in important organizations.

Table 3. Major studies following M.J. Gregory's study

Year	Authors	Article*	Journal	Volume & Page Numbers
2009	Cetindamar,D.; Phall, R.; Propert D.	Understanding technology management as a dynamic capability: A framework for technology management activities	Technovation	Vol. 29, pp. 237-246
2007	Rush,H.; Bessant, J.; Hobday, M.	Assessing the technological capabilities of firms: developing a policy tool	R&D Management	Vol.37, pp.221-36
2006	Farrukh, C.; Fraser, P.; Gregory, M.	Technology management tools: concept, development and application	Technovation	Vol. 26, pp.336-44
2004	Phaal,R.; Farrukh, C.; Probert, D	A framework for supporting the management of technological knowledge	Technology management	Vol. 27, pp. 1-15
2003	Farrukh, C.; Fraser, P.; Gregory, M.	Development of a structured approach to assessing practice in product development collaborations	Institution of mechanical engineers	Vol. 217, Part B
2001	Phaal,R.; Farrukh, C.; Probert, D	Technology management process assessment : a case study	International journal of operations & production management	Vol. 21 No. 8, pp.1116-32
2000	Probert, D.; Phaal,R.; Farrukh, C.	Development of a structured approach to assessing technology management practice	Institution of mechanical engineers	Vol. 214, Part B
1998	Phaal,R.; Farrukh, C.; Probert, D	Technology Management in manufacturing business: process and practical assessment	Technovation	Vol. 18, pp.541-53
1997	Skilbeck, J.N.; Cruickshank, C.M.	A framework for evaluating technology management process	IEEE/IET, Innovation in Technology Management - The Key to Global Leadership. PICMET '97: Portland International Conference on Management and Technology	pp.138 - 142

** The significance of articles was measured by their citation rates*

2.2. **IT Management**

Over the time, not the basics but the scope of the definition of technology management that was made by NRC is expanded. With the advancements in technology, the scope of technology management broadened to include information technology management. As encountered in technology management, concept and understanding of information technology and IT management became an issue in early years. Several major obstacles arose such as training, business integration, poor performance levels and resistance

(Benamati, Lederer, & Singh, 1997). But after all, it was a need to understand and explore IT, because IT became a resource to determine strategic and operational capabilities of the firm for maximizing corporate productivity, profitability and competitiveness (Badawy, 94–115, 1998). IT management studies were, similarly to technology management, searching for the ways that lead to create effective management approaches and resolve management effects on IT use (Boynton, Zmud, & Jacobs, 1994). The studies are advanced dramatically over the time with the increasing need to IT management by the industries (Crowston & Myers, 2004). This situation proved that IT management became an inevitable part of every company.

The meaning of IT governance and IT management are conceptually accepted similar but their field of use may vary. Even though there is not any clear distinction, governance term is usually used for documentation-intensive duties as setting standards and policies, but management covers more broad terms including governance (Plain Language about Corporate Governance of Information Technology, 2009).

2.3. **Technology assessment**

Technology assessment concept emerged after mid-80s in the studies of sociology. In organizational terms, technology assessment (TA) has been accepted as a part of technology management which examines management circumstances for assisting decision making process and providing control over the technologies of a company (Cetron & Bartocha, 1973). The new forms of technology assessment emerged as the result of social needs, such as participatory TA, constructive TA, innovative TA and ethical TA (Palm & Hansson, 2006). Even though the social influence of technology has been the main concern for TA in many researches, the organizational influence has been considered in this study.

It is observed that the more technology use in a company, the more control over technology is required for business operations. Each additional need of control conduce advancement of assessment methods in technology management (Cetron & Bartocha, 1973). This control needs advanced in IT management. IT assessment, as a part of technology assessment at information side, satisfies control needs over IT. This situation led to the emergence of standards and best practices which are developed to determine paths and parameters for IT assessment. They will be mentioned in the following section.

2.4. Background Information: Best Practices and Standards

2.4.1. Best Practices

A **best practice** can be defined as method, activity or process that is accepted by authorities and communities as more effective way to reach a particular outcome than any other ways (Camp, 1989). Best practices can be only about a specific field or condition. They are the completion of experiences and procedures which enable users to effectively and efficiently complete the tasks. It also helps to deal with fewer problems in operations. As market conditions change, evolvement of best practices becomes inevitable. They may be altered or modified to fit in current situations as required (Camp, 1989).

Today, best practices are popular tools in the business world especially in the fields of management, software and policy making. They are also used in domains of sustainable development, project management, construction, health care and transportation. Even though best practices are well accepted tools in the business environment, the academic studies over best practices are rare. (ScienceDirect, 2010) The confidential issues based on commercial rights set barriers between the private sector and academic studies regarding in knowledge and information sharing. The private sector companies produce the solutions by in-company studies or through associations, which leads to best practices. Today the most explicit examples are COBIT, ITIL, CMMI and ISO standards, which are designed and developed by private companies and institutions for creating solutions to specific problems. The followings are the most popular best practices used for IT and services, and process management.

2.4.1.1. COBIT

COBIT is a best practice developed by ISACA providing IT governance to the companies for creating value from IT and understanding the risks (ISACA, 2010). COBIT "provides good practices across a domain and process framework and presents activities in a manageable and logical structure". COBIT practices are deemed as experts' agreement which is emphasis more on control than execution. COBIT practices are believed to "help optimize IT-enabled investments, ensure service delivery and provide a measure against which to judge when things do go wrong" (Control Objectives for Information and related Technology, 2007).

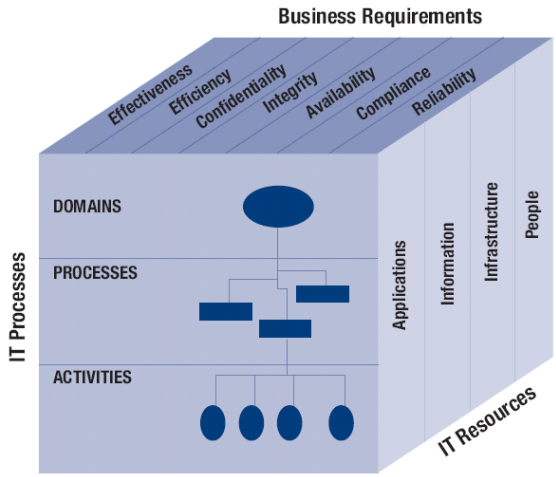


Figure 2. COBIT diagram (Control Objectives for Information and related Technology, 2007)

COBIT includes 4 domains with subgroups consists of the 34 processes and control objectives (Appendix A). The 4 main domains are grouped as follows: Plan & Organize, Acquire & Implement, Deliver & Support, and Monitor & Evaluate. Each processes under 4 domains interrelate to 3 other sources which are (1) IT resources -Applications, Information, Infrastructure, and People; (2) Information Criteria (or business requirements) - Effectiveness, Efficiency, Confidentiality, Integrity, Availability, Compliance, Reliability; and (3) IT governance focus areas -Strategic alignment, Value delivery, Risk management, Resource management, Performance measurement. IT resources, Information Criteria and IT governance focus areas are considered when evaluating the results from the COBIT control objectives (Figure 2). This relation brings the ability to clearly identify the problems. The maturity level is the accepted scoring scale of COBIT, which has 6 levels to determine a company's score (Table 4). Each control objective has its own maturity scale. Thus, instead of overall scoring, COBIT scores are granted through objectives. No certification is presented for COBIT implementations.

Table 4. Maturity levels and definitions of COBIT (Control Objectives for Information and related Technology, 2007)

Generic Maturity Model of COBIT	
0 Non-existent	*"Complete lack of any recognizable processes. The enterprise has not even recognized that there is an issue to be addressed".*
1 Initial/Ad Hoc	*"There is evidence that the enterprise has recognized that the issues exist and need to be addressed. There are, however, no standardized processes; instead, there are ad hoc approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganized".*
2 Repeatable but Intuitive	*"Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures, and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and, therefore, errors are likely".*
3 Defined Process	*"Procedures have been standardized and documented, and communicated through training. It is mandated that these processes should be followed; however, it is unlikely that deviations will be detected. The procedures themselves are not sophisticated but are the formalization of existing practices".*
4 Managed and Measurable	*"Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way".*
5 Optimized	*"Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modeling with other enterprises. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt"*

What COBIT brings for IT management is set of objectives that are required to fulfill in order to accomplish best IT governance and minimize IT risks.

2.4.1.2. ITIL

ITIL, which developed in 1989 by British government, is a collection of defined and published best practice processes for information technology service management. In the field of information technology service management, it is accepted as the most applied and influential framework (McNaughton, Ray, & Lewis, 2010). ITIL provides the IT service management key areas to guide IT management for auditing and control. The purpose of ITIL is to provide recommendations about best practices in IT service management. It involves set of options that can be adapted by organizations with regards to circumstances and business needs. ITIL works in compliance with the IT service management standard ISO 20000. Certification on ITIL can be available through ISO, but scoring or maturity level is not applied. In the second version of ITIL, the disciplines were as followings:

- Service Support
- Service Delivery
- IT Infrastructure Management
- Security Management
- Application Management
- Software Asset Management

Even though these disciplines were covered in the study of ITMEM, the latest version of ITIL was initially considered. The latest version of ITIL was released as the version 3 and consists of five publications which include ITIL core and complementary guidance with latest updates upon the needs of management:

- *Service Strategy*. The primary goal of service strategy is to get the IT organization to think and perform in strategic ways. It is a guideline for "how to design, develop and implement service management as a strategic asset in addition to organizational capability". (ITIL - Service Strategy, 2007)
- *Service Design*. Service design provides guideline for "the design of appropriate and innovative IT services, including their architectures, processes, policies and documentation, to meet current and future agreed business requirements." (ITIL - Service Design, 2007)
- *Service Transition*. It presents guideline about the changes to services and service management processes which are maintained coordinately. (ITIL - Service Transition, 2007).
- *Service Operation*. It is a guideline for "how to operate service delivery and support in terms of achieving effectiveness and efficiency to ensure that service user and service provider get value". (ITIL - Service Operation, 2007)
- *Continual Service Improvement*. "How to create and maintain value by better design and operation of services" is defined in continual service improvement. (ITIL - Continual Service Improvement, 2007)

What ITIL brings for IT management is set of tools that include advices and standards in IT service management which is important in service industries.

2.4.1.3. CMMI

Capability Maturity Model Integration (CMMI) is an approach for process improvement that presents the key items for effectiveness in processes of software engineering and organizational development (What is CMMI?, 2008). At the beginning of its development,

CMMI was proposed by Software Engineering Institute (SEI) as software capability maturity model (CMM) to define principles about software development process only in software industry. By the advancements, CMM was upgraded to CMMI which can be applied in other industries. Hence, it has matured and advanced set of guidelines that include the best components of disciplines of CMM (Yoo, et al., 2006).

CMMI studies demonstrated that CMMI has been in compliance with other studies and standards. Such as, CMMI can be used as a complementary tool for ITIL framework. The scope of CMMI is the development of the system whereas scope of the ITIL is the operation of the system (Alho, 2006). CMMI was also studied with ISO 9001 for process improvement (Mutafelija & Stromberg, 2003) and ISO 15504 to evaluate process entities (Rout & Tuffley, 2007).

CMMI addresses 3 areas of interest which are (1) product and service development, (2) service establishment, management and delivery, and (3) product and service acquisition. Like COBIT, CMMI has maturity levels to score the companies (Table 5). But CMMI level is given by overall scoring instead of domain-based scoring in COBIT. Certification is not applied but appraisal in CMMI with levels is used according to overall success in specified processes.

Table 5. Maturity Level classification of CMMI (Huang & Han, 2006)

Maturity levels	Focus Area	Process area
5: Optimizing	Continuous process improvement	Organization innovation and deployment (OID) Causal analysis and resolution (CAR)
4: Quantitatively managed	Quantitative management	Organization process performance (OPP) Quantitative project management (QPM)
3: Defined	Process standardization	Requirements development (RD) Technical solution (TS) Product integrated (PI) Verification (VER) Validation (VAL) Organizational process focus (OPF) Organizational process definition (OPD) Organizational training (OT) Integrated project management (IPM) Risk management (RSKM) Decision analysis and resolution (DAR)
2: Managed	Basic project management	Requirements management (REQM) Project planning (PP) Project monitoring and control (PMC) Supplier agreement management (SAM) Measurement and analysis (MA) Process and product quality assurance (PPQA) Configuration management (CM)
1: Initial	ad hoc process	None of process areas

What CMMI brings for IT management is set of process control for effective processes in IT management which is important in IT operations.

2.4.2. Standards

Standard is defined as "a level of quality" or "something used as a measure for comparative evaluations" in Oxford dictionaries. According to International Organization of Standardization (ISO), standards provide essential characteristics of products and services which involve quality, safety, reliability, efficiency, interchangeability and environmental care at an affordable level. (ISO.org, 2010). Standards bring a quality level for IT use and applications. This provides to IT management a guideline for maintaining control over IT. In contrast to best practices, standards are easy to apply, require less training, and do not apply scoring.

Even though there are many standards related to the branches of IT, especially in quality and software, in our study we elaborated on the most related standards with IT use and management which are ISO 17799 and ISO 38500. The most related standards were derived from studies about standards in last 10 years. ITMEM also utilized other standards as the concept while establishing the framework and implementation (Table 6).

Table 6. Other standards that ITMEM conceptually utilized (ISO.org)

Standard	Definition	Utilized Concepts
ISO 12207	Software lifecycle processes standard	Process steps of lifecycle
ISO 9000	Set of quality management systems standards	Auditing blueprints
ISO 15288	Standard for systems engineering including stages of life cycle and processes	Process steps system engineering
ISO/IEC 15504	A framework for the assessment of processes	Assessment procedures
ISO/IEC 20000	Standard for IT Service Management (Covered by ITIL)	IT service management
ISO 19770	Standard about Software Asset Management	Process steps of management
ISO/IEC 24762:2008	Guidelines on the provision of information and communications technology disaster recovery services	Security techniques

2.4.2.1. ISO 38500

ISO 38500 is widely-used IT governance standard which introduces a series of principles for the "effective, efficient, and acceptable use of Information Technology within the organizations" (ISO/IEC 38500- Corporate governance of information, 2008). The objectives of the ISO 38500 standard are defined in the official web site that (1) it helps for confidentiality of stakeholders about IT, (2) guides management in governing the use of IT and (3) provides a basis for objective evaluation of IT governance (ISO.org, 2010). It is defined that ISO 38500 is applicable in an organization relating to the information and communication services management governance. The standard consists of 6 principles which are required for good IT governance (Table 7).

Table 7. ISO 38500 principles (ISO/IEC 38500- Corporate governance of information, 2008)

Principle	Definition
1: Responsibility	*"Individuals and groups within the organization understand and accept their responsibilities in respect of both supply of, and demand for IT. Those with responsibility for actions also have the authority to perform those actions".*
2: Strategy	*"The organization's business strategy takes into account the current and future capabilities of IT; the strategic plans for IT satisfy the current and ongoing needs of the organization's business strategy".*
3: Acquisition	*"IT acquisitions are made for valid reasons, on the basis of appropriate and ongoing analysis, with clear and transparent decision making. There is appropriate balance between benefits, opportunities, costs, and risks, in both the short term and the long term".*
4: Performance	*"IT is fit for purpose in supporting the organization, providing the services, levels of service and service quality required to meet current and future business requirements".*
5: Conformance	*"IT complies with all mandatory legislation and regulations. Policies and practices are clearly defined, implemented and enforced".*
6: Human Behavior	*"IT policies, practices and decisions demonstrate respect for Human Behavior, including the current and evolving needs of all the 'people in the process".*

In the final model of ISO 38500, each principle is processed by 3 elements. These elements form a lifecycle which takes place into each principle to fulfill the requirements of related principle. The elements of ISO 38500 are defined as follows:

- Evaluate: "Evaluate the current and future use of IT"
- Direct: "Direct preparation and implementation of plans and policies to ensure that use of IT meets business objectives"
- Monitor: "Monitor conformance to policies, and performance against the plans"

2.4.2.2. ISO 17799 / ISO 27002

Security is an important factor for IT management (Boynton, Zmud, & Jacobs, 1994). The information security standards are considered as important starting point to take measures for any organization, especially software development companies. ISO 17799 –also known as ISO/IEC 27002 defined as a tool for building "guidelines and general principles for commencing, implementing, maintaining, and advancing information security management" of a company (ISO.org/27002, 2010). ISO 17799 was utilized in COBIT and ITIL in security sections.

ISO 17799 has a process based approach for management of security like COBIT and ITIL (Eloff & von Solms, 2000). The standard contains twelve main sections some of which include important control points for IT management: Risk assessment, security policy, organization of information security, asset management, human resources security, physical and environmental security, communications and operations management, access control, information systems acquisition, development and maintenance, information security incident management, business continuity management, compliance (ISO.org/27002, 2010).

The needs for the guidelines and practices for IT led the studies to find the way of how to utilize the standards and best practices more effective. The pros and cons are extracted and examined by academic studies to achieve better understandings (Solms B. v., 2005; Yoo, et al., 2006). Our study similarly is processed and utilized from standards and best practices to gain comprehensive knowledge about IT assessment and auditing. During the utilization of them, benefits and deficiencies, which were mentioned above, were taken into account. The strengths and limitations of considered best practices (COBIT, ITIL, and CMMI) and standards (ISO 38500, ISO 17799 and others) are provided in Table 8.

Table 8. Strengths and limitations of best practices and standards (Ozkan, Hackney, & Bilgen, 2007; ISO.org, 2010; ITIL, 2007; ISACA, 2010; Yoo, et al., 2006)

	COBIT	ITIL	CMMI	ISO Standards
Strengths	-Good checklists for IT -Enables IT to address risks not explicitly addressed by other frameworks and to pass audits -Can work well with other quality frameworks, especially ITIL	-Well established, mature, detailed, and focused on IT production and operational quality issues -Can combine with CMMI to cover all of IT - In compliance with ISO standards	-Most comprehensive process improvement models available for product and service development and maintenance -Strong in organizational practices and provide a roadmap for continuous process improvement -Build on and extend the best practices of CMMIs and other process improvement models -Can be used for self-assessment – Detailed Engineering practices – Comprehensive Program Management practices	-Contribute more to a company's economic sustainability - Provides more efficient and cost-effective production processes - Brings Reliability and trust in international business relationships -Enhance image and reputation of a company
Limitations	-Says what to do but not how to do it -Does not deal directly with software development or IT services -Does not provide road map for continuous process improvement	-Does not address the development of quality management systems -Not geared to software development processes -Use is highly dependent on interpretation Limited in security and system development	-Does not address IT operations issues, such as security, change and configuration management, capacity planning, troubleshooting and help desk functions -Focused exclusively on software development processes -Sets goals, but no guidance	- Requires rigorous and time-intensive process -Can be expensive to adapt and implement -Heavy emphasis on documentation -Length of the process -Does not guarantee better quality

CHAPTER 3

PROCESS OF ITMEM PRACTICE: OVERVIEW

3.1. Conceptual Framework of ITMEM

The standards and best practices provide tools for a company who needs to improve IT management abilities. ITMEM utilized these standards as well as best practices to determine the key points for assessing IT use and assisting IT management. Then, ITMEM extracted and converted them into research questions. The extracted questions about IT use were categorized into a conceptual framework to conduct significant and credible studies by connecting all aspects of inquiries (Kaplan, 1964).

As the result of investigations in conceptual framework that is able to fit in our model, Gregory's model was accepted as the conceptual framework of our study. The main reasons are as followings:

- It is the result of a comprehensive study which involves the influential elements of technology management considering deficiencies in management processes. This provides a path to receive further insight about technology management and its requirements (Cetindamar, Phall, & Propert, 2009). The studies that cited M.J. Gregory's study are indicators of its success in the field of technology management. (Google Scholar Citation Results, 2010).
- It addresses different characteristics of companies in technology management and provides a generic model of assessment. Thus, it helps to create a generic model of assessment in IT use which is applicable to the companies in different industries (Cetindamar, Phall, & Propert, 2009).
- The established framework helps to understand the current practices and applications of the company about technologies and management. It helps to evaluate current

practices, measure the quality and identify differences before and after implementation of ITMEM (Phaal, Farrukh, & Propert, 2006).

- Constructs of the Gregory's framework of the model designed comprehensively which are aimed to be clearly apprehended by managers and applied effectively through domain-based management process. The scope of the study is considered by ITMEM to provide a useful guide for IT use and management (Phaal, Farrukh, & Probert, 2004).
- The Gregory's framework provides a basis for auditing which is fundamentally an aim of ITMEM to gather practicable insight about the IT management of companies and assist to the top management (Phaal, Farrukh, & Probert, 2004).

Even though Gregory evaluated technology management assessment under process-base, the domains of Gregory's model are not considered as continuous process steps but constant constructs by ITMEM. Distinctively, our study includes different facets of technology management which do not require process steps. The facets of technology management that ITMEM includes are related to assessment of information technology use and assisting IT management which are not part of a continuous operation. In Gregory's model the domains complement each other, but in ITMEM, they are independently applicable and affect the results individually.

The domains are modified to fit in information technology assessment requirements as followings:

- **Identification**: It includes issues of awareness about information technologies that are significant for business operations. It contains research subjects targeting existing and emerging information technologies.
- **Selection**: Selection involves preferences of information technologies that should be encouraged and promoted within the company.
- **Acquisition**: The acquisition is interested in decisions about suitable ways of selected information technologies' acquisition and embedding them effectively. Selected information technologies may be acquired internally or externally.
- **Exploitation**: Exploitation is concerned with realization of information technologies' value or systematic conversion of information technologies into marketable products. The link among market, technologies and platforms is important. It involves contribution of IT in the final product and to the market share.

- **Protection**: It is concerned with preservation of the expertise and knowledge that are related in products and systems. It also includes legal issues as patenting and licensing. Protection is matters for the operations about all other constructs.

3.2. Process of ITMEM Practice: Overview

Implementation process of ITMEM consists of a set of steps which includes specific duties. This section introduces the steps which make up the whole process of ITMEM. It provides an overview about the practice of ITMEM from the beginning (i.e. model formation) to the end (i.e. result evaluation of companies) (Figure 3). The benefits for step-based implementation of ITMEM can be given as followings:

- To clarify the path for who applies ITMEM and for participants from companies
- To present an overview about how the things are done and will be done throughout the implementation, and thus, to provide a conception about the process for authorities and third parties.
- Helping to improve the implementation method by monitoring and getting feedback from the processes step by step.

ITMEM was practiced in ten companies through 6 steps. As shown in figure 3, steps are divided into two parts as Phase A and B. Phase A contains the step 1, 2 and 3 which are the common steps in the practice of ITMEM for each company: Literature Review on Technology Management, Development of the Conceptual Framework and Development of Survey questions and answers. Phase B includes the steps step 4, 5 and 6 which is specific to each company: Implementation, Quantification and data analysis and Results evaluation. The steps are explained under following subtitles but detailed information about each step is presented in the methodology section.

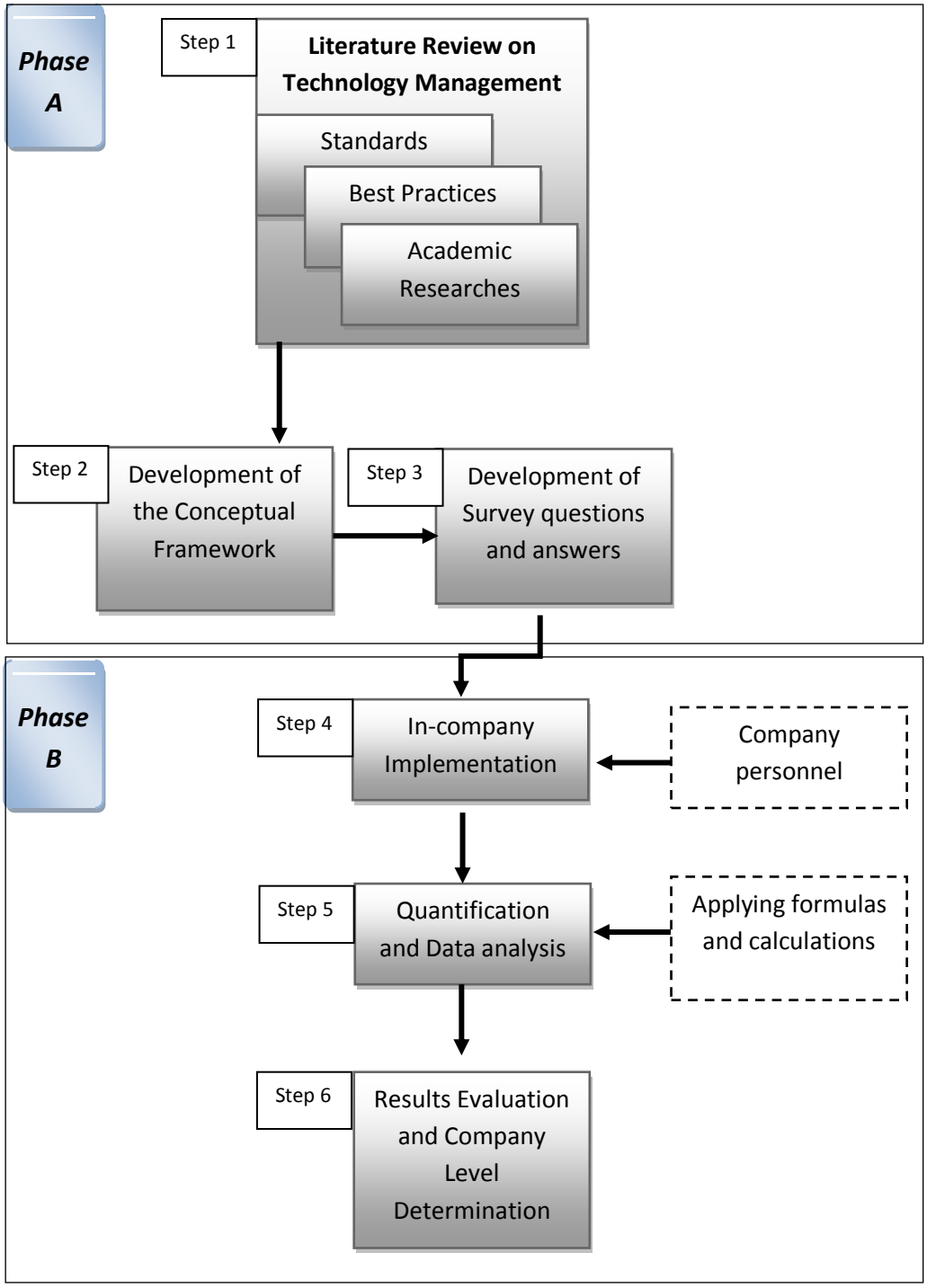


Figure 3. Flow diagram of preparation & implementation of the model

Step 1: Literature Review on Technology Management. The need for development of the model emerged as a way of solution to a common problem/ deficiency about IT management and so, assessment of IT use. This step consists of detailed research about technology management studies. It is divided into three parts: academic researches, best practices and standards. As explained in "Literature Review" section, possible technology management studies, best practices and standards are reviewed and decided on the following points:

- The framework of study,
- The complementary studies as primary and secondary,
- Research approaches as case study, semi structured interview and triangulation,

Step 2: Development of the Conceptual Framework. The model of technology management assessment process developed by M.J. Gregory has been adopted as the conceptual framework of the study (Please see: Chapter 2. Literature Review). Each domain was accepted as construct of information technology management assessment (Figure 4).

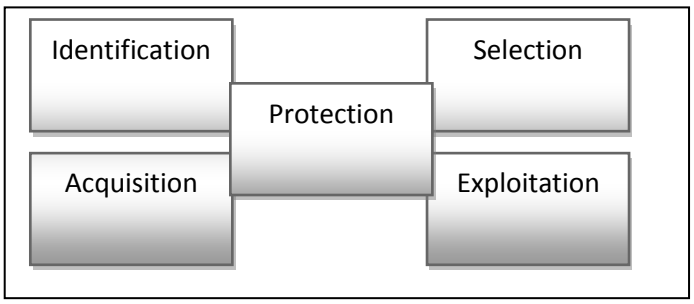


Figure 4. ITMEM conceptual Framework

Step 3: Development of Survey questions and answers. ITMEM utilizes academic studies, best practices and standards for retrieving insight about the companies and their needs about IT and its management, extracting the right questions pointing at the problems and allocating them under constructs of the model. These three dimensions of sources concluded in a three-folded structure to establish a comprehensive and insightful model (Figure 5).

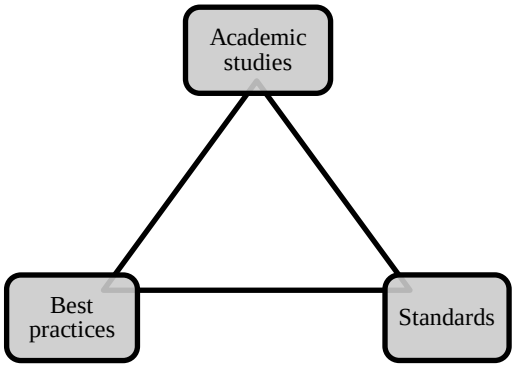


Figure 5. Three-folded structure of the model

Step 4: In-Company Implementation. It is needed to observe a company within its" habitat" for learning its actual behavior as a living organism. Thus, an important part of ITMEM practice was conducted within companies through surveying, interviewing, documenting, recording and observing. The survey is implemented over the selected employees of each company. The selection criteria were determined to get accurate, valid and interpretable information (Please see: Chapter 4.3. Data Collection). Figure 6 demonstrates the path of in-company implementation. First, Particular experts of company determined the weights of the questions. Then, the survey was implemented on other groups of employees. Additional to the quantitative data retrieved from survey, interview records brought qualitative data for validation of the results.

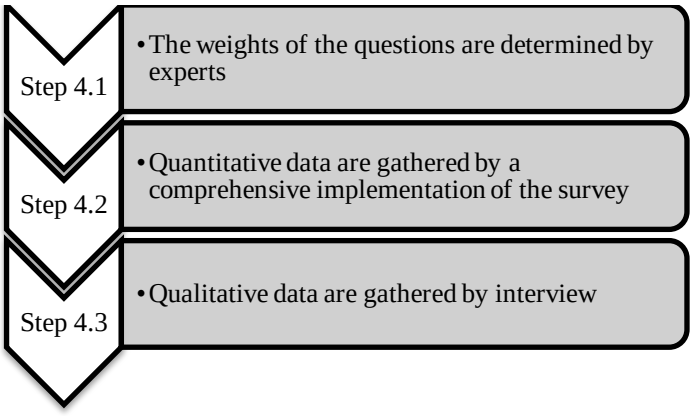


Figure 6. Steps of the in-company implementation of the survey

Step 5: Quantification and Data Analysis. The data that were gathered from companies were needed to be quantified for analysis (Please see: Chapter 4.4 Quantification and data analysis). For each company, answers were aggregated to a final score. Mathematical formula (Formula 1) was applied to calculate the score of each company.

Step 6: Results Evaluation and Company Level Determination.) The results were comprehensively evaluated including statistical analysis of quantitative (survey responses) and qualitative data (interview records). Final quantitative level of each company has been determined based on the 5-Point-Likert type questionnaire data. (Please refer to Chapter 5 for further details).

CHAPTER 4

RESEARCH METHODOLOGY

4.1. Selection of Respondents

The study of ITMEM was practiced within 10 case studies. Each case study contained a company in the industry of software & development or manufacturing. When researching potential companies to be used in case study, main goal was to select companies having elements which would help to conduct effective and useful analysis such as used IT applications, industry, size, market, experience, IT policies and culture. The selection process was conducted in 3 steps: (1) Search and select a potential company, (1) Compare it with other selected companies, (3) Keep or drop the company. To deduct useful data for analyzing, competitiveness between companies and the degree of general use of IT were initially considered. Other elements which were found significant in selecting companies were determined as: Size, Number of IT employees, Industry, Type of ownership, Age/experience, Location and Applied standards & Best practices. The elements and indicators, which were significant during selection of companies, were determined with the guidance of best practices (ISACA, 2010). The elements were designated with the guidance of implementer's views of best practices and standards (ISACA, 2010; ISO.org, 2010)

The companies which are located in Ankara were especially chosen for convenience and communication (Table 9). Bigger companies, like corporations and conglomerates, were found to have more stabilized structure, which have less impact by market and economic fluctuations, settled management practices and strong culture (Laudon, 2006). These characteristics were found useful to retrieve accurate and verifiable data by many researchers (ISACA, 2010). Thus, size and age/experience of companies considered in order to select a company. But due to few numbers of potential companies, big scale companies were limited to seven. Standards & best practices, which were applied by companies, are also

advantageous to conduct analysis comparatively considering pros and cons of other practices. Addition to that, industrial classification was applied. There are two kinds of industries in the study which are software & development and manufacturing. This discrimination provides an opportunity for investigating IT management and conducting IT assessment within two different industries, and it gives ability to comparatively analyze each industries. Within 3 months, each selected company has visited and ITMEM was practiced in 2 to 3 hours sessions. The common characteristics of these companies are as followings:

- Companies from software & development (Company A to G) and manufacturing (Company H, J, I) industries
- Software and development companies mostly work on project basis.
- Manufacturing companies are highly experienced and productions are in big scales.
- Appraised or preparing to be appraised in CMMI
- Domestic companies
- Mostly big sized and experienced companies over 200 employees

Table 9. Company Information

Company Name	Size (# of employees)	# of IT employees	Industry	Public/ Private	Foundation Year	Location	Capability Maturity Model Integration appraisal level *
Company A	1600	600	Telecommunication and information technologies and software, defense industry appliances	Public-private partnership	1975	Ankara-Turkey	CMMI Level 3
Company B	240	200	System Integration and software quality, simulation and modeling for defense industry	Private	1998	Ankara-Turkey	CMMI Level 5
Company C	315	200	Software development, consulting and defense technologies	Private	1991	Ankara-Turkey	CMMI Level 3
Company D	80	70	Health Informatics, software	Private	1989	Ankara-Turkey	Preparing (expected level 3)
Company E	30	28	Software, modeling and simulation	Private	2006	Ankara-Turkey	Preparing (expected level 2)
Company F	200	160	Education software and information technologies, networking	Private	1988	Ankara-Turkey	Preparing (expected level 3)

Table 9. (cont..)

Company G	40	35	Health informatics, software, project development and consultancy	Private	2002	Ankara-Turkey	Preparing (expected level 2)
Company H	850	8	Communication appliances	Private	1986	Ankara-Turkey	Preparing (expected level 3)
Company I	1000	20	Home appliances	Private	1955	Eskisehir-Turkey	Preparing (expected level 3)
Company J	950	18	Agricultural appliances	Private	1954	Ankara-Turkey	Preparing (expected level 3)

**A company can be appraised from 1 to 5 maturity levels in CMMI.*

The following paragraphs present detailed information about companies which was retrieved from official company web sites and interview results. The level of market competitiveness being mentioned in this section was retrieved from the Turkish Competition Authority (Turkish Competition Authority, 2010).

Company A is highly experienced and well-known company in national and international markets. It is one of the oldest and biggest companies among the other companies. The defense industry is the main work field. It is being operated in dynamic market environment in which competitiveness is high. Company A concentrated on software developments and telecommunication technologies. Most of the employees of Company A works at development side, approximately 1000 people. The remaining, which are about 600 employees, work for other divisions including IT resources. The CMMI level of Company A is 3. It is one of the rare companies in Turkey that holds CMMI level 3 and maintains uniformity in this field meticulously. Unlike other companies, ITIL is applied and maintained by Company A for IT service management optimization. Use of standards in the company A is relatively low, but use of IT- enhanced management systems is high which consists of self-developed and off-the-shelf software and systems (Appendix B). Use of IT applications on divisional (departmental) basis is highly motivated in every division and internet use is inevitable part of routine and scheduled operations including marketing, human resources, communication, and customer relationships (Appendix B).

Company B is comparatively young but also experienced as Company A. It also works in defense industry including quality and simulation. It is in a market where competitiveness is high. Company operations are maintained in national and international markets. The CMMI level of Company B is 5. It is the only company that holds CMMI level 5 and its sustainability is highly important. The use of standards in company B is at average level including self developed standards in security. Use of IT- enhanced management systems is high which are mostly off-the-shelf software applications and systems (Appendix B). The

use of IT applications on divisional basis is intensive especially in production, R&D, finance and accounting departments. Internet use is also a significant part of the routine and scheduled operations intensively in human resources (Appendix B).

Company C is young, but an experienced company. It has operations in national and international markets. It is in software and development industry but also maintains consultancy in defense industry. The CMMI level of Company C is 3. It is one of the rare appraised companies in Turkey which considers sustainability of quality important piece of operations. The use of standards in company C is above average, and the use of IT- enhanced management systems is also at high levels relatively which are mostly off-the-shelf software applications and systems (Appendix B). The use of IT applications on divisional basis is at intensive level especially in production, R&D, finance, human resources and purchasing departments. Internet use is also an inevitable part of the routine and scheduled operations including marketing, communication, and customer relationships (Appendix B).

Company D is a company under a highly experienced and well-known international corporation. The health informatics and software industry is the main work field. It is being operated in a dynamic and newly emerged market. Competitiveness is rising. Almost all of the employees work as IT personnel under research & development and production divisions. The CMMI level of Company D is yet undefined. The company is preparing to be appraised in CMMI, and unofficially appraised level is 3. The use of standards in the company D is very low, but the use of IT- enhanced management systems is high which are mostly off-the-shelf software and systems (Appendix B). The use of IT applications on divisional basis is highly motivated in every division except Purchasing, and internet use is important part of the routine and scheduled operations especially in communication, then marketing and human resources (Appendix B).

Company E is the youngest and least experienced company among the other companies. It is being operated in the national market in field of software, modeling and simulation. Even though the market size is relatively small, it has a competitive environment. Almost all of the employees work as IT personnel under research & development and production divisions. The CMMI level of Company E is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is 2. The use of standards in the company E is very low, but the use of IT- enhanced management systems is at moderate levels which are off-the-shelf software and systems (Appendix B). The use of IT applications on divisional basis is motivated in every division, and internet use is inevitable part of the routine and scheduled operations intensively in the departments of communication and customer relationships, then marketing, human resources and purchasing.

Company F is medium sized, highly experienced and well-known company in national and international markets. The education, information technologies and networking industry is the main work field. It is being operated in a dynamic market like other companies in software industry. Competitiveness is high. Three out of four employees work as IT personnel under research & development, quality and production divisions. The CMMI level of Company F is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is 3. The use of standards in the company F is low, but the use of IT- enhanced management systems is high which are mostly off-the-shelf and outsourced software and systems (Appendix B). The use of IT applications on divisional basis is highly motivated in every division, and internet use is important part of the routine and scheduled operations in all divisions.

Company G is one of the youngest and inexperienced companies. It is being operated in national market in field of health informatics, software & development and consultancy. Market competitiveness is in a rising trend. Almost all of the employees work as IT personnel under production division. The CMMI level of Company G is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is between 2 and 3. The use of standards in the company G is very low, but the use of IT- enhanced management systems is at high levels which are mostly self developed and outsourced software and systems (Appendix B). The use of IT applications on divisional basis is motivated in every division but marketing, and internet use is important part of the routine and scheduled operations in the departments of communication, customer relationships and marketing.

Company H is big scale, highly experienced and well-known manufacturing company operating in national and international markets. It is in the communication appliances industry. It is being operated in a less dynamic market unlike other software companies. Competitiveness is in moderate level. Most of the employees of Company H's works are mainly at manufacturing side. The management side, which is related with IT use, consists of 150 employees. The CMMI level of Company H is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is 3. The use of standards in the company H is at moderate level, but the use of IT- enhanced management systems is high which are mostly off-the-shelf and self-developed software and systems (Appendix B). The use of IT applications on divisional basis is highly motivated in every division, and internet use is important part of the routine and scheduled operations in all divisions.

Company I is the branch of a big scale, highly experienced and well-known manufacturing company in national and international markets. It is in the home appliances industry. It is

being operated in a less dynamic market. Competitiveness is in moderate level. Most of the employees of Company I work at manufacturing side. The management side consists of 200 employees. The CMMI level of Company I is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is 3. There is also a preparation process defined on implementing ITIL. The use of standards in the company I is at high level. The standards were self-developed (mostly modified from existing standards). The use of IT-enhanced management systems is very high which are mostly off-the-shelf software and systems (Appendix B). The use of IT applications on divisional basis is highly motivated in every division, and internet use is important part of the routine and scheduled operations in all divisions but Purchasing.

Company J is a big scale, highly experienced and well-known manufacturing company in national and international markets. It is in the agricultural appliances industry. It is being operated in a less dynamic market. Competitiveness is in moderately low level. The main operation of Company I belongs to manufacturing side. The divisional side consists of 220 employees. The CMMI level of Company J is undefined yet. The company is preparing to be appraised in CMMI, and unofficially appraised level is 3. The use of standards in the company J is at moderate level. The use of IT- enhanced management systems is high which are mostly off-the-shelf software and systems (Appendix B). The use of IT applications on divisional basis is motivated in every division but accounting and purchasing, and internet use is important part of the routine and scheduled operations in all divisions but marketing and purchasing.

4.1.1. Summary of Companies

Cases consist of mostly experienced, medium or big sized companies which can be divided into two industries as intensively IT-related software and development industry (7 companies) and rarely IT-related manufacturing industry(3 companies). 3 of them appraised in CMMI and the rest are preparing. The other best practices, ITIL and COBIT, are not applied in the companies yet. IT-enhanced management systems are mostly in use by each company, and they are of- the-shelf systems developed by third parties. Relative to management systems, standards are applied and maintained rarely. But big companies and manufacturing companies give importance and apply standards, especially security and quality standards. On divisional basis, IT applications are used intensively in each division. Internet is commonly used for communication and marketing operations.

4.1.2. Categorization of Companies

IT use and IT management approaches vary in different industries. In our study ITMEM was practiced in two industries which are software and development, and manufacturing. These industries use distinctive IT applications and have different approaches in IT processes. Software industry uses IT as an inevitable part of business processes. IT has a vital role in every departments of a software and development company. The market conditions are also more competitive than manufacturing market. On the other hand, manufacturing industry needs IT as a complementary tool for business processes. IT make differences in operations but it does not play a vital role as much as its role in software and development industry. Because of these differences between two industries, categorization is required to conduct scalable and proper analysis of study results.

There are three categories that companies can be grouped: (1) Companies of software and development industry which were appraised in CMMI, (2) Companies of software and development industry which were in progress of being appraised in CMMI, (3) Companies of manufacturing industry which were in progress of being appraised in CMMI. This categorization method included mainly two parameters, CMMI appraisal and field of industry, which are main factors in evaluation of assessment in IT use. It also enables to group companies by industries as software and development (category 1 and 2) and manufacturing (category 3). Hence, this categorization gives the ability to discuss results of the study from 5 different aspects. In addition to the 3 groups above, results can be discussed in CMMI basis and industry basis by using group 2 as a common denominator.

4.2. **Research Approach**

4.2.1. Case Study

In this study**,** case study methodology was adopted with qualitative and quantitative data collection techniques. Case study methodology is a widely used research strategy in information systems discipline (Khalfan, 2004). As Yin proposed, case study approach enables the researcher to conduct in-depth study by utilizing multiple sources of evidence (Yin, 1994). Case study aims to search for the answer of “how” and “why”. It helps to the researchers for increasing their control over behavioral events and for implementing a contemporary event in real life context. Case study methodology is also useful in theory building from the research. The strengths of theory building from a case study are defined by Eisenhardt as: (1) the likelihood of producing a new theory. It is stated that creative insights can be retrieved from successive contradictory evidence. (2) Produced theory is “likely to be testable with constructs which can be easily measured” due to their assessment during

building the theory.(3) The results of the theory is "likely to be empirically valid" due to the reason that process of building the theory is closely tied with the evidence. It indicates that the results of theory will be consistent with empirical observation. (Eisenhardt, 1989)

The criticism of case studies is commonly as followings (Khalfan, 2004):

- *Lack in systematic use in data*. Evidence needed to be systematically reported but inapplicable due to implementation process.
- *There is no basis for generalization scientifically to theoretical proposal.* There is a need for a scientific path and guideline for generalization of data into proposition.
- *Much time and document requirements*. The time and documents that are required to investigate are up to the researchers.

Case study methodology is found advantageous for ITMEM in gathering useful data, building theory and validating through a set of reliable processes. It also allows conducting quantitative and qualitative data collection techniques within the research. Considering the case study research of Yin, case study research design was determined as followings:

1) *Study's questions***.** The study is based on the question "what" and "how", but the detailed investigation is made on "why".
2) *Study's units of analysis*. The units of analysis constitute main items of the study which are being analyzed. The units of analysis can include events, individuals and groups and organizations (Khalfan, 2004). Holistic design, which includes a single unit of analysis, is accepted while determining units of analysis. In this study, the units of analysis were the employees' IT use which focuses the events part of the units.
3) *Study's proposition*. "ITMEM is a useful tool for assessment of IT use in companies and assisting to IT management".
4) *Deciding between explanatory, exploratory and descriptive designs***.** The research approach can be characterized as exploratory due to the lack of systematic research in this field. Exploratory design is also appropriate due to limited sample size, not clearly defined problems and use of qualitative research method. This design helps in data collection method and selection of subjects (Babbie, 1989).
5) *Selection of cases***.** Multiple cases selected to analyze similar and contrasting results of the study. The cases are selected from two different industries but companies that show similar characteristics in management, operations and production.
6) *Conducting case studies.* Due to the reason that one conductor was applicable, a written case study protocol was not created but guidelines proposed by Yin about

desired skills of conductor (good knowledge, sensitivity, flexibility, asking good question, being a good listener) and application procedures were adapted.

7) *Collecting the evidence***.** There are 4 types of evidence source defined by Yin which are all adapted in the practice of ITMEM:
   - Company documents (i.e. progress reports, letters, certificates)
   - Company archival records (i.e. service records, organizational charts, budgets etc.)
   - Interviews (i.e. open-ended/close-ended survey with semi-structured interview)
   - Observations (formal or informal observation of researcher)

8) *Analyzing the data***.** Explanation-building analytic technique is adapted for analyzing the collected data. It is about analyzing case study data by forming an explanation about the case and identifying a set of links. It consists of set of iterations which goes as: First statement > Findings comparison of first case -> Revising statement > Comparison of case details > Revising > Comparison to other additional cases.

4.2.2. Triangulation

Triangulation is accepted as a strong method that simplifies data validation through cross verification from more than two sources (Bogdan & Biklen, 2006). It is defined as "the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings" (Denzin, 2006). In qualitative studies, triangulation is very helpful to support credibility and validity of the results. Thus, triangulation is the method used by ITMEM to constitute validity. Denzin classified triangulation into four forms:

- *Data triangulation*. It involves congregating data through several sampling strategies, so data parts from different times and social situations are collected.
- *Investigator triangulation*. It involves using more than a researcher to collect and interpret data.
- *Theoretical triangulation***.** It involves using more than one theoretical situation in interpreting data.
- *Methodological triangulation***.** It involves using more than one method for collecting data.

As identified by Denzin, methodological triangulation includes contrasting research methods as a questionnaire and observation. This definition demonstrates methodological triangulation as multi-method research that utters combined use of quantitative research and qualitative research (Denzin, 2006). The methodological triangulation fits in our model with the selected data collection methods. With this method, Data collection will be conducted through interviews, observations, questionnaires, and documents.

The methodological triangulation of our model consists of the 3 sections which are questionnaires, documents and interviews including observation (figure 7). Questionnaires are supported by company documents such as certificates and reports (as defined in section of "collecting the evidence" above) through interview process. Interview method supports implementation process of questionnaire by extended communication abilities, as explained in following section.

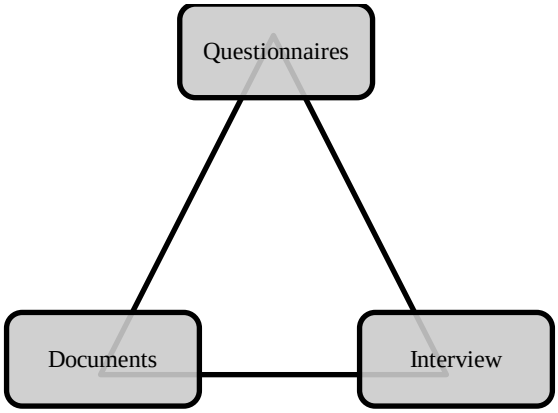


Figure 7 Methodological Triangulation of ITMEM

4.2.3. Interview method

Semi-structured interview method was adopted to conduct a qualitative research in our study. It is advantageous for any study which is needed be applied within flexible interview techniques (Lindlof & Taylor, 2002). This method is used to gather qualitative data through the interview that provides scope and time to participant for mentioning about their opinions on a specified subject. The objective is to apprehend participants' point of view instead of making generalizations about their acts. The focus of the interview and flow of the interview are decided by the researcher depending on the level of exploratory needs. It generally uses open-ended questions, but the flow of the interview can be shaped by suggestions of the researcher like "Tell me about that …", and addition to that, instant queries like "You said a

second ago, ... a little more, …can you tell me about?". The researcher tries to draw a picture with the given responses, and the interview is carried on like a proper conversation. (Lindlof & Taylor, 2002). Lindorf et al.'s further studies indicate that, in a 1 to 10 (high to low) scale, semi structured interview method was presented difficult to be reliable (7) due to the fact that there are multiple factors that may affect the answer of question, like emotional end environmental factors. Encouraged participants to talk freely and non-pre-determined questions make it difficult to repeat conducting similar interviews. This ruins uniformity of study. The method was also presented significantly valid (3) through open-ended questions, non- constrained responses (talking freely) and body language. The strengths and weaknesses of semi structured interview method are described by Wengraf as in Table 10 (Wengraf, 2001).

Table 10 Strengths and weaknesses of semi structured interview (Wengraf, 2001).

Strengths	Weaknesses
• Positive relation between interviewer and participant. Very effective way of getting data in multiple communication channels • High Validity. Getting information in detail and depth is possible with directions of interviewer • Sophisticated questions and events can be discussed and clarified. The interviewer is able to investigate suggested areas through the answers of participant. • Pre-Judgment. To avoid interviewer to prejudge what is and is not important information, few pre-determined questions can be involved. • Ease of recording interview through video and audio.	• The success of research depends on the skill of the interviewer and expressiveness of participant. • Interviewer may convey unwitting signals that guide participant to give misguided answers. • Time Consuming and expensive to practice • Not much reliable. It is hard to repeat similar interview. Different questions may be asked respondents through different ways (no standards). Samples are likely to be small. • Depth of data including qualitative information may be inconvenient for analyzing. Excessive data and organizing relevant information may cause difficulties. • Difficult to generalize findings by personal nature of interview. • Validity. No evidence of truth for the participant's responds

4.3. Data Collection

4.3.1. Questionnaire design

The questionnaire was aimed to retrieve the information about the use of IT in the companies and provide comprehensive insights. To be applied properly over companies, the questionnaire was extracted from sources and classified into conceptual framework which includes 5 main constructs (Identification, Selection, Acquisition, Exploitation, and Protection) (figure 8). The questions were prepared by investigating sources in detail considering IT management dimensions (appendix C). The allocation of questions under constructs was evaluated and validated by academic professionals who studied on technology management and experts who involved in pilot study.

In total, 64 questions constitute the questionnaire (Appendix C. Survey Questions and answers). Each question has detailed descriptions to ensure that the participants fully comprehend the objective and goal in each question. The type of questions is close ended and 5-point Likert-type response scales are adapted. This question type was selected due to its ease to complete, efficiency and specificity in measuring attitudes (Robson, 1993). The answers of the questions scale ranged between 0 and 4. In each question, every answer has also comprehensive description as much as the question itself. Additionally, each question has a comparative question. The comparative question is asked in order to provide comparative view for the company about the questioned criteria with the closest rivals (See Table 13 for template of a survey question). A checklist of popular IT systems and tools that are used in the market applied additional to the main questionnaire (Appendix B). Detailed information will be given in following sub-sections.

The questionnaire was tested on a domestic, relatively small, software company in order to gain understanding about its applicability and acceptability. The pilot study was very helpful to revise survey questions, implementation process and to develop interview techniques.

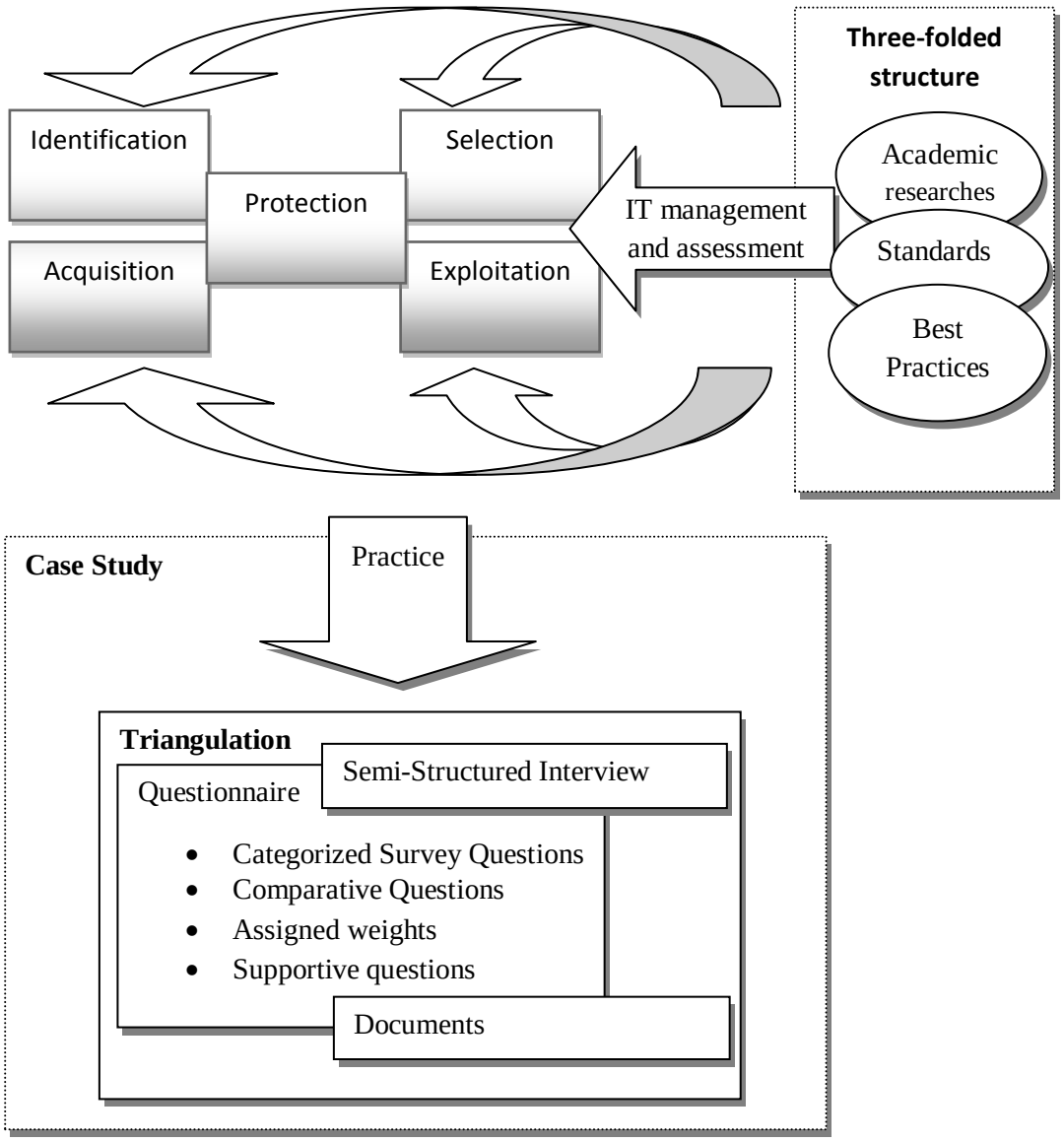


Figure 8. Question Allocations and relations of methods

The following two sections present detailed information about the structure of survey questions:

4.3.1.1. Survey Introduction

The survey starts with a short description of IT. The purpose of the study and what is expected from participants are explained in this part comprehensively. In order to standardize the implementation process in each case, the definition of IT (Table 11), extent of the study and objectives are explained. Especially the definition of IT is found necessary to be on the same page with the participants about common knowledge. As explained earlier

in case study, it is possible to being misguided about scope of the study. Especially for avoiding misunderstandings by software companies about produced IT and used IT, the edges were strictly identified. When it is required, the definitions of the terms used in the survey questions are given.

Table 11 Presented definition of IT (businessdictionary.com)

> "IT is Set of tools, processes, and methodologies (such as coding/programming, data communications, data conversion, storage and retrieval, systems analysis and design, systems control) and associated equipment employed to collect, process, and present information. In broad terms, IT also includes office automation, multimedia, and telecommunications."

Introductory questions are asked to get to know about the company's size and financial situations, and to determine its rivals. It is important for classifying companies at the same level for further comparative analysis. The classification was made in scale basis according to their income, investment and personnel number, which are common parameters for classification of companies by their sizes (Boynton, Zmud, & Jacobs, 1994). (Table 12)

Table 12. Introductory questions

Introductory Questions	Answer
IT department (Y/N)	
Total personnel	
Total IT personnel	
The sector	
Value of the company	
Annual income (TL)	
Annual investments (TL)	
Change in annual investment portion	
Annual IT investments (TL)	
Change in annual IT investment portion	

4.3.1.2. Framework of Survey Questions

This section is going to be presented through Table 13, which is a template framework of the survey questions:

Table 13. Survey Question Template

(a) Question …? (A/C/M)- (G/S) – (ST/MN/OP)

(b) *Definition: …*

(c)

Answer Weight	Description of weights
4	The most effective answer. The highest compliance with the questioned criteria. Continuous improvement is a must.
3	The effective answer. High compliance with the questioned criteria. Continuous improvement is a not strictly required
2	Medium effective answer. Normal compliance with the questioned criteria. Continuous improvement is a not required but implementation is needed.
1	Ineffective answer. Low compliance with the questioned criteria. Implementation is not required.
0	Most Ineffective answer. No compliance with the questioned criteria

(d)

Answer	Description
4	Very powerful
3	Powerful
2	Average
1	Less powerful
0	Weak

(e)

Question Weight	Description of weights
3	The controlled criteria involve the factors that are crucially needed to be done or exist. The lack of these factors may cause severe damages for the company.
2	The controlled criteria involve the factors that are needed to be done or exist. The lack of these factors may cause some damages for the company.
1	The controlled criteria involve the factors that may be needed to be done or exist. The lack of these factors may cause little damages for the company

(f) Given Weight (1-3):

(g) Definition of terms:

(h) Notes:

(i) Perceived Benefits and necessities of question? Recommendations?:

a. This part involves **question body.** Survey questions were placed here under particular categories which are given by parenthesis**.** Survey questions consist of "To what extent",

"What ...? Degree" and "How …? Degree" questions. The structure of questions aims to retrieve the answers in scalable forms.

a1. Categorization of questions

The pilot study demonstrated that, for clarification of questions for researchers, categorization is required. The aims of categorization are (1) to inform the researchers about how the questions formed, (2) to help to categorize the questions in industrial basis and (3) to guide the researcher about questions to whom it should be asked. There are 3 categories applied to the study. The first category is question type. The question type shows that if the question is directly acquired from a source, created based on the needs or modified form of a question(s). It is shortly expressed by their capital letters (A) - acquired, (C) - created and (M)-modified. Question type is created because if the existed question may not be appropriate but inspiring or need to be changed in any study, the researcher should consider investigating the roots of questions.

The second category is target field. It shows that if the question was created to be asked as generic (G) or it is related to specific sectors/ industries (S). It aims not to direct sector-specific studies instead of redundant questions in each sector. For example, in the figure 9, there in n sectors that ITMEM can be practiced. Intersection area of them represents the field of generic questions. The others include groups of sector-specific questions. The classification of questions into target fields was made by the experts who involved in question weight determination and survey.

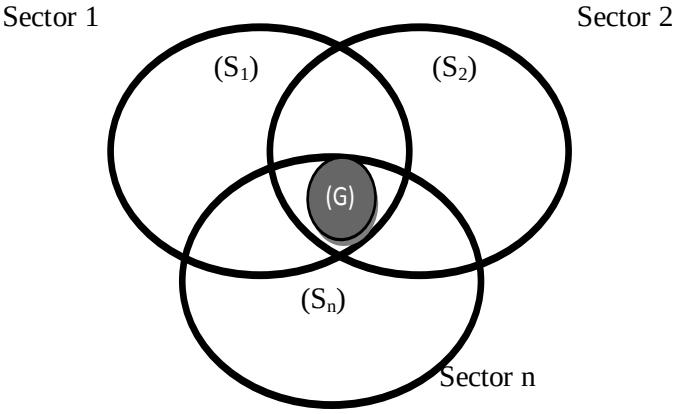


Figure 9. Schema of groups- sectoral and general questions

The third category is the level of question. It provides the level of authority that the question should be asked to get most satisfactory (highly reliable and accurate) answer. It consists of 3 stages. First stage is strategic level in which top level management involved such as CEO, CIO, vice president, chairman. Second stage is management level in which the middle level managers and experts can involved. Third stage is the operational level in which the introductory level personnel and assistants can be involved. This classification is a commonly used classification of management levels in management studies (Laudon, 2006; Skilbeck & Cruickshank, 1997). The classification of questions into the level of questions was made by the experts who involved in question weight determination and survey in ITMEM practice.

For instance, in the Table 13a, selected "A-G-ST" informs the researcher about 3 aspects of question. (1) This question is acquired from the sources defined in Appendix C. (2) This is a generic question which can be applied in every sector. (3) The most satisfactory answer can be retrieved from a strategic level employee for this question.

b. Each question has a detailed **definition**. Definitions assist to the participant to comprehend the purpose of the question, and so, aim to increase accuracy of answers. Definitions also help for standardization of the processes. Because it is expected that the perceptions of the participant about concepts and terms may vary with regards to sectors (Gomez-Mejia, Balkin, & Cardy, 2008). It is also possible to interpret the question related to their personal or educational background. For clarity of answers, the clarity of questions is needed.

c. Answer chart is constituted by the 5 point Likert scale ranged from 0 to 4. The selected interval starts from zero because if there is no evidence or application about the questioned field, the answer should be ineffective in calculations. The answers range from the most effective answer (4) to least one (0). Answers have unique explanations in each question which are also seeking for particular evidence for their level. The most effective answer includes the devotion of the company to related field. It can be measured critically by continuous improvement query inside the answers. Because, when utilizing from an application, system or development, or using processes in operations, the important point to reach about that particular system or process is maintaining its continuity and its development (ITIL, 2007). To keep or increase the quality of any application, the continuous development is required by specific tools and investments (Council of Quality, 2010). By this way, it can be explicitly measurable through the assets, investment records and used applications. This gives the ability to investigate the evidences clearly.

d. The **comparative question** is used in each question set which asks the participant to compare the company state about the questioned criteria with the closest rivals. The need of

comparative question emerged after pilot study, as a result of interviews. It is found that there should be stimuli to consider environmental factors. The purpose of comparative questions is to guide the participant to revise the answer of the question and consider the effective factors especially the rivals' advancements about a particular situation. Thus, comparative questions help to increase consistency of information and decreases possible biases. Comparative questions also enable interviewer for instant intervention to that question and seek for more accurate answers when inconsistencies happen. Comparative question includes only one question during to survey which is: "*What is your position about the questioned criteria compared to your closest rival?*" Scale type of comparative question is the same as the survey answer scale, which is 5 points Likert type ranges from 0 to 4 (from weak to very powerful).

e. **Question weights** aim to collect data from participants with regards to the importance of the question. Due to the reason that there are not sufficient experts in the group of study, the experienced employees in each company were used to determine the importance level of each question. By this way, the calculation of final score will be affected with companies' level of success in important questions. Thus, the final score will be unique to each company. Question weights' scale ranges between one and three (1-Little important, 2-Medium Important, 3- Highly Important). The weight criteria determined by the experts considering:

- Current needs,
- Future needs,
- Damage if breakdown,
- Damage in inefficient and ineffective use

According to weight criteria, if the questioned subject is highly important (level 3), its duties should be fulfilled. Lacks may cause severe damages for the company and its operations. If the questioned subject is medium important (level 2), lacks may cause some damages for the company its operations. If the questioned subject is little important (level 1), lacks may cause little or no damages for the company its operations.

f. Given Weight is the weight level of the question determined by the group of experts considering criteria which were mentioned in "Question Weights" section above**.**

g. Definition of terms is a part that used when a specific term is used in the question that may not be known by the participants, such as "service level agreement", "strategic vision" or "disposal management". It is also a practice aiming standardization of study processes.

h. Notes is reserved part for researcher to take notes about the observed or spoken evidence about the questioned subject.

j. Perceived Benefits and necessities of question and recommendations part is for noting feedbacks from the participants about the questions if they are found necessary or helpful about particular topic. Recommendations about questions are noted for improvement of the model.

In addition to the main question sets presented in Table 13, a supportive question group created to gather the data that helps for the validation of information by retrieving additional data and document (Appendix B). Supportive questions aims to investigate the proofs for the IT use with applications, systems. It is in a form of checklist including questions about IT-based management systems, applicable standards and practices, internet and IT use by divisional base. The main goal in here is to increase validity and retrieve detailed information in IT use. Supportive questions also help to identify inconsistencies in the survey results by extracting relevant information about survey. Thus, instant queries would be possible to get the accurate respond.

The supportive questions were gathered from internet sources through investigating current management systems and IT standards. The most applicable and possible systems and standards were chosen by experts in the pilot study. On the top of that, IT use in divisional base and internet use were found valuable while assessing the IT use in companies. The answer chart of supportive questions consist of 3 level of answers which are (0) not applied, (1) applied for once and (2) applied and still being used and developed. The answer choices determined similar to survey questions for ease of understanding

4.3.2. Data collection steps

In this study, ITMEM was applied within each company using case study method enhanced with triangulation and semi structured interview. The participants, who attend survey and interview, were carefully selected in each organization with regards to their level of IT knowledge and organizational IT awareness.

Data collection process in each company occurred in 2 steps as followings:

- Step 1. The weights of the questions are determined by experts

  Survey questions are answered by at least 3 participants from each company. One or two of the participants took role to weight determination .The personnel who have experience and knowledge about the IT use, IT operations, investments and assets in the

company were chosen to determine weight of each question. The list of roles of participants is given in Table 14**.**

Table 14. Roles of participants

Companies	Weight determination	Survey implementation
Company A	IT expert and Quality personnel	IT personnel (x2)
Company B	Quality director	IT director and personnel
Company C	IT director	IT personnel (x2)
Company D	IT expert	IT director and personnel
Company E	IT director and personnel	IT personnel (x2)
Company F	IT director	IT personnel (x2)
Company G	IT expert	IT director and personnel
Company H	IT director and personnel	IT director and quality personnel
Company I	Quality director and IT personnel	IT personnel (x2)
Company J	Quality director	Quality personnel and IT personnel

- Step 2. Quantitative and Qualitative data is gathered by a comprehensive implementation of the survey

The participants who are presented in "survey implementation" column of Table 14 filled out the questionnaire. The questionnaire provided quantitative data by the given answers to survey questions and supportive questions and their question weights. Qualitative data was gathered by the records of interviews as described in the following paragraph. They are congregated to convert data into meaningful information in analysis (Please see: Chapter 4.4. Quantification and Data Analysis).

The semi-structured interview method helped to gather qualitative data when conducting the survey. It was useful method while conducting the survey in an interactive environment. Face- to face interview helps to enhance communication by body language and observing working environment. Interviews were recorded for accurate data collection and avoiding misunderstandings. The interview language was chosen as Turkish due to ensuring clear and unambiguous communication. Feedback for the questions noted. The collected data from the survey was supported by the documents which consist of the forms of the applied standards, reports of applied best practices, reports of IT operations and other IT related documents. The documents were investigated to provide additional understanding about the questioned field and also to provide proof for accuracy of information. Ad-hoc problems during the interview were eliminated by focused questions.

4.4. **Quantification and Data Analysis**

After the data collected by quantitative and qualitative approaches, it needs to be converted meaningful and interpretable values in order to initialize analysis. In our study, the quantitative survey results mathematically calculated to find the success level, which is the aggregated score in percentages for each construct and final score. The qualitative data is used to ensure validity and reliability of quantitative data, and it is used in interpreting the final results (see "discussion" section). The gathered data, which were quantified answers and weights of questions, were calculated by formula 1. For each company, the formula applied individually and scores were assigned. Formula is applied as: given quantitative answer of survey question (p) is multiplied by the designated weight (w) of the question for all of the questions (m, between 1 and 64, question number). To find the success level (SL), which is the score of a company over 100, total score converted to percentage.

$$\mathrm{SL} = \nabla \sum_{m} w_m p_m \qquad \textbf{(Equation 1)}$$

The success level of each company converted to 5 point scale- named as quantitative level to present simple and scalable score to the authorities and decision makers. The quantitative level conversion was inspired from best practices' maturity level scoring framework. The studies including best practices indicated that simple and appraisable score level were found useful by company decision makers and analyzers (ISACA, 2010). Addition to that, this framework provides the ability to compare with best practices like COBIT and CMMI which use the 5 point scale for scoring. The conversion of the success level to maturity level was conducted by the experts from each company who are experienced in best practices and scoring. The applied practices and standards, operation reports and company procedures were considered while determining the intervals of success level and its quantitative level (Table 15).

Table 15. Conversion of Success levels to Quantitative levels

Intervals of success level	Qualitative Level	Quantitative Level
0-30	Very low/none use of IT	1
31- 55	Low use of IT	2
56- 75	Medium use of IT	3
76- 90	High use of IT	4
91 – 100	Very high use of IT	5

Table 16 presents the interpretation guide of quantitative level of a company at 5 levels: 1- Initial, 2- Rising, 3- Promising, 4- Manageable, 5- Improved. This table helps authorities to understand the missing points and achievements in IT use through ITMEM. The framework of quantitative levels interpretation table is inspired from COBIT's generic maturity level, which defines maturity levels in levels of IT processes to describe possible current and future states. (Control Objectives for Information and related Technology, 2007). Similarly, purpose of quantitative level interpretation table is to provide a profile to companies which describe their current status with regards to their quantitative levels.

Table 16. Quantitative level interpretation

Level	Explanation
1 Initial	There is no evidence or little evidence that the company is aware of IT issues, and they are required to be addressed. Standardized processes do not exist in IT; instead, there are demand-base methods in which IT is applied or IT utilities are used on demands. The overall methods and processes in IT management are irregular. No compliance is observed in IT and related approaches.
2 Rising	IT has developed to the level where employees are responsible of IT tasks which operates similar procedures. The awareness is low. Awareness of standardized processes of IT exists but not implemented. There is not communication or formal training of IT, instead, responsibility of IT learning is left to individuals. There is a confidence bout IT knowledge of employees at a significant level which causes problems in operations including IT. Low compliance is observed in IT and related approaches.
3 Promising	IT procedures and processes are mostly communicated, documented and standardized. But updating processes and tools are not applicable. Company accepted IT in its culture but little problems are possible in its applications. IT takes place in long term and short term plans. Continuous improvement is not applied but promising. Compliance is observed in IT and related approaches in a rising trend.
4 Manageable	IT awareness is high. IT Management can monitor and measure IT use and procedures compliance, and brings precautions in problems. IT applications and processes are continuously improving and help for effective and efficient business operations. IT automation is quite used in routine operations. High compliance is observed in IT and related approaches. Continuous improvement slowly becomes a part of company culture in IT.
5 Improved	IT becomes an inevitable part of company culture and operations. IT processes and level of IT use have been reached to a good practice level, through continuous improvement and effective use of IT in every division. IT is integrated to business processes to automate and control the workflow. IT applications are used to increase quality and effectiveness and make the company fast for adapting market changes. Compliance and continuous improvement are compulsory.

CHAPTER 5

RESULTS

A survey including 64 questions (Appendix C) -with comparative and supportive questions were implemented over 10 companies, in total 34 personnel. 14 personnel took roles for allocating scores (weights) to the questions, the rests were participated to survey. For each company, defined roadmap in "Process of ITMEM Practice" section was followed, and each tasks and processes were applied in a standardized manner. All questions were answered and relevant documents were presented including company reports, plans, procedures, blueprints and certificates. The given answers were checked through presented documents, comparative and supportive questions and interview records to provide consistency and validity of the answers. During the implementation of ITMEM, inconsistencies were identified between survey answers and presented/ spoken evidences. Interview records and observations showed that they were occurred because of the following reasons:

- Lack of knowledge
- Lack of awareness in IT and applications
- Communication gaps between individuals and departments within the company

The inconsistencies were detected through triangulation method, which requires validating information with documents, interview records and questionnaire answers. They were eliminated with interventions seeking for evidences or with changes in scores during the interview. The final scores and quantitative levels were calculated according to formula 1 discussed in "Quantification and Data Analysis" section. The views of experts were utilized to check the consistency of the final results and the success level interval allocation to quantitative levels. Appendix D presents the numerical results of survey questions, supportive questions and assigned weights for each question.

Following paragraphs explain the quantitative results of the study. Qualitative results including interview records and documents are presented and analyzed in "Discussion" section.

Descriptive statistical analysis conducted for quantitative results (Appendix E). Detailed statistical analysis was not possible due to limited sample size. It is used to explain main aspects of the quantitative data. Addition to that, correlation analysis conducted to measure interrelation between answers and weights of questions. The purpose of analysis is to present participants' tendency in answering and weighting the questions. The data set involve question weights, results of survey questions and comparative questions of each company. Analysis consists of:

(1) *Descriptive analysis*:

a. *Mean*: This method gives the average value of selected data set (Healey & Prus, 2009). In this study, mean value of data sets, which are given survey answers, comparative question answers and weight of questions, were calculated. The results demonstrated central tendency of the scores in each data set.

b. *Median*: This method provides a numerical value from a data set which is located in the middle of the data range. It separates the higher half of the sample from the lower half (Healey & Prus, 2009). In this study, median value of given survey answers, comparative question answers and weight of questions calculated. The results demonstrated distribution of higher and lower half of the scores in each data set.

c. *Standard deviation*: This method used to measure variability of a data set (Healey & Prus, 2009). In this study, standard deviation value of given survey answers, comparative question answers and weight of questions calculated. The results demonstrated variability of the scores in each data set.

d. *Frequency analysis*: This method provides the number of times of an incident occurrence in a study (Healey & Prus, 2009). Frequency of given survey answers, comparative question answers and weight of questions calculated in our study. The results demonstrated number of frequencies of the scores in each data set.

(2) *Correlation analysis*: It describes the degree of relationship between two variables (Healey & Prus, 2009). Correlation between given survey answers, comparative question answers and weight of questions calculated in our study. The results demonstrated degree of relations between data sets.

The survey results are demonstrated on table 17, 18 and 19 with graphical presentation of quantitative levels. The tables present the success levels and quantitative levels of companies

in construct basis. The web graph of quantitative levels clearly presents the differentiation between the perfect profile and companies' profile.

Table 17. Success and Quantitative Levels of Company A, B and C- Appraised in CMMI- Category 1

	Company A		Company B		Company C	
Constructs	**Success Level (%)**	**Quantitative level**	**Success Level (%)**	**Quantitative level**	**Success Level (%)**	**Quantitative level**
Identification	79,3	4	90,4	5	79,6	4
Selection	77,1	4	100	5	72,7	3
Acquisition	79,4	4	82,3	4	75	3
Exploitation	75,0	3	93,1	5	77,9	4
Protection	76,1	4	88,9	4	86,8	4
TOTAL	**77,5**	**4**	**90,2**	**5**	**79,9**	**4**

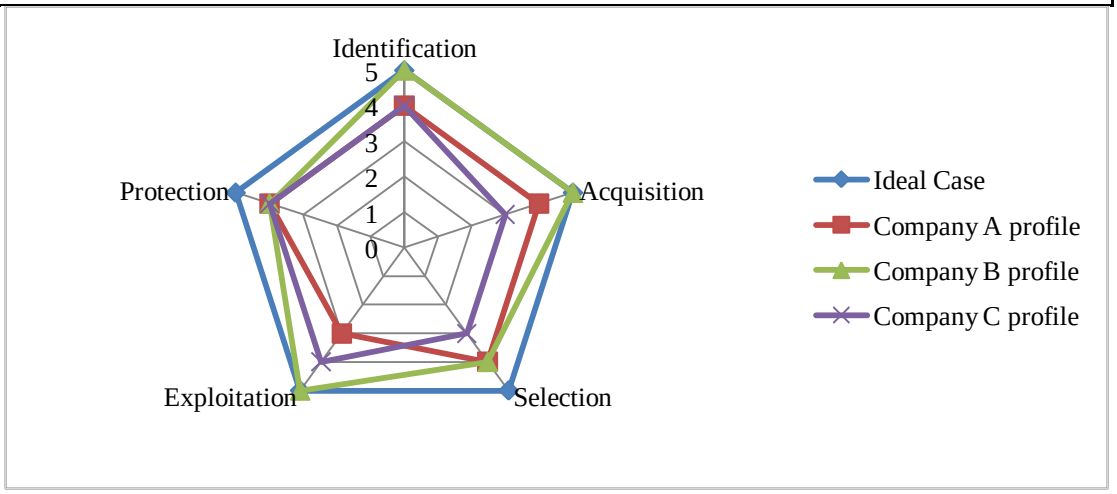


Table 18. Success and Quantitative Levels of Company D, E, F and G – Preparing to be appraised in CMMI- Category

	Company D		Company E		Company F		Company G	
	Success Level (%)	**Quantitative level**	**Success Level (%)**	**Quantitative level**	**Success Level (%)**	**Quantitative level**	**Success Level (%)**	**Quantitative level**
Identification	85,2	4	79,3	4	84,3	4	79,2	4
Selection	84,1	4	71,3	3	95,8	5	75,0	3
Acquisition	69,7	3	60,4	3	69,1	3	68,1	3
Exploitation	80,9	4	88,0	4	83,0	4	62,5	3
Protection	48,3	2	66,0	3	62,2	3	73,8	3
TOTAL	**70,5**	**3**	**73,3**	**3**	**76,9**	**4**	**73,6**	**3**

Table 18. (cont)

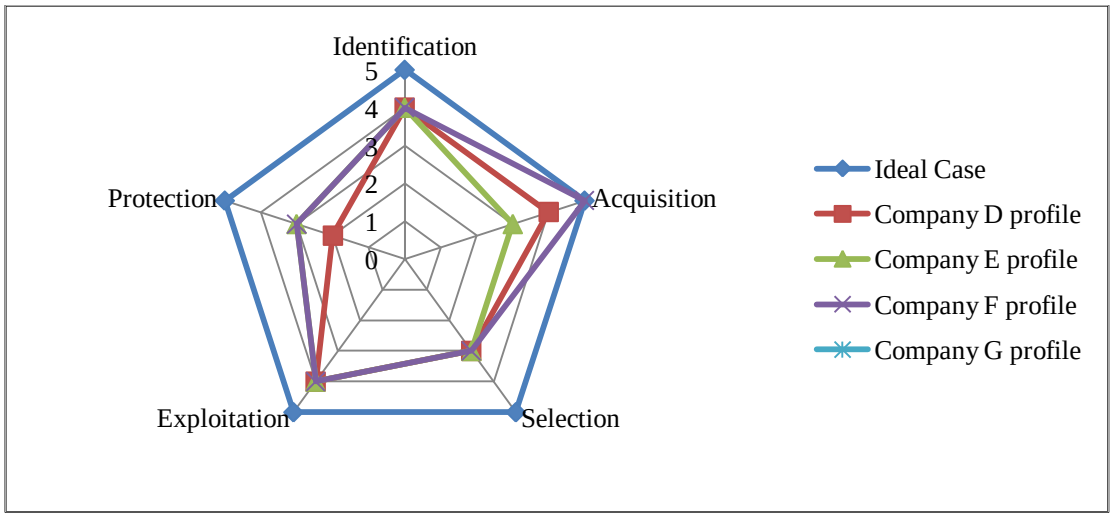
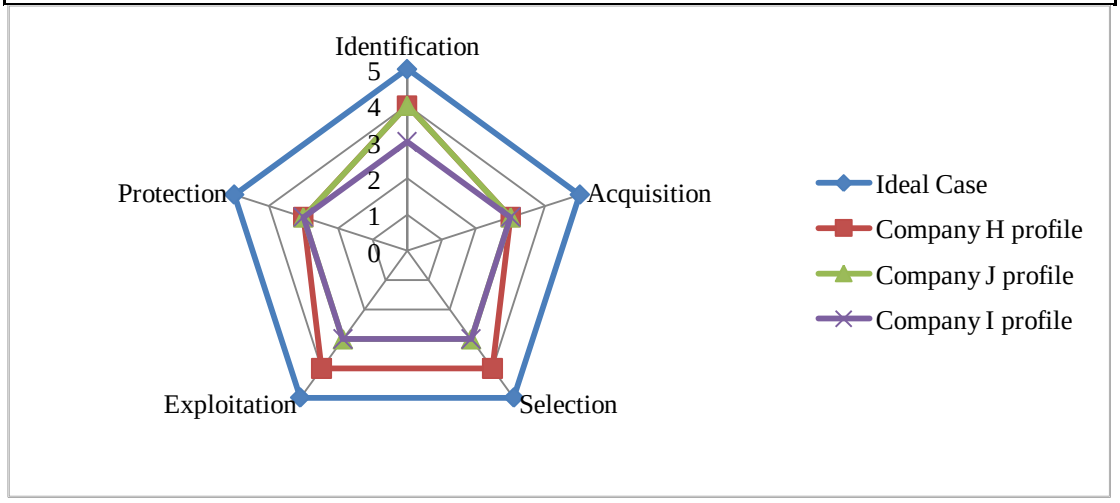


Table 19. Success and Quantitative Levels of Company H, J and I - Manufacturing Industry- Category 3

	Company H		Company I		Company J	
	Success Level (%)	**Quantitative level**	**Success Level (%)**	**Quantitative level**	**Success Level (%)**	**Quantitative level**
Identification	75,5	4	78,9	4	72,8	3
Selection	62,5	3	75,0	3	70,5	3
Acquisition	76,6	4	68,3	3	66,7	3
Exploitation	76,7	4	73,2	3	67,9	3
Protection	70,3	3	73,0	3	67,6	3
TOTAL	**73,2**	**3**	**74,8**	**3**	**69,7**	**3**



Categorization has been applied over companies while demonstrating the results. Companies A, B and C constitute the first category which is the group of being appraised in CMMI and work in software and development industry. The second category includes the group of companies- D, E, F and G which are preparing to be apprised in CMMI and work in the software and development industry. The last category includes group of companies – H, I and J which are preparing to be apprised in CMMI and work in manufacturing industry.

Considering the results from the tables 17, 18 and 19, it is seen that Company B is the only company on level 5 and got the highest score, and Company J got the lowest score. The ranking goes as followings: B, C, A, F, J, G, E, H, D and I. The top three companies consists of the CMMI appraised companies A, B, and C (Success level of 77.5, 90.2 and 77.9 respectively). Then, they are followed by other software companies D, E, F and G which are preparing to be apprised in CMMI (Success level of 70.5, 73.3, 76.9 and 73.6 respectively). The last companies are H, I and J which are in manufacturing industry (Success level of 73.2, 74.8 and 69.7 respectively). The quantitative level of companies is 3 except company A, B, C and F. In construct base, the highest success is observed in Identification, and the lowest success in Protection construct. Statistical results are given in following paragraph.

Figure 10 Change in overall Success Levels of companies

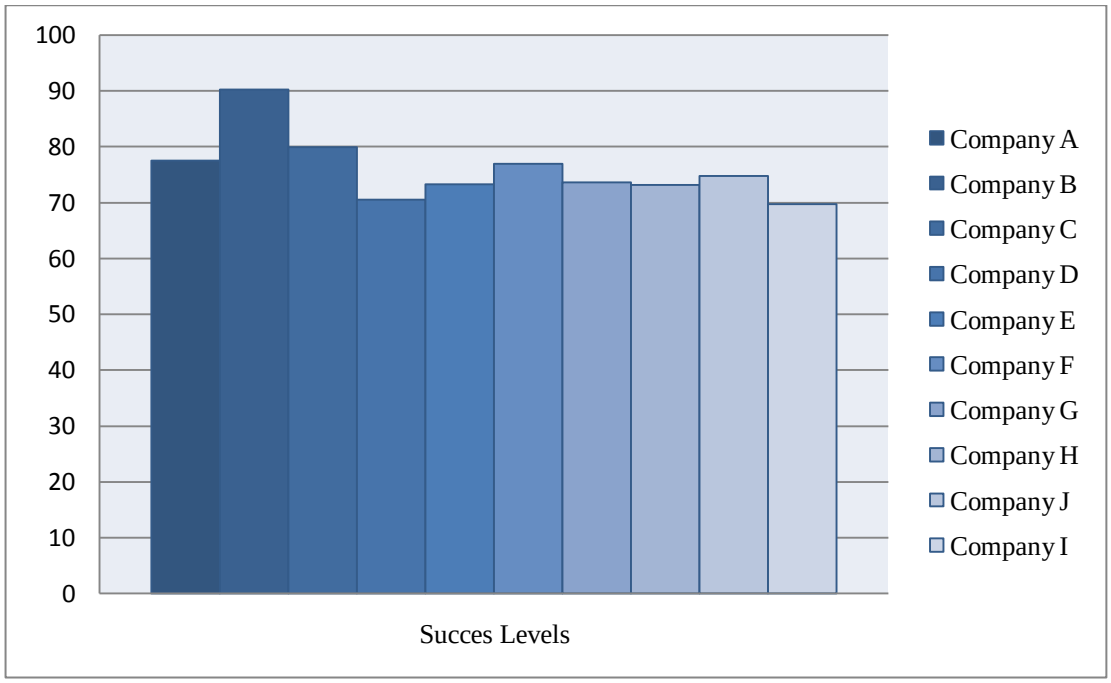


Table 20. Statistical results

		Survey Question Answers			Question Weights			Comparative Question Answers		
	Name	**Mean**	**Standard Deviation**	**Median**	**Mean**	**Standard Deviation**	**Median**	**Mean**	**Standard Deviation**	**Median**
Category 1	Company A	3.047	0.765	3	2.156	0.718	2	3.172	0.703	3
	Company B	3.468	1.020	4	2.476	0.644	3	3.419	0.801	4
	Company C	3.125	0.864	3	1.984	0.701	2	2.619	0.771	3
Category 2	Company D	2.906	0.849	3	2.094	0.706	2	2.641	0.627	3
	Company E	2.875	0.745	3	2.828	0.631	3	2.719	0.701	3
	Company F	3.016	1.046	3	2.313	0.588	2	2.797	1.011	3
	Company G	2.844	0.895	3	2.266	0.672	2	3.145	0.846	3
Category 3	Company H	2.875	0.678	3	1.953	0.700	2	2.578	0.498	3
	Company I	2.984	0.745	3	1.906	0.684	2	2.406	0.660	2
	Company J	3.094	0.830	3	1.906	0.684	2	2.328	0.592	2

Category 1 companies A, B and C had highest scores with respect to the other categories by average score of 82 (Figure 10). Within category 1, company B is the only company had quantitative level 5. Company A and C share level 4 (Table 17).

For company A, average value of answers to survey questions and comparative questions are between 3 and 3.1 which means the answers are mostly 3 but standard deviation presents slightly changes by 0.7. Company A found itself comparatively powerful to the rivals by 3.1. Question weights average value, which is 2.16, shows that Company A experts assigned question weights mostly in medium-important level (Table 20). Frequency table of company A demonstrates that frequency of selection of choices in survey, comparative answers and weights. From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 42%, answers of comparative questions are “powerful (3)” by 48%, and weights are “medium-important” by 47%. Correlation analysis was conducted to demonstrate the relations between the assigned weights of survey questions with answers of survey and comparative questions. Correlation between responses to survey questions and comparative questions found significant (.694) for company A (Appendix E/ Company A).

For company B, Average value of answers to survey questions and comparative questions are between 3.4 and 3.5 which means the answers are mostly between 3 and 4 but standard deviation presents that there are also scores around 2.4. Company B found itself comparatively highly-powerful to the rivals by 3.4. Question weights average value, which is 2.47, shows that Company B experts assigned question weights mostly between medium and highly important levels (Table 20). From the frequency table, the highest frequencies support

the results: survey answers are in “level 4” by 71%, responses to comparative questions are “highly powerful (4)” by 56% and weights are “high-important” by 54%. Correlation between responses to survey questions and comparative questions (.801), assigned weights and responses to comparative questions (.338) and survey answers (.305) found significant for company B (Appendix E/ Company B).

For company C, average value of answers to survey questions 3.1, and comparative questions are 2.6 which mean the responses to survey questions are mostly given as 3 and Company C found itself comparatively powerful to the rivals by 2.6. Standard deviation presents slightly changes in scores by 0.7-0.8. Question weights average value, which is 1.98, shows that Company C experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 41%, responses to comparative questions are “Average (2)” by 45% and weights are “medium-important” by 56%. Correlation between responses to survey questions and comparative questions (.693), and assigned weights and responses to comparative questions (.301) found significant for company C (Appendix E/ Company C).

Category 2 companies D, E, F and G had medium scores with respect to the other categories by average score of 74 (Figure 10). Within category 2, company F is the only company had quantitative level 4. Company D, E and G share level 3. The differences between success levels of companies are small, mostly around 73 (Table 18).

For company D, average value of answers to survey questions 2.9, and comparative questions are 2.6 which mean the responses to survey questions are mostly given as 3 and Company D found itself comparatively powerful to the rivals by 2.6. Standard deviation presents slightly changes in scores by 0.6-0.8. Question weights average value, which is 2, shows that Company D experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 51%, responses to comparative questions are “powerful (3)” by 72% and weights are “medium-important” by 50%. Correlation between responses to survey questions and comparative questions (.711), assigned weights and responses to comparative questions (.425) and survey answers (.303) found significant for company D (Appendix E/ Company D).

For company E, average value of answers to survey questions 2.8, and comparative questions are 2.7 which mean the responses to survey questions are mostly given as 3 and Company E found itself comparatively powerful to the rivals by 2.7. Standard deviation presents slightly changes in scores by 0.7. Question weights average value, which is 2.8, shows that Company E experts assigned question weights mostly in high-important level (Table 20). From the frequency table, the highest frequencies support the results: survey

answers are in “level 3” by 53%, responses to comparative questions are “powerful (3)” by 53% and weights are “high-important” by 62%. Correlation between responses to survey questions and comparative questions (.631), assigned weights and responses to comparative questions (.427) and survey answers (.358) found significant for company E (Appendix E/ Company E).

For company F, average value of answers to survey questions 3, and comparative questions are 2.8 which mean the responses to survey questions are highly given as 3 and Company F found itself comparatively powerful to the rivals by 2.8. Standard deviation presents the scores changes between 2 and 4 by 1.04. Question weights average value, which is 2.3, shows that Company F experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 4” by 43%, responses to comparative questions are “powerful (3)” by 32% and weights are “medium-important” by 56%. Correlation between responses to survey questions and comparative questions found significant (.889) for company F (Appendix E/ Company F).

For company G, average value of answers to survey questions 2.8, and comparative questions are 3.1 which mean the responses to survey questions are mostly given as 3 and Company G found itself comparatively powerful to the rivals by 3.1. Standard deviation presents slightly changes in scores by 0.8. Question weights average value, which is 2.3, shows that Company G experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 50%, responses to comparative questions are “high-powerful (4)” by 40% and weights are “medium-important” by 48%. Correlation between responses to survey questions and comparative questions (.670), assigned weights and responses to comparative questions (.335) and survey answers (.404) found significant for company G (Appendix E/ Company G).

Category 3 companies H, I and J had lowest scores with respect to the other categories by average score of 72 (Figure 10). Within category 3, all companies share level 3. The lowest score within 10 companies belongs to Company I by 69. The differences between success levels of companies are small, mostly around 72 (Table 19).

For company H, average value of answers to survey questions 2.8, and comparative questions are 2.5 which mean the responses to survey questions are mostly given as 3 and Company H found itself comparatively powerful to the rivals by 2.5. Standard deviation presents slightly changes in scores by 0.6 and 0.5. Question weights average value, which is 1.9, shows that Company H experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results:

survey answers are in “level 3” by 58%, responses to comparative questions are “powerful (3)” by 57% and weights are “medium-important” by 51%. Correlation between responses to survey questions and comparative questions found significant (.546) for company H (Appendix E/ Company H).

For company I, average value of answers to survey questions 2.9, and comparative questions are 2.4 which mean the responses to survey questions are mostly given as 3 and Company I found itself comparatively powerful to the rivals by 2.4. Standard deviation presents slightly changes in scores by 0.6 and 0.7. Question weights average value, which is 1.9, shows that Company I experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 54%, responses to comparative questions are “average (2)” by 59% and weights are “medium-important” by 53%. Correlation between responses to survey questions and comparative questions (.465), and assigned weights and responses to comparative questions (.297) found significant for company I (Appendix E/ Company I).

For company J, average value of answers to survey questions 3.1, and comparative questions are 2.3 which mean the responses to survey questions are mostly given as 3 and Company J found itself comparatively powerful to the rivals by 2.3. Standard deviation presents slightly changes in scores by 0.5 and 0.8. Question weights average value, which is 1.9, shows that Company J experts assigned question weights mostly in medium-important level (Table 20). From the frequency table, the highest frequencies support the results: survey answers are in “level 3” by 45%, responses to comparative questions are “average (2)” by 64% and weights are “medium-important” by 53%. Correlation between responses to survey questions and comparative questions found significant (.550) for company J (Appendix E/ Company J).

Fom10 companies, in total 640 survey answer data, 640 comparative questions answer data and 640 weight data were assigned by the participants. 42% of survey answers were at “level 3”, 32% of survey answers were at “level 4”, 17% of survey answers were at “level 2”, 5% of survey answers were at “level 1”. 42% of comparative question’s answers were at “powerful”, 34% of comparative question’s answers were at “average”, 19% of comparative question’s answers were at “high-powerful”, 4% of responses to comparative questions were at “low-powerful” and no “weak” answer is given. The experts assigned weights of questions as: “medium-important” by 48%, “high-important” by 33% and “low-important” by 17% (Figure 11, 12 and 13). The overall Correlation within 10 companies demonstrated that correlation between responses to survey questions and comparative questions (.654), assigned weights and responses to comparative questions (.240) and survey answers (.147) found significant (Appendix E/ All Companies).

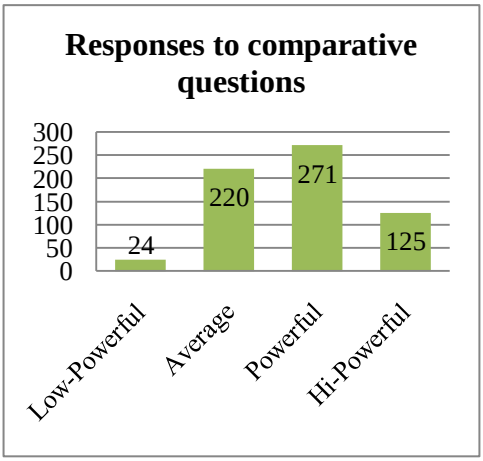


Figure 11. Frequency graph of responses to comparative questions for all companies

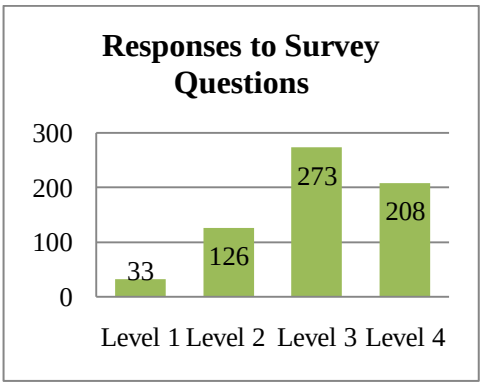


Figure 12. Frequency graph of Responses to Survey Questions for all companies

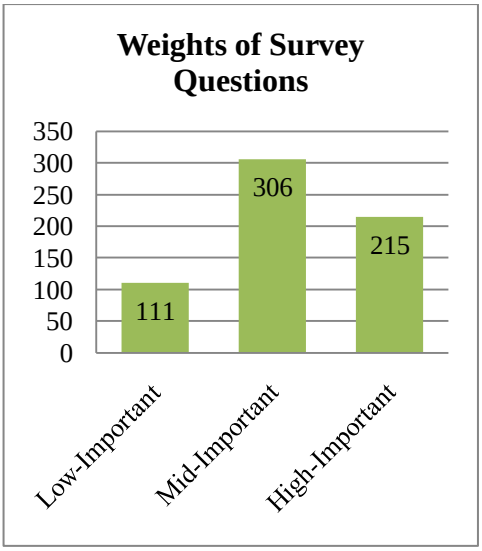


Figure 13. Frequency graphs of weights of survey questions for all companies

CHAPTER 6

DISCUSSION

In this study, a model for assessing IT use was presented with its academic based methodology and distinguished approaches. It was practiced through case studies and results were demonstrated in the previous chapter. The proposed arguments about methodology and practice of the model will be considered in this section. Overview of the results showed that companies placed themselves at high levels but not perfect (level 3) (Figure 12). It presents their knowledge in lacking IT use and processes. Mostly powerful position was selected by all of the companies to present their altitude at acceptable level (Figure 13). They also expressed the high significance of survey questions by assigning the question weights as medium and highly important (Figure 14). Even though we presented the quantitative data in the results section, qualitative data is more significant phase for the study due to the understandings of implementation.

6.1. Discussion of the Results in Categories

Results were categorized in 3 sections (Please see: Chapter 4.1.2 Categorization of companies). This categorization helped to conduct analysis more focused and distinguished within and among those groups. Furthermore, its presentation in industry-basis and CMMI-basis was useful to analyze from different perspective and to provide decision makers and researchers detailed information about companies.

Category 1. This category includes companies of software and development industry which were apprised in CMMI (company A, B and C). Category 1 companies have specialized ways and methods in operations that became a part of company culture. For instance, self-developed enterprise resource planning, database management and supply chain

management systems popular applications that are used to coordinate and plan every business operations. It is observed that these methods were also reflected to results of ITMEM practice. Intensive use of management information system applications including especially decision support system, enterprise resource planning system, customer service system, project management system provided a web of communication into these companies. These systems also encourage employees for IT use. An IT expert of Company A stated that: "Our work in telecommunication and software requires fast communication channels and quick decision making processes. These are fulfilled by effectively working IT infrastructure". In contrast, the use of standard was found at medium or low levels. The reason was explained by quality personnel as: "Standards are beneficial in terms of credibility of company but it may require expertise, training, and routine renewal which are costly. When necessary, we use standards as principles". The responses to supportive questions (appendix D) and presented documents also proved the statement of the quality personnel. Statistical analysis demonstrated that category 1 companies found ITMEM questions important to assess IT use. They scored high in results, and expressed that they were better than the rivals with regards to queried subjects. IT director of Company B supported as "The questioned subjects related to our main work fields. Hence, we should excellently fulfill them to keep competitive advantage". The correlation analysis showed that mostly the given weights to questions, answers to questions and comparative questions are related significantly. It means that companies are mostly better in the fields which they found important, and they find themselves comparatively higher than the closest rivals. IT director of Company C supported as: "I believe the questions that weighted high will be responded by high scores, because we try to do things better which is found important." IT personnel of company A commented as: "Our rivals are mostly market followers which copy our technologies for their developments. So, we are a powerful company in most of the fields that are questioned". The effect of best practices which were applied by category 1 companies (CMMI for all companies, ITIL for company A) clearly identified. By the best practices, it was observed that the need of continuous improvement became a part of all processes. The procedures forced companies to operate in proper and defined manner, thus IT use was advanced to fulfill duties. IT director of company B explained that: "Even though CMMI is not a directly IT related practice, but it indirectly requires a good and practical IT use".

Category 2 is close to category 1 in terms of use of IT systems and standards (Appendix D) but encouragement in IT use was not the same. Even though IT investments were remarkably high, its acceptance process within business operations was problematic. Bad investments, unused systems were observed in category 2 companies. As an IT director of company F

stated that: “There is a lack in IT use. Investments are good but few people can use the systems. This causes to inefficiency in business operations”. However, the procedure of CMMI preparation started to put the companies in shape about IT use in organizational communication and operation. The 2008- 2010 investment reports of company D and G showed that investments in IT rose dramatically including IT management applications and organizational IT training sessions. The other category 2 companies were demonstrated traces of similar investments. Statistical analysis presented that category 2 companies found ITMEM questions important to assess IT use, especially company E. They scored average level and have belief on that they were better than the rivals with regards to queried subjects. The correlation analysis showed that mostly the given weights to questions, answers to questions and comparative questions are related significantly as in category 1. It means that companies are mostly better in the fields which they found important, and they placed themselves comparatively higher than the closest rivals. In category 2, company F has the closest score to category 1. Observations also showed that company F has similar characteristics with category 1 companies in terms of used methods and systems in business operations, organizational structure and common IT use. Considering the relation between ITMEM and CMMI, company F was found as a good candidate for appraisal in CMMI level 3.

Category 3 has more IT systems than other categories but effective use and sustainability is relatively low. Similarly, they have IT standards but use of IT standards are generally low relative to category 2 (Appendix D). It was appeared that these companies pay attention to IT developments and use, but it is in a limited scope and inefficient. The major problem is that IT is not accepted a part of company as a whole, it is given as a duty to IT departments instead. Category 3 companies are focused on manufacturing, thus most of the IT investments were aimed to support decision making process of management, which is operated by IT department and used by top management. It was observed that companies’ culture were not adopted IT as a part of operations. It is explained by a quality director of Company H as: “Our business objective does not strictly need the involvement of IT. The required jobs are fairly fulfilled by IT personnel”. One of the managers of company J stated that: “IT was needed by our company at a level that one department can fulfill those needs. But now it is a widespread concept that is also unavoidable in our industry”. Standards were used by IT department in operations of management systems and information security. Annual reports of company H showed that preparation of appraisal in CMMI affected positively the use of IT tools in other departments. IT personnel of company I confirmed that: “It is expected that a manufacturing company cannot be in IT too much. But CMMI slightly extended the scope of IT use in other departments.” Statistical analysis demonstrated

that category 3 companies found ITMEM questions important to assess IT use. They scored average level and stated that they were at similar level with the rivals with regards to queried subjects. The correlation analysis showed that mostly the given weights to questions, answers to questions and comparative questions are related significantly as in category 1 and 2. It means that companies are mostly better in the fields which they found important.

Industry-basis Discussion

It was clearly observed that software and Development industry presented higher scores than manufacturing industry. Even though remarkable investments on systems and standards were made, manufacturing companies have lacked in IT use. It was found that lacking is related with the current needs of market. Due to stable market environment in manufacturing, there was no need for IT required fields like fast decision making process or effective business operations. IT employee of Company J explained that: "IT was not enabled us to have competitive advantage by far, instead mostly helps for routine operations".Thus, IT was not needed to be applied company-wide, and there was no need to be adapted by other departments in business operations. It was operated and assisted by IT departments.

CMMI-basis Discussions

Category 1 companies which were apprised in CMMI showed remarkable success in ITMEM. Especially in identification, acquisition and protection constructs, these companies proved their capability in IT use (Table 16). This means that companies appraised in CMMI were well aware of information technologies, effectively decide and acquire needed ITs, and ably secure IT assets. Category 2 and 3 companies which were preparing to be apprised in CMMI showed that there were missing links in IT adoption and use of IT applications and standards. There were also important lacks in acquisition and protection of IT. The main reason behind the lacks was determined as the cost. Details will be explained in section 6.3.

These results showed that CMMI appraisal levels are coherent with ITMEM quantitative levels. Even though CMMI and ITMEM have not precisely the same objectives to fulfill, it is obvious that for satisfying the requirements of CMMI, performing developments in IT is needed. As explained earlier, CMMI leads to increase the use of IT in the company. The IT director of Company B stated that "CMMI is a useful tool to improve processes and increase credibility of the company. If any company needs to be appraised in CMMI, particular IT developments are slightly required. These requirements carried our company in more effective track in the market". IT expert in company A supported by saying "CMMI carried the production processes to an upper level in the industry. It is very helpful in challenging

projects, and should be supported by proper use of IT. It became part of our culture by the time." This claim is verified by appraisal requirements of CMMI report. It states that planning, preparing, data collection and verification partially requires the use of IT (Software Engineering Institute, 2006).

6.2. **Discussion of the Results in Construct Basis**

Discussion in construct basis presents analysis of companies considering the information gathered through the survey such as awareness, decisions, acquisition plans, effects on market and security. Companies were analyzed under the categories.

-Identification. Being aware of IT and researching its advancements are two main issues about identification which were purely fulfilled by the company B. It is explored that IT training and IT use in project risk management are common issues to make amendment by most of the companies. But there is a general awareness of information technologies by employees which is gained through common computer and internet use in jobs or daily life. That effects IT identification in business but at basic levels. Still it was not a complete part of business plans and strategies, especially by companies in second and third category. Manufacturing companies follow the general developments as well as other companies but it is limited to IT division.

-Selection. Selection study was resulted similarly to identification for each company. It explained that choices of information technologies widely effected from IT research and level of IT awareness within companies, and these choices were encouraged through them. Company B and F were the most successful companies in selection, which was also presented by their short term plans. IT processes, IT based operation methods and ad-hoc procedures for business operations were common indicators of the level of selection for all companies. The IT director of company B stated that: "We have all the procedures and policies required for operations including IT accordingly to annual plans". Selection was achieved by category 1 and 2 better than category 3. Low level of IT research and use in category 3 companies put category 3 at the end of the line, and main industry of category 1 and 2- Software and development kept the level of selection at medium and high by its IT requirements.

- Acquisition. Acquisition was the construct that every company achieved their lowest scores. Due to the fact that it involves the decision making concept about IT acquisition and implementation, budget played an important role in this construct. Even though companies were well aware of IT and developments, and have applicable preferences, with limited budget, acquisition decisions cannot be fulfilled. An IT employee of company H stated that:

“Limited budget of IT investments ties up our hand in acquiring and implementing ITs”. It told us that companies in each category were aware and could give decisions about IT but fulfillment of requirements is not easy to satisfy as it is on the paper.

-Exploitation. IT should bring value. Company B and E showed that they can manage to convert their IT assets into marketable products through adding them to products as value. As quality director of company E explained: “IT is the inevitable part of the production process. We mostly produce software products. Thus IT provides major value to the products”. It is achieved by most of the companies including manufacturing- Category 3. Their achievement in the IT was about monitoring mass production and controlling. However, problems were detected throughout the study. Company C has systems and infrastructure to utilize IT in production which was working effectively. But the problem occurrence portion was above average, which was %12.2 according to the annual report that interfere the operations. The problems mainly included system crashes, work overloads, network bottlenecks and unstable communication channels. Company G had the similar interference with company C but more frequently which also damages in- market operations. The quality personnel stated that “IT is vital for final product but the problems that are occurred during the production cause to lose customers and eventually loss in market share.” The results show that the problem is mainly lack of knowledge in IT use and the utilities. Those problems were observed commonly in each category.

- **Protection.** IT provides us set of tools by which we can control, store and operate intangible assets. These assets are vital especially for software companies. But satisfying protection needs about IT assets is hard to accomplish. Companies were observed that they use variety of security tools and procedures in mostly essential fields of software and hardware protection. Security software was mostly off-the-shelf security systems which have created problems by limiting the control over ad-hoc situations. Statutory protection was also found important but mostly ignored by company authorities. “Protection is taken as a high priority issue. But we could not have managed to purely accomplish” stated the IT expert of Company A. Distinctively, Company B cooperates with the security companies for protection. It was observed that they established and developed own standards and have strictly applied the security policies and procedures. Security tools and systems are self developed and maintained within the company. It was stated that they do not need to rely on third parties especially in protection issues. As summarizing the point of view of category 1 and 2, the IT quality director of Company B stated that: “We protect our assets, products and projects in high level of security tools and systems. But overtime, it is inevitable to confront any protection problems by forthcoming developments. It is very challenging to take purely all protection measures”. Manufacturing companies in category 3 believed that they have

sufficient protection measures for their level of IT use. The reports showed that their success in protection is sufficient with 70 points in success level of ITMEM.

The feedbacks from company authorities and results of study showed that ITMEM succeeded to assess IT use in companies through case study approach. It is believed that the success highly depends on validity by triangulation, comprehensive systematic implementation through survey and interview method. The following sections will present findings, benefits and problems of ITMEM.

6.3. **Lessons Learned**

This section presents the lessons learned from the case studies by paragraphs.

There is a positive relation between CMMI and ITMEM. The positive relation between CMMI and ITMEM was explored with regards to the fulfillment of CMMI appraisal requirements and company reports. The outcome of obligatory duties for having the appraisal in CMMI was determined as continuous IT developments. This also led to evolution in culture in some companies (e.g.Company B). Over the time, by this outcome, culture of the company adopts IT use more, and the company reaches a more dynamic level. The statements and operation reports of last 5 years demonstrates the change dramatically. ITMEM clearly revealed that CMMI directly relates to IT development and IT use in the companies. It positively affects the company ant the culture to adapt market conditions.

There is a need for assessment. ITMEM practice and results of CMMI studies proved that companies require periodic assessment. As the outcome of ITMEM practice, it is revealed that the revision of operations and procedures through practices demonstrates strength and weaknesses of the company, which was found valuable for future plans. IT director of company E confirmed that: "Control and assessment tools like CMMI or ITMEM help to revise company operations, and provide insight about the state of company". Besides, it was observed that assessment helps to conduct effective control, maximize the utilization of resources and increase the savings as Council of Quality stated. (Council of Quality, 2010).

General perception exists. It was appeared that employees have general perception about identification, selection, acquisition, exploitation and protection issues which are also involved in the companies' culture with little fragments. The observations about overall awareness about the subjects of constructs were found positively related with the ITMEM results. It was also observed that the more personnel were aware of the issues about IT, the better implementations about IT use were conducted in the operations. The source of the

perception was determined by the interview reports as the use of internet in daily life and routine business operations.

Cost, lack of awareness, regulations, fast changing IT and knowledge are main reasons for discrepancy between desired results and ITMEM results. Although, interviews indicated higher scores were aimed in ITMEM, at some levels, to satisfy the needs of constructs remained unachieved. It was found that there was disparity between desired results and ITMEM results (Table 21). Even though desired results were mostly coherent with current results, the small differences were the result of needs in more effective conducting IT operations and use of tools. The disparity was observed in protection at high levels due to the fact that the highest goals were stated about the protection issues. As Solms indicated in his studies, protection of information and technologies is the major concern to preserve the products and other outcomes especially for the category 1 and 2 (Solms R. V., 1998). Table 21 demonstrates the current success levels and desired success levels in ITMEM. The desired success level was approximately deducted through the statements of participants in the interviews.

Table 21. Current and Desired Success Levels in ITMEM

	Category 1		**Category 2**		**Category 3**	
	Current Average Success Level (%)	**Desired Average Success Level (~%)**	**Current Average Success Level (%)**	**Desired Average Success Level (~%)**	**Current Average Success Level (%)**	**Desired Average Success Level (%)**
Identification	83	92	82	90	77	83
Selection	83	90	82	89	70	80
Acquisition	79	85	67	84	70	85
Exploitation	82	85	79	85	72	83
Protection	83	95	64	88	69	78

The gaps between the desired level and current level show the level of need of companies about particular issues. Category 1 and 2 companies presented high desires to achieve protection. Category 2 companies needed to develop themselves in acquisition and protection. Category 3 companies did not show high desires as others but needed to reach the level above average in each construct The reasons of the difference between current and desired success levels were examined through the interview, and determined as: cost, lack of awareness, lack of regulations, fast changing IT and knowledge requirement.

a) Cost

Most of the software companies were expected to invest in security to protect their assets but cost mostly became a major problem to sufficiently fulfill these needs. (Gordon & Loeb, 2002). Cost is also important factor for acquisition of IT tools. Thus, IT requirements and protection issues were performed partially which cause internal integration problems between divisions, violation of company rights, and interruption of operations. Due to that reason, reactive approaches were observed as the preferred treatment about security in many companies. As the concept, reactive approach allows for precautions and actions after a problem occurred. It was found acceptable by companies at a particular degree of protection violation and security breach, but not healthy for all operations.

b) Lack of company awareness

IT was not comprehensively adopted by any company culture. Hence, there cannot be a homogenous diffusion of information between company divisions. This situation causes problems in practice and cause security deficiencies (Solms B. V., 2001). Even though there is infrastructure and usable communication channels within the company, it was found that they were not being used by companies as effective as needed.

c) Lack of regulations

The authorities may misapprehend IT use as a duty of particular employees. Study showed that required regulations, especially including IT protection protocols and policies which involve all the company employees, were not frequently considered. This behavior led to misguidance in IT operations which may cause severe consequences like disorganized IT tools, non-profitable investments and inefficiency in IT use. As observed in several companies, it causes diminution of motivation in IT use. Taylor's study supported that motivation lack in IT use by its effect on the intention to use (Taylor, 1995).

d) **IT is on the fast track**

IT has a dynamic role in a company which is required the most to have competitive advantage and, also obsolescence in a short period of time. It was observed in companies which have severe use of IT that IT should always be updated for utilizing effectively. It is especially expected in protection measures. But keeping the IT up-to-date needs special efforts and considerations. Each company has small or rising problems about keeping IT running due to the fact that they avoid or stall updating the IT tools and utilities. The results may appear in terms of inefficiency

and ineffectiveness in IT use over the time (e.g. Company I in management information systems).

e) Knowledge is required

Even if all the IT needs were fulfilled by a company, knowledge is the need for its applicability and continuity (Grant, 1996). Therefore, level of knowledge for IT use requires training and investments. Company authorities explained the deficiency in knowledge as: "sustainability of IT equals to knowledge but knowledge requires considerable expenses". Addition to that, it was observed that misunderstandings were occurred about concept of IT use. The common perception showed that IT systems and tools were supposed to be working mostly stand alone and with little human interaction requirements. This view ignores the maintenance and additional services by human intervention. Thus, investments in knowledge were at minimum levels. By the lack of knowledge, inefficient use of IT was observed in the companies which led to low scores in protection. Interviews demonstrated that the companies which have invested in the security systems and tools cannot be utilized efficiently due to the lack of knowledge.

Implementation of ITMEM with case studies also pointed out that, ITMEM has some **missing links** through practicing. It is believed that completing the missing links will lead to more reliable and applicable model. These can be explained as followings:

- **Unable to assess the rivals**. The comparative questions were not found highly reliable due to the fact that ITMEM cannot get detailed information from the rivals at the first place. The only source of information about rivals was participant and limited information over the internet. Even though answer of comparative questions were cross checked via web, they were not applied through triangulation, thus, those information were not found as reliable as the responses to survey questions.
- **Free to choose rivals.** Companies were free to choose rivals to compare themselves. This led participants to instinctively select weak rivals instead of similar or higher level rivals. Thus, the comparative results were high or normal even though survey scores were low.
- **Complete objectivity is not possible**. The participants were not able to speak objective, especially in question weight determination. Responding in each question, the first matter was the benefits of the company instead of objective view to the situations. This was occurred in most of the companies through survey questions, weight determinations and comparative questions. This is the possible reason of why these parameters were correlated significantly with each other in statistical analysis.

At least, it was expected to have no or little relation between responses to survey questions and weights of survey questions.

- **Structure of the answer of survey questions.** The 5 point-likert-type scale of responses to the model was effective but the explanations of choices were insufficient for participants to evaluate their companies clearly at particular situations.
- **Not all the constructs are equally perceived within the company.** Due to the fact that each construct have different subjects and requirements at different levels of understandings, the effective results can be available with regards to the knowledge of participants.
- **Roadmap of IT use for companies.** Even though the model aims to be a roadmap in IT use, its applicability is hard to accomplish due to the limited sample size for detailed analysis. A comprehensive verification analysis of questions and sufficient implementation to gain reliability are required to be a roadmap of IT use.

6.4. Recommendation

6.4.1. Recommendation about Case Studies

The ITMEM study demonstrated the strength and weaknesses of Companies in IT use. According to the results, the deficiencies of each company were determined. For the companies highly suffers from ad-hoc problems IT operations, it is recommended to adopt proactive behavior. It requires well defined IT plans, policies and detailed training of IT personnel. Long term IT investment plan is recommended for the companies who have costly IT investments. Long term IT investment plan is required for timely and affordable investments. The awareness is also an issue. The effective use of IT tools and systems and IT awareness of employees and up-management are highly depending on divisional trainings about IT and its importance. The problems mentioned are presented by the authorities as the result of deficiencies in company culture. To shape the culture, the right regulations with the right policies and procedures are needed to be applied (Solms & Solms, 2004). The effective use of IT systems can also provided by outsourcing system services or transferring the knowledge.

6.4.2. Recommendation about ITMEM

Considering the missing links of ITMEM, recommendations were prepared as followings:

- In comparative questions, participants should select rivals within participated companies. It allows knowing the rival companies and evaluating the results.
- The set of rivals can be predetermined for comparative questions of each company. Industry based rival selection with regards to the size and general characteristics enable participant comparing their companies with similar level companies.
- Using free agents which have insight about participated companies and able to investigate them in detail can bring a solution for objectivity problem of participants.
- Structure of the answer of survey questions can be simplified by expanding the questions' definitions instead of explaining answers, or standardize the explanations can be used for each answer.
- Pre-test can be applied to participants to assess their knowledge and capability if they are able to fulfill the duties of practice within satisfactory levels.

CHAPTER 7

CONCLUSION

IT use takes a significant role in operations of any organization to stay competitive in the market and to be effective. The position of IT brings the IT management concept in considerable states. Studies and developments in IT management field evolved over the time depending on the changing market needs (Benamati, Lederer, & Singh, 1997) . The emergence of best practices, standards demonstrated the need of assessment and control over operations. But implementation phase has particular defects. These are mainly: (1) high cost of implementation, (2) focusing on only limited area of IT involved operations, (3) need for training, (4) not guiding for solutions. In our study, we considered those major defects in establishing the framework and developing implementation methods. ITMEM framework based on Gregory's technology management assessment model, and developed by the contribution of best practices, standards and other studies about technology management.

10 major companies selected within case studies to practice ITMEM which have different characteristics including the market, size, age. But common point was the applied best practice: CMMI. The results were promising. It was observed that the purpose of the study which is assisting to IT management in decision making and improvement of IT structure by exploring strengths and weaknesses of the company about IT was fulfilled. The effects of the results over the companies and feedbacks from authorities supported this view. The observation has continued after the implementation of ITMEM over the companies. It was explored that they has been taken steps about particular fields of IT, which are found inadequate as the result of ITMEM. ITMEM provided an increase the awareness of IT use and needs. According to the latest result, it was shown that company F and G emphasized on security training and policy development initiatives. This demonstrated that protection issues have been a priority to fulfill.

As a result, in these case studies, ITMEM enlightened a distinguished way for assessment of IT use in a company. It follows unique (-by three folded framework structure), distinctive (-by its purposes about IT use) and reliable (–by methodological triangulation) path for its implementation. Here are the **benefits** that ITMEM brings to a company presented:

- **Cost saving**. The cost of implementing ITMEM is relatively very low. It provides considerable deduction from control expenses.
- **No need for training.** ITMEM has an understandable structure with detailed explanations. Thus, there is no need for training any employees.
- **Practical**. Implementation does not require any additional tool, procedure or preparation. ITMEM has well defined steps which enable to practice ITMEM with ease.
- **Time saving**. ITMEM can be practiced in a short time which does not disrupt the company operations.
- **Flexible**. Modular structure involving 5 constructs and elaborately categorized questions provides flexibility to conduct sector or company-specific studies, or assessment on specific fields.
- **Reliable results by cross validations**. Methodological triangulation helps to conduct cross validation for data. Comparative and supportive questions also seek for reliability.
- **Understandable calculation and interpretable results**. ITMEM practiced with a simple mathematical calculation which is resulted in construct-based and overall scoring. The result interpretation is supported with the interview reports.
- **Broader perspective.** ITMEM does not focus on a specific field of study such as security, or governance. Rather, it includes all fields inside and guides for improvement of inadequate fields.
- **Guideline for IT use**. After considerable practices, it is believed that the weights of the questions will be important guide for industries which demonstrates trends in IT use.

Other benefits were stated by participants that can be achieved after a set of practices are as followings:

- "ITMEM provides key factors about IT assessment". (Company G, B)
- "ITMEM can be used as a tool to compare the IT levels of organizations". (Company A,H)
- "Competitive advantage can be measurable on IT use". (Company D,I)
- "ITMEM can provide indicators for IT investments". (Company F, C, J)
- "It can present metrics to make SWOT analysis".(Company B)
- "Helpful for IT business alignment"(Company I)

7.1. Limitations and Assumptions of the Study

The major limitation of the study is the sample size. We can only conduct the survey on 10 companies. For more consistent and reliable results, more companies needed. Due to the lack of incentives, and the required time and face to face interview, companies remained unwilling. Trust issues were also matter. Companies' treatment to unknown practices was biased. Without an associate in a company, authorities hesitated to share the information. Another reason is tendency to avoid bad reputation. It was thought that when applying a public practice, possible low scores may damage the company reputation.

Another restriction that is brought by sample size limitation is in quantitative and comparative analysis between companies. It disables us to statistically analyze:

- Question- Construct allocation relationship,
- Comparison between companies with regards to industries and other variables
- Reliability

7.2. Future Works

The current practices of ITMEM are limited to particular set of companies. Further and much detailed studies on different sectors and different companies are required to establish more comprehensive, accurate and acceptable model. Increasing sample size enhances the reliability to the model, validity of responses.

The experts from each company determined the question weights specifically for their companies in the current practices of ITMEM. After particular set of practices, common weights for each question can be determined considering the mean values of given weights in specific sectors. This will conclude sector-specific weights which can be objectively applied in any company in selected sector. Addition to that, scope of the questions in each construct is expandable depending on the aim of practice. The further studies are just required to expand ITMEM's scope which includes detailed investigation and researches about particular subject inside the market and corporations.

The study results also present promising data in further behavioral studies. The interview results are believed that they provide supportive data for social studies targeting human behavior about understanding employees towards IT.

Even though descriptive statistics used in analysis of study, after sufficient practices, further statistical analysis can be conducted for measuring the relations between the comparative questions and supportive questions with the main question, identifying interrelations between companies, measuring reliability, and clarifying question-construct and construct-construct relations.

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APPENDICES

APPENDIX A

DOMAINS AND PROCESSES OF COBIT

	PLAN AND ORGANIZE
PO1	Define a Strategic IT Plan and direction
PO2	Define the Information Architecture
PO3	Determine Technological Direction
PO4	Define the IT Processes, Organization and Relationships
PO5	Manage the IT Investment
PO6	Communicate Management Aims and Direction
PO7	Manage IT Human Resources
PO8	Manage Quality
PO9	Assess and Manage IT Risks
PO10	Manage Projects
	ACQUIRE AND IMPLEMENT
AI1	Identify Automated Solutions
AI2	Acquire and Maintain Application Software
AI3	Acquire and Maintain Technology Infrastructure
AI4	Enable Operation and Use
AI5	Procure IT Resources
AI6	Manage Changes
AI7	Install and Accredit Solutions and Changes

	DELIVER AND SUPPORT
DS1	Define and Manage Service Levels
DS2	Manage Third-party Services
DS3	Manage Performance and Capacity
DS4	Ensure Continuous Service
DS5	Ensure Systems Security
DS6	Identify and Allocate Costs
DS7	Educate and Train Users
DS8	Manage Service Desk and Incidents
DS9	Manage the Configuration
DS10	Manage Problems
DS11	Manage Data
DS12	Manage the Physical Environment
DS13	Manage Operations
	MONITOR AND EVALUATE
ME1	Monitor and Evaluate IT Processes
ME2	Monitor and Evaluate Internal Control
ME3	Ensure Regulatory Compliance
ME4	Provide IT Governance

APPENDIX B

SUPPORTIVE QUESTIONS

	0	1	2	Explanation
Systems	**Not used/ not applied**	**Used once, not repeated**	**Used, continuously developed/ updating**	**What/ How?**
IT portfolio management system				
Multisourcing system				
Enterprise Resource Planning system				
Customer Relationship Management system				
Data mining				
Enterprise feedback management				
Enterprise relationship management				
Web management system				
Customer Service System				
Issue tracking system				
Support automation				
Sales force management systems				
Predictive analytics				
Business performance management				
Online analytical processing				
Business service management				
Business process management				
Service-oriented architecture				
Executive information system				
Decision support system				
Database management systems				
Project management system				
Web Services				
Cloud Computing				
Management Information				

Systems				
Transaction Processing System				
Supply Chain Management				

Standards

ISO/IEC 19770-1:2006 (Software Asset Management)				
ISO/IEC 20000 (IT Service Management)				
ISO/IEC 24762:2008 (Disaster Recovery Service Guidelines)				
ISO/IEC 27001: 2005 (Information Security - ISMS - ISO 27001)				
ISO/IEC 27002:2005 (ISO/IEC 17799:2005) (ISO 1779 and ISO 27002 are the same standard)				
Information Security Standards Kit (ISO 27001 plus ISO 27002 / ISO 17799)				
All 3 ISMS Standards (ISO27001, ISO 27002, ISO27005)				
ISO/IEC 27004:2009 (Information Security Measurement and Metrics)				
ISO/IEC 27005: 2005 (Information Security Risk Management)				
ISO/IEC 27006: 2007 (ISMS Certification Bodies)				
ISO/IEC 38500:2008 (Corporate Governance of ICT)				
ISO 9000 Series of Standards (Quality Management Systems)				
ISO 14001 (Environmental Management Systems Standards)				
EN 16001 (Energy Management Systems. Requirements.)				
ISO 18028 (Network Security Management)				
BS 7799-3:2006 (Information security risk assessment)				
BS 7858 (Screening Individuals)				
BS 25777 (ICT Service Continuity Management)				
BS 25999 (Business Continuity Management)				
BS 31100 (Risk Management)				
ISO 31000 (Risk Management - Principles and Guidelines)				

ISO/IEC 31010 (Risk Management - Risk Assessment Techniques)				
INCITS standards				
ISO/IEC JTC 001 "Information technology"				
ISO/IEC Standard 15408				
Best Practices				
COBIT				
ITIL				
CMMI				
The Standard of Good Practice for Information Security				
CAIS - Assessing business-IT Alignment Maturity				

Query of IT on Divisional Basis

To what extent IT is used in divisional basis?	**Intensive**	**Average**	**Low**
Finance			
Accounting			
Human Resources			
Marketing			
Purchasing			
Research & Development			

Others:

Given Weight (1-3):

Notes:

Perceived Benefits and necessities of question?
Recommendations?:

Internet Use Query

To what extent are you effectively using internet?	**Intensive**	**Average**	**Low**
Communication			
Customer Relations			
Human Resources			
Marketing			
Purchasing			

Others:

Given Weight (1-3):

Notes:

Perceived Benefits and necessities of question? Recommendations?:

APPENDIX C

SURVEY QUESTIONS AND SOURCES

	Survey Questions	Question Type (A\C\M)	Target Field (S\G)	Question Level (ST\MN\OP)	Source (For each question, the first row: Main source, other rows: Secondary sources)	Source details
	Identification					
1.1.	To What degree does IT take place in main strategic business goals?	*A*	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Awareness
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 1.4.
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Strategy
					CMMI, Software Engineering Institute,2008	Strategic Service Management
1.2.	Please degree the importance of certificate and standards about IT for your company.	*M*	*G*	*MN*	*AIA0109 –Technology capability survey, Enterprise Europe Network, 2009*	"What are the certifications that are aimed to acquire by the company?"
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 3.4.

					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Conformance
1.3.	To what degree IT performance and efficiency are measured in the company?	*M*	*G*	*MN*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Performance: "Does IT support business processes with the required capability and capacity?"
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 1.3; Deliver and Support 3.3; Monitor and Evaluate 1.1-1.6
					CMMI, Software Engineering Institute,2008	Organizational Process Performance
1.4.	What is the proportion of IT investment to total investments?	*M*	*G*	*ST*	*AIA0109 -Technology capability survey, Enterprise Europe Network, 2009*	"Son üç yılda gerçekleşen yatırımların satışa oranı nedir?"
					COBIT 4.1, IT governance Institute, 2007	Plan and organize 5.1, 5.2
1.5.	To what degree does your company assess compliance IT with standards, rules and policies and requirements?	*M*	*G*	*ST*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Conformance: "Is there a regular evaluation of IT conformity with obligations, policies, standards and guidelines?"
					COBIT 4.1, IT governance Institute, 2007	Plan and organize 3.4, 8.3; Monitor and Evaluate 3.1-3.4
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Compliance
1.6.	To what degree are IT risk management and its concept part of company culture? Degree.	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Monitor and Evaluate 4.5; Plan and organize 4.8, 9.1, 9.2
					CMMI, Software Engineering Institute,2008	Risk Management
					ISO 17799	14.1 Information Security

						Aspects Of Business Continuity Management
1.7.	To what degree does your company use IT in communication and cooperation between company divisions and functions?	A	*G*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building core competence
					ITIL, Office of Government Commerce, 2007	Service Transition
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 4.7, 4.15
1.8.	To what degree are IT units used in the company that is specific to education and learning?	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Learning
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 7.1, 7.2
					CMMI, Software Engineering Institute,2008	Organizational Training
1.9.	To what degree do you support business processes with the required IT?	*M*	*G*	*MN*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Performance
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 3.1
					ITIL, Office Of Government Commerce, 2007	Capacity Management
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Capacity Planning
					CMMI, Software Engineering Institute,2008	Capacity and availability management

1.10.	To what degree IT affects the competitive position of your company? What is company's attitude?	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building a core competence
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 3.2
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Strategy
1.11.	To what degree does your company fulfill technological requirements considering the market?	A	*G*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology Strategy
					ITIL, Office Of Government Commerce, 2007	Availability Management
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 2.4
1.12.	Do you follow national and international technological developments about your industry? Degree the attitude of your company.	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Learning
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 7.1
1.13.	What is the place of IT within major technological priorities of your company? Degree.	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology Strategy
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 5.2
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Strategy

1.14.	To what degree do you use IT in decision making processes about production and strategy?	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building a Core Competence
					COBIT 4.1, IT governance Institute, 2007	Monitor and Evaluate 4.1, 4.4
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Strategy
1.15.	Does your company have strategic vision including IT? Degree.	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology Strategy
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 6.3
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Strategy
1.16.	Do you use IT in project risk management? Degree.	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Awareness
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 10.13
					CMMI, Software Engineering Institute,2008	Risk Management
1.17.	What is the role of IT about organizational learning? Degree.	A	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Learning
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 7.4

					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Responsibility
1.18.	To what degree is institutional training about IT given in your company?	A	*G*	*MN*	*COBIT 4.1, IT governance Institute, 2007*	Deliver and Support 7.1, 7.2
					CMMI, Software Engineering Institute,2008	Organizational Training
					Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36	Learning
1.19.	Degree the importance of technology infrastructure for your company.	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 3.2; Acquire and Implement 3.1
					Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36	Awareness
					CMMI, Software Engineering Institute,2008	Organizational Environment for Integration
1.20.	To what degree does IT take place in organizational structure?	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 4.4; Monitor and Evaluate 4.1
					Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36	Awareness
1.21.	To what degree do you audit IT applications and IT including processes? BT	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 4.5
					Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36	Building external linkages
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Responsibility

1.22.	To what degree are employees informed about IT policies, procedures and updates?	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 6.4, 6.5
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Responsibility
					ITIL, Office Of Government Commerce, 2007	Availability Management
1.23.	To what degree does IT tactical planning implemented in your company?	A	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 1.5
					ITIL, Office Of Government Commerce, 2007	Service Strategy
	Selection					
2.1.	To what degree are businesses goals in accordance with IT structure?	*M*	*G*	*ST*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Strategy: "Does IT align with organizations objectives?"
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 1.2
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Conformance
2.2.	What is the importance of IT outsourcing for your company?	*A*	*G*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology acquisition
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	12.5 Security in Development and Support Processes
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 2
2.3.	To what extent does IT investments take place in your long term plans?	*M*	*G*	*ST*	*"AIA0109 Technology Capability Survey 2009"*	
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 5
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Acquisition

					ITIL, Office Of Government Commerce, 2007	Financial Management
2.4.	To what extent is technological direction planning used?	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 3.1
					ITIL, Office Of Government Commerce, 2007	Service Strategy
					CMMI, Software Engineering Institute,2008	Project Monitoring and control
2.5.	To what extent IT supports the potential business needs?	*M*	*G*	*ST*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Strategy
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 3.5
2.6.	Does your company have practices to keep and sustain competitive advantage in IT?	*A*	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Search, Assessing and Selecting Technology
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 3.5
	Acquisition					
3.1.	To what extent is IT used in project management?	*C*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 10.2, 10.5
					CMMI, Software Engineering Institute,2008	Project Management
3.2.	To what extent is IT used to determine risks and alternatives in investments?	*M*	*G*	*MN*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Acquisition: "Does the organization have IT investment system to assess the risk, alternatives by documentation"
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 10
3.3.	Does your company use service level agreement for provided IT services? Degree	A	S	ST	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 1.1, 10.1; Deliver and Support 2.2
					CMMI, Software Engineering Institute,2008	Supplier Agreement

						Management
					ITIL, Office Of Government Commerce, 2007	Service Design -Service Level Management
3.4.	To what extent does your company acquire applications and software in order to satisfy IT needs?	A	G	MN	*COBIT 4.1, IT governance Institute, 2007*	Acquire and Implement 2
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Acquisition
3.5.	Does your company have specific procedures and systems to procure IT resources? Degree.	A	G	ST	*COBIT 4.1, IT governance Institute, 2007*	Acquire and Implement 5
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Acquisition
					ITIL, Office Of Government Commerce, 2007	Service Operation- Sourcing
3.6.	Does your company have a system to evaluate IT projects? Degree.	*A*	*S*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Learning
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 10.9
					CMMI, Software Engineering Institute,2008	Project monitoring and control
3.7.	Does your company have a system for IT outsourcing process management? Degree.	A	*G*	MN	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology Acquisition
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 2

3.8.	To what extent does your company encountered obstacles that while using IT outsources?	A	*G*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Technology Acquisition
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 2.5
	Exploitation					
4.1.	To what extent does IT used to create new advantages in your future businesses?	*A*	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building core competence
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 3.3
4.2.	Does the IT responsibilities allocated in the company which is resulted effectively? Degree.	*A*	*G*	*ST*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Responsibility: "Does the IT responsibilities allocated in the company which is resulted effectively?"
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 4
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Responsibility
4.3.	To what extend does your company use IT capabilities to create strategic advantage in the market?	*A*	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building core competence
					ITIL, Office Of Government Commerce, 2007	Continual Service Improvement
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Performance
4.4.	Does your company have automation	*A*	*G*	*MN*	*COBIT 4.1, IT governance Institute, 2007*	Acquire and Implement 1

	solutions for IT use? Degree.				*ITIL, Office Of Government Commerce, 2007*	Release Management
4.5.	Does your company have IT operations procedure? Degree the level of use.	*A*	*G*	*OP*	*COBIT 4.1, IT governance Institute, 2007*	Deliver and Support 13
					ITIL, Office Of Government Commerce, 2007	Service Delivery
4.6.	Does your company have distinguished and unique IT methods and advantages? Degree.	*A*	*G*	*ST*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building core competence
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 3.1
4.7.	To what extent does your company maintain IT process assessment?	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 9
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Performance
4.8.	To what extent are your IT investments in accordance with business requirements?	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 1.1, 1.6, 5.1
	Protection					
5.1.	To what extent IT security management and its concept are placed in your company's corporate culture?	*C*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Deliver and Support 5
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	5.1 Information Security Policy
					ITIL, Office Of Government Commerce, 2007	Service Design -Security Management
					ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008	Conformance
5.2.	Does your company maintain copyright protection policies and plans for intellectual properties? Degree the importance.	*A*	*G*	*MN*	*Rush,H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Building external linkages

					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Compliance With Legal Requirements
5.3.	To what extent does your company use IT-based monitoring in production?	*C*	*S*	*MN*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Performance
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 3.1
					ITIL, Office Of Government Commerce, 2007	Capacity Management
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	8.2.1 Capacity Planning
5.4.	Does your company have quality management system and plans that involves IT processes and operations? Degree.	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 4.7, 8.1, 8.2
					CMMI, Software Engineering Institute,2008	Support
5.5.	Does your company have a tool or mechanism to control IT roles and responsibilities? Degree.	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Plan and Organize 4.10, 4.12
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Internal Organization
5.6.	Does your company have a tool for assessing IT opportunities and threats in the market? Degree.	*A*	*G*	*ST*	*Rush, H. Bessant, J. Hobday, M. Assessing the technological capabilities of firms: developing a policy tool, R&D Management,2007, Vol.37, pp.221-36*	Search
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Environmental Security
5.7.	Does your company have IT security policy and procedures? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans*	Security Policy

					Institute, 2002	
					COBIT 4.1, IT governance Institute, 2007	Plan and Organize 4.8, 7.6
5.8.	Does your company have IT security infrastructure? Degree.	*A*	*G*	*MN*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Organization of Information Technology
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 3.1
5.9.	Is IT hardware of your company kept and placed securely? Degree.	*A*	*G*	*MN*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Physical Security
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 3.2
5.10.	To what extent is IT software security provided by your company?	*A*	*G*	*MN*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Information Systems Acquisition, Development And Maintenance
					COBIT 4.1, IT governance Institute, 2007	Acquire and Implement 3.3
5.11.	Does your company have IT incident management plan? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Information Security Incident Management
					COBIT 4.1, IT governance Institute, 2007	Deliver and Support 5
5.12.	Does your company have IT capacity management plan? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Communications And Operations Management/ System Planning And Acceptance
					COBIT 4.1, IT governance Institute, 2007	Deliver And Support 3.3
5.13.	Does your company have IT network management plan? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Communications And Operations Management/ Network Security Management
					COBIT 4.1, IT governance Institute, 2007	Deliver And Support 5.20

5.14.	Does your company have disposal plan for IT resources? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Communications And Operations Management/ Media Handling
					COBIT 4.1, IT governance Institute, 2007	Deliver And Support 11.4
5.15.	Does your company have resource access policy for IT? Degree.	*A*	*G*	*ST*	*ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002*	Business Requirement For Access Control
					COBIT 4.1, IT governance Institute, 2007	Monitor and Evaluate 4.4
5.16.	Does the company have IT data protection and back up procedures? Degree.	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Deliver And Support 11.2
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Communications And Operations Management/ Back up
5.17.	Does the company have IT continuity plan? Degree.	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Deliver And Support 4
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Business Continuity Management
5.18.	Does the company have IT auditing system? Degree.	*A*	*G*	*ST*	*COBIT 4.1, IT governance Institute, 2007*	Monitor and Evaluate 2
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Compliance Information Systems Audit Considerations
5.19.	To what extent is monitoring used for IT operations?	*M*	*G*	*ST*	*ISO 38500- Cooperate Governance of Information Technology, ISO/IEC, 2008*	Performance
					ISO 17799, Information Security Management BS 7799.2:2002 -Audit Check List, Sans Institute, 2002	Communications And Operations Management Third Party Service Delivery Management
					COBIT 4.1, IT governance Institute, 2007	Monitor and Evaluate 1

APPDENDIX D

ANSWERS FOR SURVEY QUESTIONS AND SUPPORTIVE QUESTIONS ANSWERS FOR SURVEY QUESTIONS

Survey Questions The survey question weights, answers of survey and comparative questions are given for each company																														
	Weight	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*	***Weight***	*Answer*	*Comperative Q.*
Question #	**Company A**			**Company B**			**Company C**			**Company D**			**Company E**			**Company F**			**Company G**			**Company H**			**Company I**			**Company J**		
1.1.	3	4	3	3	4	3	3	4	4	3	4	4	3	4	3	3	4	4	3	4	4	3	2	3	3	3	2	3	3	2
1.2.	2	3	3	3	3	3	3	4	4	3	3	3	2	4	3	2	2	2	2	3	2	3	2	2	3	3	3	3	3	2
1.3.	2	3	3	2	2	3	3	4	4	3	3	4	2	3	2	2	4	4	2	3	2	3	3	3	3	3	2	2	3	3
1.4.	2	4	3	1	2	3	1	3	3	3	4	3	1	2	2	1	2	2	1	2	2	1	2	3	1	1	2	1	2	3
1.5.	2	3	3	3	4	3	3	4	4	3	3	3	2	4	3	2	3	3	2	3	2	3	4	2	3	3	2	3	3	3
1.6.	2	3	3	2	3	2	2	4	4	2	3	2	2	3	2	3	3	3	3	3	3	2	3	3	2	2	2	2	3	2
1.7.	2	4	3	3	4	4	3	4	4	3	4	3	2	3	3	3	3	3	3	4	3	3	4	3	3	3	2	3	4	3
1.8.	1	2	3	2	3	2	1	2	3	2	3	3	1	3	2	2	4	4	2	3	2	1	2	2	2	2	2	2	3	2

1.9.	3	4	3	3	3	3	3	3	4	3	4	4	3	4	4	3	4	4	3	3	3	3	4	4	3	3	2	3	2	3
1.10.	3	4	3	2	4	4	3	4	4	3	4	3	3	3	2	3	4	4	3	4	4	2	4	3	2	3	2	2	4	3
1.11.	2	3	3	2	3	3	2	4	4	3	3	3	2	2	2	2	4	4	2	3	4	2	4	4	2	3	2	2	3	3
1.12.	2	3	3	2	3	2	3	3	4	2	3	4	2	2	2	3	3	3	3	4	4	2	4	4	2	3	3	2	2	2
1.13.	2	4	3	2	3	2	3	4	3	3	4	3	2	4	3	3	4	4	3	4	4	2	4	4	2	4	3	2	3	2
1.14.	1	4	3	2	4	3	2	4	4	3	3	3	1	2	1	2	4	3	2	3	3	2	3	3	2	3	3	2	1	2
1.15.	2	3	3	1	4	3	2	3	3	3	4	4	2	3	2	2	4	3	2	3	4	2	3	3	1	4	3	1	4	3
1.16.	1	2	2	1	3	2	2	1	1	2	2	2	1	2	2	2	2	2	2	2	3	1	2	2	2	4	3	1	3	2
1.17.	1	3	3	1	3	2	1	2	3	2	3	2	1	4	3	2	4	4	1	2	3	1	2	2	2	4	3	1	3	2
1.18.	2	4	3	2	2	2	2	3	3	2	2	2	2	3	2	3	4	4	2	3	3	2	3	2	1	3	3	2	2	2
1.19.	1	3	3	1	3	2	2	4	4	3	3	3	1	3	2	2	1	1	2	4	4	1	2	3	1	3	3	1	3	2
1.20.	2	3	3	2	3	3	3	4	4	4	2	3	2	3	2	2	4	3	3	3	4	2	3	4	2	3	3	2	4	3
1.21.	3	3	3	2	2	2	3	4	4	4	3	3	3	4	3	2	2	2	3	3	4	2	3	3	2	2	2	2	2	2
1.22.	2	4	3	2	3	3	3	3	4	2	2	2	2	2	2	3	3	2	3	2	3	2	3	3	2	4	3	2	4	3
1.23.	1	3	3	1	3	2	2	4	4	3	3	3	1	4	4	2	4	4	1	2	2	2	4	4	1	3	3	1	3	2
2.1.	3	4	3	2	3	3	3	4	4	3	3	2	3	4	3	3	4	4	3	3	4	2	3	4	2	3	3	2	4	3
2.2.	2	3	3	3	4	3	2	4	4	3	3	3	2	3	2	2	3	3	2	3	3	3	3	3	3	2	3	3	4	3
2.3.	2	3	3	2	3	2	2	4	4	3	3	2	2	3	2	2	4	4	2	3	4	2	3	3	1	2	3	2	3	2
2.4.	2	3	3	1	2	2	3	4	4	4	3	3	2	2	1	2	4	4	2	3	4	2	3	3	1	2	2	1	3	2
2.5.	1	4	3	2	2	2	2	4	4	3	2	2	1	3	3	2	4	4	2	3	4	2	3	3	2	3	3	2	2	2
2.6.	1	3	3	1	3	2	1	4	4	4	3	3	1	1	2	1	4	4	1	3	3	1	4	4	1	3	2	1	3	2
3.1.	2	3	3	2	3	2	3	4	4	3	2	3	4	2	4	3	3	3	3	4	4	3	3	3	2	4	3	2	3	2
3.2.	3	2	3	2	2	2	2	2	2	4	3	3	2	1	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2

3.3.	2	3	3	1	3	2	2	3	3	3	2	2	2	3	2	2	3	2	2	1	1	1	2	2	1	2	2	1	3	2
3.4.	2	4	3	3	3	3	3	4	4	4	3	3	2	3	2	3	4	4	3	3	4	3	4	4	3	3	3	3	4	3
3.5.	3	2	1	1	3	2	1	4	3	3	2	2	1	4	3	1	4	3	1	2	2	1	4	4	1	3	3	1	4	2
3.6.	3	3	2	1	3	2	2	1	2	4	3	3	3	4	3	2	2	2	3	4	4	2	3	4	2	4	3	1	3	2
3.7.	2	3	2	3	3	2	2	4	3	1	2	1	2	4	4	2	1	1	2	1	2	3	3	3	3	3	3	3	3	2
3.8.	2	3	2	2	2	1	2	4	3	2	1	2	2	4	4	2	3	3	2	3	4	2	4	3	2	2	2	2	2	1
4.1.	2	4	3	1	3	2	3	4	4	3	4	3	2	3	2	3	4	4	3	3	3	2	3	3	2	3	3	1	3	2
4.2.	2	3	3	2	2	2	3	4	3	3	3	3	2	2	2	3	2	1	3	3	3	3	3	3	2	4	3	2	2	2
4.3.	3	3	3	2	3	2	3	4	4	2	3	4	3	3	3	3	4	4	2	4	4	2	3	4	2	3	2	2	3	2
4.4.	2	2	3	2	3	4	3	4	3	3	3	3	2	4	4	3	4	3	2	2	2	2	4	4	2	3	3	2	4	4
4.5.	1	3	3	1	2	2	2	4	3	3	4	3	1	3	2	2	3	3	2	1	2	2	2	3	1	2	2	1	3	2
4.6.	2	4	3	2	4	3	3	4	4	3	4	4	2	2	2	3	3	3	3	3	4	3	3	3	2	3	3	2	4	3
4.7.	2	4	3	2	3	2	2	1	1	3	3	3	2	4	4	2	2	1	2	2	2	2	3	3	2	3	2	2	3	2
4.8.	3	3	3	2	3	2	3	4	4	3	4	3	3	3	2	3	4	3	3	3	4	2	3	3	2	3	3	2	3	2
5.1.	2	3	3	2	4	2	3	4	4	3	3	2	2	4	4	3	2	2	3	3	3	3	3	4	2	3	2	2	4	2
5.2.	3	2	1	2	3	2	3	4	4	2	3	2	3	2	2	3	2	2	2	3	4	3	4	4	3	2	2	2	3	2
5.3.	1	3	2	3	3	4	2	4	3	3	4	3	1	2	-	2	4	3	2	1	2	3	4	4	3	3	3	3	4	4
5.4.	3	1	1	3	1	2	3	4	4	3	3	3	3	4	4	3	4	3	3	4	2	3	2	2	3	4	3	3	1	2
5.5.	2	3	3	3	2	2	3	4	3	2	2	2	2	4	3	2	2	2	3	2	3	3	2	2	3	3	3	3	2	2
5.6.	1	3	3	1	3	2	2	4	3	2	2	2	1	2	2	2	1	1	1	2	2	1	3	3	1	2	2	1	3	2
5.7.	2	2	2	3	4	2	3	4	4	2	2	3	2	4	3	2	3	2	2	3	3	3	4	4	2	2	2	3	4	2
5.8.	2	3	3	2	3	3	3	4	4	3	3	3	2	3	3	3	3	3	3	3	3	3	4	4	3	3	3	2	4	3
5.9.	1	3	3	2	3	3	2	4	4	3	3	2	1	4	3	2	4	4	1	3	3	1	4	4	1	2	3	2	4	3

5.10.	2	3	2	2	3	2	3	4	3	3	2	3	2	3	2	3	3	3	3	4	4	3	4	4	2	4	3	2	3	2
5.11.	3	1	2	1	3	2	3	1	2	3	2	2	2	4	3	2	4	3	2	3	3	2	2	3	1	2	2	1	3	2
5.12.	3	1	1	2	1	1	2	1	2	3	2	2	2	4	3	2	2	1	3	3	3	3	3	3	2	2	2	2	1	1
5.13.	3	1	1	1	4	3	2	1	2	2	3	2	2	4	3	2	1	1	2	4	4	1	2	3	1	3	3	1	4	3
5.14.	3	2	2	1	4	3	3	4	3	2	2	2	2	3	2	2	1	1	2	3	3	3	2	3	2	2	2	1	4	3
5.15.	3	2	2	2	4	3	3	4	4	3	3	3	2	4	3	3	2	2	2	2	2	2	3	3	2	3	2	2	4	3
5.16.	2	2	2	1	4	2	3	4	4	3	3	3	3	4	3	2	3	2	2	4	4	2	4	4	2	3	3	1	4	2
5.17.	3	2	2	2	2	2	3	1	2	3	3	2	3	4	3	2	3	3	2	4	4	2	2	3	1	3	2	2	3	2
5.18.	3	1	2	2	4	2	3	4	3	3	3	3	2	3	3	2	1	2	3	2	2	2	2	2	2	3	3	2	4	2
5.19.	1	3	3	2	3	2	2	3	3	2	1	1	1	2	2	1	1	2	1	2	4	1	3	4	1	3	3	2	4	2

Supportive Questions

The answers of supportive questions with explanations are given for each company

	Answer	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*	*Answer*	*Explanation*
Systems	**Company A**		**Company B**		**Company C**		**Company D**		**Company E**		**Company F**		**Company G**		**Company H**		**Company I**		**Company J**			
IT portfolio management system	2	self									**2**	monitor/env anter	**2**	self	**1**	self	1					
Multisourcing system																	1					
Enterprise Resource Planning system	2	sap	2		2	sap	2		2		1	(trial)			2	oracle	2		2			

Customer Relationship Management system							2				2	(outsoruce)	2	self		planned	2		2	
Data mining											2		2	self			1			
Enterprise feedback management			2										2	self			2			
Enterprise relationship management							2						2	self			2		2	
Web management system							2		2		2		2	outsourc e	2	self	2			
Customer Service System	2	self					2				2		2	self			2		2	
Issue tracking system			2		2	primaver a	2		2		2		2	outsourc e	1	IBM rational	1		1	
Support automation											2		2	self			2			
Sales force management systems															2	oracle	2		2	
Predictive analytics			2														2			
Business performance management			2				2		2				2	self			2			
Online analytical processing											2						2			
Business service management													2	self			2		1	

Business process management			2		2	sharepoint portal							2	self			2		1	
Service-oriented architecture							2				1						1			
Executive information system	2	sap/bw	2										1				2			
Decision support system	2	sap/bw							2								2		2	
Database management systems	2	oracle/ms.sql	2				2		2		2		2	ms sql			2		2	
Project management system	2	sap/ps-ms project			2	primavera	2		2		2		2	self	2	IBM rational	2			
Web Services	2	ms-iis					2		2		2		2			çeşitli	2			
Cloud Computing											1						2			
Management Information Systems	2	sap			2	YBS	2		2							çeşitli	2		1	
Transaction Processing System																	2		2	
Supply Chain Management					2	sap									2	oracle	2		2	
Standards																				
ISO/IEC 19770-1:2006 (Software Asset Management)																	2	self		
ISO/IEC 20000 (IT Service																	2	self		

Management)																				
ISO/IEC 24762:2008 (Disaster Recovery Service Guidelines)																	2	self	2	
ISO/IEC 27001: 2005 (Information Security - ISMS - ISO 27001)					2											Prep.	2	self	2	
ISO/IEC 27002: 2005 (ISO/IEC 17799:2005) (ISO 1779 and ISO 27002 are the same standard)					2											Prep.	2		2	
Information Security Standards Kit (ISO 27001 plus ISO 27002 / ISO 17799)					2						1						2	self		
All 3 ISMS Standards (ISO27001, ISO 27002, ISO27005)					2															
ISO/IEC 27004:2009 (Information Security Measurement and Metrics)																				

ISO/IEC 27005: 2005 (Information Security Risk Management)																				
ISO/IEC 27006: 2007 (ISMS Certification Bodies)																				
ISO/IEC 38500:2008 (Corporate Governance of ICT)																				
ISO 9000 Series of Standards (Quality Management Systems)			2		2				2		2				2		2		2	
ISO 14001 (Environmental Management Systems Standards)	2																2			
EN 16001 (Energy Management Systems. Requirements.)																				
ISO 18028 (Network Security Management)																	2	self		
BS 7799-3:2006 (Information security risk assessment)																				

BS 7858 (Screening Individuals)																				
BS 25777 (ICT Service Continuity Management)						SEI technical report											2	self		
BS 25999 (Business Continuity Management)					2															
BS 31100 (Risk Management)					2															
ISO 31000 (Risk Management - Principles and Guidelines)					2															
ISO/IEC 31010 (Risk Management - Risk Assessment Techniques)																				
INCITS standards																				
ISO/IEC JTC 001 "Information technology"																				
ISO/IEC Standard 15408																				
Others																				
ISO 3001:2008							2													
Hardware Asset management																	2	self	2	self

Tesis güvenlik belgeleri (MSB: MYS 317-2, NATO: CM 55-15			2																	
UA standards: (System Eng: EIA/IS 632, IEEE 1230; Software Eng: IEEE 12207, MIL STD 498; Config Management: ISO 15486, ANSI / IEEE 1042, MIL STD 973)			2						MIL STD 498, 973											
Quality: (NATO AQAP 160)			2		2				AQAP 2110, 160											
ISO/IEC 12207									1											
IEEE documentation													2							
TSE -Recycling													2						1	
Best Practices																				
ITIL	2																intention		intention	
CMMI	Level 3		Level 5		Level 3															
IT ON DEPARTMENTS																				

Finance	3		3		3		3		2		3		3		3		3		3	
Accounting	3		3		2		3		2		3		3		3		3		1	
Human Resources	3		2		3		2		2		3		1		2		3		3	

APPENDIX E

Statistical Results

COMPANY A
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	2.1563	.71755
S. Answer	64	2.00	4.00	3.0469	.76490
Comparative Q.A.	64	2.00	4.00	3.1719	.70271
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	12	18.8	18.8	18.8
	Mid-Imp	30	46.9	46.9	65.6
	High-Imp	22	34.4	34.4	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	17	26.6	26.6	26.6
	3	27	42.2	42.2	68.8
	4	20	31.3	31.3	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mid-Imp	11	17.2	17.2	17.2
	Powerful	31	48.4	48.4	65.6
	Hi-Pwr	22	34.4	34.4	100.0
	Total	64	100.0	100.0	

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.218	.072
	Sig. (2-tailed)		.084	.573
	N	64	64	64
S. Answer	Pearson Correlation	.218	1	.694(**)
	Sig. (2-tailed)	.084		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.072	.694(**)	1
	Sig. (2-tailed)	.573	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY B
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	2.4687	.64164
S. Answer	64	1.00	4.00	3.4531	1.00680
Comparative Q.A.	64	1.00	4.00	3.4063	.79120
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	5	7.8	7.8	7.8
	Mid-Imp	24	37.5	37.5	45.3
	High-Imp	35	54.7	54.7	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	10.9	10.9	10.9
	2	3	4.7	4.7	15.6
	3	8	12.5	12.5	28.1
	4	46	71.9	71.9	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	2	3.1	3.1	3.1
	Average	6	9.4	9.4	12.5
	Powerful	20	31.3	31.3	43.8
	Hi-Pwr	36	56.3	56.3	100.0
	Total	64	100.0	100.0	

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.305(*)	.338(**)
	Sig. (2-tailed)		.014	.006
	N	64	64	64
S. Answer	Pearson Correlation	.305(*)	1	.801(**)
	Sig. (2-tailed)	.014		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.338(**)	.801(**)	1
	Sig. (2-tailed)	.006	.000	
	N	64	64	64

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

COMPANY C
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	4.00	1.9844	.70130
S. Answer	64	1.00	4.00	3.1250	.86373
Comparative Q.A.	63	1.00	4.00	2.6190	.77102
Valid N (listwise)	63				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	15	23.4	23.4	23.4
	Mid-Imp	36	56.3	56.3	79.7
	High-Imp	12	18.8	18.8	98.4
	4.00	1	1.6	1.6	100.0
	Total	64	100.0	100.0	

S. S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	3.1	3.1	3.1
	2	14	21.9	21.9	25.0
	3	22	34.4	34.4	59.4
	4	26	40.6	40.6	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	2	3.1	3.2	3.2
	Average	29	45.3	46.0	49.2
	Powerful	23	35.9	36.5	85.7
	Hi-Pwr	9	14.1	14.3	100.0
	Total	63	98.4	100.0	
Missing	System	1	1.6		
Total		64	100.0		

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.239	.301(*)
	Sig. (2-tailed)		.057	.017
	N	64	64	63
S. Answer	Pearson Correlation	.239	1	.693(**)
	Sig. (2-tailed)	.057		.000
	N	64	64	63
Comparative Q.A.	Pearson Correlation	.301(*)	.693(**)	1
	Sig. (2-tailed)	.017	.000	
	N	63	63	63

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

COMPANY D
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	2.0938	.70640
S. Answer	64	1.00	4.00	2.9063	.84925
Comparative Q.A.	64	1.00	3.00	2.6406	.62659
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	13	20.3	20.3	20.3
	Mid-Imp	32	50.0	50.0	70.3
	High-Imp	19	29.7	29.7	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5	7.8	7.8	7.8
	2	11	17.2	17.2	25.0
	3	33	51.6	51.6	76.6
	4	15	23.4	23.4	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	5	7.8	7.8	7.8
	Average	13	20.3	20.3	28.1
	Powerful	46	71.9	71.9	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.303(*)	.425(**)
	Sig. (2-tailed)		.015	.000
	N	64	64	64
S. Answer	Pearson Correlation	.303(*)	1	.711(**)
	Sig. (2-tailed)	.015		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.425(**)	.711(**)	1
	Sig. (2-tailed)	.000	.000	
	N	64	64	64

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY E
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	4.00	2.8281	.63132
S. Answer	64	1.00	4.00	2.8750	.74536
Comparative Q.A.	64	1.00	4.00	2.7187	.70076
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	1	1.6	1.6	1.6
	Mid-Imp	16	25.0	25.0	26.6
	High-Imp	40	62.5	62.5	89.1
	4.00	7	10.9	10.9	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	3.1	3.1	3.1
	2	16	25.0	25.0	28.1
	3	34	53.1	53.1	81.3
	4	12	18.8	18.8	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	2	3.1	3.1	3.1
	Average	21	32.8	32.8	35.9
	Powerful	34	53.1	53.1	89.1
	Hi-Pwr	7	10.9	10.9	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.358(**)	.427(**)
	Sig. (2-tailed)		.004	.000
	N	64	64	64
S. Answer	Pearson Correlation	.358(**)	1	.631(**)
	Sig. (2-tailed)	.004		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.427(**)	.631(**)	1
	Sig. (2-tailed)	.000	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY F
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	2.3125	.58757
S. Answer	64	1.00	4.00	3.0156	1.04642
Comparative Q.A.	64	1.00	4.00	2.7969	1.01073
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	4	6.3	6.3	6.3
	Mid-Imp	36	56.3	56.3	62.5
	High-Imp	24	37.5	37.5	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	10.9	10.9	10.9
	2	13	20.3	20.3	31.3
	3	16	25.0	25.0	56.3
	4	28	43.8	43.8	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	8	12.5	12.5	12.5
	Average	16	25.0	25.0	37.5
	Powerful	21	32.8	32.8	70.3
	Hi-Pwr	19	29.7	29.7	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.224	.215
	Sig. (2-tailed)		.075	.087
	N	64	64	64
S. Answer	Pearson Correlation	.224	1	.889(**)
	Sig. (2-tailed)	.075		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.215	.889(**)	1
	Sig. (2-tailed)	.087	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY G
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	2.2656	.67241
S. Answer	64	1.00	4.00	2.8750	.82616
Comparative Q.A.	64	1.00	4.00	3.1094	.85667
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	8	12.5	12.5	12.5
	Mid-Imp	31	48.4	48.4	60.9
	High-Imp	25	39.1	39.1	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	6.3	6.3	6.3
	2	14	21.9	21.9	28.1
	3	32	50.0	50.0	78.1
	4	14	21.9	21.9	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	1	1.6	1.6	1.6
	Average	17	26.6	26.6	28.1
	Powerful	20	31.3	31.3	59.4
	Hi-Pwr	26	40.6	40.6	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.404(**)	.335(**)
	Sig. (2-tailed)		.001	.007
	N	64	64	64
S. Answer	Pearson Correlation	.404(**)	1	.670(**)
	Sig. (2-tailed)	.001		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.335(**)	.670(**)	1
	Sig. (2-tailed)	.007	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY H
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	1.9531	.69988
S. Answer	64	1.00	4.00	2.8750	.67847
Comparative Q.A.	64	2.00	3.00	2.5781	.49776
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	17	26.6	26.6	26.6
	Mid-Imp	33	51.6	51.6	78.1
	High-Imp	14	21.9	21.9	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.6	1.6	1.6
	2	16	25.0	25.0	26.6
	3	37	57.8	57.8	84.4
	4	10	15.6	15.6	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Average	27	42.2	42.2	42.2
	Powerful	37	57.8	57.8	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.221	.033
	Sig. (2-tailed)		.079	.793
	N	64	64	64
S. Answer	Pearson Correlation	.221	1	.546(**)
	Sig. (2-tailed)	.079		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.033	.546(**)	1
	Sig. (2-tailed)	.793	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

COMPANY I
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	1.9063	.68357
S. Answer	64	1.00	4.00	2.9844	.74519
Comparative Q.A.	64	1.00	4.00	2.4063	.65994
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	18	28.1	28.1	28.1
	Mid-Imp	34	53.1	53.1	81.3
	High-Imp	12	18.8	18.8	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	3.1	3.1	3.1
	2	12	18.8	18.8	21.9
	3	35	54.7	54.7	76.6
	4	15	23.4	23.4	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	2	3.1	3.1	3.1
	Average	38	59.4	59.4	62.5
	Powerful	20	31.3	31.3	93.8
	Hi-Pwr	4	6.3	6.3	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.028	.297(*)
	Sig. (2-tailed)		.825	.017
	N	64	64	64
S. Answer	Pearson Correlation	.028	1	.465(**)
	Sig. (2-tailed)	.825		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.297(*)	.465(**)	1
	Sig. (2-tailed)	.017	.000	
	N	64	64	64

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

COMPANY J
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	64	1.00	3.00	1.9063	.68357
S. Answer	64	1.00	4.00	3.0937	.83035
Comparative Q.A.	64	1.00	4.00	2.3281	.59240
Valid N (listwise)	64				

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	18	28.1	28.1	28.1
	Mid-Imp	34	53.1	53.1	81.3
	High-Imp	12	18.8	18.8	100.0
	Total	64	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	4.7	4.7	4.7
	2	10	15.6	15.6	20.3
	3	29	45.3	45.3	65.6
	4	22	34.4	34.4	100.0
	Total	64	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	2	3.1	3.1	3.1
	Average	41	64.1	64.1	67.2
	Powerful	19	29.7	29.7	96.9
	Hi-Pwr	2	3.1	3.1	100.0
	Total	64	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.068	.195
	Sig. (2-tailed)		.593	.123
	N	64	64	64
S. Answer	Pearson Correlation	.068	1	.550(**)
	Sig. (2-tailed)	.593		.000
	N	64	64	64
Comparative Q.A.	Pearson Correlation	.195	.550(**)	1
	Sig. (2-tailed)	.123	.000	
	N	64	64	64

** Correlation is significant at the 0.01 level (2-tailed).

All Companies
Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weight	640	1.00	4.00	2.1875	.72460
S. Answer	640	1.00	4.00	3.0250	.85360
Comparative Q.A.	640	1.00	4.00	2.7766	.80009
Valid N (listwise)	640				

Frequencies

Statistics

		Weight	S. Answer	Comparative Q.A.
N	Valid	640	640	640
	Missing	0	0	0

Frequency Table

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Imp	111	17.3	17.3	17.3
	Mid-Imp	306	47.8	47.8	65.2
	High-Imp	215	33.6	33.6	98.8
	4.00	8	1.3	1.3	100.0
	Total	640	100.0	100.0	

S. Answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	33	5.2	5.2	5.2
	2	126	19.7	19.7	24.8
	3	273	42.7	42.7	67.5
	4	208	32.5	32.5	100.0
	Total	640	100.0	100.0	

Comparative Q.A.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low-Pwr	24	3.8	3.8	3.8
	Average	220	34.4	34.4	38.1
	Powerful	271	42.3	42.3	80.5
	Hi-Pwr	125	19.5	19.5	100.0
	Total	640	100.0	100.0	

Correlations

Correlations

		Weight	S. Answer	Comparative Q.A.
Weight	Pearson Correlation	1	.147(**)	.240(**)
	Sig. (2-tailed)		.000	.000
	N	640	640	640
S. Answer	Pearson Correlation	.147(**)	1	.654(**)
	Sig. (2-tailed)	.000		.000
	N	640	640	640
Comparative Q.A.	Pearson Correlation	.240(**)	.654(**)	1
	Sig. (2-tailed)	.000	.000	
	N	640	640	640

** Correlation is significant at the 0.01 level (2-tailed).