A STUDY FOR THE REQUIREMENTS OF A QUALITY MATURITY FRAMEWORK FOR IT FACILITIES IN ORGANIZATIONS: A CASE FOR QUALITY ASSESSMENT IN TURKISH INSTITUTIONS

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ABSTRACT

A STUDY FOR THE REQUIREMENTS OF A QUALITY MATURITY
FRAMEWORK FOR IT FACILITIES IN ORGANIZATIONS: A CASE FOR
QUALITY ASSESSMENT IN TURKISH INSTITUTIONS

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Nowadays, almost all organizations use information technologies (IT) in some extent that they have gained many advantages from it. However, the wrong management of IT processes may cause big problems for organizations. It is first required to reach the quality to successfully govern IT and its processes. At this point, it is essential to have a quality maturity framework that organizations could use to follow a logical path in achieving quality. This thesis represents a study for determining the general quality requirements of a possible quality maturity framework for IT facilities in

organizations. Many quality models, awards and frameworks will be discussed to determine those quality requirements and a possible leveling of the requirements will be also represented. Besides, a quality assessment survey will be performed in Turkish institutions regarding the quality requirements and the factors affecting them to determine the quality level of IT facilities in Turkish institutions.

Keywords: IT, IT Quality, Quality Requirements, Quality Assessment, Quality Maturity Framework

ÖZ

KURUMLARIN BİLGİ İŞLEM BİRİMLERİNE UYGUN BİR KALİTE OLGUNLUK YAPISININ GEREKSİNİMLERİ İÇİN BİR ÇALIŞMA: TÜRK KURUMLARI İÇİN KALİTE DEĞERLENDİRME İNCELEMESİ

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Günümüzde çoğu kurum, bilgi teknolojilerini bir şekilde kullanarak bir çok avantaj elde etmektedir. Bununla birlikte, bilgi teknolojileri süreçlerinin yanlış yönetimi kurumlara bir çok problem doğurmaktadır. Bilgi teknolojilerini ve süreçlerini başarılı bir şekilde yönetmek için öncelikle kaliteye ulaşmak şarttır. Bu noktada, organizasyonların mantıksal bir yol izlemesini sağlayan bir kalite olgunluk yapısı tek gerekli olan şeydir. Bu tez, olası bir kalite olgunluk yapısının gereksinimlerini belirleyen bir çalışmayı göstermektedir. Bir çok kalite modeli, ödülü ve yapısı incelenerek, bu gereksinimler belirlenecek ve bu gereksinimlerin olası bir

seviyelendirilmesi de sunulacaktır. Ayrıca, bu gereksinimleri ve onları etkileyen faktörlerin doğrultusunda, Türk kurumlarının kalite seviyelerini belirlemek için bir kalite değerlendirme incelemesi de yapılacaktır.

Anahtar Kelimeler: Bilişim Teknolojileri, Bilişim Teknolojileri Kalitesi, Kalite Gereksinimleri, Kalite Değerlendirmesi, Kalite Olgunluk Yapısı

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ABBREVIATIONS

BT: Bilişim Teknolojileri

CI: Continuous Improvement

CMM: Capability Maturity Model

CobiT: Control objectives of information and related technologies

EFQM: European Foundation for Quality Management

HKQAA: Hong Kong Quality Assurance Agency

HP: Hewlett-Packard

IBM: International Business Machines

IIE: Institute of Industrial Engineers

IQMM: International Quality Maturity Model

ISO: International Organization for Standardization

IT: Information Technology

ITGI: Information Technology Governance Institute

JQA: Japan Quality Award

KPA: Key Process Area

MBNQA: Malcolm Bald ridge National Quality Award

QM: Quality Management

QMF: Quality Maturity Framework

QMMG: Quality Management Maturity Grid

QMMM: Quality Management Maturity Model

QMS: Quality Management Systems

QSS: Quality Satisfaction Surveys

SEI: Software Engineering Institute

UK: United Kingdom

USA: United States of America

CHAPTER 1

INTRODUCTION

This chapter starts with an overview explain the correlation of IT to quality in IT facilities briefly. Then the motivation behind that study and problem statement is defined. And in the last section, the organization of the thesis is explained.

1.1. Overview

These days, IT is crucial to the majority of businesses. Almost all organizations use IT to some extent, making it important for employees to have proficient knowledge in the area. It is not longer just IT jobs where staff needs a good knowledge of IT. Almost all office-based jobs are now almost entirely based around computers and IT. However, IT is a complex subject and has increased in direct proportion to its spread throughout the organization. Today, IT is developed throughout the organization and also even in the company's relations with its partners and clients. Of course, IT has a huge impact on overall performance of the organization and it mostly depends on implementing an IT quality [1]. IT quality is one of the main important concepts for IT industry and it facilitates improvement of IT products and services through process improvement, people development, and improved communications. When we consider the direct relationship between system quality and organizational impact, and information quality and organizational impact, it can be said that service quality was also identified as an important variable that affected positive IT outcomes [2]. Thus, it is believed that quality is a critical factor in IT effectiveness for demonstrating value.

1.2. Motivation

The starting point of this work is the wide usage of IT for businesses. And IT plays a vital role to add a value for business purposes to organizations. However, IT should be governed or managed effectively to get its benefits. At this point, there are several significant factors that affect the effectiveness of usage of IT. Considering these factors, it can be concluded that all of the factors that affect something becomes from the quality of it. That's why, the importance of quality in IT development and usage can be considered as the main aim of this study.

Quality is a complex topic that it has many requirements that must be ensured to successfully provide quality in the organization. For example, product quality is considered as important for a manufacturing company and the only requirement may be customer requirements. However, if quality is taken as a whole concept, quality should be ensured not only for products and/or services, but also for the organization itself including its people and processes. So, a general definition of quality requirements is the vital point in the quality approach. So, this study firstly aims to determine those general quality requirements from the available quality models, awards, and frameworks.

1.3. Problem Statement

In the global world, IT has become essential. Without using IT, an organization has no chance of going further. And also, organizations gather an important competitive advantage by using IT. However, sometimes, the wrong usage of IT causes negative effects. It is essential to use IT efficiently and effectively. Thus, IT Governance is vital for organization. To govern or manage something, it is required to reach the quality first. It will be possible only if an organization reaches a high quality level, which shows the level of IT quality of that organization. Organizations should follow a logical path while improving their quality level and this can be provided by following a quality maturity framework. A quality maturity framework consists of required processes, activities and practices for quality management and assurance. It is first required to determine general quality requirements for developing a quality management framework including its processes, activities and practices. Quality

requirements basically show the areas that need to be focused in a quality approach. So, the main aim in this study to find out the general quality requirements that should be taken into consideration to develop a quality maturity framework for IT facilities in organizations. Therefore, the following question has been used to guide this research work:

What will be the quality requirements to develop a quality maturity framework?

The idea behind that question is the issue of analyzing the quality requirements in IT facilities to ensure the quality requirements for quality maturity frameworks. Therefore, we started to define the concept of quality in IT first and continued with its core values to determine the quality requirements for quality management and assurance.

1.4. Thesis Organization

The thesis begins with the Chapter 1 including an introduction to the study, motivation behind it and the problem statement.

The next chapter, Chapter 2, mainly includes the literature survey about the concept of IT quality and quality management, and available quality models and awards and frameworks in this concept. Each model has a different framework, which includes several quality principles, features and categories. These factors will be discussed to explain these models and to find out the core values of quality.

Chapter 3 represents the determination and definition of core quality requirements and the leveling approach of the requirements. The evolution of quality assessment survey questionnaire including the factors affecting general quality requirements defined for the study will also be explained in this chapter.

In Chapter 4, the result of the survey conducted to the IT facilities is presented. Within the results, the analysis of the findings will be evaluated.

Chapter 5 discusses the justification of the study regarding the survey results discussed in Chapter 5. Some statistical analysis and approaches are used to justify the study.

Last chapter, Chapter 6, summarizes the study in general and makes a conclusion for the study with giving the limitations considered in the study and the ideas for the future work to improve the study.

All in all, the main aim of the study is to prepare a background to develop a quality maturity framework for IT facilities in organizations by determining quality requirements that should be taken into consideration for a quality approach. Besides, the study represents a possible leveling for quality requirements that will be determined and provides a possible distribution of the quality requirements defined in this study.

Following the body of this thesis, there are several appendices which show the list of surveyed IT facilities, the sample questionnaire used in the survey, detailed analysis on quality requirements, detailed analysis on each IT facility surveyed, and maturity attribute table of CobiT.

CHAPTER 2

BACKGROUND TO QUALITY

This chapter describes the importance of quality in IT in detail and major stages of the research undertaken. Some quality models, awards and frameworks; and information systems research methodologies are discussed that are necessary for the study for determining the quality requirements and core values.

2.1. IT Quality and Quality Management

Quality is meeting or exceeding customer requirements. *Quality Management (QM)* is a customer-focused approach achieved by empowering employees to continuously improve processes and services to achieve organizational objectives. IT quality is that it facilitates improvement of IT products and services through process improvement, people development, and improved communications.

As mentioned previously in this study, IT is one of the essential things in the business environment. It not also adds a great value for businesses but also, makes them a competitive advantage in the global market. To be have all of these privileges, IT and business alignment needs to be done in a perfect way.

According to a survey of 450 IT directors of large German, UK and French companies done by Mercury Interactive (a global business unit of HP Technology Solutions Group), it is stated that:

"All the more crucial, because the research demonstrates that IT systems need to be improved: the majority of the companies interviewed as part of this survey (73%) revealed major defects in their IT system. The consequences of these defects can be even more negative, since today; the information is no longer purely contained within the company, but is increasingly affecting clients, prospective clients and partners directly. Companies identify the costs associated with this lack of quality" [1].

It is clearly seen from above survey that IT quality is one of the major concepts in the development and deployment of IT systems. It does not mean that IT facilities in organizations achieve quality by using only quality hardware and software. Quality is much deeper concept and many IT units have still some problems to provide or control quality. And another question arises for those facilities:

How can we solve the quality issues?

One reasonable answer to this question is to manage the quality. Quality management is focused not only on product/service quality, but also on the means to achieve it. QM therefore uses quality assurance and control of processes as well as products to achieve more consistent quality. As a result, organizations do have an ability to control quality by knowing the quality requirements for their organizations. By controlling and managing quality also provides organizations to be mature in terms of quality and its processes.

At that point another question is raised related to above issue:

Is there a match between quality management and maturity?

The idea behind *Quality Management* and *Maturity* is first expressed by **Philip Bayard "Phil" Crosby**, who was a philosopher and practitioner of quality management. His writings have been used to guide many international interests in the quality field and also as a catalyst for a global awakening [3]. He developed a 14-step program, the first quality model, and explains it in his well-known book "*Quality is Free*". His belief was that a company that established a quality program

will see savings returns that more than pays off the cost of the quality program, and most important is that he refers quality is a free thing, although it is not a gift [4].

Quality maturity can be defined as an assessment of organization's level of maturity in terms of quality system within the organization. Within the quality maturity assessment, an organization can evaluate itself about its level of progress toward quality goals [5].

Quality can be considered as a system and a strategy for an organization; a system includes customers, organizational processes, leadership and management responsibilities, organizational improvements etc. (Figure 2.1). Quality is the way for organizations to strategically differentiate themselves from the competition [6].
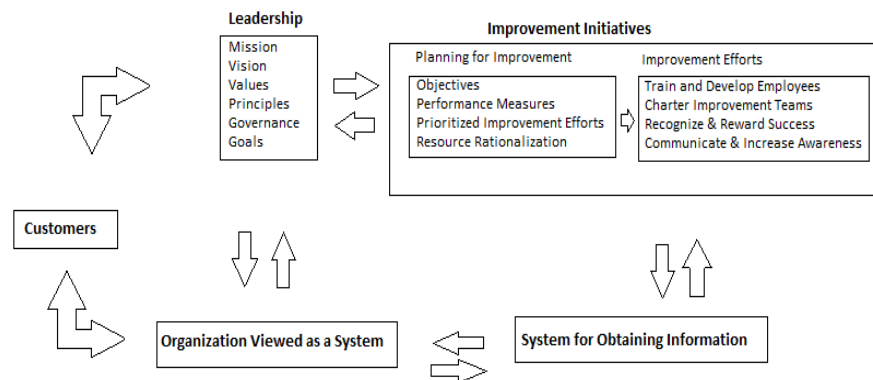
Figure 2. 1 Quality System

(taken from University of Houston website. [7])

Quality must be ensured in all areas of the organization including people quality, process quality, communication quality, and strategic quality etc. Organizations achieve quality only by considering all features and requirements of quality and then have ability to be mature in terms of quality. The primary focus must be the management part of quality while quality system is applying to all levels of the organization [6]. Before achieving a successful quality management, it is vital to be aware of what the quality means and how it adds a value for the organization which is the fundamental requirements of quality. It is both important for managers and all

the employees within the organization. Then, it will be easier to be an expert in quality and in managing the quality.

2.2. Quality Awards & Models

2.2.1. Malcolm Baldrige National Quality Award (MBNQA)

The Malcolm Baldrige award was a program established in 1987 by congress to raise awareness for the importance of quality. The award can be applied to both service and manufacturing organizations. That makes the criteria interpret difficult [8]. When companies apply for the Malcolm Baldrige award, they have to go through a rigorous process with many stipulations for entry. An independent board of examiners researches the organization and follows specific criteria for this evaluation.

The criteria evaluation considers two dimensions of the organization. Actual business performance is the basis of 45% of the evaluation, while 55% of the evaluation is based on how the organization is run. The evaluation concerning results is based on the results that the company keeps on its performance in areas such as financial, customer satisfaction, product and service quality, and supplier performance and productivity. There are seven areas that are specifically needed for winning the award. These areas include Leadership, Strategic planning, Customer and market focus, Measurement, analysis, and knowledge management, Workforce (Human resource) focus, Process management, and Business results Figure (2.2). Each category has different weights according to their importance in the overall evaluation [8]. By using those weights, an organization gets a score regarding its performance on these categories.

For the scoring scale, MBNQA has those scores for each category:

- Leadership – 110 points,

- Strategic planning – 80 points,

- Customer and market focus – 80 points,

- Measurement, analysis, and knowledge management – 80 points,

8

- Workforce focus – 100 points,

- Process management – 100 points,

- Business results – 450 points.

If all other factors are aligned with the organizations plans, and the company has a good plan for managing quality, it will show up in the business results, this is the reason for its high point total.

The MBNQA can help an organization by having the entire organization rally around a common goal, by creating clear objectives to improve quality, and the national recognition should the company win the award. In addition to that, an organization can find out exactly where to focus its improvement efforts in the next few years.
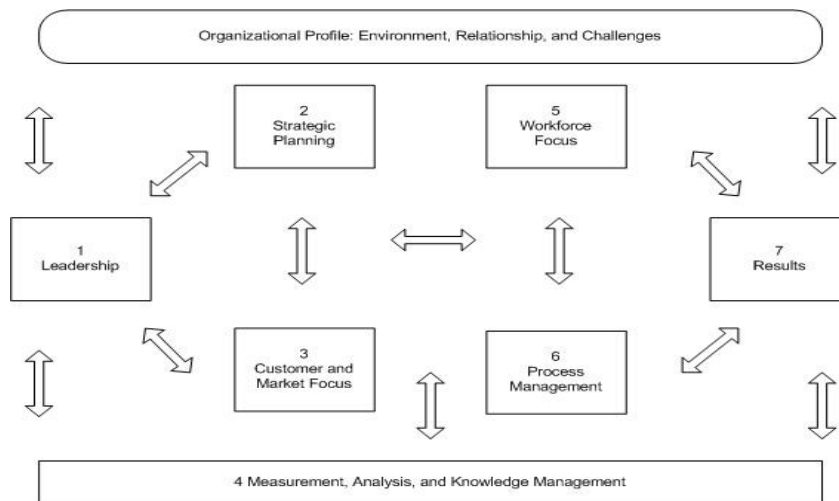
Figure 2. 2 Seven Criteria of MBNQA

(taken from Measuring Business Excellence (1997). [9])

2.2.2. IIE Award for Excelling (IIEAE)

IIE is an international non-profit and professional society dedicating to advancing the technical ad managerial excellence of industrial engineers. IIE has different awards for organizations and one of them is Award for Excellence in Productivity Improvement. Organizations have been awarded with significant achievements in

productivity or quality. All companies and organizations, including subsidiaries or divisions within a company or organization, can apply the award [10]. The purpose of the award is to recognize, reward and disseminate information on the application of excellent efforts resulting in long term continuous improvement. The award's ultimate goal is the improvement of private and public organizational competitiveness [11].

IIEAE has 5 areas to be judged the applicants (Table 2.1). The applicants of the award are required to complete a nomination form in which they describe the five areas by answering the questions for related areas in the nomination form. These five areas to be questioned are shown in the Table 2.1. The definitions in the table are basically the required information for the related area.

Table 2. 1 Five areas of IIEAE with definitions

5 Areas	Definition of each area
Strategic and Business Planning	Describes how the company's/organization's overall management philosophy demonstrates its commitment to planning for productivity and related quality improvement
Productivity and Quality Leadership	Describes the extent of personal involvement by top management in creating an environment for accelerating productivity and quality improvement efforts.
Productivity and Quality Measurement and Analysis	Illustrates the primary analytical tools used to identify root causes of problems, pinpoint areas of concentration, implementation of improvements, and measurement of results.
Productivity and Quality Management	Describes how the company's/organization's productivity and quality improvements are integrated into the management system
Measurement of Results	Illustrates trends through the use of data from the last five years and the data must not be proprietary and must be independently verifiable

The jury, then, evaluates the nomination forms and decides whether the organization has the ability to reach the award.

2.2.3. Japan Quality Award (JQA)

In 1990's, because of the rising of the MBNQA in U.S.A, Japan started to think developing a model for their companies. In 1995, they developed Japan Quality Award. With the award, they aim to support a structure for organizations that will create values needed by customers and markets, and that can maintain long-term competitiveness. They have also a goal that Japanese companies will improve their quality in the global market in the near future [12].

The model starts with four important concepts that are customer focus, public responsibility, employee oriented and unique capabilities. Under those concepts it has 7 core values (Table 2.2) and measures taken to achieve management innovation, which create performance excellence through quickly responding to business environment or market changes utilizing the concepts of the Japan Quality Award. With the assessment Criteria available to the public, the Award winner selection process can be made increasingly clear and help organizations to better learn and understand best practice.

Table 2. 2 Core Values of JQA

Core Values of JQA
1 – Customer-driven Quality
2 – Leadership
3 – Process Oriented
4 – Creating 'Knowledge'
5 – Agility
6 - Partnership
7 - Fairness

The framework of JQA consists of five basic factors, which are very common to all kinds of organizations. These are categorized in the figure 2.3.
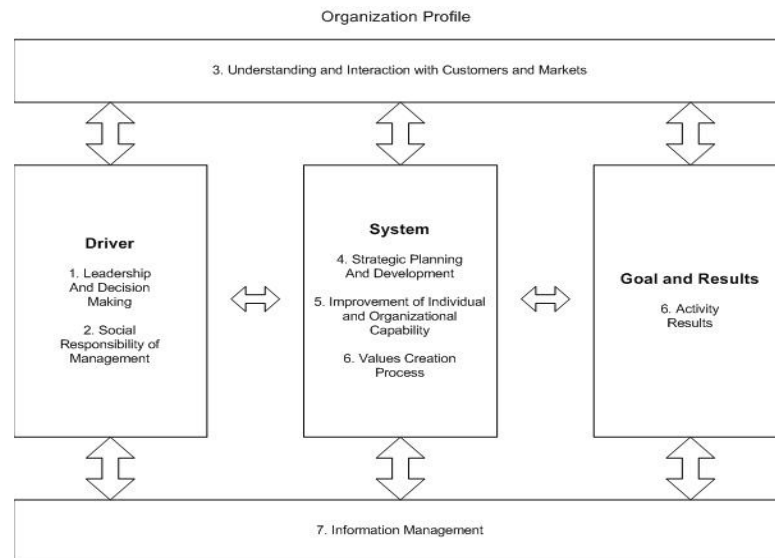
Figure 2. 3 JQA Framework

(taken from JPC-SED website. [12])

Similar to other models, JQA has a scoring scale for its categories:

- Leadership and decision making – 120 point,

- Social responsibility of management – 50 points,

- Understanding and interaction with customers and markets – 110 points,

- Strategic planning and deployment – 60 points,

- Improvement of individual and organizational capability – 100 points,

- Vales creation process – 100 points,

- Information management – 60 points,

- Activity results – 400 points.

The scoring guidelines indicate six levels of management conditions and contribute a maturity model (Figure 2.4). Each category is observed under those levels and there is no distribution of those criteria to the maturity levels. An organization with a low maturity level has uncertain objectives and uses short term remedies in situations.

There are no objective criteria to accomplish management goals through solving problems in current activities.
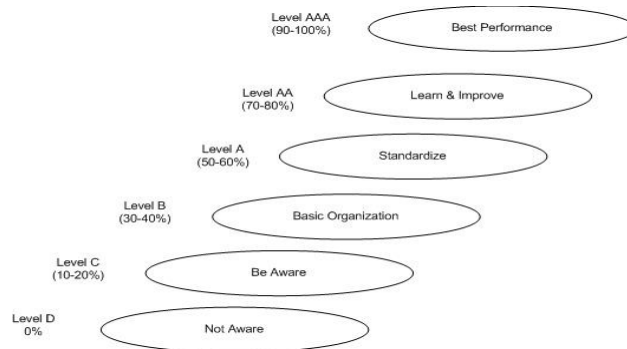
Figure 2. 4 Leveling in JQA

(taken from JPC-SED website. [12])

On the other hand, a mature organization has high overall management capability. They implement strategic elements into management, define clear processes to achieve customer value, follow this planned process, and understand the results. They know the goals and results at all times using data and are continuously learning how to effectively improve management.

A low maturity organization cannot turn around and become a high maturity organization in the short term. Organizations set goals for the next level of maturity and achieve higher maturity levels by continuous improvement.

2.2.4. ISO 9000-series – Quality Management System

The ISO family of quality standards guidelines, maybe the most well-known quality model all over the world, makes the interpretation clear. The quality system referred in the ISO standards is related to the company's overall system of management of all activities performing within the company. More specifically, those activities affect the quality of the company's products and/or services in some ways. Every activity of function in the typical ISO 9000-based quality system is essential for successful company operation [13].

ISO 9001, ISO 9002 and ISO 9003 are a tiered set of documents, which provide the benefit of choosing different levels for a company's intended ISO 9000-based quality system. For example, everything in ISO 9003 is included in ISO 9002, and everything in 9002 and 9003 is included in ISO 9001 [14]. Also, ISO 9001 has requirements beyond those in ISO 9002 and ISO 9003 when it addresses requirements for design and/or development. As such, the ISO 9001 is the most comprehensive directive [13]. ISO 9001 has 20 quality system elements (Table 2.3) and 8-step implementation process (Table 2.4).

Table 2. 3 20 elements of ISO

The 20 ISO 9001 System Elements	
1. Management Responsibility	11. Inspection, Measuring, & & Test Equipment
2. Quality System	12. Inspection and Test Status
3. Contract Review	13. Control of Nonconforming Product
4. Design Control	14. Corrective and Preventive Action
5. Document and Data Control	15. Handling, Storage, Packaging, Preservation, & Delivery
6. Purchasing	16. Control of Quality Records
7. Control of Customer-Supplied Product	17. Internal Quality Audits
8. Product Identification and Traceability	18. Training
9. Process Control	19. Servicing
10. Inspection and Testing	20. Statistical Techniques

Table 2. 4 ISO 9001 Implementation framework with clustered clauses

Steps	Clauses in ISO 9001
1. Establish commitment (4-12 weeks)	4.1 Management responsibility
2. Define program structure (4 weeks)	4.2 Quality system Quality manual
3. Establish foundation elements (24 weeks)	4.5 Document and data control 4.14 Corrective and preventive actions 4.16 Control of quality records 4.18 Training
4. Define development methodologies (32 weeks)	4.3 Control review 4.4 Design control 4.8 Product identification and traceability 4.9 Process control 4.10 Inspection and testing 4.12 Inspection and test status

Table 2.4 (cont.)

1. Define major supporting elements (8 weeks)	4.6 Purchasing 4.13 Control of non-conforming products 4.14 Handling, Storage, Packaging, Preservation, & Delivery 4.19 Servicing
2. Define remaining supporting elements (8 weeks)	4.7 Control of Customer-Supplied Product 4.11 Control of inspection, measuring, and test equipment 4.17 Internal quality audits 4.20 Statistical techniques
3. Preliminary Audit	Audit Correction
4. Registration Audit	Audit Correction

An effective Quality Management System is the vital part for organization to become an excellent quality system. In ISO-9000 series, it is significant to understand and analyze the standard's requirements which are stated in terms of SHALLS like many models. With the capability of the QMS requirements, implementation process can be accomplished easily in ISO 9000-series.

An organization that ensures the requirements of ISO's quality management system is ready for the final point of having a deal with the official ISO 9000 series compliance approval audit. If preparatory activities have been performed as described in the quality management systems, the company should be fully capable of passing any compliance audit and receive an ISO 9000-series quality management system certificate.

2.2.5. European Foundation for Quality Management (EFQM) Excellence Model

The European Foundation for Quality Management (EFQM) Excellence Model is a self-assessment framework which can be used for organizations to measuring the strengths and areas for improvement within the organizational activities. The word "*Excellence*" has a meaning that what an organization does or could do to provide excellent products and/or services to its customers or service users [14].

The Excellence Model can be implemented by following the broad and coherent set of assumptions provided in the model. Within that, organization can figure out what

is required for improvement. Each organization can use it in its own way regarding the processes or activities within the organization.

The Model starts with the premise that Customer Results, People Results and Society results are achieved through Leadership driving Policy and Strategy, People, Partnerships and Resources leading ultimately to excellence in Key Performance Results, which are also the nine criteria of the Model [14] (Figure 2.7).
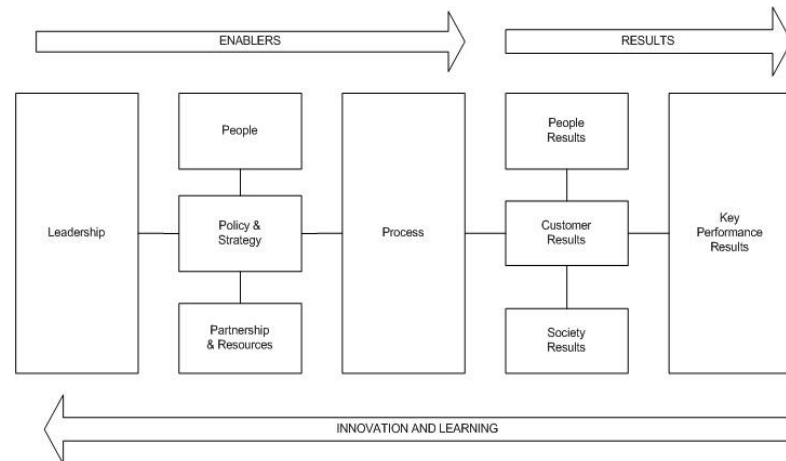
Figure 2. 5 Excellence Model Framework

(taken from Proving and Improving. [14])

An organization who is a candidate for the award has to be investigated by a team to determine the eligibility of the organization's situation to win the award. The team examines the organization's strategic challenges and implementation and then provides a review that explains the organization's strengths and weaknesses. After submitting the application form, a jury evaluates the organization's ability to receive the award by looking the reviews of organization's strengths and weaknesses.

2.2.6. Hong Kong Quality Assurance Agency Approach

The main aim of HKQAA is to develop an assessment tool for Hong Kong companies to be used in the implementation of ISO based Quality Management Systems. The idea behind that assessment again lies under some of the essential principles of quality management. HKQAA defines those principles as:

- Customer Focus

- Leadership

- Involvement of People

- Process Approach

- System Approach to management

- Continual Improvement

- Factual Approach to decision making

- Mutual beneficial supplier relationship

By using these principles and the factors related to those principles, HKQAA provides a checklist for the companies intending to apply an ISO certification. By following HKQAA approach, organizations can determine the areas that needs improvement and besides the maturity levels defined for performance levels. HKQAA also provides objective performance data platform for benchmarking [15].

2.3. Maturity Frameworks

In this part, various maturity frameworks and some quality improvement models will be discussed. Maturity Frameworks can be used for organizations to see their capabilities for each maturity level defined and for the key process areas within the levels. In this study, the quality requirements are also categorized to see their primary focus and a possible quality levels of them will be defined. These maturity frameworks basically give an idea to see where quality concepts are stated mostly regarding the levels defined.

2.3.1. Quality Management Maturity Grid (QMMG) - Crosby's 14-step Approach

Quality Management Maturity Grid was one of the first frameworks considering the quality and maturity correlation. It was developed based on the Philip Crosby's

quality management principles and can be implemented by following his 14-step quality improvement program.

The Quality Management Maturity Grid provides organizations and managers to see their capability by assessing six measurement categories. These measurement categories are:

• *Management understanding and attitude*: According to Crosby's ideas, this category emphasizes the importance of top-level participation which can be achieved by motivating people to change, accept responsibility, and discipline their behavior [4].

• *Quality organization status*: It is the organization's ability to recognize and incorporate quality as a function

• *Problem handling*: It is the ability to handle the problems within the organization and taking preventative actions.

• *Cost of quality as a percent of sales*: Quality cost calculating by fully loaded of various cost such as all scrap, warranty etc.

• *Quality improvement actions*: Including both short-term and continuing actions for quality improvement.

• *Summation of company quality posture*

 Within those measurement categories, five maturity levels defined for organizations. These are:

- • Stage 1 - Uncertainty

- • Stage 2 - Awakening

- • Stage 3 - Enlightenment

- • Stage 4 - Wisdom

- • Stage 5 – Certainty

QMMG provides these maturity levels for each of the measurement categories. It means that the capability of each measurement categories and organization's behavior in those categories are different at each level.

In *"Uncertainty"* stage, there is no comprehension of quality as a measurement tool for the organization. There are no organized quality improvement activities and problems are handled by experiences. The cost of quality is unknown and there is no awareness of quality.

In *"Awakening"* stage, top management recognizes that quality management may be of value and a quality leader is appointed to manage the quality. Problems are handled for major issues but long-range solutions are not solicited. Activities are limited to short range, motivational efforts. The actual quality cost is 18%.

In *"Enlightenment"* stage, top managers become more supportive and helpful. Quality manager has a role in management. Problems are resolved by taking corrective actions. Cost of quality is calculated as 12%.

In *"Wisdom"* stage, top management participates in and understands quality. Problems are identified early and effective resolving systems take place. The quality improvement program is continual. The cost of quality is calculated as 8%.

When organizations can be considered as stated on *"Certainty"* stage (Stage 5), it is understood that quality is an essential part of the organization. All problems are prevented and quality improvement is normal and continual. Organization knows why it does not have problems with quality. Cost of quality is known as 2.5% [4]. As implementing the QMMG, 14-step quality improvement program that defined by Philip Crosby in his book *"Quality is Free"* can be followed. These 14 steps are named as:

1 – Management Commitment

2 – Quality Improvement Team

3 – Quality Measurement

4 – Cost of Quality Evaluation

5 – Quality Awareness

6 – Corrective Action

7 – Establish an Ad Hoc Committee for the Zero Defects Program

8 – Supervisor Training

9 – Zero Defects Day

10 – Goal Setting

11 – Error Cause Removal

12- Recognition

13 – Quality Council

14 – Do It Over Again

Crosby's 14-step approach is also very useful for quality managers to get their organization on track by focusing not only short-term strategies but also long-term employee participation [16].

2.3.2. Quality Management Maturity Model (QMMM)

Quality Management Maturity Model has been developed as a guidance and policy in support of the managing quality aspects of UK Mod Defense Acquisition. It was again developed based on the Crosby's quality principles. The QMMM can also be used by organizations and businesses to see the maturity of their processes and to benchmark them [17].

QMMM has 10 process areas. These process areas have different capabilities in each level and within that, the capability of each process can be determined. Unlike some maturity models, QMMM has definitions for each process for each maturity levels and so the main aim is to see the capability of the processes not the whole organization.

10 process areas named as:

- Customer Focus

- Leadership

- Involvement of People

- Process Approach

- System Approach

- Continual Improvement

- Factual Approach

- Supplier Relationships

- Risks

- Benefits

These 10 process areas are defined for each maturity levels within their capabilities. The maturity stages are stated as:

Developing, Performing, High Performing, and Excelling.

Definitions of each 10 process areas under those five levels of maturity stages are shown in the Table 2.5.

Table 2. 5 Quality Management Maturity Model

STAGE	Beginning	Developing	Performing	High Performing	Excelling
Customer Focus	Customer requirements not fully understood.	Customer requirements are identified but not fully understood.	Customer requirements are being satisfied.	Customer requirements and expectations are being satisfied.	Customer requirements and expectations exceeded.
Leadership	Organization has no clear direction or purpose.	Organizational vision, policies and strategic objectives defined and promulgated at senior management level.	Awareness, and commitment, throughout the organization of vision and strategic objectives.	Organization needs minimal leadership to maintain purpose and direction.	All areas of the organization contributing to leadership.

Table 2.5 (cont.)

Involvement of People	People's abilities not identified or recognized.	People's skills and abilities being identified.	People's skills and abilities being used to the benefit of the organization.	People's skills and abilities are matched to organizational objectives.	People are fully involved and their abilities are used to the benefit of the organization.
Process Approach	Process approach not adopted by the organization.	Understanding of the benefits of process approach. Key processes identified.	Key processes identified and mapped. Process metrics being identified.	All organizational processes identified, mapped and performance monitoring in place.	All activities and related resources are managed as a process.
System Approach	No understanding of interrelated processes.	Key processes reviewed and interdependencies identified.	Interdependent processes mapped.	All interrelated processes are identified and being managed.	Interrelated processes are subject to review and coherence with strategic planning.
Continual Improvement	Continual improvement not being considered.	Continual improvement process being developed / implemented.	Continual improvement being applied to key processes and benefits monitoring in place.	Evidence being generated that continual improvement is benefiting organizational efficiency and effectiveness.	Continual improvement culture embedded within the organization and used as the cornerstone of organizational efficiency.
Factual Approach	No data and information collection process in place.	Some data being collected but not being used to influence decision making.	Data being collected against key process and being used to inform decision making.	All decisions are based on the analysis of data and information.	Analysis and data collection process being used to predict future trends and govern actions.
Supplier Relationships	Supplier treated as an outside entity and not considered integral to organizational efficiency.	Strategy being developed to involve Supplier with organizational issues.	Supplier contributes to the decision making process but only across the contractual boundary.	Supplier advice and opinions are sought during pre-contract phases.	Supplier is considered as a major stakeholder in the team, whose views and opinions are sought and valued.

Table 2.5 (cont.)

Risks	Poor or unpredictable results resulting from no systematic or customer focused approach.	Loss of customer confidence. Dissatisfaction amongst the team. Inefficient processes.	Decisions made on the basis of limited information. Full use of supplier skills not being made.	Continual improvement process lapses. Stagnation.	Complacency.
Benefits	None !!	Customers focus becoming prevalent. Organizational objectives generated. Understanding of organizational efficiency.	Staff committed to organizational vision and objectives. Staff abilities recognized and used to maximum organizational effect. Continual improvement process generating results.	Satisfied customer. Effective control of business process. Decision making based on factual information.	Delighted customer. Full involvement and commitment of all the team. Continuous improvement process results in maximum organizational efficiency.

As can be understood from above figure, the model can be considered as a process improvement model. The name of stages is in order to the amount of improving the processes. For example, for Customer Focus process, Customer requirements are not fully understood at the begging level, however, the requirements and expectations exceeded at the excelling level [17].

2.3.3. Control objectives for information and related technologies (CobiT)

As mentioned fluently throughout in this study, IT has become essential in the support of growing the businesses. Now a days, the extend usage of IT requires some specifications and requirements to use it effectively and efficiently. One of the specific focuses about that issue is the *IT Governance* concept. *IT Governance* can be performed only with a high quality leadership and organizational structures and processes [18]. The IT Governance Institute (ITGI) states one of the similar definitions of *IT Governance* as:

IT Governance is the responsibility of the Board of Directors and executive management. It is an integral part of enterprise governance and consist of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategy and objectives [19].

ITGI formed in 1998 because of the increasing criticality of information technology to enterprise success. Today, they have become a leading reference on IT governance for the global business community with helping enterprise leaders to understand and have the tools to ensure effective governance over IT within their enterprise [18]. ITGI's success behind being a leading reference on IT governance mostly came from their successful framework called CobiT. They primarily designed CobiT for IT managers to use it as a guide or a best practice while governing IT. In the global world, many IT facilities have used CobiT to control and govern their processes within the organization.

Generally speaking, CobiT's mission can be state as; it is an IT governance framework for IT managers, professionals, and business managers to use in aligning business and IT.

CobiT's basic principle is providing the required information for enterprise to achieve the enterprise's objectives and to invest in and manage and control IT resources using a structured set of processes to provide services within that (Figure 2.6).
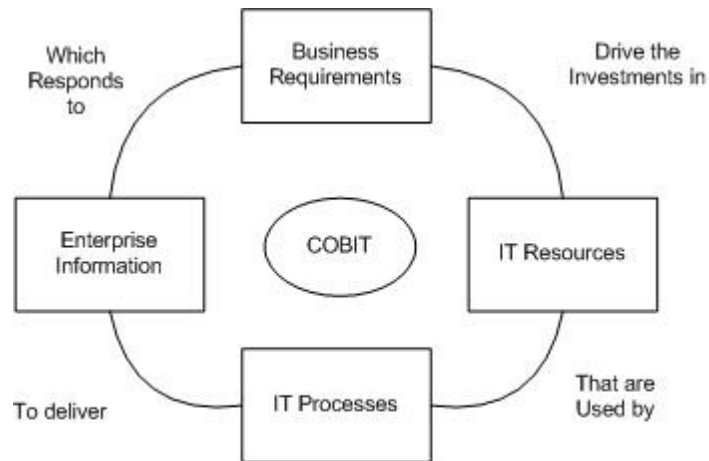
Figure 2. 6 Basic CobiT principle

(taken from Cobit v4.1 (2007). [20])

Under that basic principle, CobiT provides 34 process areas within 4 IT domains (Figure 2.7). Those 34 processes are defined regarding the all processes that can be performed for all IT facilities. For small organizations, it is not required to perform the CobiT framework for all of the 34 processes. Every organizations use CobiT as its own way regarding their processes matched with the ones in CobiT.

In this study, CobiT's Manage Quality process under the Plan and Organize (PO) domain was taken as priority information to determine the basic quality requirements. CobiT's manage quality part ensures the alignment between the IT and quality concepts. Thus, Manage Quality provides ensuring continuous and measurable improvement of the quality of IT services [20]. There are 6 control objectives defined for this process. These are:

- Quality Management System,

- IT Standards and Quality Practices,

- Development and Acquisitions Standards,

- Customer Focus,

- Continuous Improvement,

- Quality Measurement, Monitoring and Review.
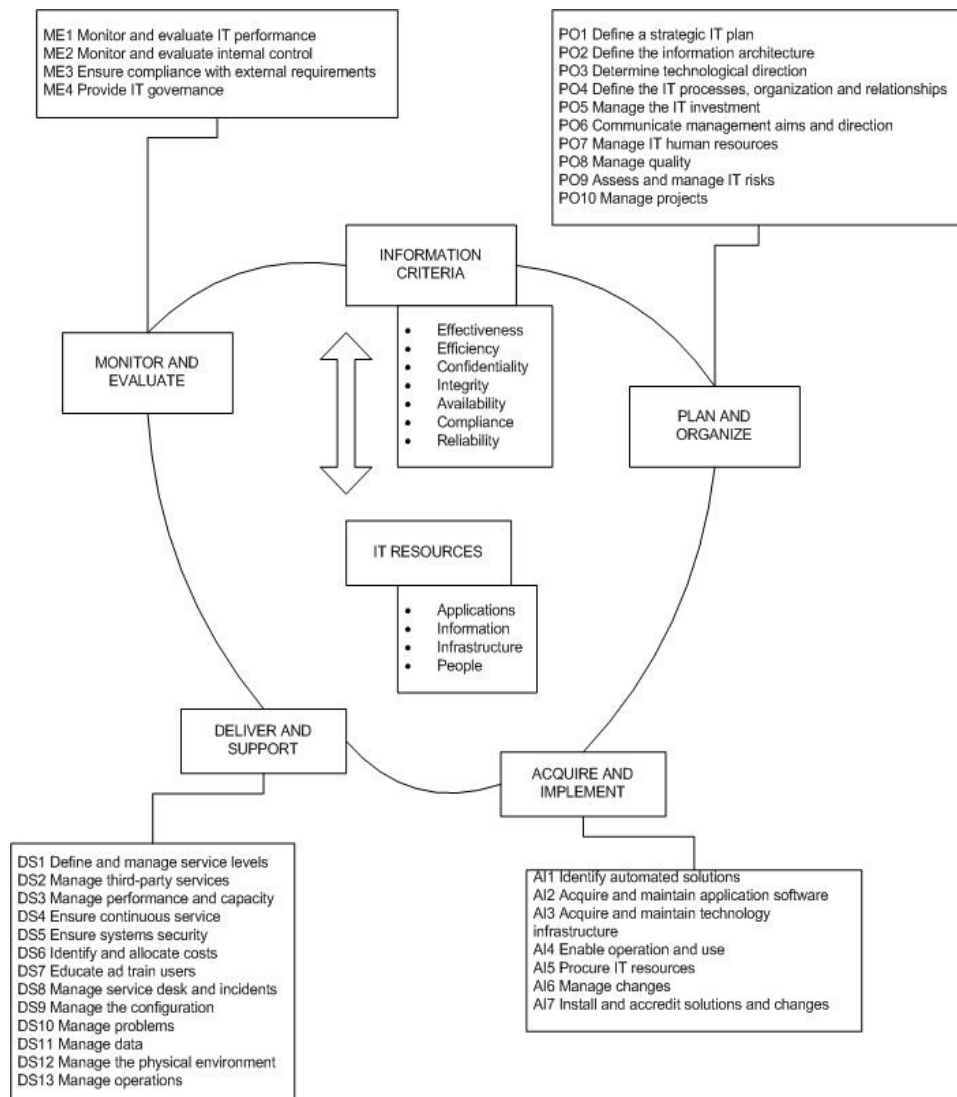
Figure 2. 7 Overall Cobit Framework including 4 domains and 34 processes

(taken from Cobit v4.1 (2007). [20])

Benchmarking and self-assessment tools are required for IT governance in response to the need to know what to do in an efficient manner [18]. It can be done by measuring the maturity of organizational processes to see where the organization is.

CobiT also provides a measurement-driven approach to its processes. In CobiT, there is an incremental measurement scale, range from 0-5, for each of the 34 processes.

The scale is associated with generic qualitative maturity model descriptions ranging from 0: *Non-existent* to 5: *Optimized* (Table 2.6).

Table 2. 6 Maturity Levels with definitions in CobiT

Maturity Level	Definition
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 different people undertaking the same task follow similar procedures. 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

The maturity models and definitions are generated from a qualitative maturity attribute table (Appendix E) in which the attributes are added in an increasing manner through the levels.

CobiT's attribute table plays an important role in this study especially while categorizing and perform leveling of quality requirements.

All in all, CobiT's maturity models are designed to be always applicable for many organizations with providing a description an enterprise can recognize as best fitting its processes. It does not primarily focus on coverage and depth control of processes but just focus on maturity [20]. It is, generally speaking, usage of Cobit as controlling the processes within the organization makes also the organization become mature or state on higher levels of maturity.

2.3.4. e – CMM : e-Organization Maturity Model

e-CMM is the model developed by Ergin M. Hande [21] in her master thesis called *Measuring Maturity Level of E-Transforming Organizations* for the graduation of Information Systems Department at METU. The model was formed by inspiring from the well-known maturity model of Software Engineering Institute (SEI), named Capability Maturity Model (CMM). CMM describes a model that can be used as a guide for organizations to follow a logical path for continuously improving the processes and practices in a cost-effective way. However, CMM is a maturity model only for software processes and practices. The e-CMM is a maturity framework for e-transforming organizations and it provides the key elements of how to be an effective and mature e-transforming organization with a continuous improvement in the management, development, and application of an information systems organization emphasizing the people, process and technology all together [21].

The e-CMM model is also helpful for organizations to reach the full mature level by determining the current maturity level at first and then adding the improvement actions on the next layer to the top of the current state.

In addition to that, organization will gain several benefits in case of implementation of e-CMM model. E-CMM model provides organizations to increase capability and maturity not only the organization itself but also with partners, internal and external

customers. Organizations have opportunity to measure their processes and products. All in all, organizations change in the culture for improvement [21].

e-CMM model has the identical structure as SEI's CMM model in maturity level formation (Figure 3.1). At the top of the structure 5 maturity levels are defined and if an organization reaches the level 5, it will be considered as full mature organization. Persse [22] defines "Full maturity in CMM" as organization produce quality software in predictable and reliable manner with placing the practices, policies and disciplines.

Under these maturity levels, e-CMM has 17 key process areas (KPAs) defined for the process improvement. KPAs are distributed to the levels and it is required for an organization to perform activities defined within the processes and achieves a set of goals to complete that key process area [23]. Figure 2.8 shows the 17 KPAs of e-CMM model. Each KPA has a set of related activities which identifies that area so performance of these activities result in obtaining the goals of the activity and so doing the key process area. The movement from each maturity level, organizations is considered as more organized and developed. The definitions of each maturity level can be seen on Table 2.7.
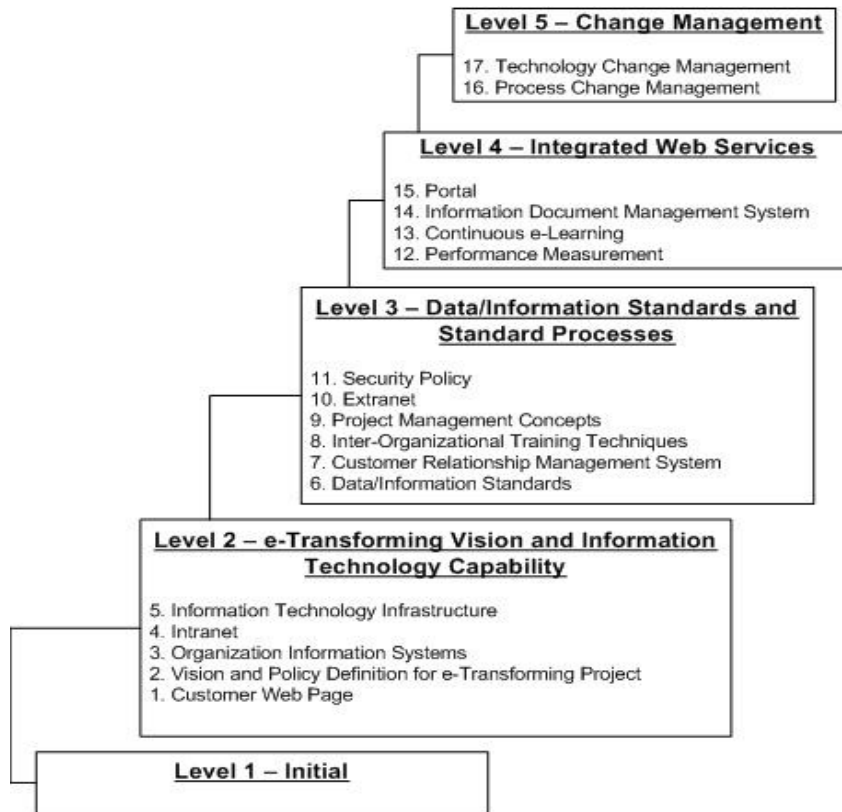
Figure 2. 8 Key process areas of the e-CMM by Maturity Level

(taken from Ergin's M.S. thesis [21])

Table 2. 7 Maturity Level definitions in e-CMM

	Maturity Level	Definition
Level 1	**Initial**	Processes are ad-hoc and unpredictable. There is no control mechanism and improvement in the processes. The flow of the process is reaction-driven. Technological infrastructure is at basic level.
Level 2	**e-Transformation Vision and Information Technology Capability**	A Transformation vision is set in the organization. Milestones and metrics are defined for the development and improvement. Repeatable capability of work flow is satisfied with the effort of implementing improvement practices. Technological infrastructure is maintained and supported.

Table 2.7 (cont.)

Level 3	Customer/Citizen Centered and Data Standards	The organization identifies its core competencies and skills required to perform its business. The usage of resources is planned accordingly. The needs and expectations of both internal and external customers are satisfied. Data is shared with the staff and partners.
Level 4	Integrated Web Services	The strategic advantages of the organization are identified by examining the strengths and weaknesses of the organization and benchmarking. Preventative actions are taken. Individuals and managers are trained themselves. The customers are considered as shareholders of the organization.
Level 5	Change Management	Continuous focus on improving processes. Technological changes are followed and evaluated for the necessary changes in processes. Efficiency data is evaluated to determine the needs of organization.

For this study, e-CMM maturity levels are taken as base while leveling quality requirements. Quality requirements will be categorized into five groups, which show different quality levels regarding the main focus of the requirements.

2.3.5. IT Services CMM

IT Services CMM is a maturity framework for the IT services providers and developed based on the CMM. The structure is same as the CMM model as consisting of five maturity levels containing key process areas.

The main aim of the model is to achieve a complete service organization in IT industry with providing all service delivery activities. The model does not measure the maturity of individual services or projects. It is designed for the whole service organizations [24].

The model, as mentioned, consist of 5 maturity levels and within these levels, there are 22 KPAs defined. These KPAs are categorized under 3 process categories which are Management, Enabling, and Delivery (Table 2.8)

Table 2. 8 KPAs assigned to maturity levels and process categories

Process categories Levels	Management Service planning, management, etc.	Enabling Support and standardization	Delivery Actual service delivery
Optimizing	Technology Change Management Process Change Management Problem Prevention		
Managed	Quantitative Process Management Service Quality Man. Financial Service Management		
Defined	Integrated Service Management	Organization Service Definition Organization Process Definition Organization Process Focus Training Program Intergroup Coordination Resource Management Problem Management	Service Delivery
Repeatable	Service Commitment Management Service Delivery Planning Service Tracking and Oversight Subcontract Management	Configuration Management Service Request and Incident Management Service Quality Assurance	
Initial	Ad hoc processes		

The KPAs are assigned to different maturity levels such that the lower level processes provides a pre-requirement for the upper level processes. For an organization being considered as that level, it is firstly required that the lower level processes from that level should be completed.

An organization that performs well and gets a high score from IT Service CMM assessment will be considered as [24]:

- IT services are delivered in quality and satisfying customers,

- Services are provided in cost-effective way,

- Different services can be integrated and combined with the current ones and providing successfully

- Service improvement can be done in a customer-focused way.

2.3.6. International Quality Maturity Model (IQMM)

IQMM is another model was developed by *Qimpro*, the pioneer of quality movement in India, and it can be used to measure, benchmark, and certify the quality of management performance [25]. It is not an actual maturity driven model meaning that there are no any maturity levels or stages. However, it has a scoring scale which gives the overall rating of quality of management system or performance. The model has 15 business elements (Figure 2.9) which are derived from fundamentals of quality management. Like the other developed quality models, IQMM was developed by inspiring the well-known quality models such as MBNQA and EFQM.
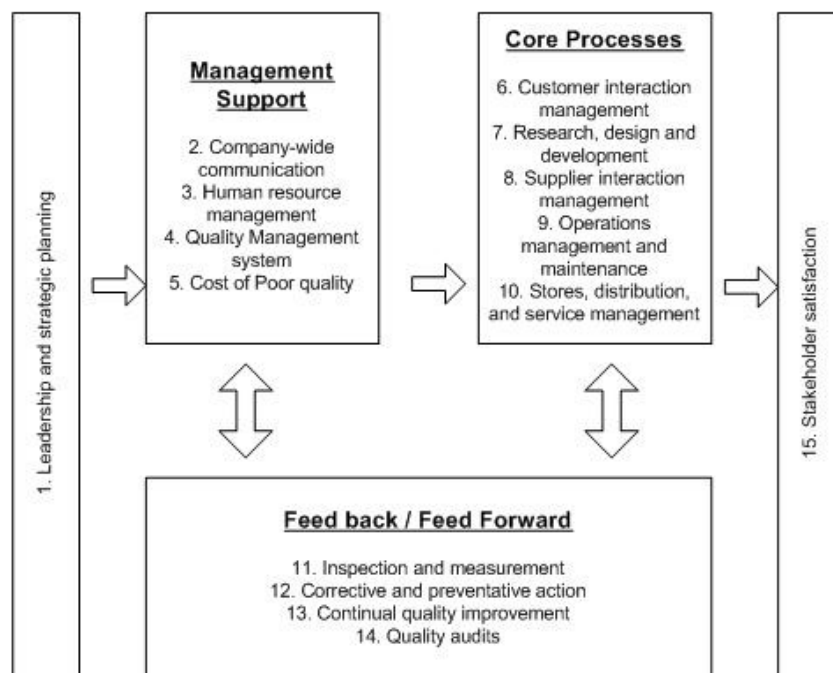
Figure 2. 9 15 business elements of IQMM

(Qimpro Standards Organization. (2001). [25])

Measurement is done by performing a scoring analysis by IQMM scoring software developed by Qimpro Standards Organization. Each 15 business elements has different weights and is scored on a scale level 1 to 10. After scoring the elements, the overall rating of quality management system or performance can be determined.

2.3.7. Quality Maturity Model (QMM)

Quality Maturity Model (QMM) was developed by Wilson and Town [26] for benchmarking and library quality maturity. The model defines the culture of quality as *"Doing things right and doing the right thing"* [26]. The model again has several core concepts:

- *Management of the organization*: includes strategic plan generation, management alignment, progress monitoring, and performance measurement.

- *Environmental sensing*: includes customers, gathering feedbacks, involvement of staff and contribution to profession.

- *Learning organization*: includes staff empowerment, involvement and encouragement.

- *Attitude to change*: includes perception of drivers for change

- *Attitude to quality*: includes definition of quality and quality improvement

- *Leadership:* includes vision, value setting, inspiration and motivation.

- *Investment in staff*: includes training.

- *Alignment:* includes business alignment, structure and communication

The model has a five-level maturity stages. Like most of the maturity frameworks observed in this study, QMM has no distribution of those core concepts to maturity levels. Instead of that, every maturity level has its own definition and the different capabilities of those concepts. Table 2.9 represents the characterization of the maturity levels of QMM.

Table 2. 9 Maturity levels and their specification of QMM

Maturity Level	Characterization
Level 1 – Initial	Quality achieved in an ad-hoc way. Customer satisfaction is unpredictable. Training is required. Quality depends on the capabilities of individuals.
Level 2 – Repeatable	Quality policies and procedures are established. Basic quality management processes are established.
Level 3 – Defined	Organizational strategy is defined and documented. All works are derived from the defined strategy. Training is performed and programmed.
Level 4 – Managed	Detailed measures of the quality processes are collected. Changes are implemented to improve the quality of products and/or services. Customer satisfaction is provided.
Level 5 - Optimizing	Continuous improvement is enabled. All staff is encouraged to continuously improve themselves. Organization is able to identify the weaknesses and strengths. Best practices are identified.

To sum up, the model can be easily followed to improve the quality processes. The 8 concepts defined in the QMM are the main focus for the organizations used QMM model. The more they have capable of those concepts, the higher the level of maturity will be.

2.4. Information Systems Research Methodologies

For the development of this study, there are two methodologies used. These are qualitative research methodologies and quantitative research methodologies.

2.4.1. Qualitative Research

Patton[27] defines the qualitative data as detailed descriptions of situations, events, people, interactions, observed behaviors, direct quotations from people about their experiences, attitudes, beliefs and thoughts and excerpts or entire passages from documents, correspondence, records, and case stories.

Qualitative research methods helps researches understand people and social and cultural contexts within them. Besides, qualitative data can be considered as positivist, interpretive and/or critical [28].

In IS studies, the most used qualitative research methods are action research, case study research, ethnography, and grounded theory, which are stated and explained in Table 2.10 (taken from Ergin's M.S. thesis [21]).

Table 2. 10 Qualitative Research Methods

Research Method	Description
Action research	In a cyclical process, a link between the theory and practice is created and by using data feedback, changes in the processes occur for practical problem solving and expanding the scientific knowledge.
Case study research	If the context boundary is not clear, case study research helps to investigate phenomenon in real-life context.
Ethnography	Ethnographic research deals with social and cultural occurrences.
Grounded theory	Grounded theory is an ethnographic approach where the knowledge is taken out from the grounded data, meaning the theory is generated from observation. The explanation, properties and the relationship between the categories as a consequence of the theory.

2.4.2. Quantitative Research

In Quantitative research, the causes and the relationships between the actions are mainly discussed. Surveys, laboratory experiments, simulation, and process and mathematical models are some of the methods including in the quantitative research [21].

In quantitative research, studies generally starts with statements of theory from which research hypothesis are derived. Then, an experimental design is established. This experiment is required to measure the variables in question while controlling for the effects of selected independent variables. After the measurement process, it is usually expected to do statistical analyses to reveal the findings. These analyses will determine whether the hypothesis is confirmed or countered [21].

These procedures are deductive in nature, contributing to the scientific knowledge base theory testing. This is basically the nature of quantitative methodology.

CHAPTER 3

QUALITY REQUIREMENTS AND ASSESSMENT

The importance of quality has rising in IT industry and it becomes one of the important things in business environment. Without providing quality, an IT facility in an organization cannot be satisfied or satisfy its customers and shareholders. Quality should be a strategy or a system for an organization. But, many organizations do not know where they start to ensure quality. Generally speaking, quality can be defined by using specifications, standards, and other measures. This makes the point that quality can be defined and measured [29].

A Quality Maturity Framework (QMF) is a model that provides organizations to follow a logical path for improving quality in their processes, people, communication and, basically, all areas within the organization. It provides the general processes, practices, and activities that an organization reaches the maturity in terms of quality.

The first step before developing such a framework is to determine the quality requirements. The processes, activities, and practices in a quality maturity framework will be driven from those quality requirements.

Thus, it is first required to determine the general quality requirements to define the quality and show the IT facilities that what their quality requirements are. When an IT facility knows their current status related to quality requirements, it can make a conclusion about their quality level and the areas that need improvement.

In this chapter, the determination and definition of core quality requirements will be discussed in detail.

Besides, the possible leveling of the quality requirements will also be shown and the evaluation of the quality assessment survey will be discussed in detail.

3.1. Defining quality requirements and assessment

In the total quality approach, it is stated that total quality consists of improvement activities and performance being at each level and involving everyone in the organization. One of the approaches to understand the concept is Dulworth & Taylor's [30] "Three-Legged Stool of Total Quality" (Figure 3.1)
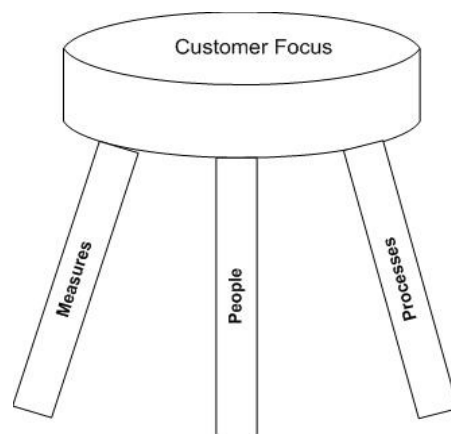
Figure 3. 1 Three Legged-Stool approach to total quality

(taken from Goetsch. [29])

The main approach of the stool is customer focused. This means that customer is the leader or in the "driver's seat" in the approach of total quality [29]. Measures, people, and processes are the core legs of the stool. Measures defines that quality should be measured. People defines that quality does not just correlates to products or services. People must be involved. And, processes define that processes must be managed, improved.

During the literature survey, it is clearly seen that all of the quality models, awards, and frameworks have a customer-focused strategy. To achieve this strategy, it is first settled that people in the IT facilities should be aware of what the quality is. Besides, the processes related to IT quality and quality management and measuring should be performed.

Quality requirements can be defined as any requirement that specifies a minimum required threshold on a quality measure of quality criteria which characterize a quality factor. In this study, 20 core quality requirements defined from the literature survey performed during the study. While determining the requirements, following procedures were performed:

- Comparison of the quality models, awards and frameworks in detail to determine and define the core quality principles, features and values which are seen fluently.

- Interviewing with the quality experts to understand and define the quality requirements

After determining those requirements, factors affecting those will be defined to develop a quality assessment questionnaire. The factors affecting the quality requirements were also found from the literature survey and also interviews with some quality experts.

Quality assessment survey questionnaire consists of those factors affecting the quality requirement and IT facilities must ensure the related factors to meet each of the quality requirement.

A quality assessment basically shows the IT facility that:

- In what manner the quality requirement is satisfied for that facility,

- The areas need improvement,

- The things to be done to meet the requirement by showing which factors are missing to meet the requirements.

3.2.   20 quality requirements and the factors affecting

As previously mentioned in this chapter, the main aim of this study is to define requirements for quality maturity frameworks for IT facilities in organizations. Quality requirements were found by comparison of quality models, awards and frameworks, which have already been discussed in Chapter 2. Comparison provides to see the identical quality features and also the important ones among the models. It

also provides to see the factors affecting those quality features and helpful to determine specific factors for the quality requirements. The comparison matrix of available models can be seen in table 3.1.

Table 3. 1 Difference in quality features in various quality models, awards and maturity frameworks

Features	M1	M2	M3	M4	M5	M6
Leadership	x	x	x		x	x
Involving, aligning & empowering people				x	x	x
Developing and Documenting Standards & Policies & Principles	x			x	x	
Communication				x	x	
Managing partnership & resources			x	x	x	x
Quality Management		x		x		
Information sharing and knowledge management	x		x		x	
Auditing				x		
Managing Processes & Products & Services and its requirements	x	x	x	x	x	x
Customer Relationships/Focus	x		x	x	x	x
Continuous Improvement				x		x
Measuring, monitoring & Reviewing		x		x		
Benchmarking						
Customer/Employee Satisfaction			x	x		
Strategy planning and goals	x	x	x		x	
Awareness & Training		x		x		
Innovation		x	x			
Operations Management		x				
Best Practicing						

M1: Malcolm Baldrige National Quality Award (MBNQA)

M2: Institute of Industrial Engineers Award for Excelling (IIEAE)

M3: Japan Quality Award

M4: ISO 9000-series Quality Management Systems

M5: European Foundation for Quality Management (EFQM) Excellence Model

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As can be seen from the above table, *Leadership, Customer Relationship and Focus, and Managing processes, products and services* are the most fluent ones that can be seen among the models. Those were almost found in all models and the principles as those are assumed to be the one of the core quality requirements. Although some of the principles can be seen rarely, namely, among the models, they are mostly included in other features. For example, *Communication, Involvement of people, or Awareness & training* can be seen half of the observed models however, other models have these features in some extent in other quality features such as *Information sharing and knowledge management.*

In this study, quality requirements are defined regarding the same principle that some of the requirements are included in the other ones or some of them are included in different quality requirement. There can be also differences in names and content when compare to available models, however, the main aim is to provide organizations to achieve consistent quality.

In addition to that, some quality requirements were defined by taking suggestions from quality and IT experts. These are the ones that mostly not included and found during the literature survey.

As mentioned in this chapter, there are 20 quality requirements defined in this study. These are shown in table 3.2.

Table 3. 2 List of 20 Quality Requirements

Number	Name of quality requirement
1	Employee Awareness
2	People & Skills
3	Championship
4	Involvement of People
5	IT Standards & Quality Practices

Table 3.2(cont.)

6	Internal Communication
7	Quality Tools
8	Quality Training
9	Quality Goals
10	Documentation for all Quality Processes
11	Customer Communication
12	Benchmarking
13	Leadership
14	Quality Management System
15	Quality Satisfaction Surveys
16	Quality Measurement, Monitoring, & Review
17	Full Customer Focused
18	Example Setting
19	Extension of QMS to the affiliated business lines
20	Continuous Improvement

After determining the quality requirements shown in above table, it is required to detail those requirements by determining the factors affecting those. These factors also show the things to be done to meet the specific requirement for an IT facility. The factors form the quality assessment questionnaire, which will be explained in the following sections of this chapter.

Each quality requirements has several factors, which are found again by observing quality models, awards and frameworks. The table 3.3 shows the general features affecting quality and also their placement in the quality requirements defined.

Table 3. 3 General features affecting quality and the distribution of the quality requirements

	GENERAL FACTORS AFFECTING QUALITY IN IT FACILITIES	INCLUDED IN THE QUALITY REQUIREMENT OF
1	Awareness of IT quality, its requirements and added-value	Employee Awareness
2	Awareness of responsibilities, skills, mission and importance of IT personnel	Involvement of People, Championship, Leadership. People & Skills, Example Setting
3	Responsibilities should satisfy goals	Involvement of People, Quality Goals
4	Information sharing and knowledge management	Involvement of People, Internal Communication, Example Setting
5	Principles, policies, and standards should exist and applied and also best practices should exist in order to minimize the possible impacts of IT quality based incidents	IT Standards & Quality Practices
6	Documentation of IT quality processes including definitions, goals, and procedures	IT Standards & Quality Practices, Documentation for all Quality Processes, Quality Goals, Quality Management System
7	Availability of best practices	IT Standards & Quality Practices
8	Stable communication	Internal Communication, Customer Communication
9	Communication techniques used by IT personnel in between	Internal Communication
10	Accessing the quality documents	Documentation for all Quality Processes, Internal Communication
11	Awareness of customer's requirements	Customer Communication
12	Satisfying customers wrt. customer's needs/requirements	Customer Communication, Full Customer Focused
13	Differentiating and segmenting customers wrt. their neeeds/requirements and providing related product/service	Full Customer Focused
14	Using the right IT personnel with the right skills and qualifications both in IT quality process management and any incidents related to any IT quality processes, which provides a powerful resource management	People & Skills, Quality Management System, Leadership
15	Quality tools used in solving problems, measuring, monitoring and reviewing quality	Quality Tools, Quality Measurement, Monitoring & Review, Quality Training
16	A plan for how to use quality tools	Quality Tools, Quality Measurement, Monitoring & Review, Quality Training

Table 3.3 (cont.)

17	Quality training plan should exist and officially performed by quality experts	Quality Training
18	Being an expert and a leader for IT personnel in terms of IT quality	Example Setting
19	Comparing IT quality and its standards, tools, and procedures to external parties to achieve the required IT quality level	Benchmarking
20	Repeated actions in finding a responsible person for an IT quality process	Championship
21	Consistency between IT quality goals and IT business goals, strategic planning	Quality Goals
22	Documenting roles and responsibilities of each IT personnel to determine the right person for an IT quality process	Leadership, Quality Management System
23	Availability of QMS including management responsibility, goals, procedures, definitions, measurement and continuous improvement of each IT quality processes	Quality Management System, Quality Measurement, Monitoring & Review, Continuous Improvement
24	Determine the satisfaction of both IT personnel and customers in terms of IT quality	Quality Satisfaction Surveys
25	A plan for how to measure, monitor and review the IT quality	Quality Measurement, Monitoring & Review
26	QMS should include the relations and processes with external parties that related to the IT organization itself	Extension of QMS to the affiliated business lines
27	A plan for continuous improvement including processes and procedures	Continuous Improvement
28	Continuous improvement should be a life style for an IT organization	Continuous Improvement

IT facilities should ensure these factors to meet each of the quality requirements. After determining these factors, it can be possible to define the requirement by the name, purpose and the factors to satisfy it. In the next section, 20 quality requirements will be defined in detail by giving the purpose and the factors affecting those.

3.3. Quality Requirements Definitions

Quality requirement is any requirement that specifies a minimum required threshold on a quality measure of quality criteria which characterize a quality factor. In this study, 20 core quality requirements defined as stated previous section.

IT facilities should satisfy the following quality requirements by ensuring the factors that are explained in their definitions:

- The purpose of *Employee Awareness* is to get IT personnel to be aware of what the IT quality is and what the importance of IT quality is. It is required to understand the quality concept and to initialize quality improvement. Awareness is not all any simple thing. Juhani Anttila [31], a quality expert, states that

> *"Awareness is a profound totality of physical, psychological, and philosophical aspects of sensations, perceptions, ideas, attitudes, and feelings related to an individual or a group having knowledge of the abstract and comprehensive object of quality of a certain item, at any given time, or within a given time spans* [32].*"*

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Knowing the definition of IT quality,

  - Knowing the IT quality requirements,

  - Knowing the added value of IT quality to the organization.

- The purpose of *People & Skills* is to make IT personnel understand and use their quality skills effectively and for the benefit of the IT facility. It is also helpful to understand the quality skills of other IT personnel and to make the right decisions when to find skilled and qualified personnel for any of the quality processes. It also provides resource management for IT facilities.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Knowing the quality skills of IT personnel,

  - Knowing and being able to find the right qualified IT personnel for an unexpected problem.

- The purpose of *Championship* is to start taking responsibilities in IT quality processes. Although this is not a formal and accountable responsibility but it allows IT staff to begin to use their knowledge and skills.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Availability of IT personnel for IT quality processes,

  - Knowing the available IT personnel with their duty and experiences,

  - Being able to find an experienced IT personnel if an unexpected problem occurs.

- The purpose of *Involvement of People* is to get involve the people in the development and improvement into the organizational IT quality processes. Remembering the three-legged stool of total quality, one of the legs is related to people. Without integrating the people into the organization, it is not possible to achieve consistent quality.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Being able to know own roles, responsibilities and importance for the IT facility,

  - Performing duties effectively and for the benefit of the IT facility,

  - Sharing knowledge and experience.

- The purpose of *IT Standards and Quality Practices* is to get the IT facility to be able to use and maintain IT standards and practices for following the strategic quality goals and achieve success. It is also helpful to determine and document the best practices for IT quality processes and practices.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Availability of IT quality standards and procedure,

- Documenting process for key IT quality processes,

- Availability of best practices.

- The purpose of *Internal Communication* is to provide a stable communication in the organization and by using advanced communication techniques.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Availability of stable communication and those,

- Availability and ability to use communication techniques such as web forms, surveys and forums.

- The purpose of *Quality Tools* is to provide the IT facility to use quality tools for the benefit of the development and improvement of IT quality processes. It also provides to document a plan or manual to for the right usage of those tools.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Availability of quality tools including all hardware and software tools to support using of quality tools,

- Availability of the plan or manual for the right usage of quality tools.

- The purpose of *Quality Training* is to educate the IT staff to increase the effectiveness and improve their quality skills and creativities. People are, as mentioned frequently throughout this study, are the organization's most valuable resource. Training does not only result in improvements in products or service quality, but also adds to personnel morale, and demonstrates to them that the organization is dedicated to helping them and investing in their future [33].

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Availability of quality training plan,

- Performing quality training officially,

- Availability and ability to use advanced methods of training such as audio visual aids, e-learning etc.

- The purpose of *Quality Goals* is to set up quality goals that organization has to focus on. Setting both short-term and long-term quality goals is also needed as an organizational strategy. Setting quality goals also makes the organization draw a path or a direction to the things that must be done to achieve and accomplish those set of quality goals.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Defining and documenting quality goals,

  - Providing the alignment between quality goals and business goals.

- The purpose of *Documentation for All Quality Processes* is to document for all quality processes including the goals and definitions of those processes. Documentation also increases the availability of quality documents and help the IT personnel reach them easily.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  - Documenting procedures, goals and definitions,

  - Availability of the documents within the IT facilities.

- The purpose of *Customer Communication* is to understand the customer requirements to be able to satisfy them with the products or services of the IT facility. Remembering the three-legged stool of total quality, customer is top of the chair. Every customer wants to be known his/her wants or needs or requirements and to communicate easily to make possible changes related to his/her requirements [34]. Similarly, to satisfy those conditions, an

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organization should communicate with its customers to understand their needs, requirements.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Understanding the customer needs,

- Communicating with the customers formally,

- Satisfying customers by providing the needs and requirements of customers.

- The purpose of *Benchmarking* is to provide a one method of measurement of the IT quality within the IT facility. Benchmarking is considered as essential for the global competition, quality awards, and breakthrough improvements. However, without a doubt, a major reason for the necessity of benchmarking is a natural evolution from total quality concept [35]. So, this requirement provides to do benchmarking both within the IT organization itself and with the external parties. It also provides to understand and experience the best practices.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Performing benchmarking with the external parties to see their quality levels and compare the IT facility's level to theirs.

- Performing benchmarking to determine and achieve the best quality standards, quality tools and procedures in the industry.

- The purpose of *Leadership* is to provide all responsibilities, roles and procedures of all IT personnel to be formal and accountable. People start to be a leader and easily share their experience with meeting this requirement. Leadership is the one of the fundamental concepts in quality management and organizational behavior and is on just about everyone's short list of prerequisites for organizational success [33].

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Attaining IT personnel for each IT quality processes and define it formally in the QMS,

- Knowing all attained IT personnel formally in the IT facility,

- Being able to find the right IT personnel who are formal and accountable in the QMS and the IT facility.

- The purpose of *Quality Management System* to provide IT facility to easily follow and manage all the processes, roles, responsibilities, goals, definitions, and tools; simply, all things related to quality. QMS is essential for the IT facility to provide a successful quality management.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Availability of an official QMS for the IT facility,

- Availability of all IT quality requirements, goals, procedures, and processes in the QMS,

- Availability of roles, responsibilities and duties of all IT personnel within the IT facility.

- The purpose of *Quality Satisfaction Surveys* is to get a feedback for IT facility about the quality of products or services provided. QSS can be applied to customers and even also the staff within the IT facility.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

- Availability of QSS,

- Performing QSS officially to the customers and IT personnel.

- The purpose of *Quality Measurement, Monitoring and Review* is to provide measuring the quality in the IT facility. Measurement is another important

concept in quality management as it is also included in three-legged stool of total quality approach. Measurement gives an idea to organization to see it level of quality and the areas that need improvement.

> - Availability of a plan to do the measurement, monitoring and reviewing processes,
>
> - Availability and ability to use the measurement tools and models including all kinds of hardware and software to support measurement activities,
>
> - Availability of all measurement, monitoring and reviewing activities, tools and methods in the QMS

- The purpose of *Full Customer Focused* is to be a customer oriented and focused IT facility as an organizational strategy. The customer is the judge of quality [33]. Full customer focused also gets an organization to provide specific products or services regarding the customer needs and requirements. Being a customer focused should be the life style of an organization.

  It involves of the following factors that IT facilities should ensure to meet the quality requirement:

  > - Providing and developing services or products regarding the customer requirements,
  >
  > - Doing customer segmentation regarding the different needs and requirements of each customer,
  >
  > - Ability to provide different products or services for each customer regarding their different needs and requirements.

- The purpose of *Example Setting* is to get IT personnel to be a guru (expert) in quality. Example setting can be defined as a role model person in terms of quality. Being an example setting makes the IT staff a positive leader for his/her colleagues and share experiences and information. It also provides the organization to manage information and knowledge more consistent and effective.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

> - Ability of obeying rules, performing duties, and to provide a best model person for the industry,

> - Ability to be a positive leader and act as a leader to colleagues.

- The purpose of *Extension of QMS to the affiliated business lines* is to extend the current QMS to a one step further. The extended QMS should include the third party relationships, processes, and procedures. This makes a fully integration of QMS into the IT facility.

It involves of the following factor that IT facilities should ensure to meet the quality requirement:

> - Availability of third party processes, relationships, and procedures in the QMS.

- The purpose of *Continuous Improvement* is to gain the ability of continually improvement of quality within the organization. Continuous improvement is a requirement for an organization to survive and fight with the competitive business world.

It involves of the following factors that IT facilities should ensure to meet the quality requirement:

> - Availability of a continuous improvement plan to support CI activities,

> - Availability of CI activities in all IT quality processes,

> - Gaining the IT facility that CI will be a life style for the quality improvement in the IT facility.

3.4.   Quality assessment and leveling of quality requirements

Quality assessment provides what the organization's status is in terms of quality. In this study, a questionnaire concluding 20 quality requirements and their related factors was used to perform quality assessment. Each quality requirement has several factors, which can be considered to be the sub-requirements to meet the general quality requirement. These factors were asked to individuals in the IT facilities while performing the quality assessment survey to see in what manner they meet the quality requirement. There are five identical choices for each question and individuals were asked to select the most appropriate one for their IT facility. Choices represent in what manner the ability of IT facility is to meet the sub-requirement. These choices will be explained in detail in the research methodology section in the chapter 4.

The main aim to do a quality assessment study is to see the requirements of IT facilities regarding the 20 quality requirements defined in this study. "Requirements of IT facilities" means that the facility's areas that need improvement and also the quality level of that facility regarding 20 quality requirements.

The survey results in determining:

- The number of IT facilities in meeting each sub-requirement regarding in what manner they have met the requirements,

- The number of IT facilities in meeting each 20 quality requirement regarding in what manner they have met the requirements.

- The performance on 20 quality requirements of each IT facility regarding the responds they gave

In this study, 20 quality requirements are leveled into five quality approaches regarding the focusing areas of quality requirements. The main aim to do such a leveling of quality requirements is that it is a proposal and a reference of how to group the 20 quality requirements defined in this study. This also provides a possible leveling approach for a future developed quality maturity framework. As can be seen in Figure 3.2 quality requirements, defined in this study, distributed to the quality

levels. Several approaches were taken into consideration for the accuracy of the distribution. These are:

- It is considered that the higher the effort required meeting the quality requirement, the higher the position of that requirement will be. This is one of the basic approaches in maturity frameworks and it is also required for this kind of leveling in quality requirements.

- The literature survey was performed to observe the available quality frameworks explained in Chapter 2. These frameworks are mostly the ones that have a leveling in their quality features. These frameworks were compared to each other to see how they categorize their quality features and how they place some identical quality requirements to the categories. The matrix of comparison of quality processes of those models is available in Chapter 5.

- IT and quality experts are also interviewed to take suggestions for the formation and distribution of the quality requirements. More detailed information is given in Chapter 5.

- Dependency analysis was also performed to see the dependencies between the quality requirements, because it is considered that some of the requirements may be dependent to each other. The findings are presented in Chapter 5.

- CobiT is one of the most well known IT frameworks and has a maturity attribute table (Appendix E). The table gives an idea of the distribution of IT processes into 6 categories. These 6 categories are related to core concepts such as *Awareness and Communication, Skills and Expertise* etc. Some of the quality requirements related to those categories could be possible to be distributed like CobiT's way.
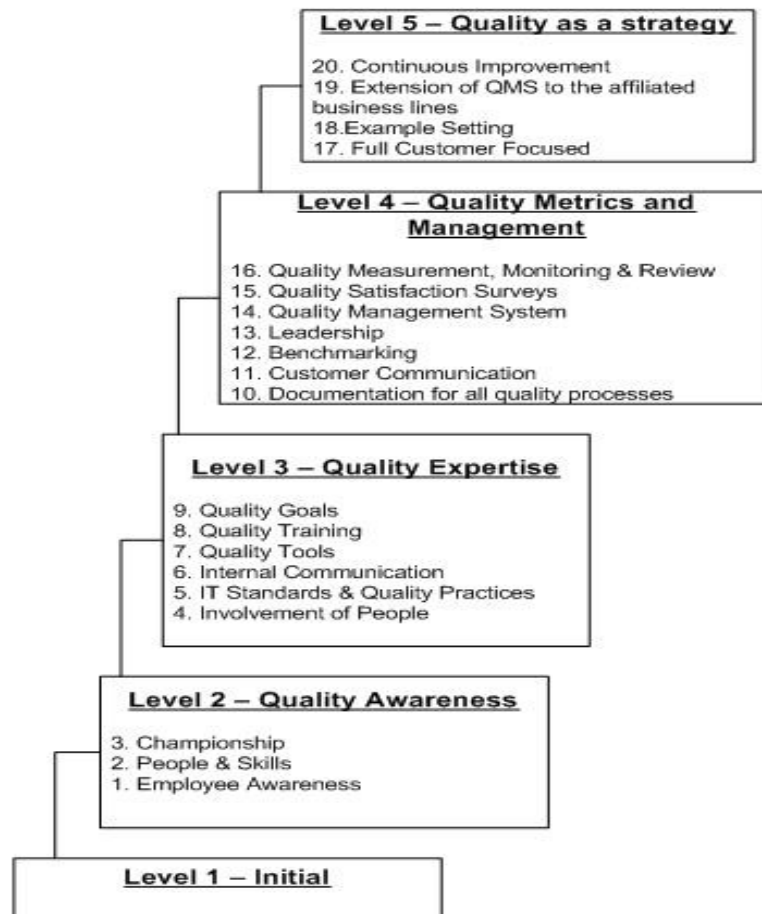
Figure 3. 2 20 Quality requirement distributed to the quality levels

The definitions and purpose of each level is explained below:

Level 1 – Initial;

Like in many improvement models, first level refers to an ad-hoc and chaotic approach. There is no quality requirements defined in that level because, it is assumed that any of the IT facilities has no ability to meet any of the quality requirements. There is no awareness of quality among the IT personnel and IT facility is not familiar the quality approach.

Level 2 – Repeatable: Quality Awareness;

The second quality level mainly focuses the awareness of quality. Being aware of quality means not only IT personnel aware of what quality is, but also they aware of their skills and how to use them effectively. So, the requirements named *Employee*

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Awareness and *People & Skills* basically provides that conscious. At this level, *Championship* requirement provides IT personnel also to take some basic management responsibilities not in a formal way but in an event-driven way.

Level 3 – Defined: Quality Expertise;

The third quality level focuses the quality expertise approach. After reaching the satisfied level of awareness in quality, IT personnel starts to use their knowledge and skills more effectively and efficiently at this level. Besides, the IT facility set quality goals and follow a logical path to reach those goals by using and maintaining IT standards, providing quality training for its employees. All in all, the quality approach becomes more formal and conscious.

Level 4 – Managed: Quality Metrics and Management;

The fourth level is maybe the most important quality level in the quality approach. This level provides important quality requirements for quality measurement and management approaches. Measuring is vital to see the status of quality and to be ready to take corrective and preventive actions. Quality Management is also very important and it uses quality assurance and control of processes as well as products to achieve more consistent quality. *Documentation of all quality processes* and using *QMS* provides controlling the processes within the IT facility. At this level, responsibilities are formal and accountable by providing *Leadership* requirement. This level needs the most effort among the others in achieving quality for an IT facility.

Level 5 – Optimizing: Quality as a strategy;

Last level refers to using quality as an organizational strategy. "Quality is not a gift" as stated by Crosby [3]. Organizations have to follow a logical path to reach it. At the final stage, quality will be improved continuously and quality is provided both for the customers and facility itself.

CHAPTER 4

A CASE STUDY: QUALITY ASSESSMENT SURVEY

The previous chapter explained the 20 quality requirements with the factors affecting them. This chapter will discuss the findings and results of the quality assessment survey conducted with a questionnaire, which was asked about 30 IT facilities in Turkish institutions.

4.1. Research Methodology

4.1.1. Steps

The research was done by following three steps:

- Preparing the Survey Questionnaire
- Interviewing with the individuals in IT facilities in organizations
- Representing of findings

4.1.1.1. Preparing the Survey Questionnaire

Quality assessment survey questionnaire was prepared regarding to the general factors affecting quality of IT facilities, which was given in previous chapter. Those factors were identified from an extensive background research in quality models, awards, and frameworks. After doing a detailed research, selected factors determined as having a potential impact on the 20 quality requirements defined in this study.

The questionnaire, presented in Appendix B, included 50 questions in total and 5 choices for each question. For each questions, it is asked to selected individual for each IT facility to select suitable choice over 5 choices for their IT facility. Each choice represents in what level that IT facility meet the specific quality requirement. In other words, choices represent the answer of the following question:

"In what degree have you met the requirement?"

The choices are the following:

- *Not at all* – The choice represents that IT facility do not meet the sub-requirement asked,

- *A little* - The choice represents that IT facility has limited ability to meet the sub-requirement asked. The limited ability is the ability that provide only event-driven approach by previous experiences,

- *To some degree* – The choice represents that IT facility meet the sub-requirement asked, however, it is partially provided. "Partially" means that only the core requirements are met.

- *Very good* – The choice represents that IT facility meet the sub-requirement asked, however, it cannot provided in all areas in the IT facility.

- *Excellent* – The choice represent that IT facility completely meet the sub-requirement asked. The level of satisfying the sub-requirement is an expert level.

4.1.1.2 Interviewing with the individuals in organizations

For the survey, 12 government organizations in which 29 IT facilities and a former government organization which is now become private with more than half percent share were selected. Thus, 30 IT facilities, in total, were surveyed for the case study. The names of the organization and IT facilities/departments are listed in Appendix A.

The organizations are selected by using direct sampling method which is a non-probabilistic sample selection. In non-probabilistic sample selection, a professional judgment is used by the auditor instead of probabilistic methods. Based on auditor judgmental criteria, each item is selected in directed sampling method. It means that the samples in the population do not have equal chance [36].

Another important concept is the determination of the sample size. In Ergin's thesis [21], it is stated that to determine the sample size, it should be determined the degree of precision and confidence level at first. There are several ways and calculations to determine the sample size depending on how to report the results of the study. In this study, results are reported neither as percentage nor as averages of the sample responding. Thus, we have difficulty in estimating percentage or standard deviation of the attribute of interest. For this kind of reporting, the following formula can be used.

$$n = \frac{NZ^2 \times .25}{[d^2 \times (N\text{-}1)] + [Z^2 \times .25]} \qquad \text{(Equation 4.1)}$$

- Where   n: sample size required

    N: total population size [known or estimated]

    D: precision level

    Z: number of standard deviation units of the sampling distribution corresponding to the desired confidence level

Likewise in the Ergin's e-CMM study [21], confidence level was taken as 88% that meant the precision level was 0.12 in this study. By using the cumulative standard normal distribution table, it was determined that $Z = 1.5548$ with a confidence level 88%. Total population size was taken as 120 since there are 120 major government organizations excluding municipalities [21]. After putting the values on the above formula, the suitable sample size was determined as:

$N = [120 \times (1.5548)^2 \times 0.25] / [((0.12)^2 \times (120\text{-}1)) + (1.5548)^2 \times 0.25)] = \mathbf{31.29}$

Therefore, the sample size was taken as 30 from above calculation.

Quality assessment survey was delivered to organizations by interviewing with IT experts within them. These individuals were selected from IT facilities in each organization. They were either a high level employee or a manager and both were fully involved in the development and improvement of IT processes and systems in the facility.

For each facility, the selected individuals were firstly given information about the topic and the survey examined. Then, they were asked about 50 questions related IT quality requirements. Each interview took about 30 - 45 minutes.

4.1.1.3 Representing of findings

In the last step, the data gathered from each interview were evaluated. Evaluation provides the number of IT facilities meet the factors regarding the five choices asked and also the general quality requirements. The quality level of IT facilities will be also evaluated according to the performance of IT facilities on the quality requirements and their affecting factors.

4.1.2. Potential Findings

As given the general features affecting the quality requirements in Chapter 3, a questionnaire was formed for conducting quality assessment survey. Questionnaire is given in Appendix B. In this part of the study, the questions in the questionnaire and the potential findings to be expected during the survey will be discussed.

In this study, quality requirements are grouped according to their main focusing areas, which are similar to the Deming's [37] Plan-Do-Check-Act circle. 20 quality requirements are leveled into four main categories.

It is expected that quality can be reached by following the order of:

Figure 4. 1 Quality Approach

As conducting the survey mostly to the public sector, some concepts and factors are expected to be found high and low. For example, the factors related to roles and

responsibilities of individuals are expected to be formal and accountable within the IT facility. However, it is expected that such factors are not formal enough but enough to perform activities and tasks in the public sector. So, it is expected that responds related to factors performed in a formal and accountable way are low as those factors performed informal and repeatable are high.

To begin with, it is required to be aware of quality. It includes 3 of the quality requirements, which are considered as some basic quality principles required for a quality approach. To be aware of quality means not only IT personnel aware of what quality is, but also they aware of their skills and how to use them effectively.

Expertise is expected for an IT facility that is aware of quality in general. Some core requirements could be met easily after full awareness of quality. People in the IT facility get involved in quality processes. People are the most valuable resource for an organization and they should be managed. Training is one of the required things to perform all these activities and tasks successfully. Training should be performed periodically not performed when necessary. Communication and use of IT standards are other important requirements to be an expert in quality.

However, it is not easy to be an expert and above factors affecting expertise in quality requires a top-level performance, fully awareness and having skills in quality. But many people think that they perform well for the organization and they thought that they are already experts. Before conducting the survey, it is expected that these factors may cause some inconsistencies and maybe the result are higher because of positive responses.

Customers play vital role in the quality system. Organizations having a high level of quality are expected to be full customer focused and have a stable and effective customer communication. Customer requirements and needs should be understood completely. In the public sector, customer is not a familiar concept, because, many government organizations provide services to the people in the country. Customer is more familiar for the organizations providing products. However, the people whom provide services are also customers. Nevertheless, it is expected that surveyed IT facilities would have a customer-focused strategy and understand their customers in an acceptable manner.

It is essential to develop a quality management system to successfully managed quality. QMS should be integrated in the IT facility and includes all roles, responsibilities, processes, activities tasks, tools etc. Without a quality management system, an organization has no chance to achieve quality. Documenting processes and using and maintaining standards and policies are also important and required for a successful quality system.

Quality is also a measurable thing. It is also helpful to see the organizational defects easily and take corrective and preventative actions. Before conducting the quality assessment survey, it is expected that measurement processes or concepts such as benchmarking, satisfaction surveys would be found a few IT facilities, especially because, the survey is conducting to government institutions.

At the final stage quality is considered as a strategy for an IT facility. Quality improvement can be performed continuously. People, processes and policies within the organization will achieve quality and easily adaptable for the changes.

All in all, these are the most expected results from the quality assessment survey. In the following sections, research findings of all quality requirements and the factors affecting them will be discussed in detail.

4.2. Research Findings

4.2.1. Data Analysis: Number of IT facilities regarding in what manner they have met the sub-requirements.

Number of IT facilities were obtained directly from the survey results and the results represent number of IT facilities regarding in what manner they meet each sub-requirement. Values were obtained from the respondent's answers for each question. As mentioned, there were 50 questions in the questionnaire and each of them represented the factors affecting the general IT quality requirements in IT facilities.

The aims of this data analysis are:

- To see the number of IT facilities in meeting each sub-requirement,

- To see the number of IT facilities in meeting 20 core quality requirements defined in the study,

For each question in the questionnaire, the responses evaluated regarding the IT facility's choices over five choices. As a result, number of IT facilities can be seen for each choice for each sub-requirement. The results are shown in the Table 4.1 and the highest numbers for each choice are shown in bold.

Table 4. 1 Number of IT facilities regarding each choice

Sub-requirements / Factors affecting 20 general quality requirements	# OF FACILITIES				
	Not At All	A Little	To Some Degree	Very Good	Excellent
Knowing the definition of IT quality	0	9	16	5	0
Knowing the IT quality requirements	0	15	13	2	0
Knowing the added value of IT quality to the organization	0	13	12	5	0
Knowing the quality skills of IT personnel	2	7	14	7	0
Knowing and being able to find the right qualified IT personnel for an unexpected problem.	0	5	16	8	1
Availability of an IT personnel for IT quality processes	4	5	9	**11**	1
Knowing the available IT personnel with their duty and experiences	2	8	10	10	0
Facing difficulties to find an experienced IT personnel if an unexpected problem occurs	4	**21**	3	0	2
Being able to know own roles, responsibilities and importance for the IT facility	0	4	15	**11**	0
Performing duties effectively and for the benefit of the IT facility	0	5	13	**11**	1
Sharing knowledge and experience	0	4	13	10	**3**
Availability of IT quality standards and procedures	1	15	9	5	0
Documenting process for key IT quality processes	6	10	10	3	1
Availability of best practices	3	12	11	3	1
Availability of stable communication and those	0	6	11	**11**	2
Availability and ability to use communication techniques such as web forms	2	10	8	8	2
Availability of quality tools including all hardware and software tools to support using of quality tools	3	4	13	9	1

Table 4.1 (cont.)

Availability of the plan or manual for the right usage of quality tools	5	8	9	8	0
Availability of quality training plan	8	10	9	3	0
Performing quality training officially	9	8	7	6	0
Availability and ability to use advanced methods of training such as audio visual aids	8	9	9	4	0
Defining and documenting quality goals	5	10	9	5	1
Providing the alignment between quality goals and business goals	5	8	9	7	1
Documenting procedures, goals and definitions	6	12	6	5	1
Availability of the documents within the IT facilities	6	8	6	8	2
Understanding the customer needs	2	3	**20**	5	0
Communicating with the customers formally	0	8	15	6	1
Satisfying customers by providing the needs and requirements of customers	0	4	19	7	0
Performing benchmarking with the external parties to see their quality levels and compare the IT facility's level to theirs	6	11	11	2	0
Performing benchmarking to determine and achieve the best quality standards, quality tools and procedures in the industry	6	14	8	2	0
Attaining IT personnel for each IT quality processes and define it formally in the QMS	7	6	10	6	1
Knowing all attained IT personnel formally in the IT facility	7	7	11	4	1
Being able to find the right IT personnel who are formal and accountable in the QMS and the IT facility	7	6	12	5	0
Availability of an official QMS for the IT facility	9	8	9	3	1
Availability of all IT quality requirements	9	9	7	4	1
Availability of roles	9	8	8	4	1
Availability of QSS	21	5	3	1	0
Performing QSS officially to the customers and IT personnel	**23**	4	1	2	0
Availability of a plan to do the measurement	14	6	8	2	0

Table 4.1 (cont.)

Availability and ability to use the measurement tools and models including all kinds of hardware and software to support measurement activities	15	5	7	3	0
Availability of all measurement	15	5	8	2	0
Providing and developing services or products regarding the customer requirements	2	4	17	7	0
Doing customer segmentation regarding the different needs and requirements of each customer	2	12	13	3	0
Ability to provide different products or services for each customer regarding their different needs and requirements	1	11	12	6	0
Ability of obeying rules, performing duties, and to provide a best model person for the industry	3	6	14	6	1
Ability to be a positive leader and act as a leader to colleagues	3	6	15	6	0
Availability of third part processes, relationships, and procedures in the QMS	11	7	10	2	0
Availability of a continuous improvement plan to support CI activities	5	12	11	2	0
Availability of CI activities in all IT quality processes	6	10	12	2	0
Gaining the IT facility that CI will be a life style for the quality improvement in the IT facility	6	11	10	3	0

As can be seen from the above table, the highest numbers of IT facilities among the choices are represented in bold format.

23 of the IT facilities do not perform quality satisfaction surveys at all. Besides, 21 of the IT facilities have no QSS. It can be concluded from those two factors that QSS requirement is the lowest one that met among the 20 general quality requirements. The numbers of the general 20 quality requirements will be represented in the following section of this chapter.

It can be seen from the "A little" column that the highest number of IT facilities is found for the factor named "facing difficulties to find an experienced IT personnel if an unexpected problem occurs" as 21. It can be easily concluded that most of the IT

facilities have minor problems in finding an experienced IT personnel. However, the most important point, here, is that this requirement is not formal and accountable. The activity performed event-driven and not by a formal document of QMS.

In addition to that, 15 IT facilities have known a little what IT quality requirements are. The availability of IT standards and processes are limited. This limitation may be related to the content of standards and processes, usability and the ability to maintain those standards and processes.

"To some degree" choice has been mainly chosen for most of the factors as can be seen easily from the table. This choice represents that the sub-requirement has been met partially but enough to run the IT facility on. That's why the choice was seen the most appropriate one for the surveyed facilities. For instance, 20 of the IT facilities has said that they understand their customer's needs partially but enough to satisfy them. It can also be seen from the sub-requirement named "satisfying customers providing their needs and requirements". 19 of the IT facilities have again responds "to some degree" for the requirement.

Although "to some degree" choice is seen appropriate for most cases, it is expected that all of the sub-requirements could be met at least in a very good level. Because, very good level represent that the sub-requirement are mostly met except in some areas within the IT facility. Quality can only be achieved if an organization provides quality in all areas including products, services, its people, processes, strategies etc. It can be seen from the above table that the number of IT facilities in very good level are very low when it is compared to previous level. The highest responds can be seen for the factor named "availability of IT personnel for IT processes". 11 of the IT facilities have appointed IT personnel for most of the facilities' processes. Similarly, IT personnel in 11 of the IT facilities have known his responsibility, own duties and importance for the facility in a very good level.

The last choice is called "Excellent Level" which represents the sub-requirement has been met fully and in an expert level. However, this level the number of the IT facilities was found very low. The highest one was found as 3 for the factor related to "sharing experience and knowledge". This means that only the IT personnel in 3 of the facilities have shared knowledge and experience in an expert level within the IT

facility. Most of the sub-requirements have not been met in an excellent level as can be seen from the table 4.1.

4.2.2. Key Findings for quality requirements

The data gathered from the survey was analyzed in two parts as raw findings and findings revised. Raw findings represent the data that is directly used by the interviews. Then, the data is revised and corrected by determining the inconsistencies among the dependent factors, if any, for each IT facility.

4.2.2.1. Raw Findings

In this part, in what manner IT facilities have met the quality requirements and missing points of each quality requirement are discussed by depending on the results of the questionnaire.

As mentioned previously, there are 50 questions asked to individuals and the results are observed by looking each responds of the related factors of each quality requirement. Since, the answers were collected over five choices, the responds of IT facilities regarding the each choice and factors used.

It is assumed that all the sub requirements of each general quality requirement have the same weight. So, it is first decided that the minimum choice within the sub-requirements of the upper general requirement was selected as the overall performance in meeting the quality requirement for each IT facility. However, it is more logical to separate the requirements into to parts as the requirements under the awareness and expertise category and the requirements under the management and strategy category. This evaluation was performed in previous chapter called leveling of quality requirements. The approaches for performing this kind of leveling were also explained in that chapter. The important point is that the first 10 requirement which are under awareness and expertise is needed lees effort to meet than the other 10 requirement. As a result, it can be more logical to use the minimum approach for the requirements that need harder effort. So, the overall performance for requirements under the quality levels 4 and 5 which are related to management,

metrics and strategic requirements, are determined by using the minimum approach. The reason why the minimum one was chosen is that a quality requirement can only be met by providing all sub-requirements. If one of the sub-requirements has been met in a lower degree than the others, it is assumed that the others cannot be met more than the level as the minimum one. All sub-requirements are considered as related and dependable with each other for these 10 quality requirement.

For the first 10 quality requirements, which are under the level 2 and 3 –awareness and expertise-, it is more logical to take median of the choices to determine the overall performance of those 10 quality requirement for each IT facility. However, taking median is only possible for the requirements that have at least 3 sub-requirement.

Therefore, the tables 4.2 and 4.3 are formed by using the approaches explained above. It is important that this is the first evaluation of raw data so the situation of each quality requirement could change when a detailed analysis performed. The analysis of raw data is given in Table 4.2. The final table, after revising, is shown in table 4.3 in section 4.2.2.2.

Quality Requirement 1: Employee Awareness

The first thing that asked to individuals in questionnaire is the awareness of IT quality in general. The aim to start with such a requirement is that it is first needed to be aware of what you are doing. If an IT facility wants to achieve consistent quality, all employees and managers need to aware of what IT quality means and importance of it. That's why it is started with *Employee Awareness* requirement for a quality approach.

It is seen from Table 4.2 that 12 of the IT facilities have a little awareness of IT quality in general. 15 of the It facilities have met the requirement in to some degree level. These two numbers justifies that most of the facilities are no awareness of quality completely. None of the 30 IT facilities responds "not at all" for the employee awareness quality requirement and this show they at least have an awareness of quality. Only 3 of IT facilities have a very good level awareness of quality in general and none of them have met the requirement in excellent level.

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For *Employee Awareness* requirement, there are three important factors that are affecting. These are being aware of the meaning of IT quality, being aware of IT quality requirements, and being aware of the added value of IT quality to the IT facility. The number IT facilities regarding the choices for those factors are represented in Figure C.1 in Appendix C.

Table 4. 2 Raw Findings from Quality Assessment Survey

QUALITY REQUIREMENTS	# OF IT FACILITIES REGARDING THE RESPONDS				
	Not At All	A Little	To Some Degree	Very Good	Excellent
Employee Awareness	0	12	15	3	0
People & Skills	2	7	15	6	0
Championship	4	8	10	8	0
Involvement of People	0	3	16	10	1
IT Standards & Quality Practices	3	14	9	3	1
Internal Communication	2	11	9	7	1
Quality Tools	5	8	9	8	0
Quality Training	9	8	9	4	0
Quality Goals	5	12	7	5	1
Documentation for all quality processes	6	13	5	5	1
Customer Communication	2	6	18	4	0
Benchmarking	7	13	9	1	0
Leadership	9	8	10	3	0
Quality Management System	9	9	8	3	1
Quality Satisfaction Surveys	23	4	2	1	0
Quality Measurement, Monitoring & Review	17	5	6	2	0
Full Customer Focused	4	15	9	2	0
Example Setting	3	8	15	4	0
Extension of QMS to the affiliated business lines	14	5	9	2	0
Continuous Improvement	7	11	10	2	0

As can be seen from figure C.1 in appendix C, all of the factors have a similar distribution among the choices, however, the second factor which is knowing the IT quality requirements is the one that most of the organization have problems in meeting that requirement. Exactly the half of the organization has met that requirement a little. The mostly part of the other half has met it in to some degree.

Employee awareness is one of the core parts in a quality approach and it is essential for IT personnel to be aware of quality. At least, none of them have any awareness of quality and this is actually a good finding for employee awareness requirement. And also, being a mature organization in terms of IT quality adds a great value for that organization whether it is private or governmental.

Quality Requirement 2: People & Skills

IT personnel are the most valuable resource for the IT facility. To become an expert in quality, it is required that all the IT personnel have to know their quality skills and importance for the facility. Besides, it is expected to know colleague's skills by all IT personnel.

As a matter of fact, it is asked to individuals that if they could know the people working in the IT facility and their skills and which people with what skills need for IT quality processes.

From the survey, it is found that exactly half of the IT facilities have met the *people & skills* requirement to some degree. This can be explained, as the IT personnel know their basic or core quality skills. Quality training is emerging to improve IT personnel skills. 6 of the IT facilities have met the people & skills requirement in a very good level. None of them have an excellent level in meeting the requirement. When these results add to each other, it can be seen that 21 of IT facilities have met the people & skills requirement to some degree or more.

If a detailed analysis performed to see the results for sub-requirements, the number of IT facilities is better in the requirement "The right IT personnel". 8 of the IT facilities have known the right IT personnel with the right skills very good. "Very Good", here, represents most of the IT personnel within the IT facility are aware of their colleagues. Only 1 of IT facilities has met the second sub-requirement

completely. The other number of IT facilities can be seen in Figure C.2 in Appendix C.

Quality Requirement 3: Championship

For *Championship* requirement, it is asked to individuals that whether the individuals in the IT facility know about the responsible person and his/her duties for each IT quality process in general. Actually this requirement is closely related to *Leadership* requirement. One different thing is that, here, the activities performed in a routine way or repeatable actions. "Championship" as a word refers to a competition between the individuals. There is no formal procedure in the IT facility and if a problem occurs in any IT quality processes, the individual who resolved those things before is again responsible for current issues. There are no problems in finding a person to attain for resolving the problem. And, that individual knows his own duty and importance at all with no extra information needed. Actually, this is one of the behaviors that an organization which does not provide consistent quality.

As a result, it is seen that 4 of IT facilities have not met the requirement at all. 8 of them have met the requirement a little. When those two percents add to each other, it can be seen that it results approximately half (12) of the 30 IT facilities. The other half of the IT facilities lies between the answers to some degree and very good level.

If a detailed analysis performed to sub-requirements, one result manifests itself among the others. 21 of the IT facilities have a little problem while finding personnel if a problem occur. This result may be seemed great at first sight; however, it is not a formal and accountable responsibility. The attended personnel were found from previous experience.

In addition to that, one of the maximum numbers related to very good level was found in one of the requirements of championship. 11 of IT facilities an available person for their most of the IT quality processes. "Very good", here, represents most of the IT quality processes have an attained IT personnel. The other results are also represented in Figure C.3 in Appendix C.

Quality Requirement 4: Involvement of People

An individual has been provided an opportunity to contribute by being a member of an organization. And also, it is significant for an organization to organize and involve its people in the manner that they will use their abilities and contributes to organizations' objectives [38].

In the quality assessment survey, it is expected that IT facilities have fully involvement of people within their processes. From the survey, Involvement of People requirement has the one that met most successfully. 27 of the IT facilities have met the requirement at least to some degree level. This means that people within the IT facility get involved at least the core IT and quality processes within the facility. 10 of them have a very good level and one of them have an excellent level in meeting the requirement.

For the three sub-requirements of Involvement of People, the results are again convincing as can be seen in Figure C.4 in Appendix C. One of the highest numbers of organization for the excellent level was found for one of the sub-requirements of involvement of people. 3 of IT facilities, which is still very low, have shared knowledge and experience in an excellent way. Excellent, here, represent all the IT personnel have shared knowledge and experience each other.

Quality Requirement 5: IT Standards & Quality Practices

For IT facilities, it is important to use and maintain standards and practices for IT quality processes to guide the whole IT facility in meeting the intent of the Quality Management System. And also, good practices have to use for reference when improving the IT facility's quality practices [20].

As a result of the survey, one of the highest number of IT facilities for this requirement was found for "a little" level as 14. When look the number of IT facilities in general, 26 of the IT facilities have met the requirement at most to some degree level. Especially in government organizations, there are no standards to guide their processes. The routine vision of thinking and acting is more common in those organizations. Therefore, they do not usually think that it is necessary to follow a standard and use best practices to achieve the quality.

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The detailed results are also seen in the factors affecting this requirement (Appendix C, Figure C.5). The availability of IT standards and quality practices is limited for half of the IT facilities. Limited means that they have follow IT standards and quality practices only for some basic processes within the IT facility.

The last sub-requirement related to this requirement is availability of best quality practices. A best practice is considered as a technique, or a method, or a process, which is thought to be the most effective and suitable action to achieve the possible outcomes for that profession [39]. From our survey, it is found that 3 of the IT facilities have no best quality practices defined and followed. Only 4 of the IT facilities have use best practices at least very good and excellent level. The other results are also shown in Figure C.5 in Appendix C.

Quality Requirement 6: Internal Communication

Internal Communication is another important requirement for quality approach and refers to the communication between the individuals in the IT facilities. The communication takes place regarding the effectiveness of Quality Management System. The more efficient and effective the communication process within the organization provides the more successful communication in quality policies, requirements, objectives, and feedbacks on accomplishments [38].

It is found from the survey that *Internal Communication* is one of the other successful ones among the other requirements. 17 of the IT facilities provide customer communication in at least to some degree level. Besides 7 of them have met the requirement at least very good level. Only one of the IT facilities have met the requirement in excellent level.

If a detailed analysis performed, it can be seen that 11 of IT facilities have stable communication at least in a very good level. The difference between excellent and very good here is that the communication provided in all areas and units within the IT facility makes the communication excellent. In addition to that, there is no availability of advanced communication techniques for 2 of the IT facilities. The other results are also represented in Figure C.6 in Appendix C.

Quality Requirement 7: Quality Tools

Quality Tools requirement is another important requirement in quality approach. In the questionnaire, not also the existence of quality tools used within the IT facility is questioned, but also the way they use them is too. Quality tools can be all kind of hardware or software products or practice, they all used for the purpose of measurement, monitoring reviewing and also for problem solving in quality processes. Quality experts have defined seven basic quality tools as cause – effect diagram, check sheets, control charts, histogram, pareto chart, scatter diagram, and stratification [40]. In this survey, it is not included a deepened investigation for such kind of tools, namely, however, IT facilities are asked about if they use quality tools for their IT quality processes.

The highest number of IT facilities (9) was found for to some degree level in meeting the quality tools requirement. 8 of IT facilities have met the requirement at least very good level. The availability of quality tools and the content of quality plan and manual are differentiate the levels of meeting the requirement.

If a detailed analysis performed, it can be seen that 5 of the IT facilities have no plan or manual for using quality tools. 8 of them have insufficient or limited content for those manuals and plans as they responded "a little" for the sub requirement. The other results are also represented in Figure C.7 in Appendix C.

Quality Requirement 8: Quality Training

Training is one of the fundamental things that all organizations should practice. There are several roles of training. First of all, training makes the processes go easier and an effective way. And also, trained employees use their skills more effectively and will be much more successful than ever before. Quality is also needs training to improve the quality of IT facilities in organizations. To train the IT personnel who especially have a knowledge and awareness of the concept of IT quality and their capabilities is easier.

Unfortunately, quality training should not be performed properly in surveyed IT facilities. 9 of them have not performed training at all. 8 of them have performed training a little. A Little, here, means that either they performed training rarely or

they performed it inefficiently. As a result, Training is one of the requirements that most of the IT facilities have not met properly. That's why most of the previous requirements especially *Employee Awareness* and *People & Skills* have caused problems for most of the IT facilities.

If a detailed analysis performed, 8 of the IT facilities have no training plan even they perform training. 8 of the IT facilities have not appropriate content in their training plan. Again, 8 of IT facilities have no use of advanced training methods including audio-visual aids, hardware and software to support training. And the most realistic result is that none of the organizations have met the quality training requirement as excellent. The other results are shown in Figure C.8 in Appendix C.

Quality Requirement 9: Quality goals

Every organization has a vision and goals including short-term and long-term. Besides that, an organization has to have quality goals in which they clearly state what they will do for quality. The important thing while stating these goals is that it does have a link or alignment with business goals. The aim of this requirement is questioning the availability and definition of quality goals and its alignment with business goals.

From the survey, it is clearly seen that quality goals are not stated very well among the surveyed IT facilities. 5 of them do not state any quality goals and 12 of them have met the requirement a little. A little, here, represents either the goals are not defined regarding the all quality requirements or not consistent with the IT facility's strategy. Since the survey conducted only to the IT departments within the whole organization, those departments do not find necessary to state a quality goal for their IT facilities. So, the insufficiency becomes from this gap. However, it is expected that they have at least a vision and a goal related to their own quality processes. Only one of the IT facilities has met the requirement excellent by providing all quality goals within the facility and alignment with the business goals.

If a detailed analysis performed, it can be seen that organizations mostly failed equally both for the sub-requirements. Similar results have found for each choice category for the requirements. These values can be seen in Figure C.9 in Appendix C.

Quality Requirement 10: Documentation for All Quality Processes

Documentation is another important step especially in developing Quality Management System. It is expected for an IT facility to document all quality processes including procedures, definitions, goals etc. *Documentation for All Quality Processes* requirement simply provides this approach.

However, documentation is another one of the missing requirement that organizations have met mostly. 6 of IT facilities have not met documentation requirement at all. Otherwise, 5 of them have met this requirement very good. The reason why those have not reach excellent level is maybe because they have some missing points with the definitions, goals or procedures for some of their quality processes. The availability of the documents is also important in meeting the requirement. Only one the of the surveyed IT facilities have met the requirement in an excellent level.

If we go to a further analysis for this requirement, it can be concluded that many organizations do not think that documentation is a requirement. However, documenting is a formal process and makes organization become easily mature within the processes. For example, it can be seen from Figure C.10 in appendix C that all documents are available for 2 of the IT facilities, although 1 of them have well documented all quality processes. This means that some IT facilities have the documents only structurally without including the real content of quality documents. This problem is also seen from the number of IT facilities in very good levels for both of the sub-requirements.

Quality Requirement 11: Customer communication

Whether an organization provides products or/and services, the outcome should be served to satisfy the customer. To do that, it is important to communicate the customers and understand their needs/requirements.

Since the survey was mostly performed among governmental institutions, the customer concept was not very familiar with the ones in private sector. Many governmental institutions provide services for country's benefits; however, for IT departments it is a little bit different. IT departments mostly provide services-

sometimes products- for the institution they connect with or for the third parties or the institutions.

From the survey, *Customer Communication* requirement is found as one of the successful requirements to be met by IT facilities. 22 of the IT facilities have met requirement at least to some degree. They mostly understand their customers and satisfy them in general. 18 of those have met to some degree and 4 of those have met the requirement very good. None of them have met the requirement at excellent level. It is maybe because of the unfamiliar concept of customer approach for government institutions.

If a detail analysis performed, it can be seen that over half of IT facilities have met all of three sub-requirements at least to some degree. None of the IT facilities do not communicate and satisfy customers. The other results can be seen in Figure C.11 in appendix C.

Quality Requirement 12: Benchmarking

Benchmarking is essential for organization to see where they stand in industry and give them an opportunity to make a comparison among related businesses and therefore, they can see what the best practice or standard for related processes and activities are.

Quality assessment survey reveals the insufficiency in meeting the benchmarking requirement for surveyed IT facilities. None of them have met the requirement at excellent level. And 13 of them have met it at most a little. 7 of them have not performed benchmarking yet.

If a detailed analysis performed, the insufficiency can be seen more obvious. 28 of the IT facilities have met both of the requirements at most at the level of "to some degree". The other results can be seen in Figure C.12 in appendix C.

Quality Requirement 13: Leadership

As mentioned in the second requirement (*Championship*), *Leadership* requirement is closely related to *Championship* requirement. However, management responsibility, here, is required to be formal and accountable and included in a well-defined QMS.

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QMS is the formal way to attend IT personnel to an IT process because all the roles and responsibilities should be defined in QMS to meet Leadership requirement completely.

The number of IT facilities for this requirement has spread first four choices as can be seen in Table 4.2. The highest number of IT facilities which is 10 of the IT facilities has been found for "To some degree" level. Those IT facilities have met the requirement with providing only the core features. "To some degree" in Leadership requirement also justifies that IT facilities have not formally defined all of their processes and attain an accounted person. The management responsibility is finite with the core processes only. None of the facilities have a management responsibility in an excellent level.

If a detailed analysis performed, some inconsistencies found for some surveyed IT facilities. Features of this requirement and QMS's have some similarities that might be caused a misunderstanding for some IT facilities. It is asked to individuals that if there is a responsible person for each IT processes and defined in QMS including roles and responsibilities of that person for Leadership requirement. However, 7 IT facilities responded that question that conflicts with the responds for the similar question in the QMS requirement. The problem here is that if an organization has not defined a complete QMS including roles and responsibilities, it won't be able to use QMS or limited use for management responsibilities. For example, one facility responded "A little" for the question: "Are the roles, missions and responsibilities included in the current QMS of the IT organization?" This means that that facility has a QMS but it's not well defined and the content of is partially provided. So, that facility wouldn't be able to use QMS for management responsibilities above "A little" capacity. However, same facility responded "To some degree" or "Very good" for the question: "Do you find a responsible person by using current QMS for an IT processes if a problem occurs?" Therefore, after revising, this error fixed regarding the capability of each responds between these two questions for those 7 IT facilities. This causes some drops in the number of IT facilities related to sub-requirements of Leadership requirement. (Appendix C, Figure C.13). This also makes a drop in the overall number of IT facilities for the Leadership requirement as can be seen in Table 4.3.

Quality Requirement 14: Quality Management System

Quality Management system is maybe the vital part in all quality approaches. In this study, QMS is also considered as essential for IT facilities and must be defined. Of course, the QMS defined for IT facilities includes only the IT processes within the IT facility. It is like developing a QMS within the IT quality concept. Actually a QMS is a set of policies, processes and procedures required for planning and execution (production / development / service) in the core business area of an organization. Meaning that the overall company-level system of management of all those performance activities that can, in any way, affect the quality of the company's products and/or services [41]. It is expected that IT facilities have defined a QMS including IT quality processes within their procedures, definitions, tasks, measurement tools etc. And also, QMS should include the roles and responsibilities for each IT personnel. Following the quality frameworks or quality guides such as ISO 9001 explained in Chapter 2, organizations could develop QMS.

In our quality assessment survey, we only questioned IT facilities about the existence and the content of it generally. There are many topics and factors affecting the QMS, however, it is not the main aim of this study to investigate QMS in detail.

From the survey, it is obvious that QMS is one of the missing parts in most of the IT facilities surveyed. 9 of them have no QMS defined for their facility. 8 of IT facilities have defined QMS partially which means that only some of the basic processes have been defined and the required content of QMS could not be provided. Only one of the IT facilities has an excellent QMS defined in its IT facility.

Many organizations have no QMS within the IT department but some of them have an organizational QMS including their IT processes. These organizations have mostly responded "To Some Degree" for the requirement.

If a detailed analysis performed, it can be seen that the number of IT facilities are similar for three sub-requirements asked. The results are represented in Figure C.14 in appendix C.

Quality Requirement 15: Quality Satisfaction Surveys

Quality satisfaction surveys are important to see or to get an idea about the quality level or performance within the organization. It can be both applied to customers and employees. Customers can give feedbacks about the quality products/services provided by the organization. Sometimes, employees can also give feedbacks about the quality of the processes or any related issues.

From quality assessment survey, it is found that this requirement is the worst one that could not be met in most of the IT facilities. 23 of IT facilities have not met the requirement. They have no QSS performed. Moreover, 29 of them have met the requirement at most to some degree level.

For the QSS requirement, it is asked to individuals whether they have a quality satisfaction survey and perform it in a period of time. 21 of them have no any QSS and 23 of IT facilities have not performed it yet. The difference between those two results justifies that some IT facilities have not performed QSS, although they have QSS. Generally speaking, the problem related to this requirement is mainly about the performing procedure as can be seen the number of IT facilities in Figure C.15 in appendix C.

Quality Requirement 16: Quality Measurement, Monitoring & Review

Measurement, monitoring, and reviewing are important to take corrective and preventive actions if a problem occurs in a process within the organization.

In this study, measurement, monitoring and review of IT quality and quality processes are investigated within the survey. Individuals asked about if there is a plan to measure, monitor and review the IT quality and they use any tools or models to do such processes. And also, it is important to procedures of those processes to be included and defined in the QMS.

Although it is another vital requirement in quality approach, many organizations have failed in meeting the requirements of quality measuring, monitoring and reviewing. Over half of the IT facilities (17) have no such activities. 5 of the IT facilities have met the requirement in a limited level. Limitation is maybe because in

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planning or using tools in such activities. None of the IT facilities have met the requirement in excellent level.

If a detailed analysis performed, it can be seen that there are problems for most of the IT facilities for each of the sub-requirement as can be seen in figure C.16 in appendix C. Besides, an inconsistency was found for one IT facility. The individual responding for that facility said that these measurement processes were defined in their QMS even they did not have any QMS defined. So, this error fixed and makes a little drop in the third sub-requirement and even the general number of IT facilities as can be seen in table 4.3.

Quality Requirement 17: Full Customer Focused

Full Customer Focused is a requirement in the quality approach and represents an organizational strategy that organizations provide services/products with respect to each customer needs/requirements. Some organizations have a unique product type or a service type and it is not changed whether the type/need/requirement of a customer. Having a full customer focused strategy requires providing different type of products and/or services regarding the customer requirements. According to CobiT framework, it is stated that "focus quality management on customers by determining their requirements and aligning them to the IT standards and practices [20]". It is vital to identify the requirements and expectations of customers if an organization wants to satisfy them.

For government institution, we mostly consider that they provide services for the country. However, IT facilities within the institutions, they mostly provide services or products to other departments of organization or to the organizations itself. Sometimes, they do these processes to other government institutions. So, it is essential to be a full customer focused IT organization.

From the quality assessment survey, it can be seen that half of the IT facilities have met the requirement in "a little" level. None of them, again, has reached excellent level for that requirement.

When a detailed analysis performed, an inconsistency was found in one of the factors related to this requirement. For the question related to "providing services / products

with respect to customer needs / requirements", 5 IT facilities responded inconsistently with the responds related to "knowing customer requirements / needs" in the *Customer Communication* requirement. It is expected that IT facilities must ensure customer communication and understanding their needs before providing services to them. When the error was fixed, the number of IT facilities changed as can be seen in figure C.17 in appendix C. Those changes also affect the general view of number of IT facilities as can be seen in table 4.3.

Quality requirement 18: Example Setting

Example Setting is a requirement in quality approach related to being an expert in IT Quality. To do so, every IT personnel should be successful with their duties and perform very well for the IT facility. Besides, they have to be a leader in their positions. Example Setting, here, describes the best model for related position or for related process or activity. To achieve that level, every employee knows their own duties, skills and even others'.

From the quality assessment survey, it was found that 15 of the IT facilities have met the requirement in to some degree level. Besides, 4 of them have met in very good level. Actually, the results may be questioning because being an example setting - expert in other words- is not easy. Most of the individuals in surveyed IT facilities have believed that they perform their duties successfully. However there was also another inconsistency found here. For the factor: "*IT quality expert*", 3 facilities responded that they were successful in performing their duties, although, they have not known their own roles and responsibilities completely as can be found from the responds related to "knowing duties and roles" in the requirement of Involvement of People. This error was fixed and that makes the number of IT facilities drop as can be seen in figure C.18 in appendix C. The general number of IT facilities have also affected from those changes as can be seen in table 4.3.

Quality Requirement 19: Extension of QMS to the Affiliated Business Lines

In this requirement, IT facilities should finalize the QMS by extending it with the processes and relationships with reliance on third parties.

It is expected that IT facilities should have a QMS including all roles, responsibilities, processes, procedures etc. in the QMS requirement. Here, IT facilities were questioned related to the extensions of current QMS. This is one of the worst requirements that IT facilities have mostly failed in meeting. 14 of them have no extension in their QMS. Generally speaking, 28 of the IT facilities surveyed have met this requirement at most in to some degree level. This represents the content of QMS has not fully provided.

After performing a detailed analysis, 4 IT facilities have responded inconsistently with the factors related to QMS requirement. It is expected from the IT facilities that they have a detailed QMS defined before extending it with the processes and relations with the third parties. So, similar inconsistencies for those 4 IT facilities was fixed and that makes a drop in the number of IT facilities as can be seen in figure C.19 in appendix C and table 4.3.

Quality Requirement 20: Continuous Improvement

Continuous Improvement requirement is the last in this study. As stated in many quality models, Continuous Improvement (CI) is essential for organizations to provide maintaining the current processes and vision and adopting the changes in the industry easily. The completed continuous improvement is considered as a culture embedded with the organization and used as a cornerstone of organizational efficiency [42].

From the quality assessment survey, it can be seen that CI is one of the failed requirement in surveyed IT facilities. Only 2 of them have met the requirement in very good level. None of them again have met in excellent level. The other have met at most to some degree including 7 of them have not met the requirement.

If a detailed analysis performed, it was found that many of them have not a consistent plan for continuous improvement for the quality approach. The number of IT facilities is represented in Figure C.20 in appendix C.

4.2.2.2. Findings Revised

Depending on the above explanations, Table 4.3 is updated for new number of IT facilities for each quality requirement regarding the choices selected.

When the Tables 4.2 and 4.3 compared, it is seen that there are some changes in number of IT facilities of five of the quality requirements which are *Leadership, Quality measurement, monitoring, and review, Full customer focused, Example setting, Extension of QMS to the affiliated business lines*. The changes, as remembered, were due to the reason that the responds of survey questions were directly used in evaluation at first. After examining each sub-requirement affecting general quality requirements one by one, some inconsistencies were found for some IT facilities' responds related to those requirements. The detailed explanations and reasons for that drop are stated in previous section.

Table 4. 3 Findings Revised

QUALITY REQUIREMENTS	PERCENTAGE OF IT FACILITIES REGARDING THE RESPONDS				
	Not At All	A Little	To Some Degree	Very Good	Excellent
Employee Awareness	0	20	8	2	0
People & Skills	2	7	15	6	0
Championship	4	8	10	8	0
Involvement of People	0	9	15	6	0
IT Standards & Quality Practices	6	13	8	3	0
Internal Communication	2	11	9	7	1
Quality Tools	5	8	9	8	0
Quality Training	9	10	8	3	0
Quality Goals	5	12	7	5	1
Documentation for all quality processes	6	13	5	5	1
Customer Communication	2	6	18	4	0
Benchmarking	7	13	9	1	0
Leadership	9	8	10	3	0
Quality Management System	9	9	8	3	1
Quality Satisfaction Surveys	23	4	2	1	0
Quality Measurement, Monitoring & Review	17	5	6	2	0
Full Customer Focused	4	15	9	2	0

Table 4.3 (cont.)

Example Setting	3	8	15	4	0
Extension of QMS to the affiliated business lines	14	5	9	2	0
Continuous Improvement	7	11	10	2	0

4.2.3. IT facilities in general

After the number of IT facilities were found for each requirement, the big picture related to quality is obviously revealed for surveyed IT facilities. The results show that quality requirements have not met completely, even consistently, among the IT facilities. Requirements such as *QSS, Quality measurement, or QMS extension* have not satisfied by more than half of the IT facilities.

A quality maturity framework, as mentioned, provides organizations to follow a logical path to achieve consistent quality. The quality assessment survey reveals that such kind of a framework is emerging for surveyed IT facilities. The main problem, here, is that most of the IT facilities have tried to achieve quality in event-driven. Therefore, most of them have only reached to some degree level in meeting the requirements.

Below table (Table 4.4) was formed by considering 30 IT facilities one by one to see how they responded the quality requirements in general. The same approaches were used to generalize the overall performance on each 20 requirement. The median of the responds were taken for the first 10 quality requirement for each institution and the minimum of the responds were taken for the other 10 quality requirements for each institution. This is actually to see the table 4.3 in different dimension. This means that table 4.3 represents the general view of 20 quality requirements by giving the number of institutions regarding their choices; however table 4.4 represents the general view of responds of each IT facility without giving the detail information about what they said for each requirement. Detailed information about the data for each IT facility is given in the Appendix D.

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Table 4. 4 The distribution of responds of each IT facility

Institution	Not At All	A Little	To Some Degree	Very Good	Excellent
1	10	8	2	0	0
2	2	12	6	0	0
3	0	10	9	1	0
4	17	2	1	0	0
5	2	8	4	6	0
6	1	13	4	2	0
7	5	12	2	1	0
8	0	8	12	0	0
9	1	16	3	0	0
10	3	11	5	1	0
11	0	0	20	0	0
12	11	9	0	0	0
13	3	10	7	0	0
14	3	12	5	0	0
15	12	6	2	0	0
16	17	2	1	0	0
17	**0**	**1**	**6**	**13**	**0**
18	3	4	10	2	1
19	11	8	1	0	0
20	1	1	9	9	0
21	12	4	3	1	0
22	5	12	3	0	0
23	1	1	10	8	0
24	1	7	10	2	0
25	1	1	12	6	0
26	1	1	10	7	1

Table 4.4 (cont.)

27	1	4	9	6	0
28	**1**	**1**	**7**	**9**	**2**
29	6	5	6	3	0
30	3	6	11	0	0

The table 4.4 does not actually gives an idea about the mising points and the areas that need improvement for each IT facility, however the detail of those information can be seen in Appendix D. The important point that can be resulted in from table 4.4 is that most of the IT facilities have many difficiulties to meet the requirement as can be seen in the results that the responds are mostly spread in the first three choices.

It can be said that 2 of the IT faclities which are represented in bold in table 4.4 are the most successful ones among the 30 IT facilities. Considering that the number of responds in "very good" and "excellent" choices in the table 4.4, we can easily say that the institution #17 and #28 are more successful than the others. These two institutions have more than 10 quality requirements that they have met at least in very good level. Logically speaking, this does not give the actual result for determining which IT facility is more successful or which has a high quality level. To get more realistic results, it may be prepared a balance score card or to weight each quality requirement and their factors. However, these are mostly considered as a future work of this study.

CHAPTER 5

JUSTIFICATION

In the previous chapter, the analysis of findings is represented. In chapter 5, some justification approaches will be discussed. Actually, the quality assessment survey justifies the study as 30 IT facilities have been conducted to survey to find out their quality status based on the 20 general quality requirements defined in the study. However, most of the justification approaches in this chapter is related to the proposed leveling of the quality requirements. The comparison of quality frameworks, dependency analysis, and interviews and studies with IT and quality experts in quality were used as justification of the study.

5.1. Quality Assessment Survey

Quality assessment survey results in what the quality status of 30 IT facilities are in terms of 20 quality requirements including the features affecting them. Survey consist of 5 choices that are available for each quality requirement and IT facilities were asked to choose the appropriate one for their facility representing in what manner they have met the quality requirement. The main aim of this study is to determine the quality areas and requirements that a future quality maturity framework has to focus. Quality assessment survey gives the answer of this research question and provides a successful investigation of quality in major IT facilities in Turkish institutions.

5.2. Available models approach

Literature survey played a vital role in evaluation of the study. Available quality models, awards, and frameworks were discussed in detail in chapter 2.

Quality models and awards were mostly helpful in determining the core quality requirements and the factors affecting them. In chapter 3, the comparison of those models and awards were represented and the identical core quality principles revealed.

Quality maturity frameworks were mostly discussed to see the distribution of quality principles into the quality stages. This study mainly discusses the quality requirements that are probably included in a quality maturity framework developed for only the IT facilities in organizations. So, quality requirements defined should be leveled according to their focusing areas and their importance. This available models approach provide to see the leveling of core quality principles in those quality frameworks that were taken as primary resource to find out 20 quality requirements defined in this study.

Therefore, the below table (Table 5.1) represents the comparison of the quality maturity frameworks discussed in Chapter 2.

Table 5. 1 Placements of quality principles/processes/features in various maturity frameworks

Features	M1	M2	M3	M4	M5
Leadership	4	5			4
Repeating actions in solving problems	2		2		2
Short-range efforts for quality improvement	2				
Communication within the organization	3		3		3
Identification of key processes		3			
Defining basic quality expectations			3	2	
Awareness of personnel	3	3	1		2
Identifying and resolving problems	3				
Involving people		3			3

Table 5.1 (cont.)

	M1	M2	M3	M4	M5
Identifying people's skills and abilities		2			2
Developing and Documenting Standards & Policies		2			3
Using tools			4		3
Quality Management	4		4		4
Information sharing and knowledge management		4			4
Managing Products & Services and its requirements		4	4		4
Customer Relationships/Focus		4			4
Risk Management		5			
Continuous Improvement	5	5	5	5	5
Measuring, monitoring & Reviewing	4	4	4	4	4
Benchmarking			5		4
Customer/Employee Satisfaction		4		4	5
Strategy planning and goals	3		3		
Training	3		4	3	3
Cost Analysis	5		4		

M1 : Quality Management Maturity Grid (Crosby's 14-step approach)

M2: Managing Quality aspects of UK MOD Defense Acquisition (Quality Management Maturity Model)

M3: Control Objectives for Information and Related Technologies (COBIT) (PO8-Manage Quality)

M4: Quality Maturity Model (QMM)

M5: Our Study

As can be seen in the above table, there are four available maturity models. IT Services CMM and e-CMM are not compared because these are not suitable models for IT quality improvement. These are mostly the models that are helpful in the structure of leveling approach and the calculation principles in this study. Besides, both models represent how a future quality maturity framework might be developed.

All frameworks except CobiT have a 1-5 level maturity stages. One of the similarities among the frameworks is that lowest level has no quality principles and consists of unpredicted actions. Between the lowest and highest levels, the quality

principles are distributed to levels. The quality principles at each level should be required to complete before moving the next level. Table 5.1 represents the leveling of the quality principles on each quality framework including our leveling approach. The numbers in the table belongs to at what level that related quality principle states.

As can be seen in Table 5.1, there are both similarities and differences in leveling of some of the quality features between the frameworks and this study. For instance, awareness of the employees states on level 2 in this study whereas the others have on levels 3 and Cobit has on level 1. One of the reason of Employee Awareness is stated at level 2 in this study is that Employee Awareness requirement is just related only the awareness of IT quality and importance. IT personnel should be first aware of quality and then, has the ability to get involve in quality processes and becoming an expert in quality. However, others have awareness feature included in the features like leadership or involvement of people. In this study, such requirements have different definitions.

In addition to that, customer satisfaction is completely provided in level 5 in our study whereas others have in level 4. This is because of the customer communication and being a full customer focused IT facility are defined in two different requirements in this study. The other frameworks determine customer requirements and satisfying customers approaches in a single quality feature.

Some features like "Continuous Improvement" and "Quality Measurement" are at same level in all frameworks therefore, these were easily placed in the leveling approach.

As can also be seen in Table 5.1, the comparison did not include all of the quality requirements in this study. Similarly, some of the features left blank because those features did not include for related frameworks or in this study. Therefore, a further analysis, called dependency analysis, will be performed in the next section of this chapter to justify the leveling approach of quality requirements.

5.3.   Dependency Analysis on Quality Requirements

While leveling the quality requirements, it is assumed that some of the requirements influence the others. It is required to do a dependency analysis to determine this

dependency. Pearson Chi-Square test for independence is one of the most used statistical tests for dependency analysis. The chi-square test for independence, simply, is used to determine the relationship between two variables of a sample. Independence means that two factors are no related. In social science research, it is usually used to determine the variables which are related or influenced by each other [43].

SPSS v16.0 was used to perform Pearson Chi-Square test for independence for the dependency analysis between the 20 quality requirements. Each pair of requirements was investigated to find the relationships between them. It is required to look for the significance values between those requirements to determine which ones were dependent. SPSS gave the significance values of each pair of quality requirements after performing the Pearson chi-square test. During the analysis, chi-square test were performed under a confidence level of 95% which means $\alpha = 0.05$. If the significance value between the requirements is lower than 0.05 that means those two requirements are dependent. The quality assessment survey data was used in dependency analysis. Chi-square test uses the responds point over total point of each IT facility of related quality requirements to determine the significance value. The pair of requirements having a significance values lower that 0.05 are shown in Table 5.2.

Table 5. 2 Significance values of quality requirements

Dependent REQUIREMENTs	Significance Value
Quality Goals - IT Standards & Quality Practices	0.001
Quality Tools - Employee Awareness	0.016
Example Setting - Quality Goals	0.017
Quality Goals - Employee Awareness	0.011
Documentation for all Quality Processes - Quality Goals	0.000
Full Customer Focused - Quality Tools	0.002
Leadership - Employee Awareness	0.011
Quality Management System – Quality Tools	0.000

Table 5.2 (cont.)

Extension of QMS to the affiliated business lines – Quality Goals	0.000
Continuous Improvement – Leadership	0.001
Example Setting – Leadership	0.000
Leadership - Quality Training	0.003
Full Customer Focused - Quality Goals	0.000
Leadership - Quality Tools	0.000
Documentation for all Quality Processes -Quality Tools	0.002
Quality Management System - Quality Goals	0.000
Extension of QMS to the affiliated business lines – Leadership	0.000
Continuous Improvement – Quality Tools	0.000
Continuous Improvement – Quality Goals	0.011
Full Customer Focused - Documentation for all Quality Processes	0.000
Quality Tools - IT Standards & Quality Practices	0.002
Leadership - IT Standards & Quality Practices	0.001
Full Customer Focused - Leadership	0.001
Leadership - Quality Goals	0.000

After finding the significance values, the dependent requirements were organized to see whether the leveling of them is justified. 4 cases of leveling assumed to perform this analysis. Besides, two rules were stated while assuming those 4 cases. These rules are:

- Two quality requirements should not be at the same level if they are dependent to each other.

- Two quality requirements can be at the same level if they are not dependent to each other.

Then, 4 cases of dependency assumptions would follow as:

1. **Case**

   X dependent to Y,

   If   X dependent to Z, and   Assumption of leveling: x over y over z (x/y/z)

   Y dependent to Z

2. **Case**

   X dependent to Y,

   If   X dependent to Z, and   Assumption of leveling: x over y with z (x/y,z)

   Y not dependent to Z

Or

   X dependent to Z,

   If   Y dependent to Z, and   Assumption of leveling: x with y over z (x,y/z)

   X not dependent to Y

3. **Case**

   If   X dependent to Y   Assumption of leveling: x over y (x/y)

4. **Case**

   If   X not dependent to Y   ignore the case

After looking for those 4 cases from Table 5.2, there were 8 relationships for case 1, 2 relationships for case 2 and 3 relationships for case 3. Those relationships can be used to re-level the dependent quality requirements regarding the 4 case assumptions. Finally, the Table 5.3 was organized from the dependency analysis.

Table 5. 3 Leveling after dependency analysis

Level 5	Full Customer Focused, Continuous Improvement, Extension to QMS, Example Setting, **QMS**
Level 4	Leadership, Documentation for all quality processes, **QMS**
Level 3	Quality Goals, Quality Tools, **Quality Training**
Level 2	Employee Awareness, **IT Standards & Quality Practices, Quality Training**

QMS and Quality Training were found suitable for two quality levels and could be state on any of them. In this study, QMS is stated on quality level 4 which is suitable and Quality Training is stated on Level 3 which is also suitable.

The other bold one shows the only inconsistency with the leveling approach in this study. The only inconsistency was found in IT Standards & Quality Practices requirement. It was found from the dependency analysis that it should be state on quality level 2. However, that quality requirement was defined for quality level 3.

All in all, it is acceptable to have a 10% error in justifying the study. So, the wrong placement of 1 quality requirement is considered as acceptable and as a result, the dependency analysis justifies the leveling approach in this study.

5.4. Interviews and studies with IT and Quality experts

Besides the statistical analysis and literature surveys, interviewing and sharing information with IT and quality experts are another important part of this study. During the study, sometimes, it was required to decide or innovate a feature or a factor affecting the IT quality and also any other important information being useful for the evaluation of this thesis. At that point, it was preferred to get a help from an IT expert or a professional in quality studies.

For example, information gathered from experts was used in definitions of some of the quality requirements and in leveling approach. Extension of QMS to the affiliated business lines is such a quality requirement that derived by a study with some of those quality experts.

Similarly, IT and quality alignment is another significant factor to be taken more attention. Selecting of quality requirements that are directly related to information technologies is another issue to be preferred getting help from IT and quality experts.

To sum up, the information and suggestions taken from experts on those areas are reliable and considered as true data to be used during the study.

CHAPTER 6

CONCLUSIONS & LIMITATIONS

Idea behind this study has started with the concept of IT quality. Throughout the study, IT quality and its requirements have been investigated. As a result, 20 general quality requirements that affects the quality of IT facilities in organizations were defined. Those requirements are also the fundamentals of a future quality maturity framework for IT facilities. Therefore, the following question has been answered for the purpose of this research work:

What will be the quality requirements to develop a quality maturity framework?

Chapter 6 of this thesis deals with a summary of actions taken for the study, contributions of the study and research, limitations faced during the study and presentation of some future work.

6.1.   Summary

The study mainly focuses to determine the general quality requirements and the factors affecting them to provide a fundamental guide in developing a future quality maturity framework for IT facilities in organizations. The requirements were determined from a deep literature survey among the available quality models, awards, and frameworks. There are 20 general quality requirements which are thought the most valuable ones for IT facilities for a quality improvement approach were defined. Besides, the features affecting those requirements were determined and used to prepare a quality assessment survey to see the areas that need improvement for some of the major IT facilities in Turkish institutions.

For the questionnaire of the survey, literature survey again played a vital role to find the features affecting those quality requirements, which represents the questions in the questionnaire. Quality assessment survey was conducted to 30 IT facilities in some major Turkish government institutions. Survey also resulted in quality status of those surveyed IT facilities.

This study also provides a proposal for a future quality maturity framework for IT facilities for their quality improvement approaches. 20 quality requirements were grouped into quality levels which are similar to the maturity approaches in e-CMM and CobiT etc. Those two models were also observed during the literature survey and taken as base frameworks for the leveling approach in this study.

At the final stage, the findings of the quality assessment survey were represented and performed a detailed data analysis. The number of IT facilities were revealed regarding the five different choice of meeting the each requirement asked. Some justification approaches were also performed to verify the study in determining the 20 quality requirements and their affecting factors and the leveling approach.

6.2. Contribution

Quality is maybe one of the most important things in the global business environment. There are many models related to process improvement or process quality in organizations. However, these models are just only focused the process improvement concept or just the maturity concept. An organizational quality approach is not provided. From this point of view, this study aims to prepare a resource or a fundamental guide; to determine the quality requirements to develop a quality maturity framework which provides organizations having a total quality approach including processes, people, communications and the organization itself. It makes the study unique that the quality requirements are determined by only considering the IT facilities. So, a possible quality maturity framework that will be developed by using this study will also differ from the available quality models and frameworks in that way.

All in all, this work determines the quality requirements of a quality maturity framework for IT facilities in organizations. Besides, the study includes a quality

assessment survey regarding those quality requirements defined. The survey provides a detailed investigation among 30 IT facilities in Turkish government institutions and represents the quality status of those facilities and in what manner they have met the quality requirements defined in the study.

6.3. Limitations

1. Generally speaking, sample size that is more than 5% of the population is required to conduct a successful survey. In this study, quality assessment survey has been performed to 30 out of 120 major public organizations. Although the sample size is at acceptable level, the more sample would probably give more accurate and realistic results. So, the model needs to be experimented with more samples.

2. This study can also be interpreted as a pilot study that align total quality approach to IT industry. Besides, it makes difficult to align some of the quality requirements such as customer satisfaction to public IT facilities in government institutions. The survey might be improved by conducting private IT facilities in the industry. However, the sample size must be more than 30 if private organizations are included because there are much more private organizations than government institutions.

6.4. Future Work

1. The factors affecting the quality requirements need more investigation and a detailed analysis. In the study, it is defined at most 3 sub-requirements for each of the general quality requirement. This also makes the questionnaire more simple and less detail. However, developing a quality maturity framework in the future would be helpful in investigating quality in detail.

2. A balanced score card, or a audit checklist can be prepared for quality assessment survey. This balance score card provides a scoring approach to see the quality status of IT facilities regarding the 20 quality requirements defined in this study.

3. A quality maturity framework for IT facilities would be developed easily by using this work as a guide. Because, 20 quality requirements within their features, defined in this study, are the core requirements in quality and must be included in any quality approach. Besides, this study provides a proposal for how to level quality requirements for that kind of study. Therefore, a quality maturity framework including quality practices, processes and principles could be developed for a future work of this study.

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APPENDICES

A. LIST OF INTERVIEWED IT FACILITIES

Government Institution	IT Facility
T.C. Maliye Bakanlığı	-Hesap Uzmanları Kurulu Başkanlığı Bilgi İşlem Dairesi -Strateji Geliştirme Başkanlığı Yönetim Bilgi Sistemleri Dairesi -Baş Hukuk Müşavirliği ve Muhakemat Genel Müdürlüğü Bilgi İşlem Dairesi -Bütçe ve Mali Kontrol Genel Müdürlüğü Bilgi İşlem Dairesi -Muhasebat Genel Müdürlüğü Bilgi İşlem Dairesi -Personel Genel Müdürlüğü Bilgi İşlem Dairesi -Devlet Malzeme Ofisi Bilgi İşlem Dairesi -Bilgi İşlem Dairesi Başkanlığı
T.C. Bayındırlık ve İskan Bakanlığı	-Yapı İşleri Genel Müdürlüğü Bilgi İşlem Dairesi -Teknik Araştırma ve Uygulama Genel Müdürlüğü Bilgi İşlem Dairesi -Tapu ve Kadastro Genel Müdürlüğü Bilgi İşlem Dairesi

T.C. Çalışma ve Sosyal Güvenlik Bakanlığı	-Sosyal Güvenlik Kurumu Sosyal Sigortalar Genel Müdürlüğü Karar Destek Analiz ve Şube Müdürlüğü Bilgi İşlem Dairesi -Sosyal Güvenlik Kurumu Sosyal Sigortalar Genel Müdürlüğü Strateji Geliştirme Başkanlığı Bilgi İşlem Dairesi
T.C. Başbakanlık	-Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK) Bilgi İşlem Daire Başkanlığı -Vakıflar Genel Müdürlüğü Elektronik Bilgi İşlem Sistemleri Dairesi
T.C. Enerji ve Tabii Kaynaklar Bakanlığı	- Türk Petrolleri Anonim Ortaklığı (TPAO) Bilgi Teknolojileri Daire Başkanlığı Bilgi İşlem Dairesi -Türk Petrolleri Anonim Ortaklığı (TPAO) Strateji Daire Başkanlığı Bilgi İşlem Dairesi - Maden Tetkik Arama Genel Müdürlüğü Bilgi İşlem Daire Başkanlığı
T.C. Tarım ve Köy İşleri Bakanlığı	-Teşkilatlanma ve Desteleme Genel Müdürlüğü Bilgi İşlem Şube Müdürlüğü -Strateji Geliştirme Bakanlığı Yönetim Bilgi Sistemler -Toprak Mahsülleri Ofisi Genel Müdürlüğü Bilgi İşlem Dairesi
T.C. Kültür ve Turizm Bakanlığı	-Devlet Tiyatroları Bilgi İşlem Dairesi
T.C. Sanayi ve Ticaret Bakanlığı	-Türk Standartları Enstitüsü Bilgi İşlem Daire Başkanlığı
T.C. Sağlık Bakanlığı	- Bilgi İşlem Dairesi Başkanlığı
T.C. Ulaştırma Bakanlığı	-Karayolları Genel Müdürlüğü Bilgi İşlem Dairesi

T.C. Çevre ve Orman Bakanlığı	-Devlet Su İşleri Teknoloji Genel Müdürlüğü Bilgi İşlem Dairesi
T.C. Milli Eğitim Bakanlığı	Yüksek Öğretim Kurulu Üniversiteler -Orta Doğu Teknik Üniversitesi Bilgi İşlem -Abant İzzet Baysal Üniversitesi Bilgi İşlem -Yeditepe Üniversitesi Bilgi İşlem
Türk Telekom	-Genel Müdürlük Bilgi İşlem

B. QUALITY ASESSMENT SURVEY QUESTIONNAIRE

BILGI TEKNOLOJILERI (BT) KALITE DEGERLENDIRME ANKETI

NOT: Lutfen bu bolumu okuduktan sonra ankete baslayiniz...

GIRIS

Bu anket, Bilgi Teknolojileri (BT) kalite degerlendirme anketi olarak BT kalitesinin seviyesini belirlemek amaci ile hazirlanmistir. Anket, toplam 20 kalite gereksinimi ile ilgili 50 sorudan olusmaktadir.

Anketdeki sorular kurumunuz bunyesinde SADECE Bilgi-Islem Bolumu/Dairesi ve ilgili bolum calisanlarini ilgilendirmektedir. Sorulari cevaplandiririken lutfen ilgili bolumden bir yetkiliyi veya calisani gorevlendiriniz. Sorulari cevaplayacak olan kisi sorulara tum Bilgi-Islem Bolumu/Dairesi ve/veya calisanlari adina cevap vermelidir. Lutfen her soru icin cevap verirken sorunun cevabinin ilgili bolum ve/veya calisanlar icin sorulan kalite gereksiminin hangi seviyede saglandigini goz onune alarak, size verilen 5 ayri seviyeyeden uygun olan secenegi seciniz...

Katildiginiz icin tesekkur ederiz...

1- Kurum Calisaninin Farkindaligi (Employee Awareness) - (Soru 1-3)   Gereksinimler ne derece saglaniyor?

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
1	BT Kalitesinin anlamini ve onemini tum calisanlar biliyor mu?					
2	BT Kalite gereksinimlerini tum calisanlar biliyor mu?					
3	Tum calisanlar, BT Kalite olgunluk seviyesinin yuksek olmasinin, sirkete nasil bir katma deger getireceginin farkinda mi?					

2- Insan Gerekliligi (Involvement of Prople) - (Soru 4-6)   Gereksinimler ne derece saglaniyor?

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
4	Her bir BT kurum calisani kurumdaki rolunu, gorevini ve onemini tam olarak biliyor mu?					
5	Her bir BT kurum calisani kendi sorumluluklarini bilerek, ongorulen hedefler dogrultusunda kuruma faydali olacak sekilde sorumluluklarini yerine getiriyo mu?					
6	Her bir BT kurum calisani bilgisini ve tecrubesini rahatlikla paylasiyor mu?					

3- Bilgi Teknoljileri Standartlari ve Kalite Uygulamalari (IT Standards & Quality Practices) - (Soru 7-9)   Gereksinimler ne derece saglaniyor?

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
7	Tum BT Kalite surecleri icin kalite standartlari ve uygulamalari tanimli ve uygulanabilir mi?					
8	Tum BT Kalite surecleri, dokumante edilmis sekilde tanimli mi?					
9	Herhangi bir BT Kalite sureci icin en iyi uygulama (best practices) tanimli ve uygulanabilir mi?					

4- Bolum Ici Iletisim (Internal Communication) - (Soru 10-11)   Gereksinimler ne derece saglaniyor?

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
10	BT organizasyonu icerisinde duzenli ve yapici bir iletisim var mi?					
11	BT organizasyonu icerisinde ileri seviye iletisim teknikleri kullaniliyor mu? (Web forms, surveys, forums)					

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5- Tum Kalite Surecleri Dokumantasyonu (Documantation for all Quality Processes) - (Soru 12-13) saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
12	Tum BT kalite surecleri icin tanimlamalar, hedefler ve prosedurler tanimli ve dokumante edilmis mi?						
13	Tum kalite dokumanlarina erisim ve dokumanlarin bolumler arasi kullanilabilirligi tam olarak saglaniyor mu?						

6- Musteri Iletisimi (Customer Communication) - (Soru 14-16) saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
14	BT musteri/hizmet gereksinimleri tam olarak biliniyor mu?						
15	BT musterileri ile en uygun iletisim saglaniyor mu?						
16	BT musterilirinin istekleri/gereksinimleri tam olarak musteriye saglaniyor mu?						

7- Tam Olarak Musteri Odakli (Full Customer Focused) - (Soru 17-19) saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
17	BT kurumu olarak tum surecler, urunler ve/veya hizmetler musteri istegi/gereksinimi dogrultusunda farklilastirilarak hazirlaniyor/degerlendiriliyor mu?						
18	Tum musteriler ayri ayri degerlendirilip, gerekirse segmante edilerek gruplara ayriliyor mu?						
19	Her musteri icin ayni urun/hizmet yerine, her bir musterinin istekleri/gereksinimleri on planda tutularak tam anlamiyla musteri odakli hizmet/urun sunuluyor mu?						

8- Insanlar ve Yetenekler (People & Skills) - (Soru 20-21) saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
20	Kurum calisanlarinin kalite konusunda yetenek ve becerileri biliniyor mu?						

| 21 | BT kalite sureclerinde yasanacak olasi bir problem icin, hangi calisanin, hangi yetenek ve becerilerinin problemi cozmede daha uygun olacagi biliniyor mu? | | | | | | |

9- Kalite Araclari (Quality Tools) - (Soru 22-23)
saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
22	BT kalite araclari (BT kalite problemlerini cozmek icin her turlu yazilimsal veya donanimsal uygulamalar) mevcut ve kullanilabilir mi?					
23	Tum BT kalite araclari icin kullanim ve uygulama plani mevcut mu?					

10- Kalite Egitimi (Quality Training) - (Soru 24-26)
saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
24	BT Kalite egitim plani mevcut mu?					
25	BT Kalite egitimi resmi olarak yapiliyor mu (Bunun icin egitimli kisiler mi kullaniliyor yoksa kisisel girisimler ile mi yapiliyor)?					
26	BT Kalite egiitm planina gore en gelismis ve olgun egitim teknikleri uygulaniyor mu?					

11- Guru/Uzman Olmak (Example Setting) - (Soru 27-28)
saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
27	Tum BT kalite surec sorumlulari, kendi isinde kurallara uyan, caliskan ve gorevlerini eksiksiz ve en iyi sekilde yerine getirebiliyor mu?					
28	Tum BT kalite surec sorumlulari gerektiginde grup arkadaslarina olgun ve pozitif bir lider oldugunu hissettiryor mu?					

12- Kiyaslama (Benchmarking) - (Soru 29-30)
saglaniyor?   **Gereksinimler ne derece**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
29	BT sektoru icinde, mevcut BT kalitesi ve diger sirketlerin BT kaliteleri arasinda kiyaslama					

Soru No	Soru					
	(Benchmarking) yapiliyor mu?					
30	Asilmasi gereken BT kalite standardini saptamak icin tum BT kalite standartlari, kalite gerecleri ve uygulamalari arasinda kiyaslama yapiliyor mu?					

13- Sampiyonluk (Championship) - (Soru 31-33)   **Gereksinimler ne derece saglaniyor?**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
31	Her bir BT sureci icin sorumlu bir kisi var mi?					
32	Bu sorumlu kisinin gorevleri ve sayilabilirligi herkes tarfinindan biliniyor mu?					
33	Herhangi bir BT surecinde bir problem yasandiginda, yetkili kisi bulma konusunda bir karisiklik oluyor mu?					

14- Kalite Hedefleri (Quality Goals) - (Soru 34-35)   **Gereksinimler ne derece saglaniyor?**

oru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
34	BT Kalite hedefleri belli ve dokumante mi?					
35	BT Kalite hedefleri, BT is hedefleri ile uyumlu mu?					

15- Liderlik (Leadership) - (Soru 36-38)   **Gereksinimler ne derece saglaniyor?**

Soru No	Soru	Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
36	Her bir BT kalite sureci icin sorumlu bir kisi var mi ve KYS de tanimli mi?					
37	Bu sorumlu kisinin gorevleri ve sayilabilirligi herkes tarfinindan biliniyor mu ve bu bilgiler dokumante edilmis mi?					
38	Herhangi bir BT surecinde bir problem yasandiginda, KYS sistemi ile yetkili kisi kolaylikla belirlenebiliyor mu?					

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16- Kalite Yonetim Sistemi -KYS (Quality Management System) - (Soru 39-41) saglaniyor? **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
39	BT is gereksinimlerine uyumlu BT Kalite yonetimini: resmi, standardize ve ileriye yonelik bir sekilde uygulamayi sgalayan bir KYS(Kalite Yonetim Sistemi) mevcut mu?						
40	Mevcut KYS, tum BT kalite gereksinimlerini, hedeflerini, prosedurlerini ve tum kalite sureclerini iceriyor mu?						
41	Mevcut KYS, BT kalite yenetimi icin tum rolleri, gorevleri ve sorumluluklari kapsiyor mu?						

17- Kalite Memnuniyet Anketi (Quality Satisfaction Survey) - (Soru 42-43) saglaniyor? **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
42	BT kalite memnuniyet anketi mevcut mu?						
43	Bu anket, belli periyodlarla musterilere ve calisanlara uygulaniyor mu?						

18- Kalite Olcum, Izleme, ve Degerlendirme (Quality Measurement, Monitoring, and Review) - (Soru 44-46) saglaniyor? **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
44	BT kalitesi olcumu, izlenmesi ve degerlendirilmesi icin bir plan mevcut mu?						
45	BT kalitesi olcumu, izlenmesi ve degelendirilmesi icin en uygun kalite olcum ve izleme araclari, teknikleri veya modelleri vb. kullaniliyor mu?						
46	BT Kalitesi olcumu, izlenmesi ve degerlendirilmesi icin izlenen her turlu plan, prosedur ve kullanilan her turlu arac KYS de tanimli mi?						

19- KYS`nin kuruma yakin is alanlariyla bagli uzantisi olmasi (Extension of QMS to the affiliated business lines) - (Soru 47) saglaniyor? **Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
47	Kurumun mevcut KYS`si, kuruma yakin ucuncu sahis/kurum`larla olan iliskileri/surecleri de kapsiyor mu?						

20- Surekli Iyilesme (Continuous Improvement) - (Soru 48-50) saglaniyor?　　　　　　　　　　　　　　　　　　　　　**Gereksinimler ne derece**

Soru No	Soru		Hic	Cok Az	Yeteri kadar	Cok iyi	Mukemmel duzeyde
48	BT kalitesinin surekli gelisimi icin her hangi bir uygulama, plan veya prosedur mevcut mu?						
49	BT kalitesi surekli iyilestirmesi, BT`nin tum kalite sureclerini kapsiyor mu?						
50	Surekli iyilestirme kavrami, BT kalite surecleri icin bir yasam felsefesi yada BT kalite dongusu icinde kalici bir yer edinmis durumda mi?						

C. DETAIL ANALYSIS ON RESEARCH FINDINGS

Figure C.1 Number of IT facilities in Employee Awareness

Quality Req. 1 - Employee Awareness

	IT Quality	IT Quality Requirements	Added Value of IT Quality
Not At All	0	0	0
A Little	9	15	13
To Some Degree	16	13	12
Very Good	5	2	5
Excellent	0	0	0
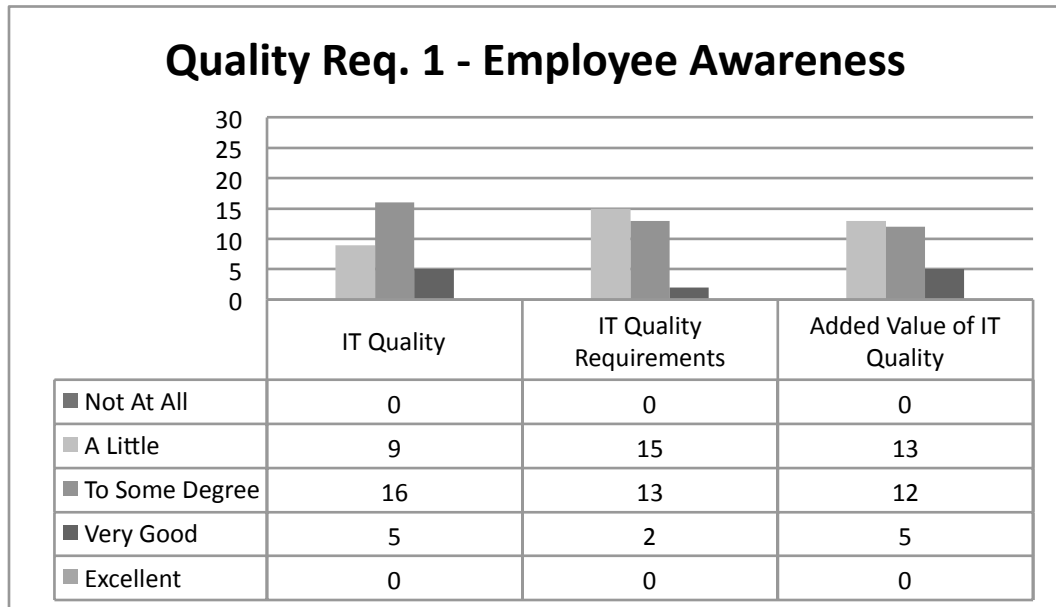
Figure C.2 Number of IT facilities in People & Skills

Quality Req. 2 - People & Skills

	IT Personnel's Skills	The right IT Personnel
Not At All	2	0
A Little	7	5
To Some Degree	14	16
Very Good	7	8
Excellent	0	1
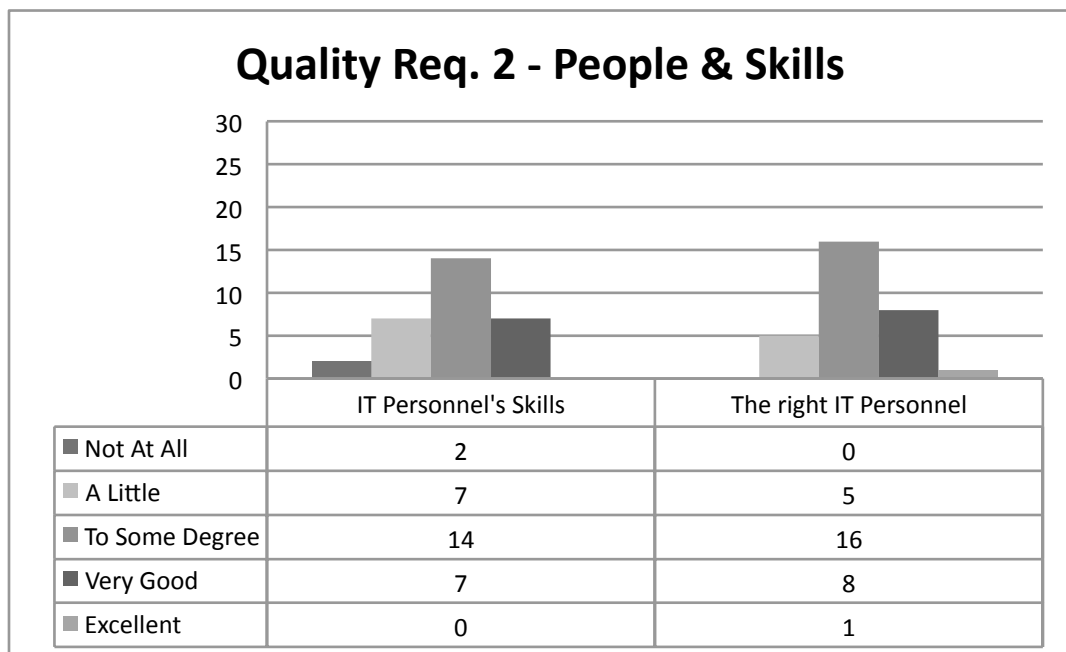
Figure C.3 Number of IT facilities in Championship

Quality Req. 3 - Championship

	Availability of IT Personnel(informal)	Knowing IT Personnel's duty (informal)	IT Quality Champion
Not At All	4	2	4
A Little	5	8	21
To Some Degree	9	10	3
Very Good	11	10	0
Excellent	1	0	2
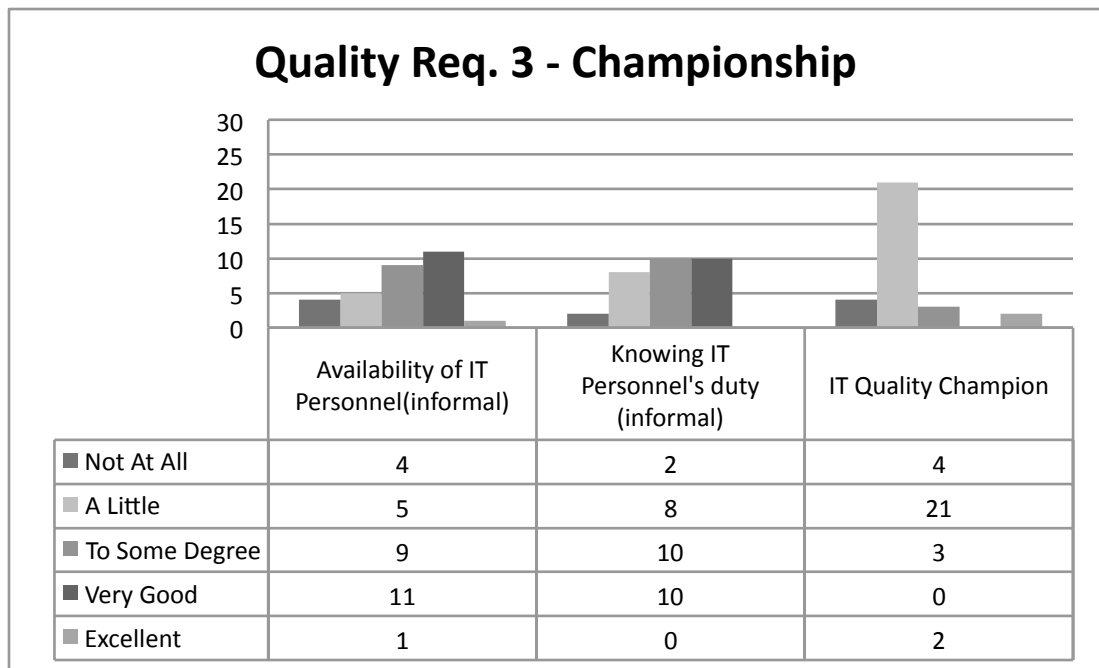
Figure C.4 Number of IT facilities in Involvement of People

Quality Req. 4 - Involvement of People

	Knowing Own Duty and Its Importance	Performing Duties	Sharing knowledge and experience
Not At All	0	0	0
A Little	4	5	4
To Some Degree	15	13	13
Very Good	11	11	10
Excellent	0	1	3
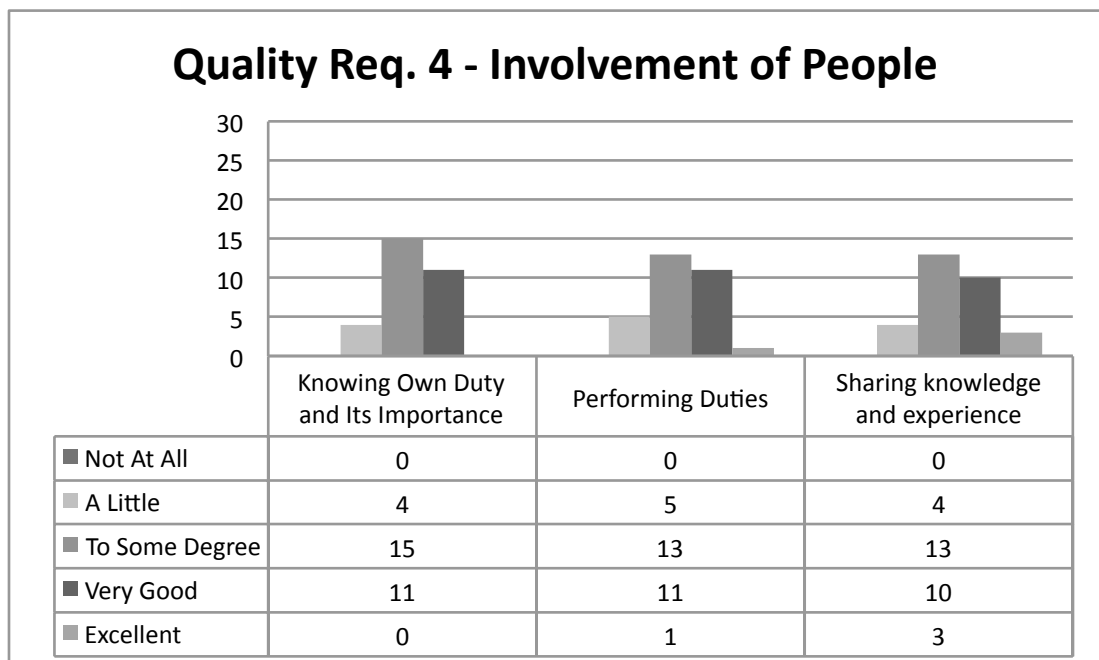
Figure C.5 Number of IT facilities in IT Quality Standards & Practices

Quality Req. 5 - IT Quality Standards & Practices

	Availability of IT quality standards and procedures	Documenting all IT quality processes	Availability of best practices
Not At All	1	6	3
A Little	15	10	12
To Some Degre	9	10	11
Very Good	5	3	3
Excellent	0	1	1
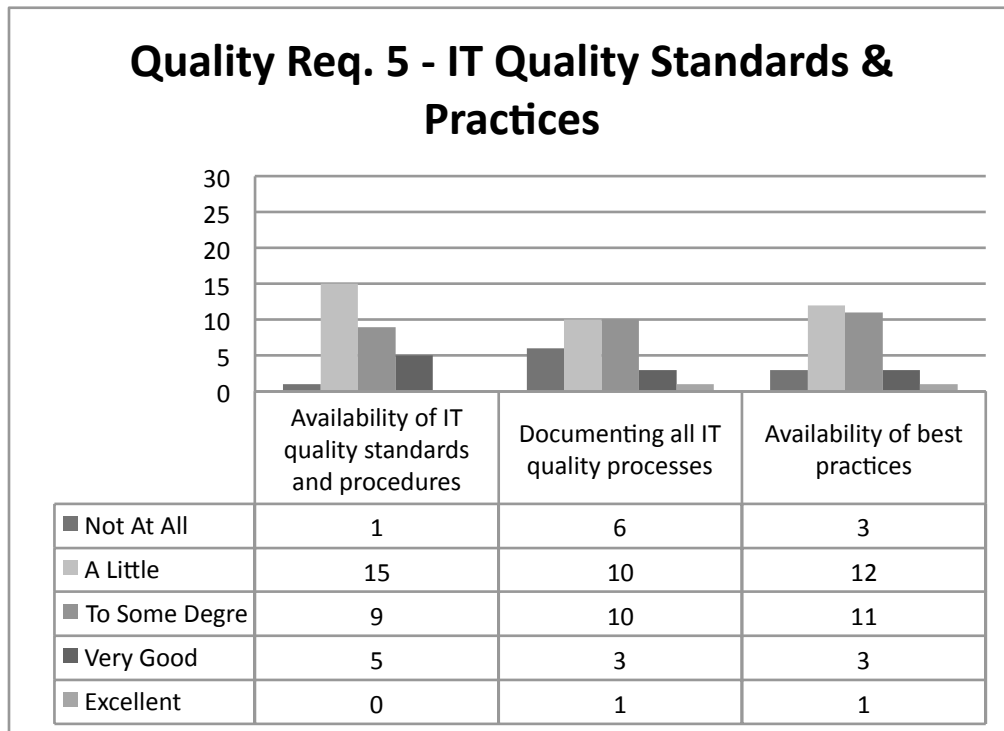
Figure C.6 Number of IT facilities in Internal Communication

Quality Req. 6 - Internal Communication

	Stable Communication	Advanced communication techniques
Not At All	0	2
A Little	6	10
To Some Degree	11	8
Very Good	11	8
Excellent	2	2
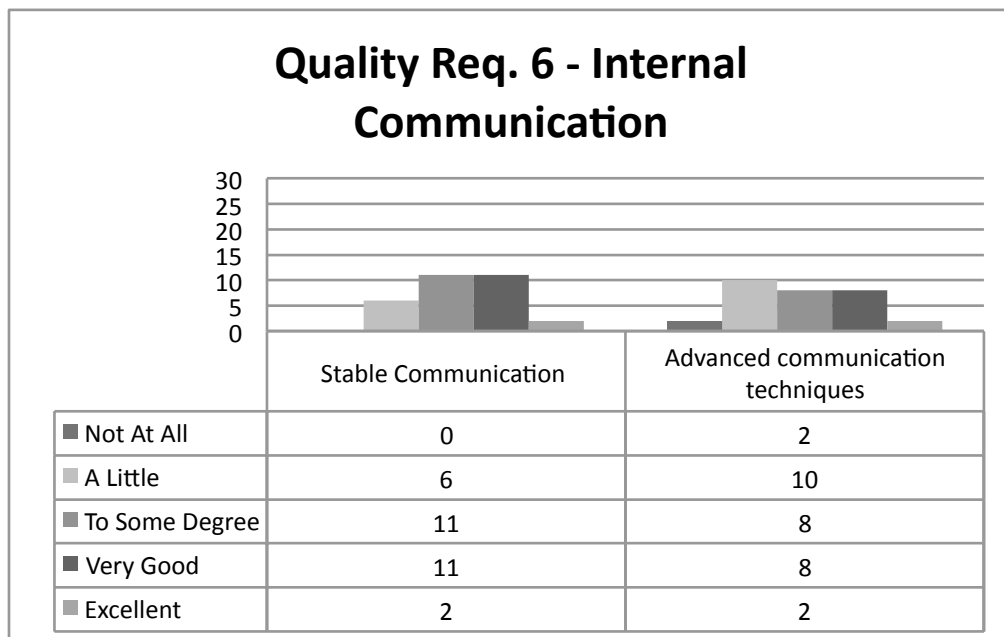
Figure C.7 Number of IT facilities in Quality Tools

Quality Req. 7 - Quality Tools

	Quality Tools	Quality Tools Plan and Manual
■ Not At All	3	5
■ A Little	4	8
■ To Some Degree	13	9
■ Very Good	9	8
■ Excellent	1	0
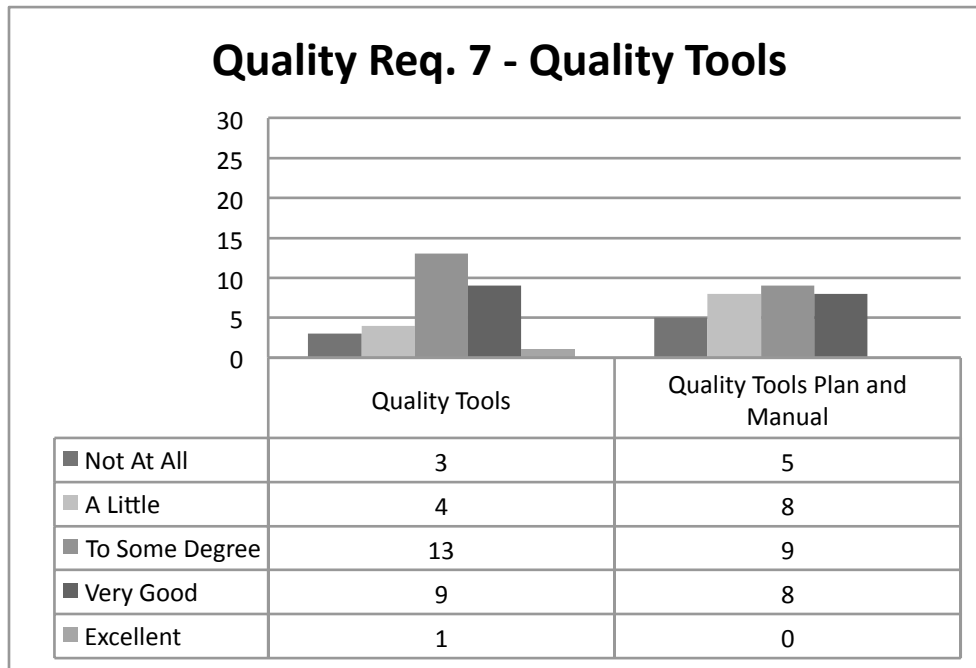
Figure C.8 Number of IT facilities in Quality Training

Quality Req. 8 - Quality Training

	Quality Training Plan	IT Quality Training	Advenced Training Methods
■ Not At All	8	9	8
■ A Little	10	8	9
■ To Some Degree	9	7	9
■ Very Good	3	6	4
■ Excellent	0	0	0
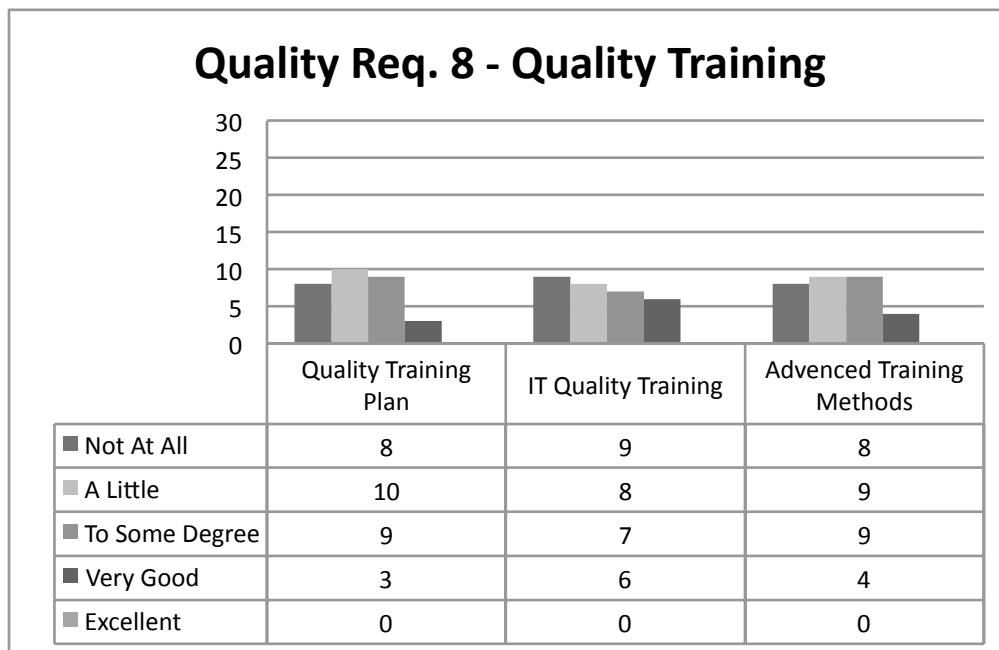
Figure C.9 Number of IT facilities in Quality Goals

Quality Req. 9 - Quality Goals

	IT Quality Goals	Quality - Business Goals' Consistency
■ Not At All	5	5
■ A Little	10	8
■ To Some Degree	9	9
■ Very Good	5	7
■ Excellent	1	1
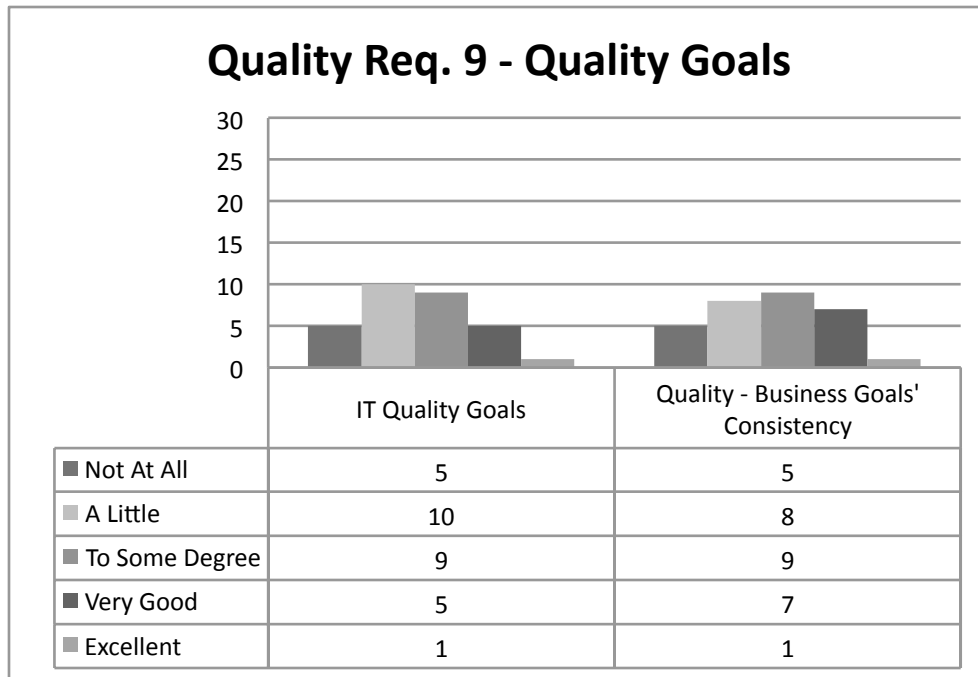
Figure C.10 Number of IT facilities in Documentation for all quality processes

Quality Req. 10 - Documentation for all Quality Processes

	Documenting procedures, goals and definition	Availabilty of all quality documents
■ Not At All	6	6
■ A Little	12	8
■ To Some Degree	6	6
■ Very Good	5	8
■ Excellent	1	2
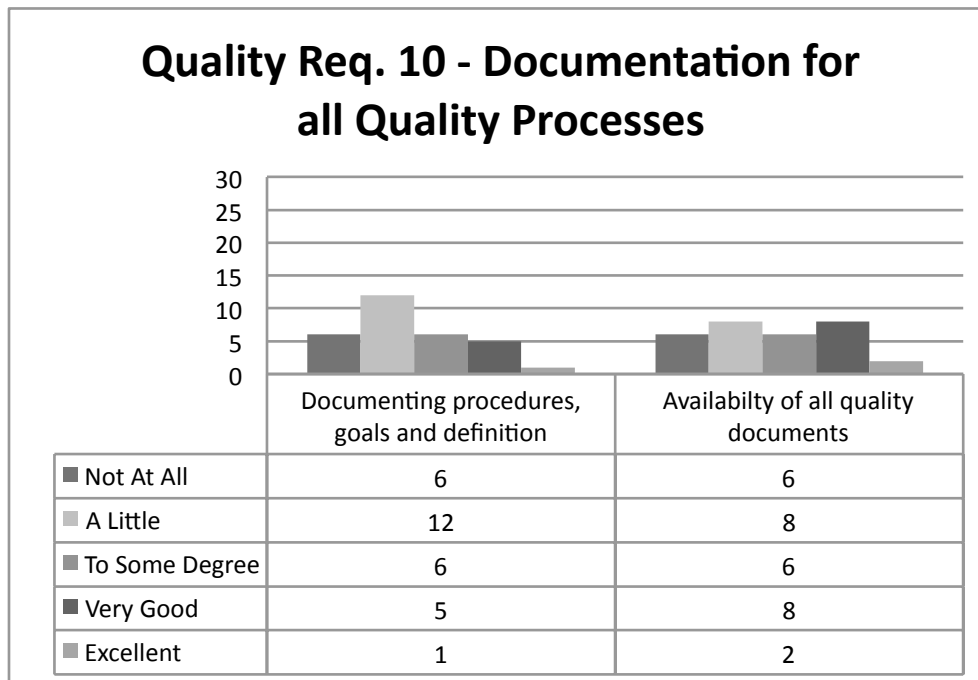
Figure C.11 Number of IT facilities in Customer Communication

Quality Req. 11 - Customer Communication

	Customer requirements/ needs	Communicating customers	Satisfying customers
Not At All	2	0	0
A Little	3	8	4
To Some Degree	20	15	19
Very Good	5	6	7
Excellent	0	1	0

Figure C.12 Number of IT facilities in Benchmarking

Quality Req. 12 - Benchmarking

	Benchmarking with External parties	Benchmarking with IT Quality in detail
Not At All	6	6
A Little	11	14
To Some Degree	11	8
Very Good	2	2
Excellent	0	0
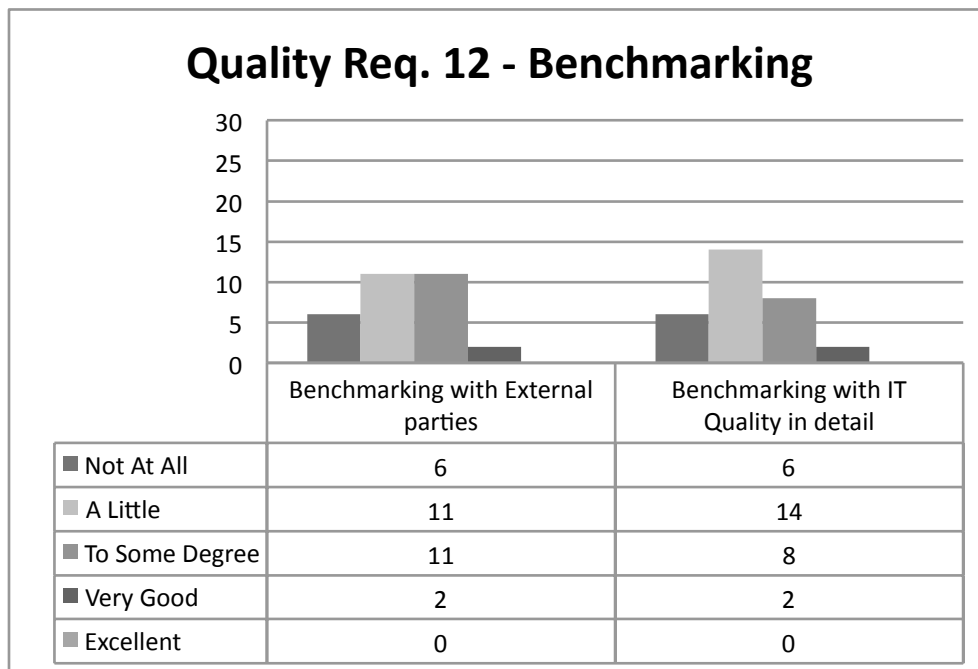
Figure C.13 Number of IT facilities in Leadership

Quality Req. 13 - Leadership

	Knowing IT Personnel (formal and available in QMS)	IT Personnel's duty (formal and available in QMS)	IT Quality Leader
■ Not At All	7	7	7
■ A Little	6	7	6
■ To Some Degree	10	11	12
■ Very Good	6	4	5
■ Excellent	1	1	0
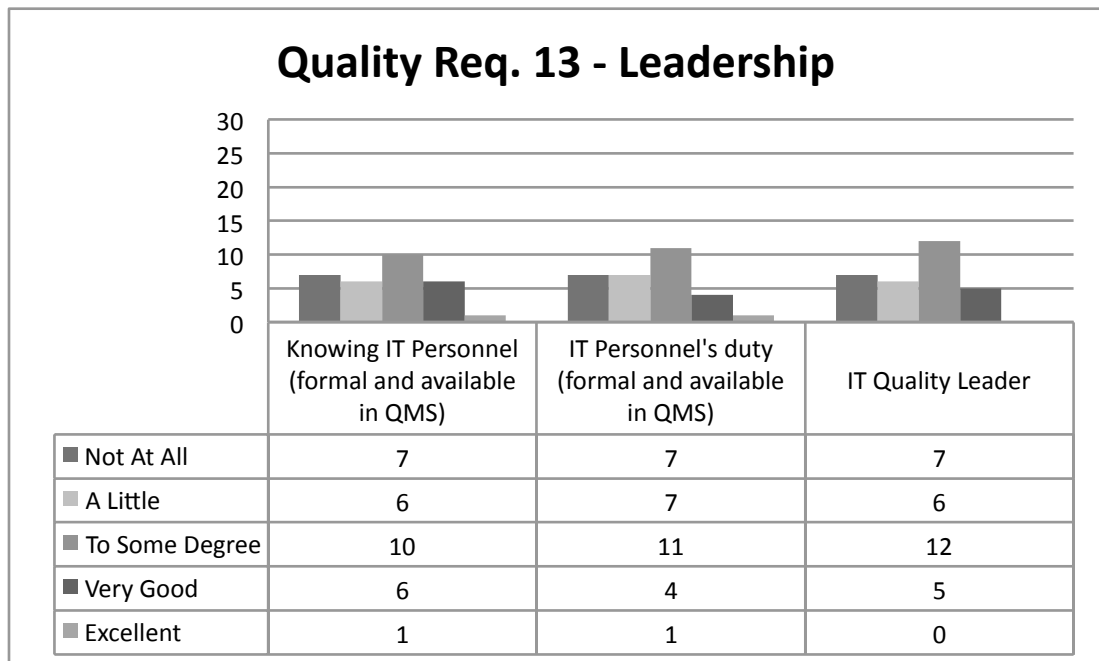
Figure C.14 Number of IT facilities in Quality Management System

Quality Req. 14 - Quality Management System

	Availability of QMS (basic)	Availability of QMS (process, procedure, goals, requirement)	Responsibility Definiton in QMS
■ Not At All	9	9	9
■ A Little	8	9	8
■ To Some Degree	9	7	8
■ Very Good	3	4	4
■ Excellent	1	1	1
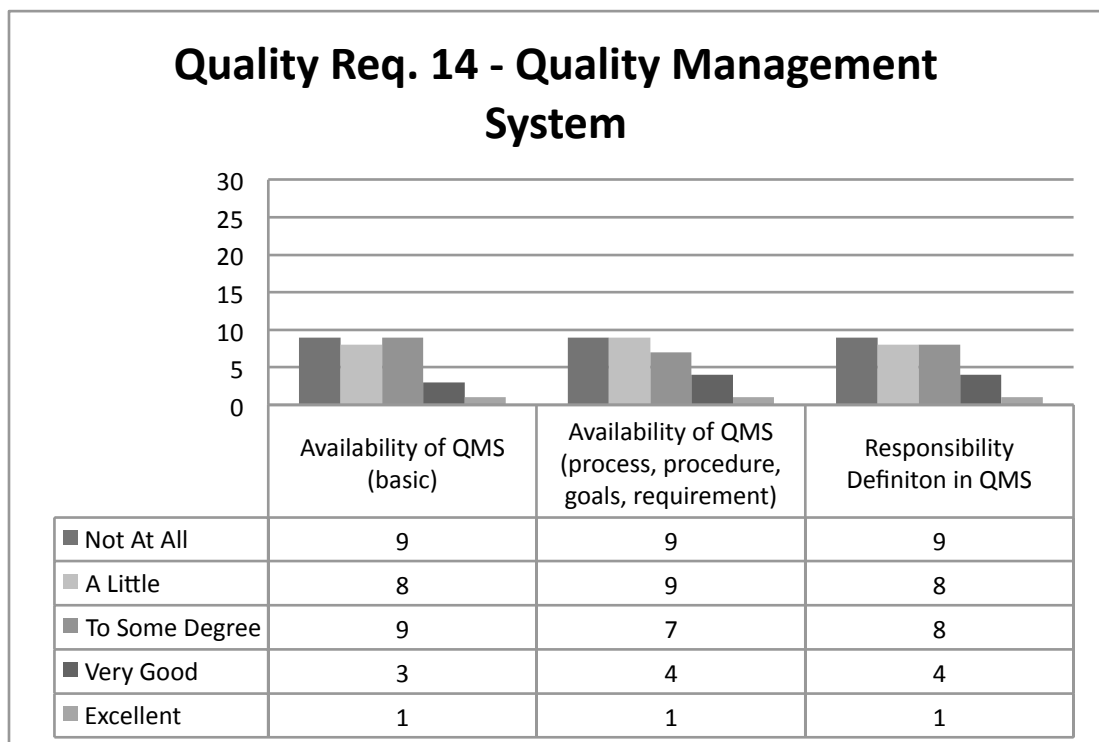
Figure C.15 Number of IT facilities in Quality Satisfaction Surveys

Quality Req. 15 - Quality Satisfaction Surveys

	Availability of Quality satisfaction surveys	Performing QSS
Not At All	21	23
A Little	5	4
To Some Degree	3	1
Very Good	1	2
Excellent	0	0
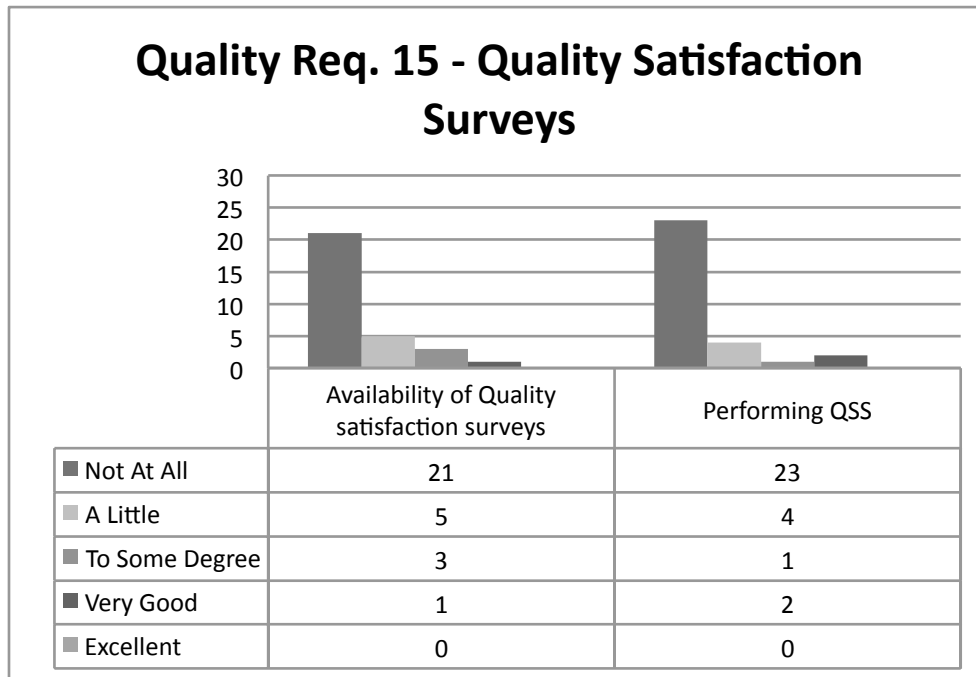
Figure C.16 Number of IT facilities in Quality Measurement, Monitoring & Review

Quality Req. 16 - Quality Measurement, Monitoring & Review

	IT Quality Measurement, Monitoring & Review Plan	IT Quality Measurement, Monitoring & Review Tools	Availability in QMS
Not At All	14	15	15
A Little	6	5	5
To Some Degree	8	7	8
Very Good	2	3	2
Excellent	0	0	0
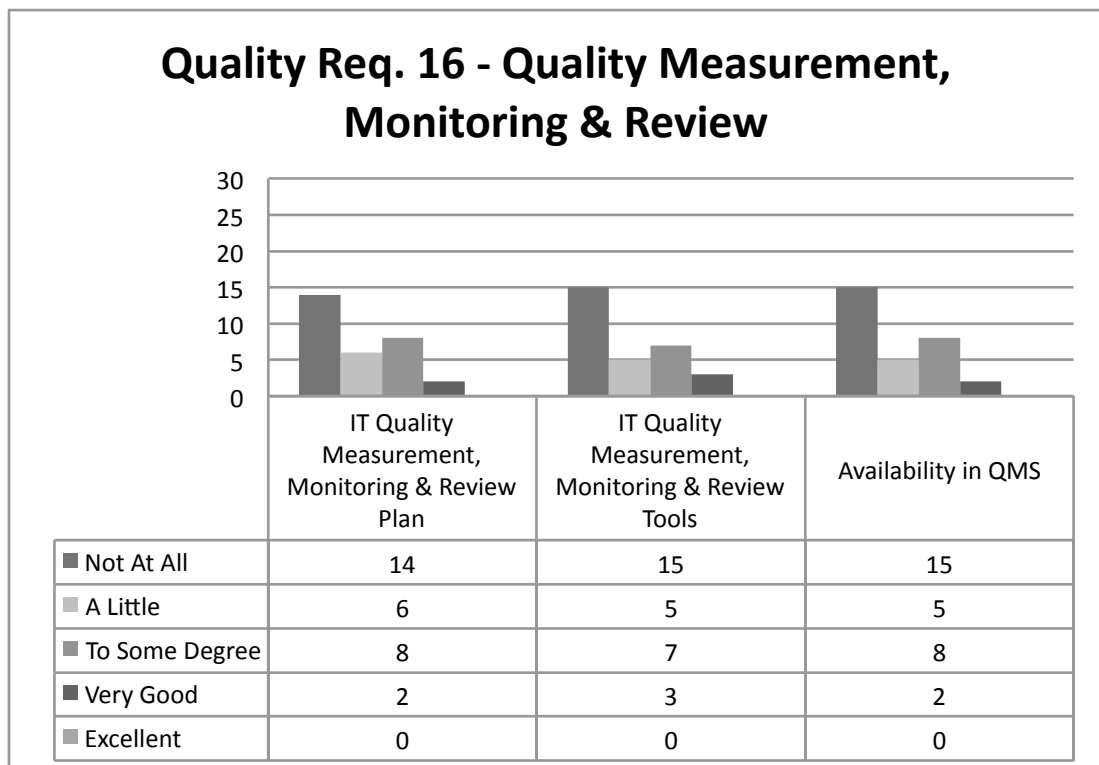
Figure C.17 Number of IT facilities in Full Customer Focused

Quality Req. 17 - Full Customer Focused

	IT processes, products or services development & Review	Customer Segmentation & Review	Specific Product/ Service development
■ Not At All	2	2	1
■ A Little	4	12	11
■ To Some Degree	17	13	12
■ Very Good	7	3	6
■ Excellent	0	0	0
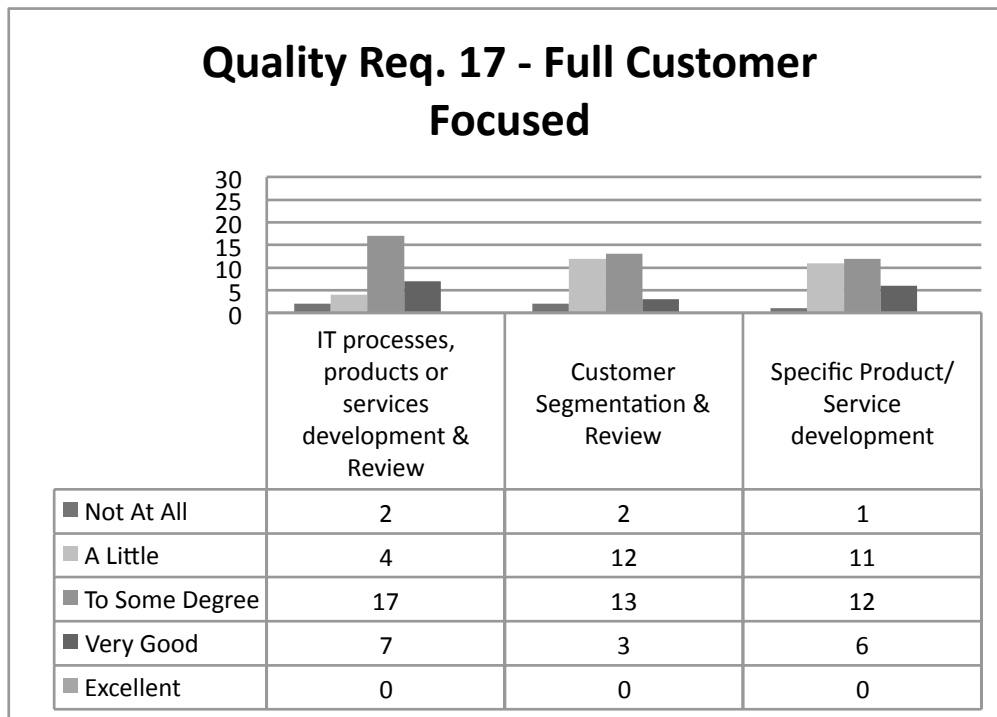
Figure C.18 Number of IT facilities in Example Setting

Quality Req. 18 - Example Setting

	IT Quality Expert	IT Quality Leader
■ Not At All	3	3
■ A Little	6	6
■ To Some Degree	14	15
■ Very Good	6	6
■ Excellent	1	0
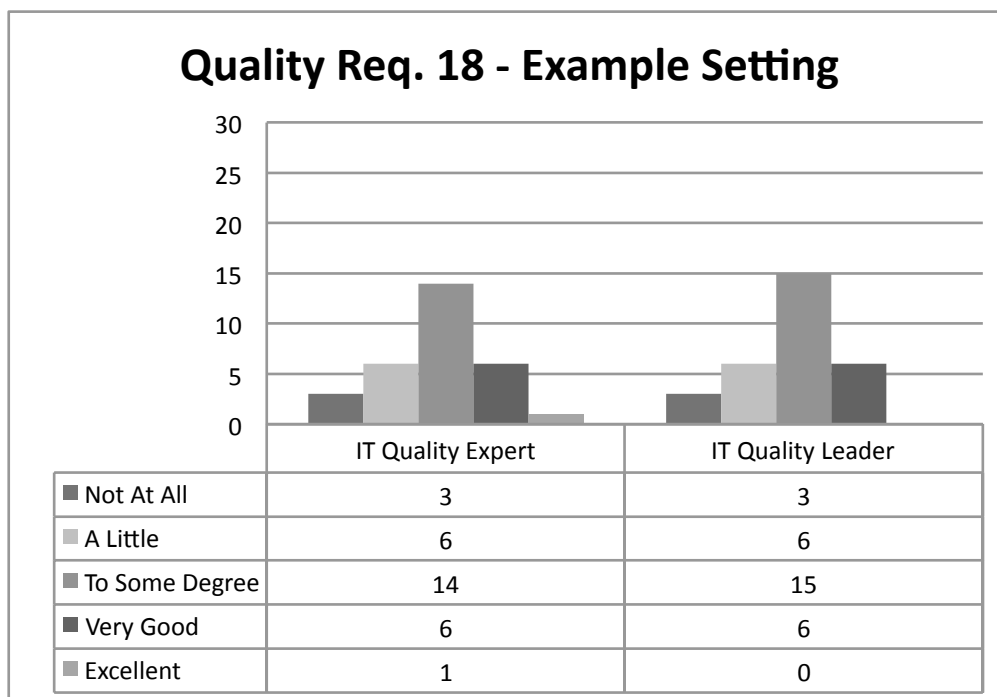
Figure C.19 Number of IT facilities in Extension of QMS to the affiliated business lines

Quality Req. 19 - Extension of QMS to the Affiliated Business Lines

	Extended QMS
■ Not At All	11
■ A Little	7
■ To Some Degree	10
■ Very Good	2
■ Excellent	0

Figure C.20 Number of IT facilities in Continuous Improvement

Quality Req. 20 - Continuous Improvement

% of IT facilities

	Continious Improvement Plan	Detailed CI for IT Quality	Life-Style for a Company: CI
■ Not At All	5	6	6
■ A Little	12	10	11
■ To Some Degree	11	12	10
■ Very Good	2	2	3
■ Excellent	0	0	0
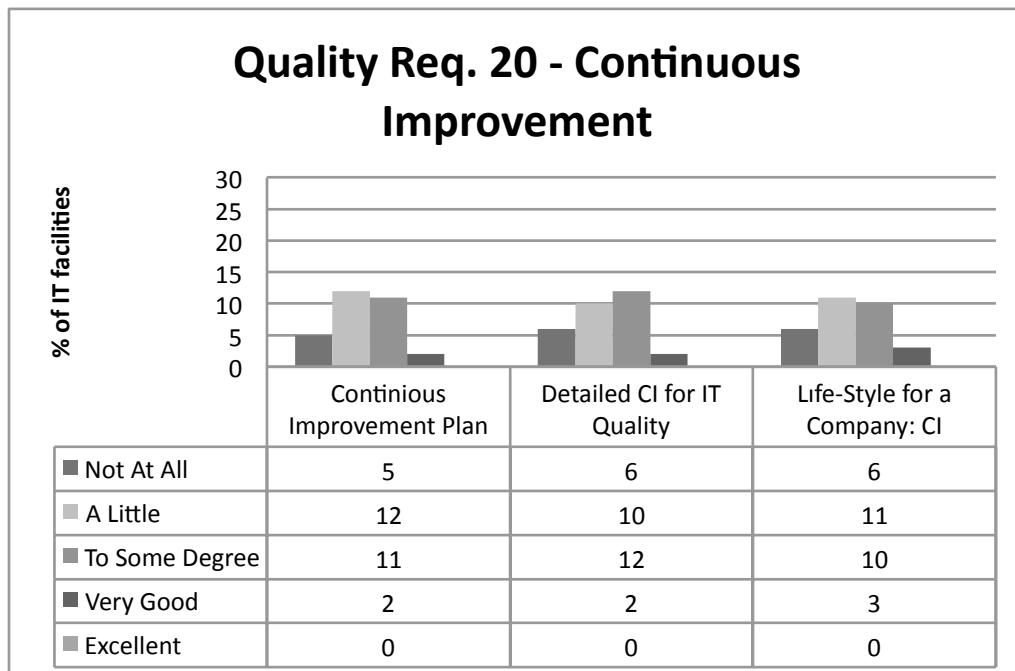
D. DETAIL ANALYSIS ON 30 IT FACILITIES

Institution* / Quality Requirement	Employee Awareness	People & Skills	Championship	Involvement of People	IT Standards & Quality Practices	Internal Communication	Quality Tools	Quality Training	Quality goals
1	A Little	To Some Degree	A Little	A Little	A Little	To Some Degree	Not At All	Not At All	A Little
2	To Some Degree	To Some Degree	To Some Degree	To Some Degree	A Little	To Some Degree	A Little	To Some Degree	A Little
3	To Some Degree	To Some Degree	Very Good	A Little	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree
4	A Little	Not At All	Not At All	To Some Degree	A Little	A Little	Not At All	Not At All	Not At All
5	To Some Degree	Very Good	Very Good	Very Good	A Little	Very Good	To Some Degree	A Little	A Little
6	To Some Degree	Very Good	A Little	Very Good	A Little	To Some Degree	To Some Degree	A Little	A Little
7	A Little	Very Good	To Some Degree	To Some Degree	Very Good	A Little	A Little	Not At All	A Little
8	A Little	To Some Degree	A Little	To Some Degree	To Some Degree	A Little	To Some Degree	To Some Degree	A Little
9	A Little	A Little	A Little	To Some Degree	A Little	A Little	A Little	A Little	To Some Degree
10	A Little	To Some Degree	To Some Degree	To Some Degree	A Little	A Little	A Little	A Little	A Little
11	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree
12	To Some Degree	A Little	A Little	To Some Degree	Not At All	Not At All	A Little	Not At All	Not At All
13	Very Good	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	A Little	A Little	A Little
14	A Little	To Some Degree	To Some Degree	To Some Degree	A Little	To Some Degree	A Little	A Little	A Little
15	A Little	A Little	A Little	To Some Degree	Not At All	A Little	Not At All	Not At All	Not At All
16	A Little	Not At All	Not At All	To Some Degree	A Little	A Little	Not At All	Not At All	Not At All

17	Very Good	A Little	To Some Degree	To Some Degree	Very Good	Very Good	Very Good	Very Good	Very Good
18	To Some Degree	A Little	To Some Degree	To Some Degree	To Some Degree	Excellent	Very Good	To Some Degree	To Some Degree
19	A Little	A Little	Not At All	To Some Degree	A Little	A Little	A Little	Not At All	A Little
20	Very Good	To Some Degree	Very Good	To Some Degree	Very Good	Very Good	Very Good	Very Good	Very Good
21	To Some Degree	Very Good	To Some Degree	Very Good	Not At All	Not At All	Not At All	Not At All	Not At All
22	A Little	A Little	To Some Degree	A Little	A Little	A Little	To Some Degree	To Some Degree	A Little
23	To Some Degree	To Some Degree	Very Good	Excellent	To Some Degree	Very Good	Very Good	To Some Degree	Very Good
24	To Some Degree	To Some Degree	Very Good	Very Good	A Little	A Little	Very Good	A Little	To Some Degree
25	To Some Degree	Very Good	Very Good	Very Good	To Some Degree	To Some Degree	To Some Degree	A Little	Very Good
26	To Some Degree	Very Good	Very Good	Very Good	To Some Degree	Very Good	Very Good	To Some Degree	Very Good
27	A Little	To Some Degree	A Little	Very Good	To Some Degree	Very Good	Very Good	Very Good	To Some Degree
28	To Some Degree	To Some Degree	Not At All	Very Good	Excellent	Very Good	Very Good	Very Good	Excellent
29	To Some Degree	To Some Degree	Very Good	Very Good	A Little	To Some Degree	To Some Degree	Not At All	A Little
30	To Some Degree	To Some Degree	A Little	Very Good	A Little	A Little	To Some Degree	To Some Degree	To Some Degree

Institution* / Quality Requirement	Documentation for All Quality Processes	Customer communication	Benchmarking	Leadership	QMS	Quality Satisfaction Surveys	Quality Measurement, Monitoring & Review	Full Customer Focused	Example Setting	Extension of QMS to the Affiliated Business Lines	Continuous Improvement
1	A Little	A Little	Not At All	Not At All	Not At All	Not At All	Not At All	A Little	Not At All	Not At All	Not At All
2	A Little	To Some Degree	A Little	A Little	A Little	A Little	Not At All	A Little	To Some Degree	A Little	Not At All
3	To Some Degree	To Some Degree	A Little	A Little	A Little	A Little	A Little	To Some Degree	A Little	A Little	A Little
4	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All
5	A Little	Very Good	A Little	A Little	A Little	Not At All	Not At All	Very Good	To Some Degree	To Some Degree	To Some Degree
6	A Little	To Some Degree	A Little	A Little	A Little	Not At All	A Little	A Little	A Little	A Little	To Some Degree
7	A Little	A Little	A Little	A Little	A Little	Not At All	Not At All	A Little	A Little	Not At All	Not At All
8	A Little	To Some Degree	A Little	To Some Degree	To Some Degree	A Little	To Some Degree	A Little	To Some Degree	To Some Degree	To Some Degree
9	To Some Degree	To Some Degree	A Little	A Little	A Little	Not At All	A Little	A Little	A Little	A Little	A Little
10	A Little	To Some Degree	Very Good	To Some Degree	A Little	Not At All	Not At All	A Little	To Some Degree	Not At All	A Little
11	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree
12	Not At All	A Little	A Little	Not At All	Not At All	Not At All	Not At All	A Little	A Little	Not At All	Not At All
13	A Little	A Little	To Some Degree	A Little	A Little	Not At All	Not At All	A Little	To Some Degree	Not At All	A Little
14	A Little	A Little	A Little	A Little	A Little	Not At All	Not At All	A Little	To Some Degree	Not At All	A Little
15	Not At All	To Some Degree	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	A Little	Not At All	A Little
16	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All	Not At All
17	Very Good	To Some Degree	To Some Degree	Very Good	Very Good	Very Good	Very Good	To Some Degree	To Some Degree	Very Good	Very Good
18	Very Good	To Some Degree	To Some Degree	To Some Degree	To Some Degree	Not At All	Not At All	To Some Degree	To Some Degree	Not At All	A Little
19	Not At All	To Some Degree	Not At All	Not At All	Not At All	Not At All	Not At All	A Little	A Little	Not At All	Not At All

20	Very Good	To Some Degree	To Some Degree	To Some Degree	To Some Degree	Not At All	To Some Degree	To Some Degree	To Some Degree	Very Good	A Little
21	Not At All	To Some Degree	Not At All	Not At All	Not At All	Not At All	Not At All	A Little	To Some Degree	Not At All	A Little
22	A Little	A Little	A Little	Not At All	Not At All	Not At All	Not At All	A Little	A Little	Not At All	A Little
23	To Some Degree	Very Good	To Some Degree	To Some Degree	To Some Degree	Not At All	A Little	Very Good	Very Good	To Some Degree	To Some Degree
24	A Little	To Some Degree	To Some Degree	To Some Degree	To Some Degree	Not At All	A Little	A Little	To Some Degree	A Little	To Some Degree
25	To Some Degree	To Some Degree	To Some Degree	To Some Degree	Very Good	Not At All	To Some Degree	To Some Degree	Very Good	To Some Degree	To Some Degree
26	Excellent	To Some Degree	To Some Degree	Very Good	To Some Degree	Not At All	To Some Degree	To Some Degree	To Some Degree	To Some Degree	To Some Degree
27	Very Good	To Some Degree	A Little	To Some Degree	Very Good	A Little	To Some Degree	Not At All	Very Good	To Some Degree	To Some Degree
28	Very Good	Very Good	A Little	Very Good	Excellent	To Some Degree	Very Good	To Some Degree	To Some Degree	To Some Degree	Very Good
29	A Little	Very Good	A Little	Not At All	Not At All	Not At All	Not At All	A Little	Very Good	Not At All	To Some Degree
30	A Little	To Some Degree	Not At All	To Some Degree	To Some Degree	Not At All	Not At All	To Some Degree	To Some Degree	To Some Degree	A Little

* The numbers of Institutions have been given randomly and does not represent any order regarding their quality status or the list of the names given in Appendix A.

E. COBIT'S MATURITY ATTRIBUTE TABLE

	Awareness and Communication	Policies, Plans and Procedures	Tools and Automation	Skills and Expertise	Responsibility and Accountability	Goal Setting and Measurement
1	Recognition of the need for the process is emerging. There is sporadic communication of the issues.	There are *ad hoc* approaches to processes and practices. The process and policies are undefined.	Some tools may exist; usage is based on standard desktop tools. There is no planned approach to the tool usage.	Skills required for the process are not identified. A training plan does not exist and no formal training occurs.	There is no definition of accountability and responsibility. People take ownership of issues based on their own initiative on a reactive basis.	Goals are not clear and no measurement takes place.
2	There is awareness of the need to act. Management communicates the overall issues.	Similar and common processes emerge, but are largely intuitive because of individual expertise. Some aspects of the process are repeatable because of individual expertise, and some documentation and informal understanding of policy and procedures may exist.	Common approaches to use of tools exist but are based on solutions developed by key individuals. Vendor tools may have been acquired, but are probably not applied correctly, and may even be shelfware.	Minimum skill requirements are identified for critical areas. Training is provided in response to needs, rather than on the basis of an agreed plan, and informal training on the job occurs.	An individual assumes his/her responsibility and is usually held accountable, even if this is not formally agreed. There is confusion about responsibility when problems occur, and a culture of blame tends to exist.	Some goal setting occurs; some financial measures are established but are known only by senior management. There is inconsistent monitoring in isolated areas.
3	There is understanding of the need to act. Management is more formal and structured in its communication.	Usage of good practices emerges. The process, policies and procedures are defined and documented for all key activities.	A plan has been defined for use and standardisation of tools to automate the process. Tools are being used for their basic purposes, but may not all be in accordance with the agreed plan, and may not be integrated with one another.	Skill requirements are defined and documented for all areas. A formal training plan has been developed, but formal training is still based on individual initiatives.	Process responsibility and accountability are defined and process owners have been identified. The process owner is unlikely to have the full authority to exercise the responsibilities.	Some effectiveness goals and measures are set, but are not communicated, and there is a clear link to business goals. Measurement processes emerge, but are not consistently applied. IT balanced scorecard ideas are being adopted, as is occasional intuitive application of root cause analysis.
4	There is understanding of the full requirements. Mature communication techniques are applied and standard communication tools are in use.	The process is sound and complete; internal best practices are applied. All aspects of the process are documented and repeatable. Policies have been approved and signed off on by management. Standards for developing and maintaining the processes and procedures are adopted and followed.	Tools are implemented according to a standardised plan, and some have been integrated with other related tools. Tools are being used in main areas to automate management of the process and monitor critical activities and controls.	Skill requirements are routinely updated for all areas, proficiency is ensured for all critical areas, and certification is encouraged. Mature training techniques are applied according to the training plan, and knowledge sharing is encouraged. All internal domain experts are involved, and the effectiveness of the training plan is assessed.	Process responsibility and accountability are accepted and working in a way that enables a process owner to fully discharge his/her responsibilities. A reward culture is in place that motivates positive action.	Efficiency and effectiveness are measured and communicated and linked to business goals and the IT strategic plan. The IT balanced scorecard is implemented in some areas with exceptions noted by management and root cause analysis is being standardised. Continuous improvement is emerging.
5	There is advanced, forward-looking understanding of requirements. Proactive communication of issues based on trends exists, mature communication techniques are applied, and integrated communication tools are in use.	External best practices and standards are applied. Process documentation is evolved to automated workflows. Processes, policies and procedures are standardised and integrated to enable end-to-end management and improvement.	Standardised tool sets are used across the enterprise. Tools are fully integrated with other related tools to enable end-to-end support of the processes. Tools are being used to support improvement of the process and automatically detect control exceptions.	The organisation formally encourages continuous improvement of skills, based on clearly defined personal and organisational goals. Training and education support external best practices and use of leading-edge concepts and techniques. Knowledge sharing is an enterprise culture, and knowledge-based systems are being deployed. External experts and industry leaders are used for guidance.	Process owners are empowered to make decisions and take action. The acceptance of responsibility has been cascaded down throughout the organisation in a consistent fashion.	There is an integrated performance measurement system linking IT performance to business goals by global application of the IT balanced scorecard. Exceptions are globally and consistently noted by management and root cause analysis is applied. Continuous improvement is a way of life.