A SIX SIGMA DEFINE PHASE METHODOLOGY FOR SERVICE-LEVEL COMPLIANCE PROCESSES

A THESIS IN ENGINEERING SYSTEMS MANAGEMENT

Presented to the faculty of American University of Sharjah
School of Engineering
In partial fulfillment of
The requirements for the degree

MASTER OF SCIENCE

By
Essam Omran Al Disi
B.S 2003

Sharjah, UAE
December 2007

A SIX SIGMA DEFINE PHASE METHODOLOGY FOR SERVICE-LEVEL COMPLIANCE PROCESSES

Essam O. Disi, Candidate for Master of Science in Engineering Systems Management

American University of Sharjah, 2007

ABSTRACT

The world economy has been recently experiencing the shift towards services, a phenomenon that is referred to as services-based or services- led economy. A service generally combines activities of a more intangible nature, and that's why are sometimes referred to as "intangible goods". Services may involve transport, distribution and sale of goods from supplier to a customer; they also may engage providing services such as security or cleaning. However, the focus of services is on people interacting with people productively to serve customers rather than transforming physical goods.

Service providers and cus tomers are usually bounded in Service Level Agreements (SLA) in order to quantify the minimum quality of service that meets business need, manage the specification of service levels and the design and implementation of service processes.

In the context of service provision, the main focus is on the compliance with the rules and regulations stated in the SLA which translate the needs of the customer and clarify the expectations of the service delivery.

To monitor the compliance of a SLA, organizations need to come up with a system of rewards and penalties for compliance and non-compliance.

A major issue that complicates the service level compliance of services is their heterogeneous character. This means that the experience of a particular service can differ from time to time since customers often play an active role in the consequential activities of service delivery.

The objective of this thesis is to develop a new methodology that shall help in applying the Six Sigma process optimization techniques to the SLA compliance. It also presents a group of new developed models that serve as the foundation for the methodology's steps. These models include: SLA Ontology, Compliance Oriented Process Maps, Generic Service Quality Attributes Model, generic Kano questions, generic CTQ table, generic QFD house, and generic SIPOC maps. These generic models serve as a guide for the continuous improvement of compliance business processes using Six Sigma DMAIC techniques.

The originality of this methodology lies in its generality, since it can be applied to non-IT services although it is mostly based on IT concepts such as Information Technology Infrastructure Library (ITIL), Service Oriented Architecture (SOA), and IBM's SLA Action Manager (SAM). This was demonstrated in Chapter 5, as the methodology was illustrated in the context of a non-IT services field.

CONTENTS

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

Table **Page**

LIST OF ABBREVIATIONS

CN	Customer Need
COA	Compliance Oriented Architecture
CTQ	Critical To Quality
DMAIC	Define, Measure, Analyze, Improve and Control
EMS	Emirates Management Services Corporation
GE	General Electric
GSLAM	Generic SLA Model
GSQA	Generic Service Quality Attribute
ITIL	Information Technology Infrastructure Library
ITsmf	IT Service Management Forum
KPI	Key Performance Indicator
OLA	Operational Level Agreement
QFD	Quality Function Deployment
SAM	SLA Action Manager
SIPOC	Supplier, Input, Process, Output, Customer
SLA	Service Level Agreement
SLCOM	Service Level Compliance Optimization Methodology
SLG	Service Level Guarantee
SLI	Service Level Intent
SLM	Service Level Management
SOA	Service Oriented Architecture

SS	Six Sigma
UC	Underpinning Contract
VOC	Voice Of Customer

ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who gave me the possibility to complete this thesis.

I am deeply indebted to my advisor Dr. Imran Zuelkernan whose help, stimulating suggestions and encouragement helped me in all the time of research for and writing of this thesis.

I would like to extend my best thanks to every one who supported me to complete my thesis, especially Dr. Ibrahim Al Kattan and Dr. Hazim El Baz for their constant support and guidance throughout the time I have spent at AUS. Without their support and encouragement this work would not have been possible.

I cannot end without thanking my family and wife, since I have relied on their constant encouragement and love throughout my time at college.

CHAPTER 1

1 INTRODUCTION

1.1 Background

The world economy has been recently experiencing the shift towards services, a phenomenon that is referred to as services-based or services- led economy. The service sector is increasingly becoming the central industrial sector of developed countries from the perspective of both value-added levels and numbers of employees [1]. That is why now, more than ever, companies want to deliver services better, faster, and cheaper. At the same time, nearly all organizations have found themselves building increasingly complex services, since a single company usually does not develop all the components that compose a service. More commonly, some service components are built in- house and some are acquired or outsourced; then all the components are integrated into the final service. Organizations must be able to manage and control the service level compliance of this complex service delivery process.

1.1.1 Services

Service industry (also known as the tertiary sector of industry) is one of the three main industrial categories of a developed econo my, along with Secondary Industry (manufacturing), and Primary Industry (extraction such as mining, agriculture and fishing). In recent years there has been a substantial shift from the other two industry sectors to the Tertiary Sector in industrialized countries. Services are defined in conventional economic literature as "intangible goods"[2].

The tertiary sector of industry involves the provision of services to businesses as well as end consumers. Services may involve transport, distribution and sale of goods from producer to a consumer as may happen in wholesaling and retailing, they also may engage providing services such as security or cleaning. Some of the services providing activities depend on goods transformation, as happen in the restaurant industry. However, the focus of services is on people interacting with people productively to serve customers rather than transforming physical goods.

Generally speaking, a service can be defined as an activity or a series of activities of a more or less intangible nature that normally, but not necessarily, takes place in the interaction between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems [3]. From the previous definition it is realized that services are not as tangible as goods, and therefore it can be difficult to explain, specify, and measure the contents of a service. And since service delivery is not as tangible as product delivery, the evaluation of a successful service can be subjective. To avoid this subjectivity, services must be clearly defined and integrated with tools and processes that define not only the technical aspects of service delivery, but also the metrics and indicators that quantify the effectiveness of the service.

1.1.2 Quality of Service

Measuring the quality of a service is not an easy thing to do since the concept of service quality is not universally defined and is often used as an umbrella term to cover a range of impressions expressed by customers when dealing with vendors [4].

Quality is often linked to the concept of excellence. Some writers referred to quality as being recognizable universally as a mark of uncompromising standards and high achievement [5].

The negative aspect of linking quality with excellence is that sometimes assuring quality is supplier driven and not customer driven, this can lead organizations to unintentionally overlook customer's understanding of quality and thus not meeting customer’s needs.

This highlighted the need for a better definition of quality that takes customer needs into consideration; such as “satisfying customer requirements”. Others expand on this by describing delivering quality services as conforming to customer expectations on a consistent basis.

This concept has been developed later on by referring to Service Quality as the ability of the organization to meet or exceed customer expectations, considering different comparisons made by consumers between their expectations and their perceptions of actual performance. Most of the definitions of service quality use the term "perceived service quality" to emphasize that it is service quality from the customer's perspective. The challenge in measuring quality from this perspective is identifying what the customer’s

expectations are and meeting them. Whether these expectations are met or not will have a significant bearing on the perceived quality [5].

Quality can be a "magic bullet" which provides lower cost, higher customer satisfaction, better products and services, and higher margins. Without managing quality, assuring and adding value become an impossible proposition. The earliest lessons of the quality movement, still applicable today, are those of [6]:

- understanding what people want from a service or product, and delivering it to match those needs ("fitness for purpose");
- drawing detailed specifications based on the articulated customer needs, and delivering carefully to them ("conformance to specification");
- understanding and managing the variables in the manufacturing/service delivery process which can lead to deviation from specification ("process control");
- Keeping detailed records of the process, allowing deviations to be traced and rectified ("quality audit/document control").

Although many quality improvement approaches are applicable equally on goods and services, there are conceptual differences between the two. Some of the more important differences can be noted as follows [3]:

- Services are not as tangible as goods, and it can therefore be difficult to explain, specify, and measure the contents of a service.
- Because services are more abstract than goods, services are perceived and evaluated more subjectively.
- The customer often plays an active role in creating a service.
- A service is often consumed at the same time as it is created; it cannot therefore be stored or transported.
- The customer does not become the owner of a tangible property after delivery of a service.
- Services often consist of a series of consequential activities; this makes it difficult (or impossible) for the consumer to test them before the purchase.
- Services often consist of a system of sub-services, but the customer usually evaluates the whole and not the separate parts.

On the other hand, the perceived service quality is related to the customer experience through the whole process, since services are produced, delivered and consumed during – in time and space – overlapping processes, in which customer plays a role as co-producer carrying out activities and deeds as well as being part of interactions (with e.g. front- line employees, other customers and technology) which will influence or decide both process quality and outcome quality. Therefore, the perceptions of service quality are formed during the production, delivery and consumption processes [7].

A related issue that complicates the quality of services is their heterogeneous character. This means that the experience of a particular service can differ from time to time. Services are heterogeneous because both the consumer and the service provider have a significant influence on the production and process delivery. That is why it is essential to design services properly from the beginning as they cannot be stored, exchanged, or redone.

1.1.3 Service Level Agreements

In this context, in order to manage customer's expectations, which are based on the definition of services, the specification of service levels and the design and implementation of service processes, a Service Level Agreement must be developed.

A Service level agreement is an agreement between the provider of a service and its customers which quantifies the minimum quality of service that meets business need [10]. That is why a Service Level Agreement (SLA) should be wide in scope, covering all key aspects of the service. Based upon the agreed set of quality standards (or service level targets), ramifications of not meeting or exceeding the standards can be explicitly included in the SLA contract. If a service level target (or a service level objective) is linked with a penalty clause for a service level violation, it is considered to be a service level guarantee (SLG); otherwise, it is a service level intent (SLI). The clarity, attainability, and manageability of a service level guarantee are usually better than those of a service level intent [11].

Typically, a SLA will fully embrace such issues as problem management, compensation, warranties and remedies, resolution of disputes and legal compliance. It essentially frames the relationship, and determines the major responsibilities, both in times of normal operation and during an emergency situation.

SLAs cannot be considered as an actual measure of acceptable performance. For example, it is entirely possible to have an incredibly upset client for whom no SLA violation has taken place, or an entirely satisfied client for whom the SLA was well and truly breached. At the end of the day, client satisfaction is not a question of documentation. It is about how the client has been treated, how the service provider has responded to his issue, and whether, in the client's mind, he should have been subjected to the issue in the first place [12]. This thesis is focused on the SLA compliance business processes, which usually but not definitely leads to customer satisfaction.

Service aggregators are entities that provide different services to their clients through outsourcing these services to sub-contractors. For them the situation is made complex because these organizations act as go-betweens and hence need to establish SLAs from suppliers as well as customers' sides. One critical factor in these situations is the need for alignment between the SLAs on both sides. This factor places significant demands on the service level monitoring process and compliance assurance.

1.1.4 SLA Compliance Optimization

In the context of service offering, the main focus is on the SLA compliance. To monitor the compliance of a SLA, organizations need to come up with a system of rewards and penalties for compliance and non-compliance. They need to have in place a resolution process which can be put into action if an SLA is breached or ideally before it is breached. This is one primary reason why SLAs need to be simple, achievable and measurable and targets set need to be realistic [13].

An essential issue that complicates the service level compliance of services is that the experience of a particular service can differ from time to time since customers often play an active role in the consequential activities of service delivery. Therefore, since services are unique and heterogeneous and because of the dynamic nature of the economy, the SLA compliance processes will always require continuous optimization.

Mentioning optimization or continuous improvement leads us to the well known concept of "Six Sigma". It is no secret that Six Sigma is the new metaphor shift and world standard for customer satisfaction and profitability improvement in today's industrial society. Almost every organization is implementing, contemplating, or busy learning more about Six Sigma [14].

Six Sigma as a business strategy has been well recognized as an imperative for operations and business excellence. This powerful business management strategy has been exploited by many world class organizations such as General Electric (GE), Motorola, Honeywell, Bombardier, ABB, Sony, to name a few from the long list. Six Sigma applications in the service sector are still limited although it has been embraced by many big service oriented companies such as J P Morgan, American Express, Lloyds TSB, Egg, City Bank, Zurich Financial Services, BT, etc. Six Sigma today has evolved from merely a measurement of quality to an overall business improvement strategy for a large number of companies around the world [15].

Although Six Sigma has been successfully implemented in many manufacturing industries, its application in the service sector is still comparatively limited due to various constraints.

1.2 Objective

Section one established the fact that services are unique and heterogeneous and because of the dynamic nature of the economy, the SLA compliance processes shall always require continuous optimization. Implementing Six Sigma techniques to optimize services had various limitations, yet research has identified four main potential complications encountered when implementing Six Sigma in a service environment [22]:

1. It is generally considered that it is more difficult to gather data in service settings than in manufacturing.
2. Measurements of customer satisfaction may be more difficult in services because the interactions between customer and service provider may create complications.
3. The measure and control phases of Six Sigma may be more difficult to control in services because service sub-processes are harder to quantify and the measurement data is harder to gather.
4. Much of the data in services is collected manually in face-to-face interactions compared to automatic data collection methods used in many manufacturing processes.

The objective of this thesis is to develop a new methodology that shall help in applying the Six Sigma process optimization techniques to the SLA compliance. It also presents a group of new developed models that serve as the foundation for the methodology's steps. The three basic models include SLA Ontology, Compliance Oriented Process Maps, and

Generic Service Quality Attributes Table. The methodology also uses a generic Kano questions generating approach, generic CTQ table, generic QFD house, and generic SIPOC maps. These generic models serve as a guide for the continuous improvementof compliance business processes using Six Sigma DMAIC techniques.

The originality of this methodology lies in its generality, since it can be applied to non-IT services although its three basic models are mostly based on IT concepts such as Information Technology Infrastructure Library (ITIL), Service Oriented Architecture (SOA), IBM's SLA Action Manager (SAM).

CHAPTER 2

2 LITRATURE REVIEW AND BACKGROUND

2.1 Background

The purpose of a SLA has recently shifted from being a financial contract towards an instrument for the mana gement of the customer's expectations. Managing customer's expectations is based on the definition of the provided services, the specification of service levels agreements and the design and implementation of service processes.

Some primary advantages of SLAs include permanence of focus of the service delivery, clarity in the expectations of the service delivery, communication vehicle between customer and service provider, mutual standards for service delivery, and definition of service- level measurements [16].

The process of monitoring the compliance of the level of the provided service to the SLA is a crucial point, and it differs from one business type to another and even in the same business type from time to time specially in these days' dynamic econo my, in addition to what was mentioned before about services being unique and heterogeneous; therefore SLA compliance processes will always require continuous optimization.

Conventional measurement and compliance systems are less functional since each client situation might be unique. That is why businesses now require a flexible architecture to keep pace with the highly dynamic compliance requirements.

This chapter discusses the background of the main concepts and knowledge bodies used to develop the proposed methodology. These include ITIL, Compliance Oriented Architecture (COA), Six Sigma, and SERVQUAL.

2.2 ITIL

Information Technology Infrastructure Library (ITIL) began in 1980’s as a UK initiative to create standard IT processes within its government departments, and has gradually evolved as the most widely accepted approach to IT infrastructure management [17]. ITIL consists of a set of best practices to enable the delivery of IT services that are reliable, consistent, and of the highest quality. These best practices, guidelines and architectures ensure that IT

processes are closely aligned to business processes and that IT delivers the correct and appropriate business solutions. ITIL is now owned and managed by the IT Service Management Forum (ITsmf), an international nonprofit membership-owned organization focused on furthering best practices in IT services.

The ITIL service management philosophy distinguishes between three leve ls of processes to be supported Strategic, Tactical, and Operational [18].

- Strategic- level service management focuses on components such as the organization of the IT service function and ensuring quality and customer satisfaction with the services provided. The development of Service Level Agreements (SLAs), which document the expectations for services to be provided, is an example of the types of activities that occur at the Strategic level.
- Tactical- level service management provides guidance regarding the planning and management of the specific IT services to be provided, such as he lp desk, capacity planning, application support, and technology refresh. Planning the policies and resources required to fulfill an SLA would typically happen at this level.
- Operational- level service management regulates the actual policies and procedures involved in offering these IT support services. It provides granular, "day-to-day" guidance on the methods and techniques of providing IT services.

ITIL consists of a set of best practices to enable the delivery of IT services that are reliable, consistent, and of the highest quality. However, IT services are more tangible and easier to monitor and measure than non-IT ones. IT services are mainly related to processing and distribution of data using computer hardware and software, telecommunications, and digital electronics.

On the other hand, non-IT services are more intangible, they are about abstractions, and managing relationships to get there. They are about process, not endpoints. The focus must be more on client service than on market share or competitive triumph. Every service/customer experience is unique. Perfection is not about zero-defects, but about unbounded excellence, and it has no upper limit.

Although this thesis is about non-IT services, ITIL framework for the service management process of the suggested Model will be extended to include non-IT processes. ITIL will

effectively assist in creating a more complete business process model which will improve resource utilization, eliminate redundant work, justify the cost of service quality, provide services that meet business, customer and user demands and integrate central processes. In addition to improving the overall compliance with the required customer needs, which is the focal issue of this thesis.

2.3 Compliance Oriented Architecture

In general, compliance means the conformation with rules and regulations. In our context compliance is more related to the rules and regulations stated in the SLA which translate the needs of the customer and clarify the expectations of the service delivery.

Stephen O'Grady of RedMonk [19] recommended the adoption of a Compliance Oriented Architecture (COA), which is a specialized instance of Service Oriented Architecture (SOA), designed to support a broad array of compliance requirements. Rather than a product or packaged application, a COA is a set of core, compliance-oriented services that can be assembled and deployed to solve a specific need or set of needs.

SOA is the aggregation of components satisfying a business driver [20]. It is a systematic approach to ho w IT functionality can be planned, conceptualized, designed and implemented as modular business services to achieve business results. It consists of components, services, and processes. Components are computer programs that do specific tasks. These programs each have a defined interface and usually one job to do well. A service, in this context, is simply a grouping of components (executable programs) to get the job done.

The key focal point of an SOA is the business process. The grouping of components satisfies the process, letting the application process pattern more closely represent the business. This higher level of application development provides a strategic advantage, facilitating more focus on the business requirement.

The main advantage of SOA is service reuse. This is where an SOA pays off. Fundamentally, an SOA is an infrastructure wherein software applications are broken into modular components called services and placed in a repository where they can be accessed either by users or other services. When this is done properly, a company can implement new business processes almost at will by writing procedures that call for sets of services to interact with one another [21].

Using SOA to define services compliance business processes and finding reusable business services will not only lead to automation but also help prevent duplicated effort for an organization.

Compliance requirements can be expressed as a set of core services, which includes all the tasks and activities related to SLA Compliance, thus, establishing a Compliance Oriented Architecture (COA). COA applies the virtues of SOA to the specific business challenge of compliance, and the result is a flexible architecture that can meet compliance challenges [19].

These services help in defining the basic terms and relations comprising the vocabulary of the service level compliance requirements as well as the rules for combining terms and relations to define extensions to the vocabulary. They also represent a foundation for modular compliance initiatives. To avoid integration problems, rather than implementing gigantic applications designed to tackle a single regulatory challenge, enterprises should implement a flexible and dynamic architecture that consumes compliance services as required [19].

The COA approach has numerous benefits, including:

- Reduced licensing costs due to fewer redundant purchases
- Increased productivity through service reuse
- Enhanced service by reducing project time to completion
- Improved management efficiencies by streamlining service portfolio
- The architectural flexibility to grow and change with regulatory requirements

Incorporating Six Sigma methodology with the SOA-based initiative (COA) should result in improved success rates, shorter delivery times and significant savings relative to traditional development approaches.

2.4 Six Sigma

Six Sigma has been successfully implemented in many manufacturing industries, yet its application in the services sector is still comparatively limited due to various constraints. Surprisingly, a review of the literature reveals that no optimal Six Sigma models have been defined specifically for the optimization of service level compliance of outsourced services. The introduction of Six Sigma into the manufacturing arena in the early 1980s by Motorola was a step in revolutionizing the scope and use of quality systems in business today. To

define Six Sigma in simple terms is not possible because it encompasses the methodology of problem solving, and focuses on optimization and cultural change. Six Sigma accomplishes this goal by utilizing an extensive set of rigorous tools, uncompromising use of statistical and advanced mathematical tools, and a well-defined methodology that produces significant results quickly. The success of this methodology within an organization has significant momentum that can only lead to fundamental organizational cultural transformation.

The roots of sigma as a measurement standard go back to Carl Fredrick Gauss (1777-1855), who introduced the concept of the normal curve or distribution. Walter Shewhart introduced three sigma as a measurement of output variation in 1922, and stated that process intervention was needed when the output went beyond this limit. The three sigma concept is related to a process yield of 99.973 per cent and represented a defect rate of 2,600 per million, which was adequate for most manufacturing organizations until the early 1980s. Two things occurred in the early 1980s that required a higher-level quality from American manufacturers. One of these was the introduction of mass produced miniature electronics, from transistor radios to televisions, which were produced in large quantities for mass- market consumption. The second and more compelling force for domestic quality improvement was the opening of global markets and subsequent introduction of Japanese electronics into foreign and American markets. The lower price and higher quality of the Japanese goods made these imports attractive to the global consumer.

Six Sigma today has evolved from merely a measurement of quality to an overall business improvement strategy for a large number of companies around the world. The concept of Six Sigma was introduced by Bill Smith in 1986, a senior engineer and scientist within Motorola's communication Division, in response to problems associated with high warranty claims. The success of the efforts at Motorola was not just achieving Six Sigma quality level rather the focus was on reducing defect rate in processes through the effective utilization of powerful and practical statistical tools and techniques. This would lead to improved productivity, improved customer satisfaction, enhanced quality of service, reduced cost of operations or costs of poor quality, and so on [15]

In application, Six Sigma is clearly one of today’s most powerful and most effective management strategy programs for cultural and process change, ultimately leading to

world-class customer quality. Although originally conceived as long ago as the early 1980s, the application of Six Sigma is still very much a novelty and long overdue in playing its dynamic part on the world stage of customer focused quality.

Manufacturing companies build Six Sigma efforts on an established base of measurable processes and established quality control programs. Services, because they produce intangible products usually with direct customer contact or participation, tend to have processes that are sometimes not very well understood and controlled and tend to develop less quantitatively oriented quality improvement programs. Service companies, if they can successfully implement and use Six Sigma methods to make process improvements, should achieve many of the same results as manufacturing companies [22]

Six Sigma in its entirety is many things including a philosophy, a methodology, a goal and a metric, and is certainly broad enough to work in pure manufacturing as well as wholly transactional and service industries, and anything in between. At the very heart of the application of Six Sigma lies a process improvement methodology of immense power and utilization, but ultimately extremely limited in its scope. The currently accepted best practice for process improvement methodology emanating from GE Capital is the DMAIC model – define, measure, analyze, improve and control.

The implementation of Six Sigma strategy involves a series of steps specifically designed to facilitate a process of Continuous Improvement.

1. Define. Identify customer needs and a project suitable for SS effort.
2. Measure. Determine what and how to measure the performance of the selected process.
3. Analyze. Understand and determine the variables that create quality variations.
4. Improve. Identify means to remove causes of defects and modify the process.
5. Control. Maintain the improvement.

2.5 Six Sigma in Service Organizations

As a quality measurement methodology, Six Sigma is also being adopted by some service industries to improve their process that results in quality customer satisfaction. While differences between small, medium, and large firms can be substantial, the differences are largely contextual in nature. For service industries, determining quality customer

satisfaction will vary depending on the type of service that is being provided. But there are basic criteria that can be used to determine quality service in customer satisfaction. These include, the amount of time the customer is placed on hold, the number of times a customer calls to resolve an issue, and the knowledge and process in place available for the service representative.

Most service enterprises operate at two or three-sigma levels and with poor-quality customer experiences. Six Sigma's goal is to reduce the amount of bad customer experience to three in a million (for Six-Sigma level). Six Sigma methodologies are used to obtain factual informa tion regarding customer satisfaction. This follows the method of define, measure, analyze, improve, and control (DMAIC). By defining, measuring, analyzing and controlling each process, service organizations can gauge the root cause of the problem. Defining and measuring the problem, opportunity, and process involves doing some business process analysis. This will enable the organization to map the process and specify customer requirement.

Analysis of the business process determines where the organization fa ils to measure up to customer expectations. This process involves more detailed evaluation of the data gathered. This will enable the organization to understand the cause of the problem.

To improve quality in customer satisfaction, it is important that the measurement being used is something that can also be measured against the competitor. The results are then analyzed and used to either improve upon the process or leave it as it is. By knowing the root cause of the problem, organizations can then come up with different alternatives for improvements. Once an improvement method is selected, controlling the process takes place. It is important that the process is constantly monitored to verify its consistency.

2.6 SERVQUAL

The construct of quality in the services literature focuses on perceived quality, which is defined as a consumer's judgment about an entity's overall excellence or superiority. This approach differs from that of objective quality, which involves an objective assessment of a thing or event. Perceived quality is a form of "attitude", resulting from a comparison of expectations with perceptions of performance. However, despite the emphasis in the literature on this approach, perceived service quality has remained an elusive concept.

Many have suggested that quality results from a comparison of perceived performance with expected performance. Indeed, this notion was the basis for the SERVQUAL model, which views service quality as the gap between the expected level of service and customer perceptions of the level received. SERVQUAL identified five determinants of service quality:

1. Reliability
2. Assurance
3. Tangibles
4. Empathy
5. Responsiveness

Conceptually, these constructs address, respectively, performance standards, expertise and physical elements of the facility, employees' willingness to assist in a timely manner with their knowledge, and sensitivity [23].

2.7 Summary

Each of the mentioned concepts and knowledge bodies is usually used separately, for example ITIL consists of a set of best practices that is usually used by IT service managers to enable the delivery of IT services that are reliable, consistent, and of the highest quality.

Compliance Oriented Architecture (COA), which is a specialized instance of Service Oriented Architecture (SOA), is a set of core services that describes compliance requirements, which includes all the tasks and activities related to SLA Compliance. It is a systematic approach to how IT functionality can be planned, conceptualized, designed and implemented as modular business services to achieve business results.

A service, in this context, is simply a grouping of components (executable programs) to get the job done and implement a flexible and dynamic architecture that consumes compliance services as required

Six Sigma is a process optimization approach that utilizes an extensive set of rigorous tools, uncompromising use of statistical and advanced mathematical tools, and a well-defined methodology that produces significant results quickly. It has been successfully

implemented in many manufacturing industries, yet its application in the services sector is still comparatively limited due to various constraints.

SERVQUAL is a service quality assurance model that views service quality as the gap between the expected level of service and customer perceptions of the level received.

Combining the features of the mentioned models in order to tackle the SLA compliance continuous improvementissue in general, shall result in producing generic models and methodologies that are applicable to any service delivery model in the services field generally.

CHAPTER 3

3 MODEL DEVELOPMENT

In the current marketplace, there are models, standards, methodologies, and guidelines that can help an organization improve the way it does business. However, none of the available improvement approaches focuses on the specific part of the business highlighted in this thesis, which is service level compliance continuous improvement in a service provider business model.

Tackling the service level compliance continuous improvement issue led the identification of three main parts, the SLA itself, the compliance processes, and the required service level. This chapter shows the approach followed to build a generic model for each of the three mentioned parts. The proposed models are based on the concepts and knowledge bodies mentioned in Chapter 2 in addition to some other models that are going to be introduced through the chapter. Theses models shall serve as the building blocks for the SLA compliance optimization methodolo gy that will be presented in Chapter 4.

The proposed Models are:

1. SLA Ontology.
2. Compliance Oriented Process Maps.
3. Generic Service Quality Attributes (GSQA).

3.1 SLA Ontology

Compliance related processes presumes the existence of a SLA that defines all customers' expectations, which are based on the definition of services, the specification of service levels and the design and implementation of service processes.

This generic SLA model that shall serve as a reference for the rest of the generic models developed at later stages. This generic SLA model was developed based on the IBM's SLA Action Manager (SAM), and ITIL SLA contents, these foundations are described below.

3.1.1 SLA Action Manager (SAM)

The IBM's SAM project [11] aims to develop a generic SLA management framework and an integrated set of advanced Service Level Management (SLM) technologies that among other benefits do the following:

1. Enable the provider to deploy an effective means of capturing and managing SLM-related contractual data as well as the provider's internal management data.
2. Enable the provider and the customer to review and analyze intermediate service level attainment reports on demand.
3. Assist service personnel and service management agents in ordering quality management alerts based upon the exposed business impact over time.
4. Automate the prioritization and execution management of SLM processes, including the assignment of SLM tasks to service personnel using continual optimization technologies.

A reproduced chart for the IBM SAM is shown in Figure 3.1.

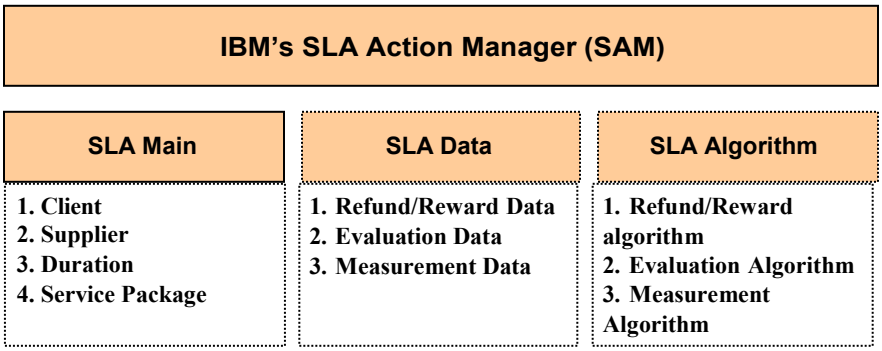


Figure 3.1 Reproduced table for the IBM SAM

The SAM is used as one of the components that provide the base to direct the development of a generic SLA model that defines the general contents of a SLA.

3.1.2 ITIL contents of a SLA

Since ITIL definition and background were mentioned earlier in Chapter 2 (section 2.2), this part is only concerned in presenting the proposed SLA contents by ITIL, which are:

1. Scope of the agreement

Covers the type of service, name of client, name of supplier, and the SLA definitions.

2. Service description

Description for the service scope and type

3. Signatories

Authorized signatures from both parties.

4. Date of next review

Set the date or dates for reviewing the SLA

5. Service hours

Specify the daily service hours during normal working days, weekends, and public holidays.

6. Service availability

The time and place of availability for each service type.

7. Support levels

Identify the agreed on support levels and response time.

8. Performance

The agreed on standards and metrics to perform the service.

9. Security

The level of service security, and the names or positions of authorized personnel.

10. Functionality

The way in which service is delivered

11. Charges

The agreed on service fees

12. Change procedure

Changes related to service

13. Contingency

Risk management or problem management plan

14. Anticipated growth

How service can be upgraded

15. Restrictions

Customer limitations

16. Training

Service supplier responsibilities related to customer training.

17. Change pro cedure for the SLA

Specify authorized name or position to change SLA's terms or conditions.

These 17 elements where presented by ITIL as the main SLA contents for any IT service level agreement and will be used as one of the bases to construct a generic SLA model that can be used for any IT or non-IT SLA.

3.1.3 SLA Model Development

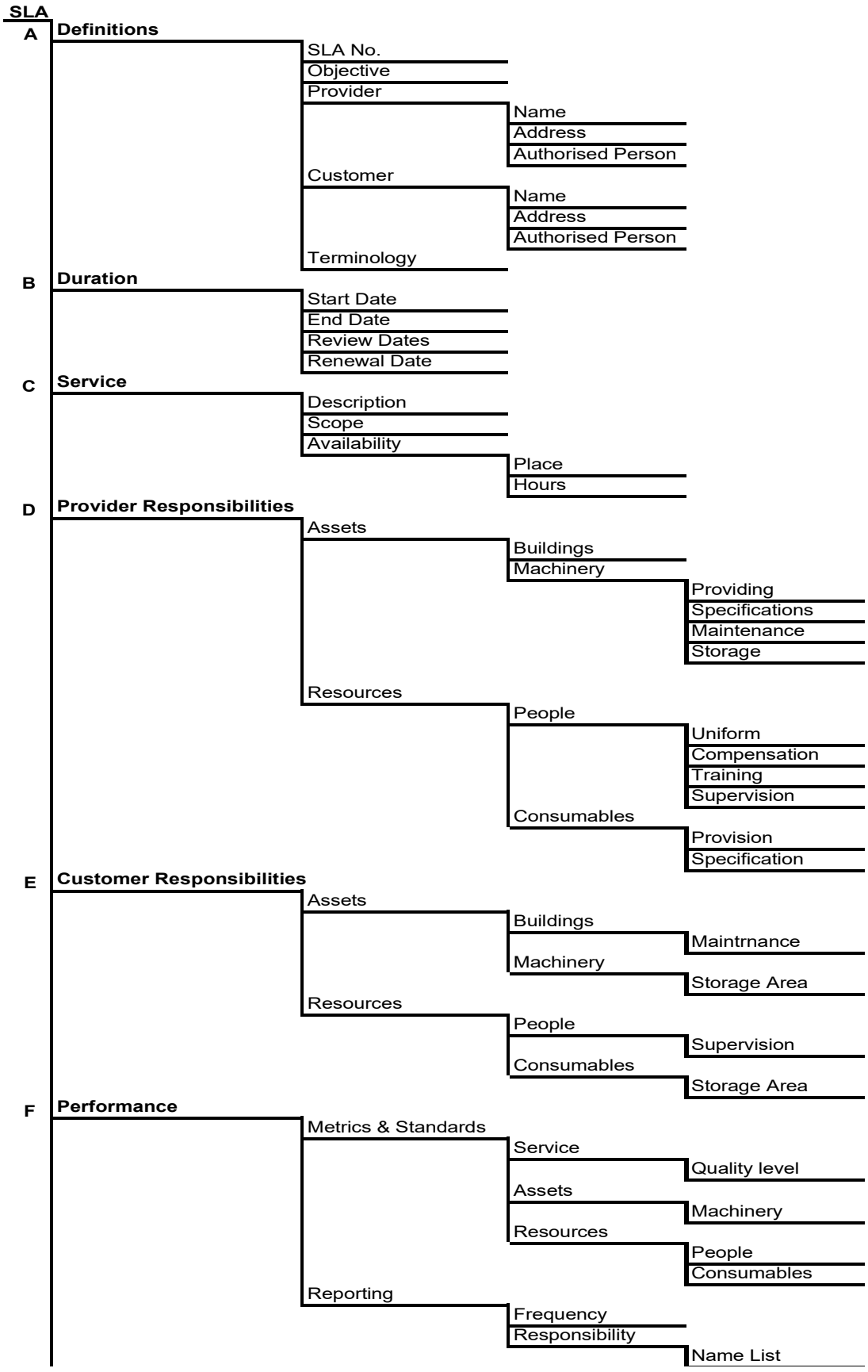
Defining the main components of a SLA using the mentioned factors of IBM's SAM and ITIL service contents resulted in a generic SLA model that can fit any service provider in general. Customizations may be required at lower levels depending on the type of the industry.

The contents of the proposed SLA Model are derived from the two mentioned models and grouped to form 12 categories. These categories guide the development or assessment of any service related agreement. Figure 3.2 shows the chart of the generic SLA model.

The defined categories are designed to fulfill service requirements based on the defined scope the model ensures performance measuring, monitoring and controlling of services, assets and resources by defining and reporting different metrics and standards. Ensuring high level of quality and effective involvement of related entities and elements would require proper handling of non-performances through a well designed procedures for problems rating, problem escalation and risk management where immediate and preventive actions are imposed.

Monitoring and controlling service quality level and performance lead to determine whether it complies with the relevant quality standards and provide the necessary details to look for and identify ways to eliminate causes of unsatisfactory and non-performances.

This would require a full understanding and assessment of customer needs and expectations, then applying planned, systematic quality assurance activities to guarantee meeting those expectations; and the most important thing would be the availability of plans, tools and techniques that would ensure continuous improvements.


SLA
A
Definitions
SLA No.
Objective
Provider
Name
Address
Authorised Person
Customer
Name
Address
Authorised Person
Terminology
B
Duration
Start Date
End Date
Review Dates
Renewal Date
C
Service
Description
Scope
Availability
Place
Hours
D
Provider Responsibilities
Assets
Buildings
Machinery
Providing
Specifications
Maintenance
Storage
Resources
People
Uniform
Compensation
Training
Supervision
Consumables
Provision
Specification
E
Customer Responsibilities
Assets
Buildings
Maintrnance
Machinery
Storage Area
Resources
People
Supervision
Consumables
Storage Area
F
Performance
Metrics & Standards
Service
Quality level
Assets
Machinery
Resources
People
Consumables
Reporting
Frequency
Responsibility
Name List

Continued..

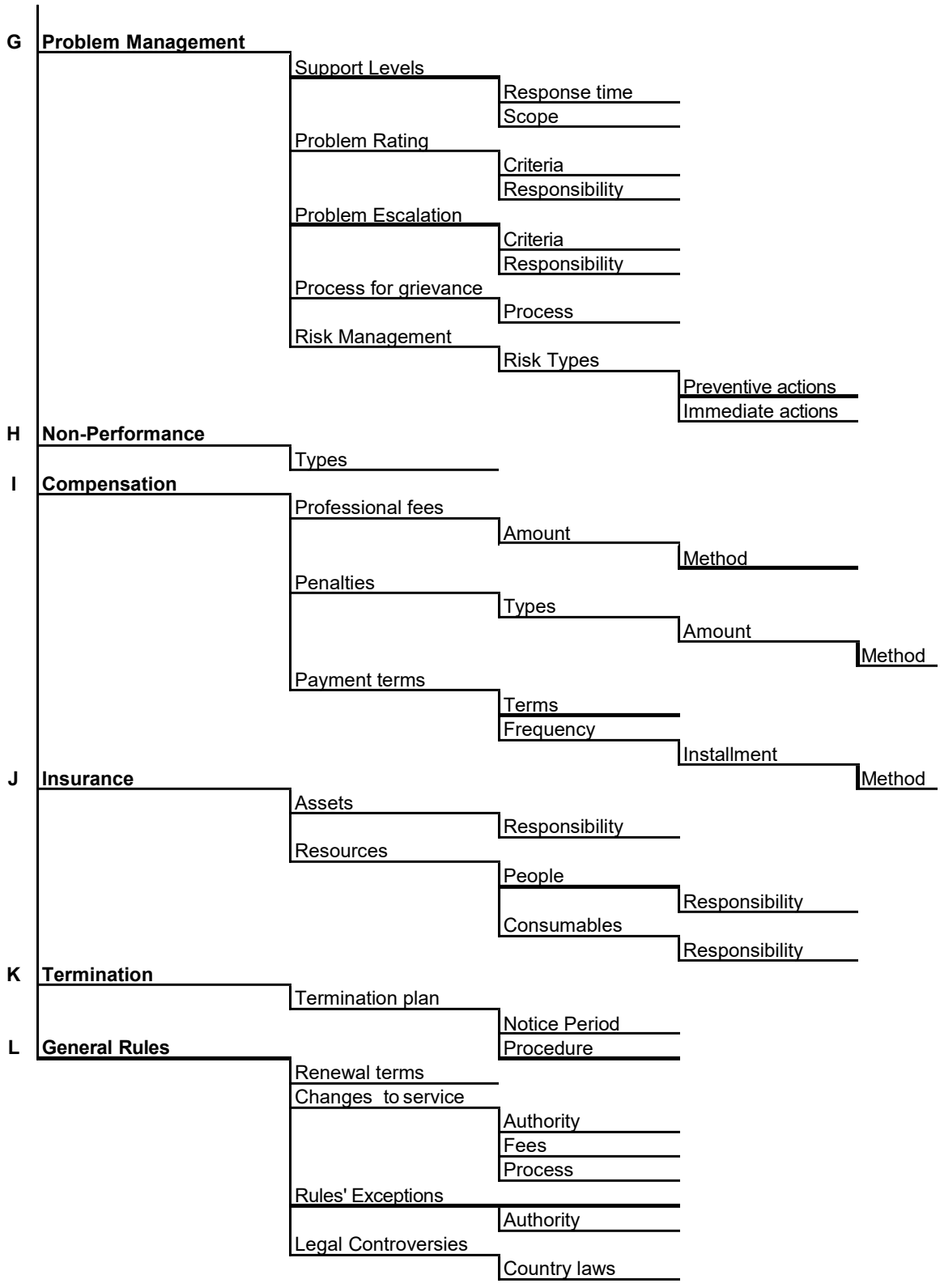


Figure 3.2 Generic SLA Model

In order to simplify the usage of the generic SLA model, ontology is developed to focus on the main SLA elements that are related to the compliance processes and explicate the relations between them. An ontology defines the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary [24].

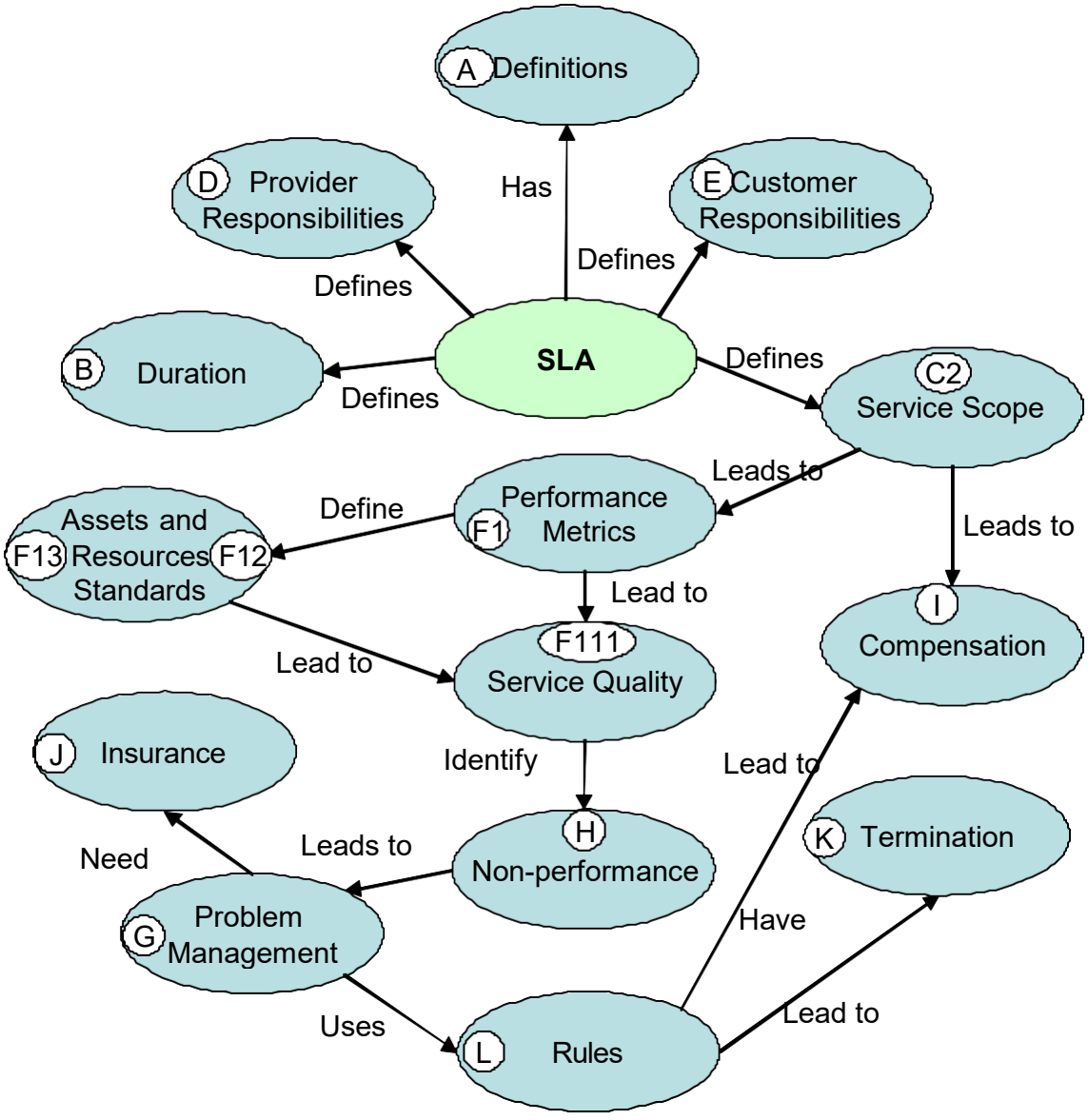


Figure 3.3 SLA Ontology

The SLA ontology shown in Figure 3.3 focuses on the most important elements of the SLA related to compliance processes, and shows the relations between them. These elements are selected from the Generic SLA Model shown in Figure 3.2. The relations between these elements can help the definition of compliance sub-processes. Each compliance process can be assigned to one or more ontology elements.

SLA elements are discrete elements with well defined interfaces; however, in practice they overlap and interact in different ways depending on the progression of the case.

As an initial stage the Generic SLA Model emphasis on listing the main elements of a SLA that enforces applying set of processes to ensure proper initialization and identification of the service as well as paving the way for effective coordination between the various elements of the SLA.

The relations between the elements mentioned in the SLA ontology shown in Figure 3.3 describe the flow of the main compliance processes. It also help analyzing the weaknesses or defects of these processes. For example, the analysis of performance metrics (F1) might require checking the agreed on service scope (C2). It also might lead to the analysis of standards of assets and resources (F12), since both metrics and standards lead to identifying the required level of service quality (F111). Having the required level of service quality identified sets the baseline for detecting Non-Performance (H), which might lead to complaints or problems and require problem management (G).

3.2 Compliance Oriented Processes Maps

Since the ultimate aim of the proposed models is to facilitate the continuous improvement of the processes related to SLA compliance, these processes should be defined clearly and in a generic matter, in order to be applicable to all compliance processes in any of the services industry fields.

The process owner should be identified now. In this context (service level compliance optimization) the owner of the compliance process is the Service Manager who is responsible for monitoring the service delivery process and making sure that neither of the two SLAs, from both the client's and the supplier's side, is breached.

Thus the service manager is the client of this model, and in order to identify his needs for managing the compliance of the service delivery process with the standards and rules stated in the SLA.

The definition of the compliance processes is based on the "Manage Ongoing Process" part of the ITIL service level management activities. The foundations of the proposed generic compliance processes model are introduced in the following sections.

3.2.1 Information Technology Infrastructure Library (ITIL)

ITIL began in 1980's as a UK initiative to create standard IT processes within its government departments, and has gradually evolved as the most widely accepted approach to IT infrastructure management [20]. ITIL consists of a set of best practices to enable the delivery of IT services that are reliable, cons istent, and of the highest quality. These best practices guidelines and architectures ensure that IT processes are closely aligned to business processes and that IT delivers the correct and appropriate business solutions. ITIL is now owned and managed by the IT Service Management Forum (ITsmf), an international nonprofit membership-owned organization focused on furthering best practices in IT services.

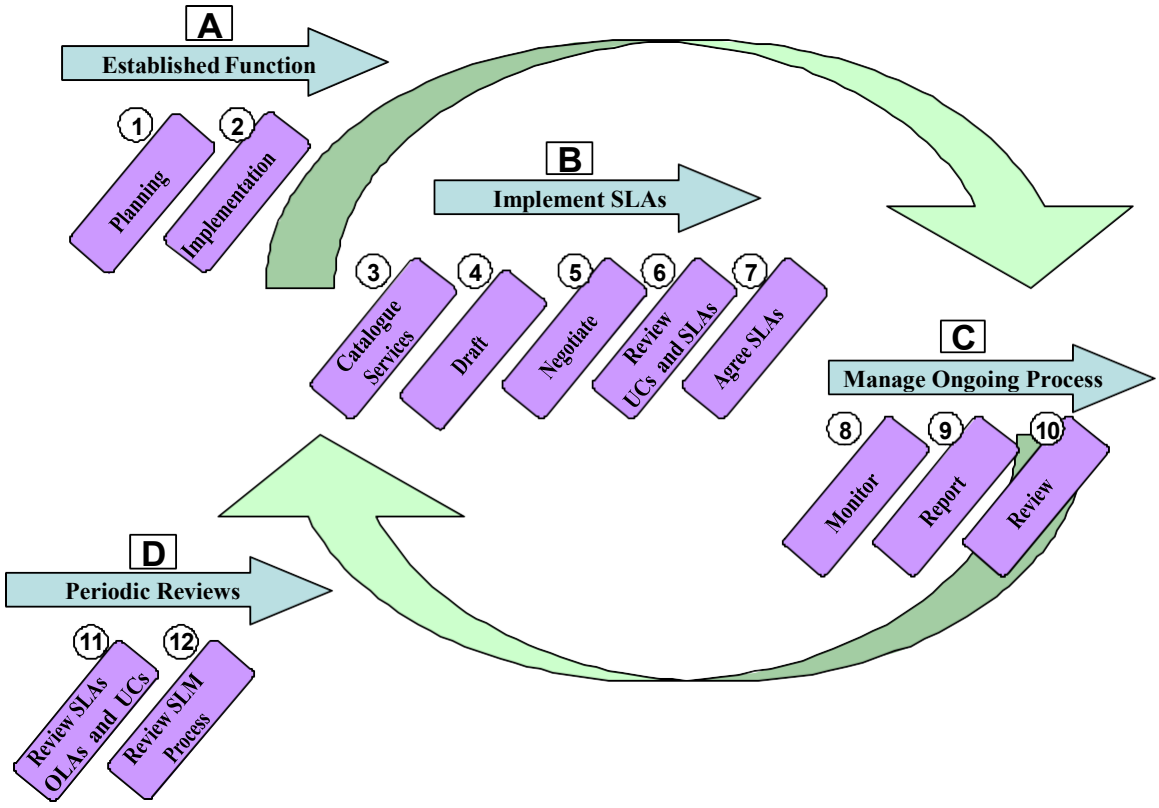


Figure 3.4 ITIL SLM

Figure 3.4 shows the ITIL Service Level Management (SLM) activities, which are grouped under four main phases:

A. Established function: contains 2 activities:

1. Planning
2. Implementation

This phase focuses on planning the service, which is the starting point in the services management process. This phase the focal issue is defining the customer's service requirements which include the service scope, performance metrics and standards, and required quality level. Another aspect is the way in which service is going to be implemented or delivered.

B. Implement SLAs: contains the following 5 activities:

3. Catalogue Services
4. Draft

5. Negotiate
6. Review UCs (Underpinning Contracts) & SLAs
7. Agree SLAs

This phase concerns with the development of the SLA, it includes drafting the agreement document and listing the service description, scope, and the estimated fees and compensation. It also includes the negotiating of proposed SLAs and reviewing of underpinning contracts. At the end of this phase a SLA should be agreed and signed.

C. Manage Ongoing Process, which contains the following activities:
   8. Monitor
   9. Report
   10. Review

Having a signed SLA, this phase focuses on the service delivery processes, and ensures that the delivered service is complied with the agreed on service levels and standards. The mentioned three activities describe the main compliance processes, which are the major concern of this thesis.

D. Periodic Reviews:
   11. Review SLAs, OLAs (Operational level agreements), & UCs
   12. Review SLM process

The SLA reviewing processes are done periodically as a result of the reviewing reports produced at the previous phase. This can be done to modify the SLA rules or conditions according to operational or quality needs.

The ITIL Service Level Management (SLM) activities are general, and should be used as a framework for the compliance process. Given the breadth and depth of compliance requirements plus the fact that the regulatory landscape is highly dynamic, it is clear that businesses now require a flexible architecture to keep pace.

3.2.2 Service Oriented Architecture (SOA)

SOA is the aggregation of components satisfying a business driver [20]. It consists of components, services, and processes. Using SOA to define services compliance business

processes and finding reusable business services will not only lead to automation but also help prevent duplicated effort for an organization.

Compliance requirements can be expressed as a set of core services, which includes all the tasks and activities related to SLA Compliance, thus, establishing a Compliance Oriented Architecture (COA). COA applies the virtues of SOA to the specific business challenge of compliance, and the result is a flexible architecture that can meet compliance challenges [19].

Stephen O'Grady of RedMonk recommended the adoption of a Compliance Oriented Architecture (COA), which is a specialized instance of SOA, designed to support a broad array of compliance requirements. Rather than a product or packaged application, a COA is a set of core, compliance-oriented services that can be assembled and deployed to solve a specific need or set of needs.

The 19 COA services are described below:

1. Access Control: Establishes control over access to specific assets and resources according to established rules and processes via authentication and authorization elements;

2. Analytics: Suite of functions encompassing tasks such as data mining and drill down, reporting, querying, measurement, etc

3. Archive/Backup: Stores long-term data for cost, convenience, or disaster recovery purposes

4. Auditing : Establishes and maintains precise asset history, including creation, alteration, renaming, date copied, etc.

5. Collaboration: Enables synchronous or asynchronous communication between individuals, teams or organizations working on the same or related business tasks.

6. Conflict Resolution: Mechanism by which conflicting requirements are automatically identified and resolved according to preset requirements, or if necessary escalated for external manual review.

7. Destruction: Provides for secure destruction of materials that have reached the end of their useful and/or mandated lifespan.

8. Disposition Management: Mechanism for determining the disposition, or requirements, for a particular asset.

9. Indexing: Crawls through asset stores and indexes them for easier browsing, search and retrieval.

10. Information Integration: Provides the ability to unify disparate data sources and types to create a virtual data source composed of two or more data sources of record.

11. Monitoring : Watch specific assets or resources for specific actions, events or conditions, often using an agent based approach.

12. Notarization: Attests to and certifies basic asset creation elements such as author, date created

13. Policy Engine : Translates human language policy information into program readable and actionable instructions and rule sets

14. Process Registry: A directory of available compliance related services and the compliance problems they map to; the registry should allow for automated discovery and description of compliance functions.

15. Retention: Ensures that assets are retained at a minimum for their required lifespan, and are not deleted, lost or corrupted prior to their scheduled end of life

16. Retrieval: Supported by Indexing and Tagging, provides for retrieval of asset based search or browse based retrieval as required

17. Tagging : Mechanism for attaching and storing metadata to assets for later consumption and manipulation.

18. Version Control: For iteratively developed assets, provides for documented version capture of asset at each stage in its lifecycle

19. Workflow: Implements established business processes to provide clear, repeatable procedures that can be controlled.

3.2.3 Model Development

The proposed model is designed to help identifying the components of the main SLA management compliance processes for a service provider. Which mean that the model is concerned with the processes related to the compliance of the delivery of service after the establishment of a SLA. The compliance processes table has two dimensions, the first one includes the thr ee activities of the ITIL "manage ongoing process" phase, and the other dimension includes the 19 compliance services.

The table shown below helps the service manager to define the compliance services related to each main or sub-process. The main processes are (Monitor, Report, and Review) and the sub-processes are any combination derived from the mentioned three main processes and any of the components of the SLA model presented earlier in this chapter.

For example, a service manager can use these generic compliance services to as building blocks to describe the flow of a generic monitoring process, which for example goes as follows: first the service inspector looks in the SLA document to review the agreed on rules and standards, then he reviews the steps of the inspection process he is welling to perform, after that he actually visits the site and perform the monitoring process which usually needs cooperation from the responsible people on site, after that the inspector takes his notes and measurements and double checks that the notes where accurate, finally he records the time and date of the inspection and the name of the person in charge.

Now in order to describe the same process in terms of compliance services, the sequence shall be as follows:

1. Retrieval: since the inspector needs to retrieve the SLA rules and standards first.
2. Work flow: to review the standardized work flow for the process.
3. Monitoring: performing the actual act of monitoring by visiting the site or viewing the actual level of the delivered service.
4. Collaboration: since monitoring may require collaboration with the responsible people from the client's or supplier's sides.
5. Analytics: related to taking actual measurements of the level of the delivered service at each monitoring instance.
6. Auditing: makes sure that the taken measures are accurate, and records the measurement's time and date, and the name of the responsible person.

The mentioned steps can be easily defined by the service manager by numbering the selected compliance service in the compliance processes services table shown in Figure 3.5:

Compliance Services		Monitor	Report	Review
	Access Control			
	Analytics	**5**		
	Archive/Backup			
	Auditing	**6**		
	Collaboration	**4**		
	Conflict Resolution			
	Destruction			
	Disposition Management			
	Indexing			
	Information Integration			
	Monitoring	**3**		
	Notarization			
	Policy Engine			
	Process Registry			
	Retention			
	Retrieval	**1**		
	Tagging			
	Version Control			
	Workflow	**2**		

Figure 3.5 Generic Compliance Process Services Model

Defining the selected compliance services and putting them in sequence can be then presented in the SOA way as shown in Figure 3.6.

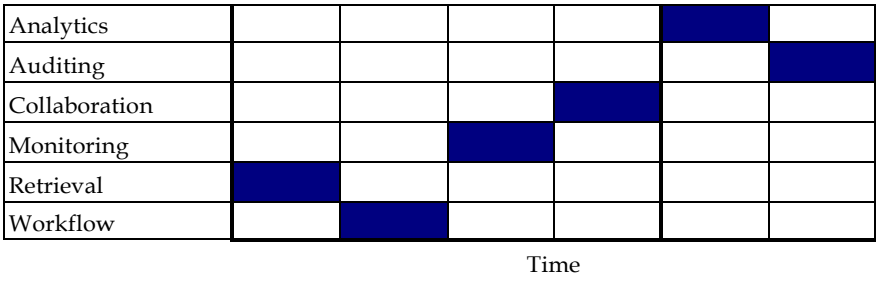


Figure 3.6 Generic Compliance Oriented Process Map

Although this model serves non-IT organizations, ITIL framework for the process modeling will be extended to include non-IT processes. Since ITIL is known for effectively assisting in creating a more complete business process models which will improve resource utilization, eliminate redundant work, justify the cost of service quality,

provide services that meet business, customer and user demands and integrate central processes.

Again, looking at the main four process groups, it is noticed that the “Manage Ongoing Process” group is the one that is more related to the service delivery phase, which is the main concern of this thesis. Being at this point “Manage Ongoing Process” presumes the existence of a SLA that defines all customers’ expectations, which are based on the definition of services, the specification of service levels and the design and implementation of service processes.

In order to expand the three main ITIL processes (Monitoring, Reporting and Reviewing), the model utilizes the COA 19 compliance services and group them under the main ITIL processes. This way the proposed model can be compliance-oriented in a more detailed approach.

The defined 19 processes are still generic and they need to be combined with another dimension of service compliance needs or criteria in order to be specific to a certain type of service. This demons trates the significance of having a generic model that shall define the vocabulary of the other part of the thesis, which is the SLA.

3.3 Generic Service Quality Attributes

Defining the general compliance processes and the general SLA contents le ad to the need to emphasize the performance assurance factor, this is mainly related to the compliance processes. SLA should clearly provide the metrics and standards to define the performance dimensions for the compliance of SLA management processes. A set of service quality attributes is derived from two different quality models to provide a third dimension for the proposed methodology. This set will play the linking role between the compliance process services matrix and the SLA Ontology, as it defines the required quality attribute for a certain compliance process of a chosen SLA component.

The two foundations for this set of quality attributes are described in the following sections.

3.3.1 SERVQUAL

As mentioned in Chapter 2, SERVQUAL has identified five determinants of service quality:

1. Reliability
2. Assurance
3. Tangibles
4. Empathy
5. Responsiveness

These determinants address, respectively, performance standards, expertise and physical elements of the facility, employees' willingness to assist in a timely manner with their kno wledge, and sensitivity [23].

In this thesis, SERVQUAL determinants are going to be used along with the ones of the Service Trustworthiness Model to help identifying the client's needs related to SLA compliance.

3.3.2 Service Trustworthiness Model

Trust in IT-based systems is a topic of current interest among researchers and practitioners. Trust is a relative user's perception of the degree of confidence the user has in the system he/she uses. A trustworthy system is a system that gains a high level of trust by its users by

satisfying the specified security, privacy, reliability and business integrity requirements. Delivering high assurance and trustworthy services has been subject to long term initiatives by Microsoft, Cisco, and the Software Engineering Institute (SEI), among others. According to Microsoft, the four pillars of trustworthy computing are security, privacy, reliability and business integrity. Security addresses issues related to confidentiality, integrity, availability and accountability. Privacy is related to the fair handling of information. Reliability is related to the dependability on the system to offer its services. Finally, business integrity is related to the responsiveness and ethical responsibility of the service provider.

Thus, the seven determinants identified by the Service Trustworthiness Model are:

1. Confidentiality (C)
2. Integrity (I)
3. Availability (AV)
4. Accountability (AC)
5. Reliability (R)
6. Privacy (P)
7. Business Integrity (BI)

Service clients expect that the provided services are protected from malicious attacks on their confidentiality (C), integrity (I) and availability (AV).

Confidentiality (C) implies that all data, information and knowledge are kept in confidence. Integrity (I) means that data, information and knowledge will only be shared with and provided to entities that are allowed to have access to it according to organizational rules.

Availability (AV) means that the service is available when required. At the strategic level, for example, confidentiality implies that all data, information and knowledge used in strategy formulation is kept confidential. Moreover, care should be taken to enforce its integrity. This means information provided to individuals involved in the strategy formulation process is consistent with their rights and roles. Availability at the strategic level is the degree to which the strategy formulation process is available to provide strategic directions to other IT processes.

Accountability (AC) can also be considered as a security requirement, since ho lding a legitimate user accountable for her actions enhances security and avoids non- repudiation.

Reliability (R): Service clients can depend on the provided service to fulfill their functions when required to do so. This feature relates to the "correctne ss" of the provided service. The smaller is the failure rate and the mean time between failures, the higher is the service reliability. At the strategic level, reliability deals with the ability of a strategic process to arrive at the "correct" strategic decisions and directions. The reliability at this level can therefore be measured by the number of times the strategy is "incorrect".

Privacy (P): Service clients are able to control their own personal or institutional data collected by the process delivering the service. Moreover, the use of this data must not be shared with external processes without the consent of the service clients. At the strategic level, for example, this means that the data that went into making the strategic choices such as productivity records, failure rates etc., is controllable by the client who provided such data.

Business Integrity (BI): The service owner behaves in a responsive and responsible manner. This means that requests from service clients are handled ethically while keeping the interest of the client and the organization in balance. In addition, such service is provided in a reasonable amount of time. At the strategic level, for example, the strategic process has business integrity if it appropriately addresses both the business and IT sides of issues in an even-handed manner.

3.3.3 GSQA Model Development

The following table shows the service quality attributes resulted after combining both sets of SERVQUAL model and service trustworthiness model [25], and after eliminating the duplicated factor (Reliability).

Eleven different service quality attributes, which are going to compose the third dimension for defining the customer compliance needs along with the ITIL processes and the SLA Ontology, the following table lists these 11 attributes with a brief description of their performance drivers:

Table 3.1 Generic Service Quality Attributes (GSQA) Model

	Attribute	Performance Drivers
1	Reliability (REL)	Performing services right the first time
		Providing services at the promised time
		Dependability in handling customers' service performed
2	Responsiveness (RES)	Prompt service to customers
		Willingness to help customers
		Readiness to respond to customers' requests
3	Assurance (AS)	Making customers feel safe in their transactions
		Employees who are consistently courteous
		Knowledgeable employee to answer customer questions
4	Empathy (E)	Giving customers individual attention
		Employees who deal with customers in caring fashion
		Having the customer's best interest at heart
		Employees who understand the needs of their customers
5	Tangibles (T)	Modern equipment
		Visually appealing facilities
		Employees who have a neat, professional appearance
6	Confidentiality (C)	All data, information, documentation are kept in confidence
7	Integrity (I)	information and knowledge shared only with authorized entities
8	Availability (AV)	Service is available when required
9	Accountability (AC)	Every Employee or worker is hold accountable for his action
10	Privacy (P)	Client is able to control his company's data collected by the process delivering the service
11	Business Integrity (BI)	keeping the interest of the client and the organization in balance
		requests from service clients are handled ethically
		Service is provided in a reasonable amount of time

These dimensions will help identifying the customer's needs which will form the base of all the used Six Sigma tools in order to optimize the compliance processes of our service delivery.

3.4 Summary

This chapter presented the three main models that are considered as the foundation of the methodology which will be presented in Chapter 4, the three models are:

1. SLA Ontology.

   Defines the main SLA contents and is based on the IBM's SLA Action Manager (SAM) and the ITIL's SLA contents. The Ontology focuses on the compliance related SLA components and describes the relations between them.

2. Compliance Oriented Process Maps.

   Defines compliance processes in terms of generic compliance services. It combines the activities of the Manage Ongoing Process of the ITIL's Service Level Management with the Red Monk's Compliance Oriented Architecture (COA) services.

3. Generic Service Quality Attributes.

   A set of 11 generic quality attributes for services derived from the dimensions of SERVQUAL and the Service Trustworthiness Model.

CHAPTER 4

4 METHODOLOGY

SLCOM (Service Level Compliance Optimization Methodology), presented in this chapter, is a process definition and analysis methodology for service level compliance that will help in applying the Six Sigma process optimization techniques to the SLA compliance processes. It integrates bodies of knowledge that are essential for defining and managing IT services, but that have been addressed separately in the past, such as ITIL, SOA, SERVQUAL, Service Trustworthiness Model, and IBM's SLA Action Manager (SAM).

SLCOM depends on the three models presented in the Chapter 3 to develop generic Kano questions, generic CTQ trees, generic QFD house, and generic SIPOC maps. These generic models serve as a guide for the optimization of compliance business processes using the Six Sigma DMAIC techniques.

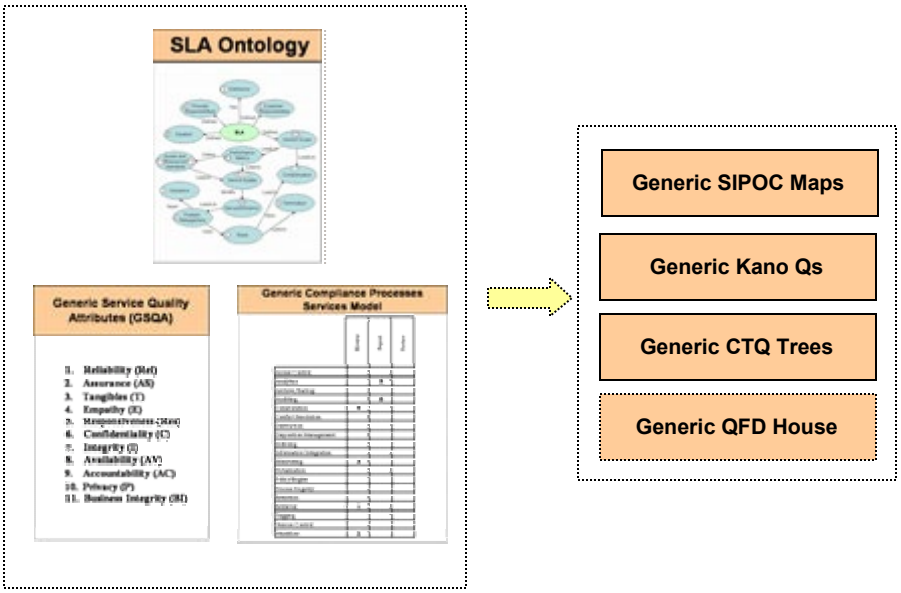


Figure 4.1 Approach of developing Service Level Compliance Optimization Methodology

Following the Six Sigma DMAIC problem solving approach is logical since it incorporates the following phases:

1. Define the problem: to develop a clear project charter based on the real problem that is relevant to the customer and that will provide significant benefits to the business.
2. Measure the process: to understand and baseline the current performance of the process through a set of relevant and robust measures (KPI's)
3. Analyze the process: to find the root causes of the problem and understand / quantify their effect on the process performance.
4. Improve the process: to develop, select, and implement the best solutions with controlled risks.
5. Control the process: to ensure the solutions are embedded, the process has robust controls, and the project has a clear closure.

In this thesis, the proposed model focuses on the initial phase: Define, as it is considered the base for building the case and proceeding with the rest of Six Sigma phases.

The Define phase shall define the client's needs in the context proposed earlier. Following Six Sigma approach, the first step should be Defining the business case (Problem statement, goal statement), then understanding the customer (VOC research, CTQs), and after that, defining the process (SIPOC).

The proposed methodology is described in the following flow chart shown in Figure 4.3:

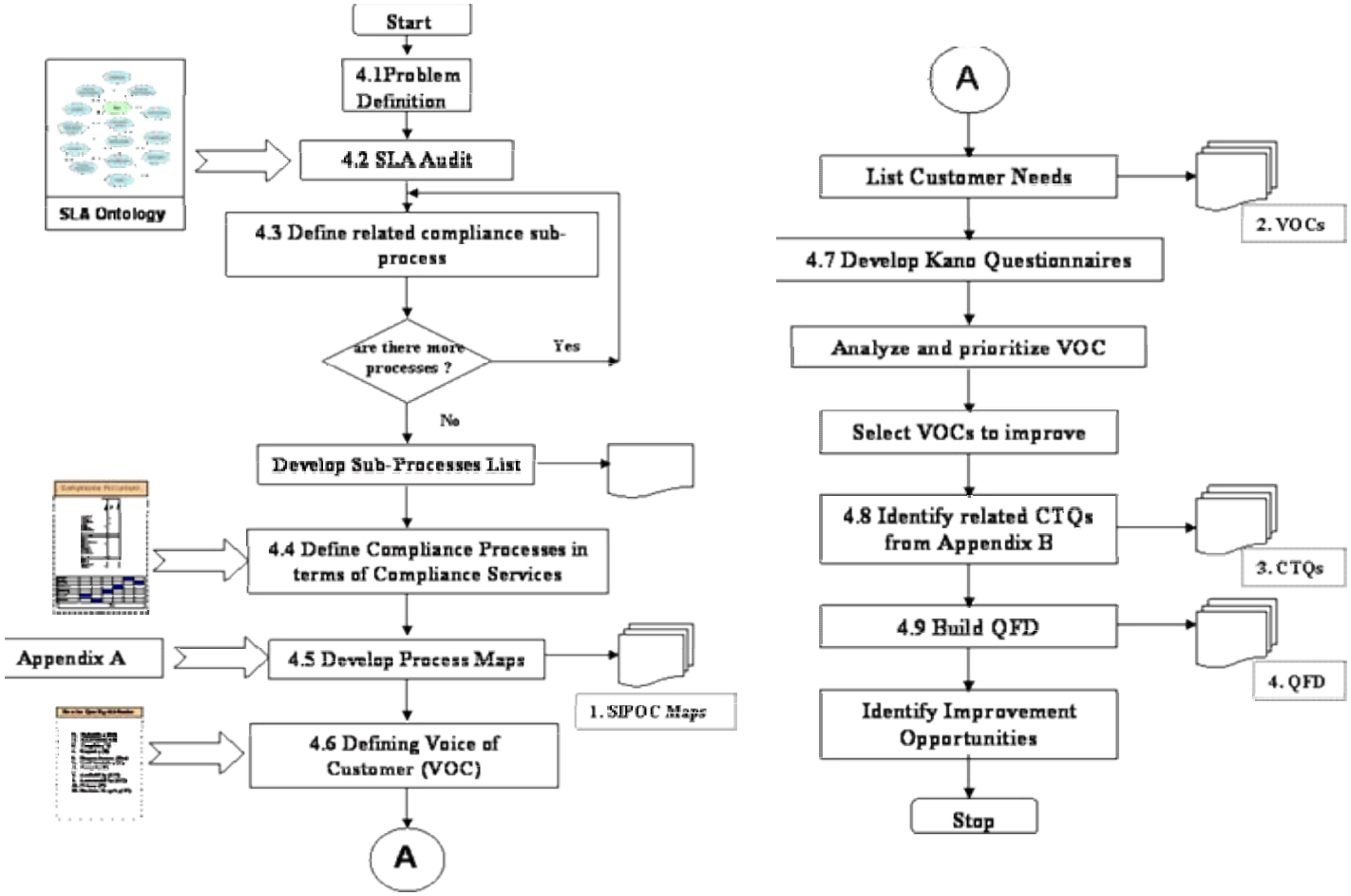


Figure 4.2 Methodology Flow Chart

4.1 Problem Definition

The first step of the methodology is to define the reason of the study. This can be achieved by defining the problem and goal statements. The generic problem is the SLA compliance and the generic target is to reach 99.996 % compliance level (or to improve the compliance level)

Since all of the used models in developing the methodology come from an IT background, taking a certain IT service shall help understanding the different steps of the presented methodology. Consider that company ABC has a SLA for providing internet service from a certain Internet Service Provider (ISP). The service manager on the ISP's side needs to comply with the rules and standards mentioned in the SLA, which define the agreed on level of service and the requirements of the client. Making sure that the provided service does not breach the agreed on level is a crucial task for the service manager. That is why a service manager needs to continuously monitor the provided service and should have advanced tools to detect and report any service level breach in order to take the suitable corrective action.

In this context, the problem statement shall focus on the compliance with the service continuity factor mentioned in the SLA, which for example states that the provided internet service should be available (24 x 7) at speed of (512 kbps). The goal statement mentioned in the SLA affirms a 99% monthly compliance level.

Having defined the problem and goal statements, the service manager can now move on with the SLCOM steps.

4.2 SLA Audit

In this step, the SLA components are checked against the ones of the Generic SLA Model. The importance of this test is to verify that the related compliance process does actually exist in the scope of the SLA, and is available for further analysis and optimization. Contrarily, if the related compliance process element is not mentioned within the SLA, then one should reconsider the optimization process, since there is a lack in the available data related to the mentioned process, and thus must move in another direction which is reviewing the SLA.

In order to perform the SLA audit, a service manager can perform a quick comparison between the SLA components and the ones of the Generic SLA Model. This test can indicate the gaps or weaknesses of the SLA. And shall provide the service manager with a more focused scope to study and analyze. Moreover when reflecting the SLA audit results on the SLA Ontology, this can provide another analysis dimension. Since the SLA Ontology shows the relations between the main SLA components related to compliance processes. It is now possible to link the weakness of defining one component to the other related ones. For example, looking back at Figure 3.3, if one of the problems that a service manager faces is the high frequency of Non-Performances, then the optimization direction can be forecasted at an earlier stage, which is the SLA audit, since it can indicate the areas that lack related data, such as Service Quality, Problem Management, Performance Metrics,…etc. knowing that one of these elements is not clearly defined in the SLA can be a good reason for Non-Performances to appear. This might guide the optimization process to move back and review the SLA again to make sure that it covers all the required rules and metrics to define the required level of service and ensure the expected quality level. This shows the importance of the SLA audit process, since it could save the time and effort invested in an optimization process that will face a dead end, in addition to its contribution to the direction of the analysis and optimization process at an early stage.

For example, in the ISP case, the service manager might realize that the signed SLA does not have any article that mentions insurance related to infected e- mails or viruses. Although it is known that these kinds of malicious data might harm the client's soft or hardware, and thus might cause discontinuity or latency of the provided service. This indicates that a SLA review should take place; it also indicates that any optimization process related to security check of the transmitted data is not applicable since the process is not there originally.

To move forward in the ISP example, the service manager identified two main contents of the SLA that are mentioned clearly, they are: Non-Performance and Complaints.

4.3 Define Compliance Sub-Processes

The third step in the presented methodology is to define the main compliance Sub-processes, which can be derived from the three main processes of the Compliance Processes Services Model and the components of the SLA ONTOLOGY presented in

Chapter 3. Each combination defines a different generic compliance sub-process, which gives a lot of possibilities for generic compliance sub-processes.

Following the methodology's flow chart, the client must define the main compliance sub-processes that are related to the main compliance issue stated in step 4.1. Using the most convenient approach, whether it was a brain storming sessio n, a workshop or a survey, the client should be able to establish a list of the sub-processes that are of great influence on the problem studied.

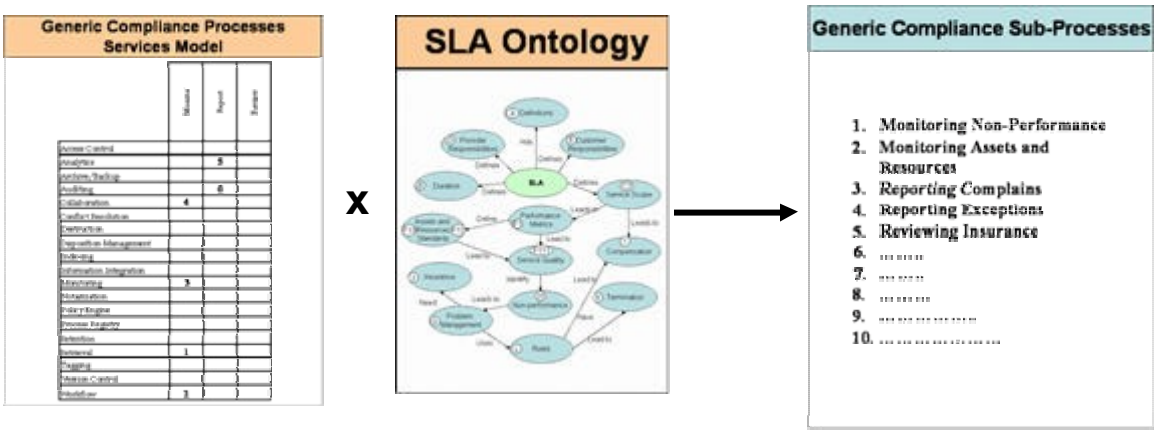


Figure 4.3 Developing Generic Compliance Sub-Processes

For example, the ISP's service manager needs to define the main compliance Sub-processes by crossing an ITIL process with one or more of the SLA Ontology components. And since the service manager has already identified the required SLA components in the previous step which are "Non-performance" and "Complaints". Now he can define sub-processes such as "Monitoring Non-performance" or "Reporting Complaints", which resulted from matching the ITIL processes "Monitor" and "Report" with the selected SLA Ontology components.

4.4 Define Compliance Sub-Processes in terms of Compliance Services

Defining the client's main sub-processes, the methodology leads the client to break down each process into a set of generic compliance services given by the table presented in Chapter 3.

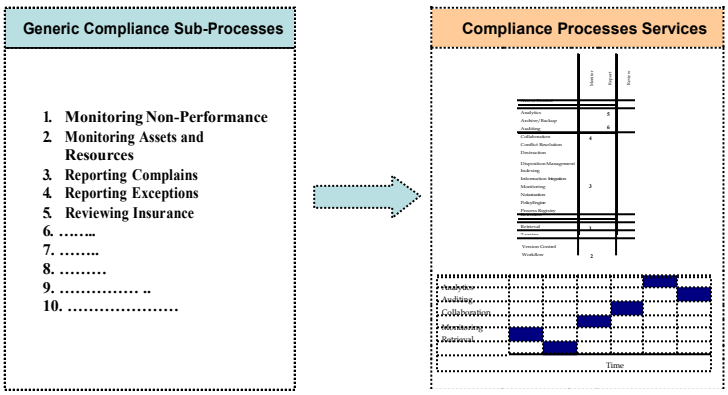


Figure 4.4 Compliance Services for defined Sub-processes

For example, the defined sub-process "Monitoring non-performance" mentioned in the previous step requires service manager to be authorized to access the monitoring program for the required client to check the required monitoring sequence and retrieve the agreed on metrics as per the SLA. Then he can perform the monitoring process and interact with the responsible people to ensure the fulfillment of requirements. Finally he can record the readings of the meters and put the time stamp and signature on the report. This sequence of activities can be constructed using the following selected generic compliance services:

1. Access Control: the service manager should be authorized to access the service monitoring program for this certain client.
2. Work flow: the service manager reviews the standard sequence of services required to monitor the level of the service.
3. Retrieval: the service manager retrieves the rules and metrics mentioned in the SLA.
4. Monitoring: the service manager uses a certain program to monitor the level of the provided service.
5. Collaboration: the service manager may interact or communicate with a responsible person from the client's side to make sure that everything is going as it is supposed to.

6. Analytics: the service monitoring program should measure the level of service provided at several instances as required by the service manager. These measurements should be recorded in a database in order to be analyzed later.
7. Auditing: at each measurement instance, the program should record the time and date of the measurement. It also should record the na me of the authorized service manager in case of any manual entry.

These steps can be easily selected and put in sequence using the generic compliance processes services table. Then a generic sub-process diagram can be created to show only the selected compliance services and present them against time in order to provide the user with a graphical representation of the process flow:

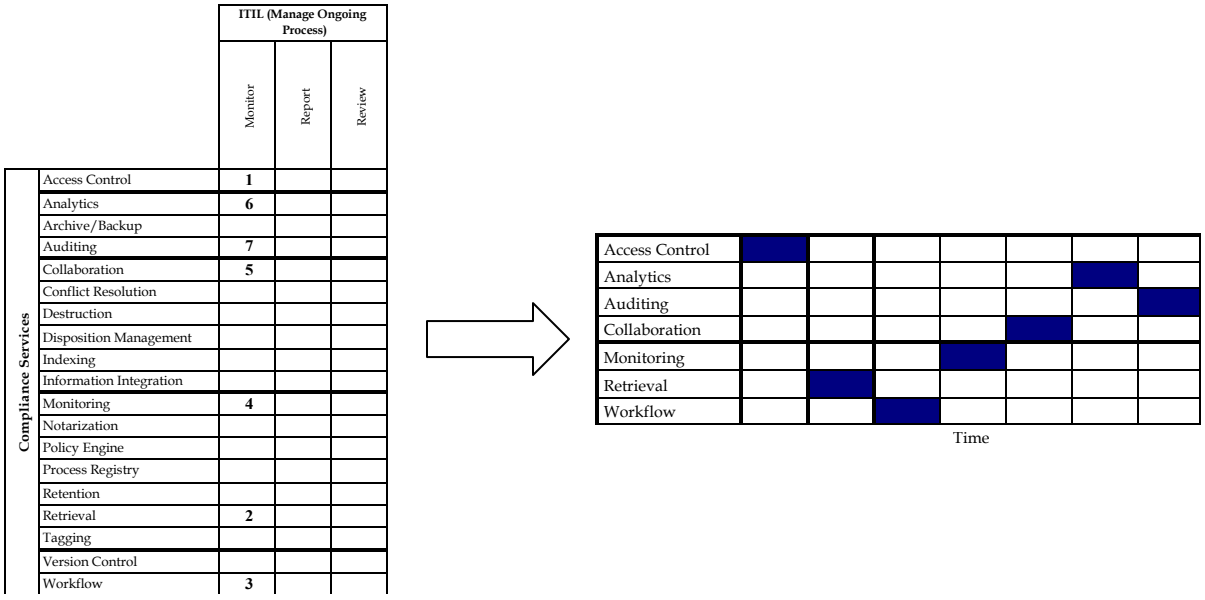


Figure 4.5 Process / Services Table for "Monitoring Non-Performance" Sub-Process

Similarly, the defined sub-process "Reporting Complaints" requires service manager to be authorized to access the monitoring program for the required client to check the client's data from integrated databases and retrieve the recorded complaints for the required period. Then he can audit the details of each complaint to ensure that it has been logged by an authorized user. After that he can perform the required statistics and create an official report and record the creator's credentials. Finally the system should record the required

tagging fields and assign a unique index code for the report so that it can be circulated to the involved parties and archived.

This sequence of activities can be constructed using the following selected generic compliance services:

1. Access Control: the service manager should be authorized to access the SLA management program for this certain client.
2. Information integration: the service manager is able to integrate different data bases for the same client to view all the complaints for a selected period.
3. Retrieval: the service manager retrieves all complaints for the selected period.
4. Auditing: the service manager is able to audit the details of each complaint, to make sure that it has been logged by an authorized user.
5. Analytics: the service manager can develop certain statistics for complaints' types, frequency, location ...etc in order to analyze the reasons.
6. Notarization: An official report is created, and credentials of the creator are recorded.
7. Tagging: required tagging fields are automatically filled by the SLA management system and approved by the service manager.
8. Indexing: the system assigns a unique code for the report.
9. Collaboration: the service manager posts the report to the involved parties.
10. Archive/ Backup: the system archives a copy of the report.

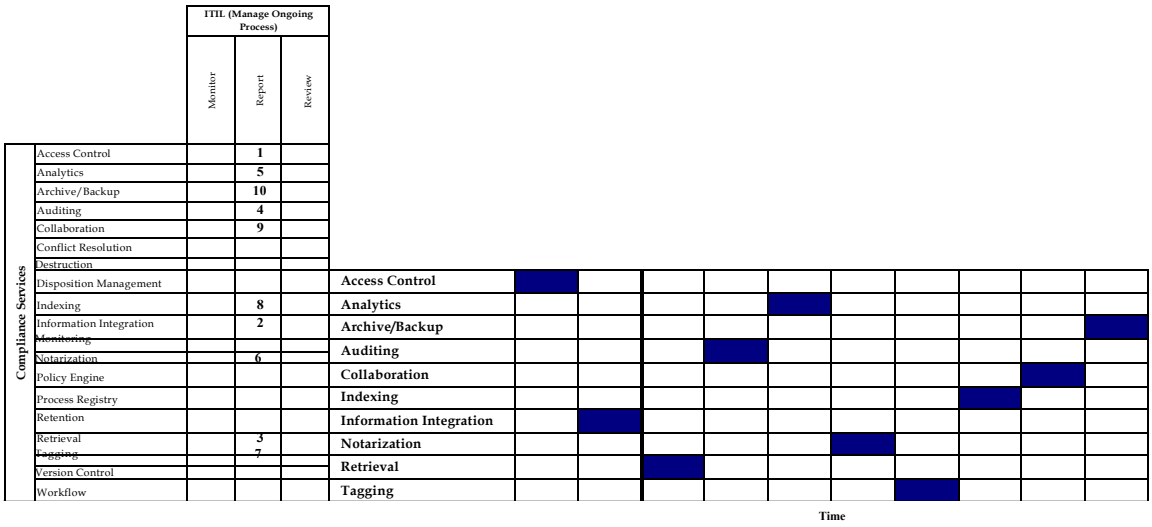


Figure 4.6 Compliance Services for "Reporting Complaints" Sub-Process

4.5 Develop Process Maps:

Since a detailed process map is usually presented in the Analyze phase of the Six Sigma exercise, a simple process definition and map should ensure the understanding of the core process.

SIPOC technique is used to define and develop a high level process map for the core processes. In order to develop a SIPOC map for a certain process, one must specify the activities of the process, and list the potential supplier, input, output, and customer for each activity. Coming up with such a map can take a lot of time and may require a brain storming session in order to cover all the potential elements.

Having the main generic processes already defined in the first step using the ITIL and the SLA ontology, and having develo ped the Process/ Services table for each sub-process. The components of these processes can now be identified by generating SIPOC maps to indicate the main parties involved (clients and suppliers) and the main (inputs and outputs). To simplify this process, and since the sub-processes are already constructed using the generic compliance services, which makes them standardized somehow, the methodology introduces a generic table in Appendix A that includes the potential elements (supplier, input, output, and client) for each compliance service. And by listing the potential elements for each compliance service mentioned in the Process / Service table, then a generic SIPOC map can be developed for the whole sub-process.

For example, to develop the SIPOC map for the "Monitoring Non-performance" can be as follows:

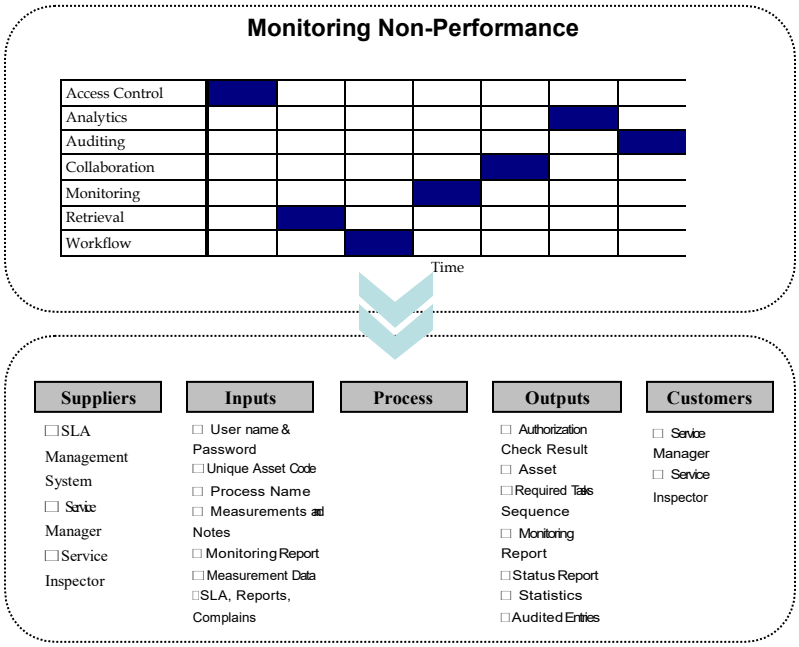


Figure 4.7 SIPOC Map of "Monitoring Non-Performance" Sub-Process

Correspondingly, the SIPOC map for the "Reporting Complaints" Sub-process can be developed as follows:

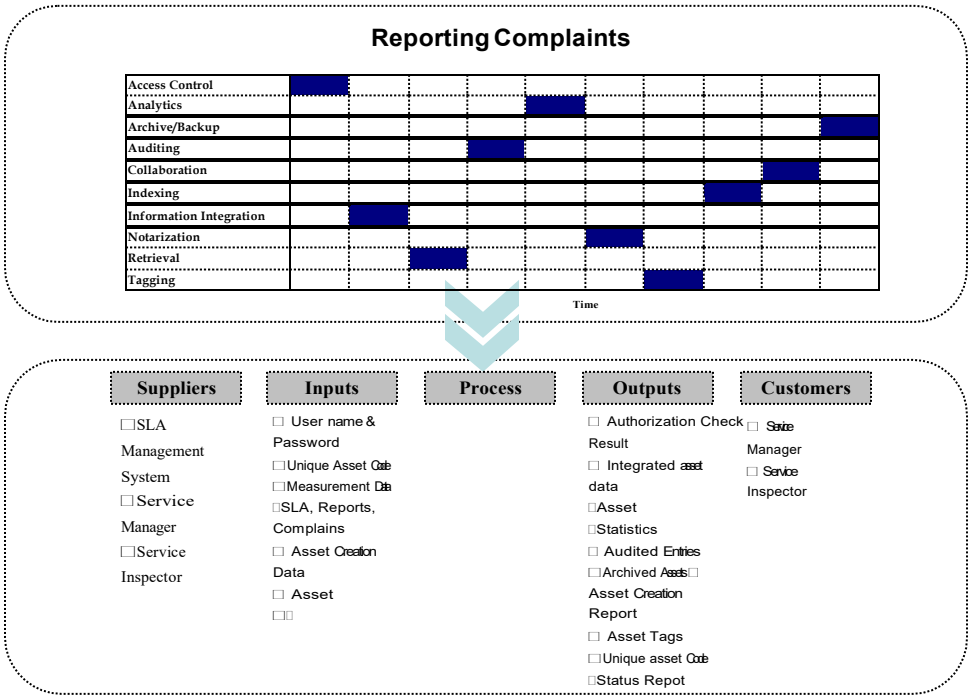


Figure 4.8 SIPOC Map of "Reporting Complaints" Sub-Process

4.6 Defining Voice of Customer (VOC)

Having defined the compliance sub-processes, service managers can now move to the next step in which they identify the required quality attributes of the chosen processes. This can be achieved by crossing each of the chosen compliance sub-processes with one or more attribute of the GSQA mentioned earlier in table 3.1.

All customer's needs are going to be defined and categorized under these dimensions. The "voice of the customer" is the term to describe these customer needs or requirements.

Moving forward in our previous example, crossing the compliance Sub-process "Monitoring Non-performance" with the SQA "Reliability" for example shall produce the generic customer need "Reliability of Monitoring Non-performance". In a similar way assuming that the service manager chooses the quality attribute "Responsiveness" for the "Reporting Complaints" sub-process, then the customer need developed is "Responsiveness of Reporting Complaints".

At the end of this step, the service manager should be able to prepare a list with all the needs related to the sub-processes selected in the previous steps.

4.7 Develop Kano Questionnaires

The customers' needs resulted from the previous step are going to be classified into satisfiers (One dimensional), dys-satisfiers (Must-be), and delighters (Attractive) according to survey results, which should also provide us with the priority and the competitive evaluation of each customer need. The methodology user should be able to get to that level of details by using Kano analysis, which is a quality measurement tool used to prioritize customer requirements based on their impact to customer satisfaction. It determines which requirements are important. Since identified requirements may not be of equal importance to all customers, Kano analysis can help to classify different client requirements to determine which have the highest priority.

This analysis is based on the groundbreaking work of Noriaki Kano, a key Figure in the Japanese quality movement. Dr. Kano realized the importance of dividing customer requirements into the mentioned three categories [26], which are shown in Figure 4.9.

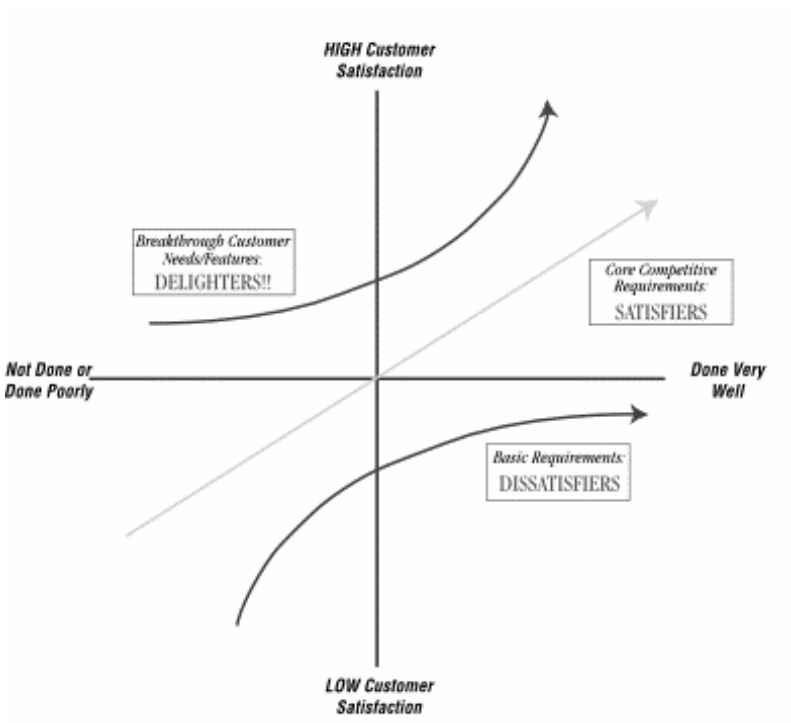


Figure 4.9 Three categories of Kano's Model

In Figure 4.9, the line going through the origin at 45 degrees graphs the situation in which customer satisfaction is simply proportional to how fully functional the service is. Such customer needs are designated as "One-dimensional" or "Satisfiers".

The curve labeled "Must-be" indicates aspects where the customer is more dissatisfied when the service is less functional, but satisfaction never rises above ne utral no matter how functional the service becomes. Such aspects are expected "Must-be" and any lack of them will cause customer dissatisfaction, that is why they are also called "Dys-satisfiers".

The attractive curve indicates areas where customer is more satisfied when the service is more functional but is not dissatisfied when it is less functional. Such features are known as "Delighters" or "Attractive".

In order to simplify the classifying and prioritization of the results, all the answers should be stated in a multiple choice form, with the following generic answers:

a) Like
b) Must
c) Do not care

d) Can live with it

e) Dislike

The following table explains how customer needs are classified according to the answers received from the clients:

Table 4.1 Classes of answers in Kano's Model

		Dysfunctional				
		Like	Must	Do not care	Can live with it	Dislike
Functional	Like	Q	A	A	A	O
	Must	R	I	I	I	M
	Do not care	R	I	I	I	M
	Can live with it	R	I	I	I	M
	Dislike	R	R	R	R	Q

O: One dimensional or linear features
I: Indifferent response
A: Attractive features
M: Must-Be features
R: Reverse (inconsistent response)
Q: Questionable response

Ranking the customer needs can be easily done by selecting the most frequent response (mode). After that customer needs can be grouped as per their classes. A general guideline is to seek to fulfill all Must-be needs, be competitive with market leaders on the One-dimensional needs, and include some differentiating Attractive needs.

An extra question can be added for each customer need to rate its importance on a 1 to 9 scale. Such question can be helpful in further sorting the Kano responses. If there were several customer needs whose mode was Attractive, then they could be ranked using the importance dimension.

Generating Kano questionnaires can be standardized by using the description of the GSQA mentioned in table 3.1. For example, to generate the functional form of a question, one can use one of the following beginnings:

- Which of the following words best describes your point of view if …
- How would you feel if …
- What is your opinion if …

And then combine it with the description of the required SQA of the selected customer need, for example, if the selected customer need was: Reliability of monitoring non-

performance, then the service manager should look at the description provided for the attribute (Reliability) which in this case mentions the following:

- Performing services right the first time.
- Providing services at the promised time.
- Dependability in handling customers' service performed.

Choosing one of these descriptions can lead to the generation of a functional form question as follows:

- How do you feel if your monitoring process could detect non-performance the first time?

Or:

- What is your opinion if your monitoring process could detect non-performance at the promised time?

The questio nnaires should also include a dys- functional form, which can be constructed in a similar way only with a negative logic, for example:

- How do you feel if your monitoring process could not detect non-performance the first time?

Or:

- What is your opinion if your monitoring process could not detect non-performance at the promised time?

For each customer need an extra question can be listed in the questionnaire in order to make the clients rate how much they think the requirement is being met currently. A 1 to 5 scale could be used.

Thus, there will be three scores for each potential customer need being investigated, Functional, Dysfunctional, and Importance. Theses scores are coded as follows:

Table 4.2 Kano Questions Rating

Functional	Like	4
	Must	2
	Do not care	0
	Can live with it	-1
	Dislike	-2
Dysfunctional	Like	-2
	Must	-1
	Do not care	0
	Can live with it	2
	Dislike	4

For each customer need, the average of the answers of the functional question gives the value on the Y axis, and the average of the answers of the dysfunctional question provides the value of the X axis.

After that a Kano model is drawn based on the mentioned results. Each plotted point represents a customer need, and its importance is indicated by a different color for each weight range, or simply by mentioning the weight on a label next to each point.

In the previously mentioned example, the first customer need is "Reliability of Monitoring Non-Performance", the service manager should start by developing questions related to the mentioned need.

The functional form question can be: How do you feel if your monitoring process could detect non-performance the first time?

Then the dysfunctional form shall be: What is your opinion if your monitoring process could not detect non-performance at the first time?

These questions can be presented in the following form:

Table 4.3 Kano's Survey (Functional Form Question)

Functional Form of Question	How do you feel if your monitoring process could detect non-performance the first time?	Like	✓
		Must	
		Do not care	
		Can live with it	
		Dislike	

Table 4.4 Kano's Survey (Dys-Functional Form Question)

Dys-Functional Form of Question	How do you feel if your monitoring process could not detect non-performance the first time?	Like	
		Must	
		Do not care	
		Can live with it	✓

The third question, which is related to rating the current status, can be as follows: How important would it be if your monitoring process could detect non-performance the first time?

The following table shows an example of survey results for the first customer need, assuming the answers of 10 clients:

Table 4.5 Kano results for the first Customer Need (CN -1)

Customers	Functional Question		Dysfunctional Question		Class	Importance
	Answer	Weight	Answer	Weight		
C1	Like	4	Dislike	4	O	7
C2	Do not care	0	Do not care	0	I	2
C3	Like	4	Can live with it	2	A	6
C4	Can live with it	-1	Dislike	4	M	7
C5	Do not care	0	Dislike	4	M	4
C6	Must	2	Dislike	4	M	8
C7	Like	4	Dislike	4	O	6
C8	Must	2	Do not care	0	I	7
C9	Like	4	Do not care	0	A	4
C10	Must	2	Can live with it	2	I	6
Results		**2.1**		**2.4**	**M**	**5.7**
		Y		**X**		

The customer need appears to fall in the "Must-be" class. Since there are similar count for "M" and "I" answers, a helpful rule is to compare the count of the responses, If (O+M+A) > (I+R+Q) then class is the maximum (O,M,A), if not then the class is the maximum (I,R,Q). The coordinates of the point are (2.4, 2.1) which are the averages of the answers of the dysfunctional and functional questions.

Similarly, the results of the questionnaire's responses of the second customer need "Responsiveness of Reporting Complaints" (CN-2) can be shown by the following table:

Table 4.6 Kano results for the second Customer Need (CN -2)

Customers	Functional Question		Dysfunctional Question		Class	Importance
	Answer	Weight	Answer	Weight		
C1	Must	2	Dislike	4	M	7
C2	Like	4	Do not care	0	A	5
C3	Like	4	Can live with it	2	A	6
C4	Can live with it	-1	Dislike	4	M	7
C5	Like	4	Can live with it	2	A	7
C6	Like	4	Do not care	0	A	6
C7	Like	4	Dislike	4	O	8
C8	Must	2	Do not care	0	I	7
C9	Like	4	Do not care	0	A	7
C10	Must	2	Can live with it	2	I	6
Results		**2.9**		**1.8**	**A**	**6.6**
		Y		**X**		

Having the coordinates of both points, a Kano diagram can be constructed as follows:

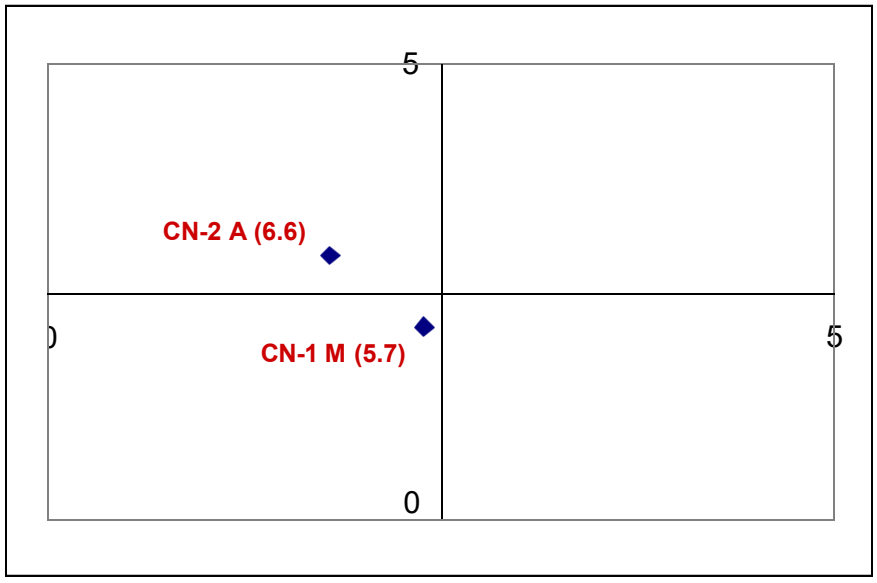


Figure 4.10 Results of Kano's Survey

4.8 CTQ Trees

For each defined customer need, a set of performance drivers is defined and related to the selected SQA in table 3.1. Then the CTQs (Critical to Quality) for each driver are defined. CTQs are the key measurable characteristics of a product or process whose performance

standards or specification limits must be met in order to satisfy the customer. They align improvement or design efforts with customer requirements.

For each customer need, the drivers that will help to achieve that need will be listed depending on the SQA of that need and the related compliance services. Appendix B presents a table that provides generic CTQs for each combination.

The mentioned generic CTQs shall help the service manager to provide metrics and KPIs to assess the required performance level of the selected customer needs. Of course extra CTQs can be derived from the mentioned drivers depending on the uniqueness of the problem tackled. Otherwise, the provided CTQs can be used for any generic compliance process definition in the field of services.

The steps of developing the CTQ tree can be described as follows:

1. Specify the customer need.
2. Identify the SQA of the customer need.
3. Match the SQA to one or more of its generic drivers mentioned in table 3.1.
4. List the related compliance services from the Process / Service table defined earlier for the selected customer need.
5. Refer to the SQA / Compliance Service table in Appendix B to find the corresponding generic CTQs .

A generic CTQ tree is shown in Figure 4.11

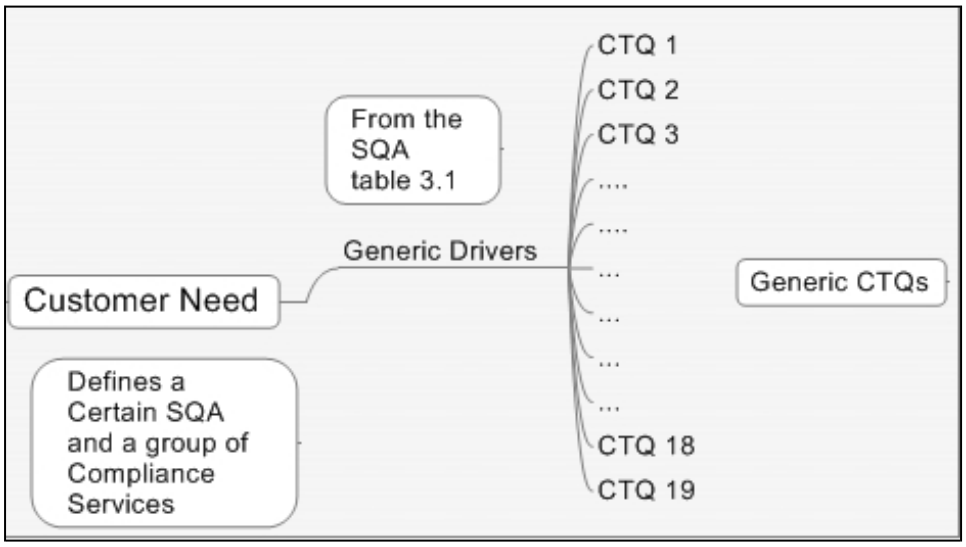


Figure 4.11 Generic CTQ Tree

Moving forward with the ISP example, since the customer need was defined in the previous step as "The Reliability of Monitoring Non-performance", and then the related CTQs can be selected from the part of the generic CTQ table that contains only the column "Reliability" and the rows of the related compliance services as shown in table 4.7:

Table 4.7 CTQs for "Reliability of Monitoring Non-performance"

		CTQs for "Reliability of Monitoring Non-performance"
Compliance Services	**Access Control**	authorization list
	Analytics	accurate measurement error < 2 %
	Auditing	required fields check list
	Collaboration	responsible employees list > 2
	Monitoring	Detailed Service Scope check list
	Retrieval	Unique Tagging and index Reference
	Workflow	Last successful approved procedures

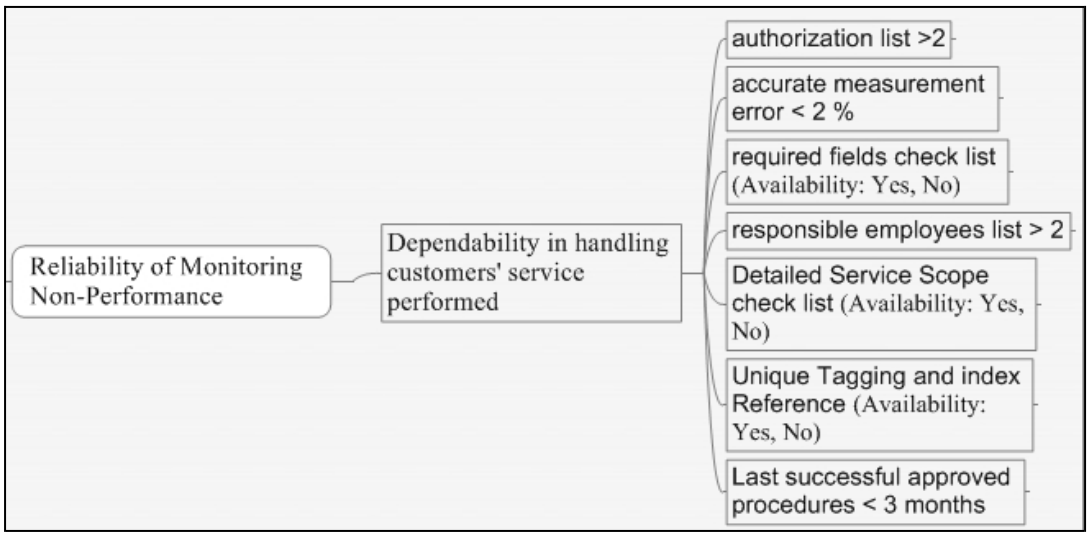


Figure 4.12 CTQ Tree for "Reliability of Monitoring Non-performance"

Figure 4.12 shows the CTQ tree for the Reliability of Monitoring Non-performance customer need related to the following compliance services:

- Access control: the process should only give access permission to authorized service managers' mentioned in the authorization list.

- Analytics: Measurement error should be less than 2%
- Auditing: Process should have predefined list of fields to be audited and recorded.
- Collaboration: at least 2 responsible employees' names on the client side must be defined.
- Monitoring: one detailed service scope check list must be available.
- Retrieval: Unique Tagging reference must be available for each SLA.
- Work flow: the approved sequence of the followed procedures must be available for the service manager to review.

In a similar way, and using the CTQs table in appendix B, the list of required CTQs for the other customer need "Responsiveness of Reporting Complaints" can be established as follows:

Tabl e 4.8 CTQs for "Responsiveness of Reporting Complaints"

		CTQs for "Responsiveness of Reporting Complaints"
Compliance Services	**Access Control**	authorization list > 2
	Analytics	accurate measurement error < 2 %
	Archive/Backup	list data type/ archiving place (Availability: Yes, No)
	Auditing	required fields check list (Availability: Yes, No)
	Collaboration	responsible employees list > 2
	Indexing	Unique Index for each asset (Availability: Yes, No)
	Information Integration	Unique Primary Key for records related to the same asset
	Notarization	required fields list (Availability: Yes, No)
	Retrieval	Unique Tagging and index Reference (Availability: Yes, No)
	Tagging	Predefined required metadata (Availa bility: Yes, No)

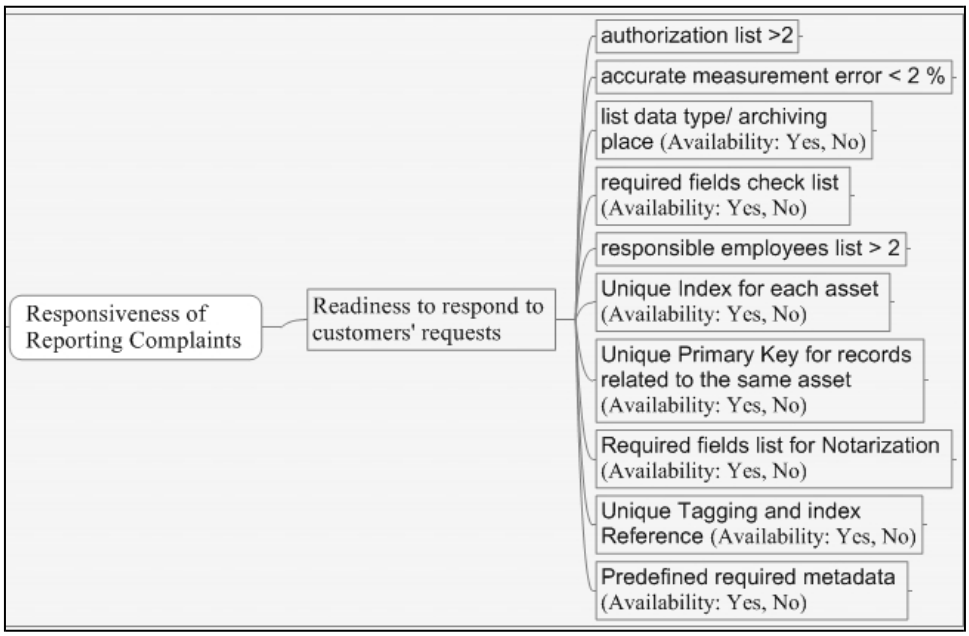


Figure 4.13 CTQ Tree for "Responsiveness of Reporting Complaints"

4.9 QFD

Quality Function Deployment (QFD) is a structured approach to defining customer needs or requirements and translating them into specific plans to produce products or services to meet those needs. It is a customer-driven process that starts with the voice of the customer, which becomes the basis for setting requirements [27].

The house of quality is constructed by listing the findings of the Kano analysis for customer needs against the ir defined CTQs by following these steps:

1. Establishing priority of the defined customer needs using a 1-5 priority scale.
2. Selecting customer needs to optimize according to priority and importance.
3. Assuring that the SLA element of the each customer need had passed the SLA audit done earlier.
4. Listing the CTQs of each customer need, and developing a final integrated CTQ list in order to avoid repetition.
5. Building the house of quality by inserting the final customer needs and their CTQs.
6. Filling the relations cells between each customer need and CTQ using a 1 – 5 scale.
7. The technical difficulty of realizing the CTQs is obtained from the specialized people in the organization also on a 1 to 5 scale.

8. Competitive evaluation will be obtained from customer satisfaction part of the KANO survey.
9. Establishing the correlation between the CTQs is done by checking the relation between the proposed metrics or KPIs, since a lot of CTQs share similar metrics.
10. Calculating the Importance rating to decide what CTQs are more importance to start the optimization process on.

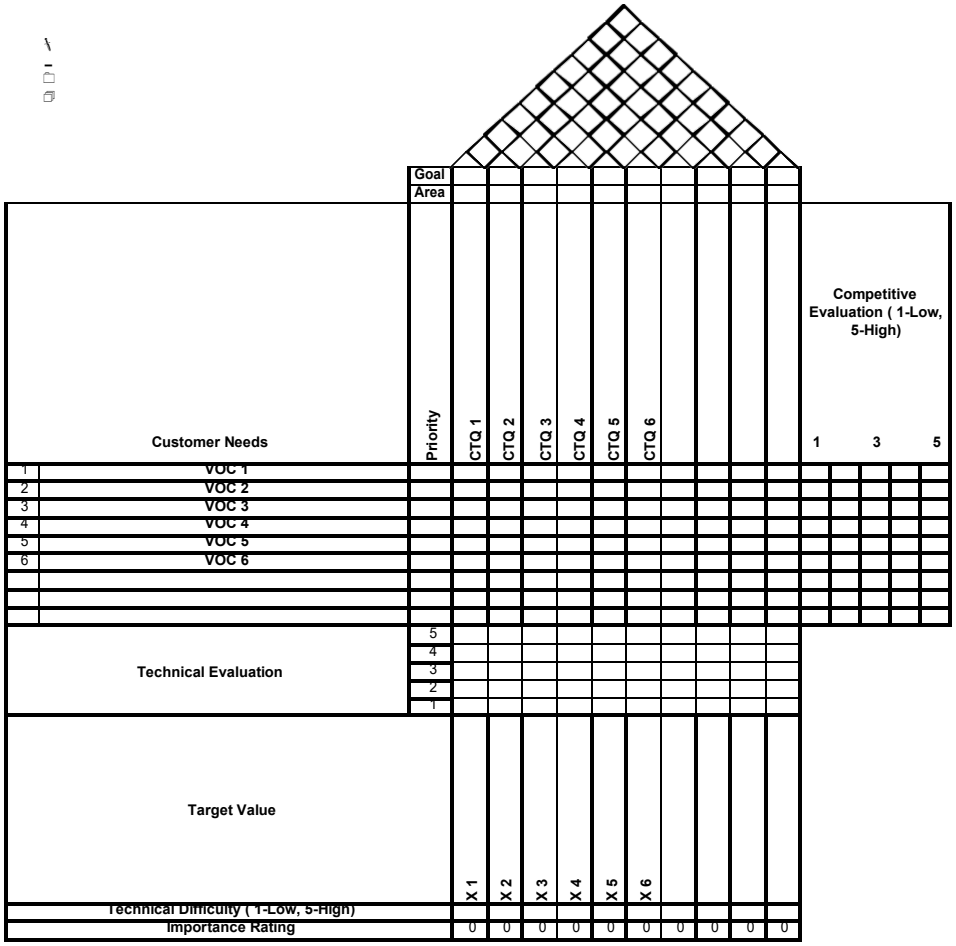
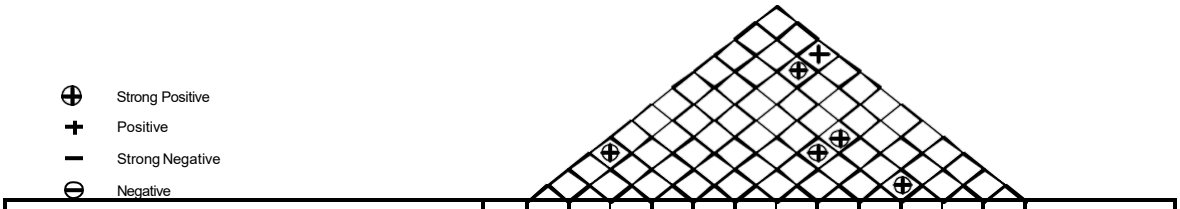


Figure 4.14 QFD

The priority of the customer needs will also be provided by the results of the survey done before for the Kano analysis, a 1 to 5 priority scale is applied according to customer rating.

Moving forward with the ISP example, the 2 mentioned customer needs are now ready to be used in building the house of quality, since their CTQs and priority has been defined in the previous steps. A sample house of quality shall look as follows:



	Customer Needs	Priority	authorization list	measurement error	required fields check list	responsible employees list	Detailed Service Scope check list	Unique Tagging and index Reference	Last successful approved procedures	list data type/ archiving place	Unique Index for each asset	Unique Primary Key for records related to the same asset	required fields list	Predefined required metadata	Competitive Evaluation (1-Low, 5-High) 1	3	5
1	CN-1 (Reliability of Monitoring Non-performance)	3	3	5	3	4	3	3	2		3						U
2	CN-2 (Responsiveness of Reporting Complaints)	5	2		3	4				2	3	4	2	3		U	
	Technical Evaluation	5															
		4															
		3															
		2															
		1															
	Target Value		3 Names (AM, SM, SI)	Error < 2%	5 < pre-defined fields	3 Names (AM, SM, SI)	1 List per SLA	1 Main ref. code	1 process map	1 Archiving table / SLA	1 Main ref. code	1 Main ref. code	5 < pre-defined fields	5 < pre-defined fields			
	Technical Difficulty (1-Low, 5-High)		2	4	2	2	4	3	4	3	2	3	1	2			
	Importance Rating		19	15	24	32	9	9	6	10	24	20	10	15			

Figure 4.15 Sample QFD for ISP

4.10 Summary

This chapter has presented the SLCOM (Service Level Compliance Optimization Methodology), which is a process definition and analysis methodology for service level compliance that helps in applying the Six Sigma process optimization techniques to the SLA compliance processes.

The methodology is based on the models presented in Chapter 3, which are:

- SLA Ontology
- Compliance Oriented Process Maps
- Generic Service Quality Attributes

The steps of the methodology are:

1. Problem Definition
2. SLA Audit
3. Define Compliance Processes
4. Define Compliance Processes in terms of Compliance Services.
5. Develop Process Maps (SIPOC)
6. Defining Voice of Customer (VOC)
7. Develop Kano Questionnaires
8. Develop CTQ Trees
9. Construct QFD

This methodology and its generic models shall serve as a guide for the optimization of compliance business processes using the Six Sigma DMAIC techniques. Applying the methodology gives the user a clear vision of the status of the related compliance processes, and directs the efforts towards the processes that are most efficient to optimize.

CHAPTER 5

5 MODEL ILLUSTRATION

5.1 Introduction

In order to illustrate the generality of the proposed SLCOM (Service Level Compliance Optimization Methodology), the model is applied to a real case but this time in a totally different field. Moving away from the tangibility of IT services, in this chapter the model is tested against a complex service delivery case in the Facilities Management field.

5.2 Emirates Management Services Corporation (EMS)

In line with the UAE Ministry of Finance and Industry's initiatives towards high performance, efficiency and quality in government institutions in the services sector, a corporatization process was undertake within the public sector. The aim of this process was to facilitate the creation of fully independent profit centers that allow for the provision of specialized expertise and services, broader asset allocation and the encouragement of greater competition in all sectors.

EMS has proven to be a model result of this new policy and has propelled the UAE as a regional leader in formulating reform policy driven by a business oriented mentality, a strong process of institutionalisation and greater transparency. This process is fully supported by the direct relationship between EMS and the private sector which has resulted in greater range and higher quality of services offered. In turn, this greater efficiency in public sector service provision has made a valued contribution to local economic growth and development.

Established by the Federal Law No. (14) for the year 2001, the Emirates Management Services Corporation (abbreviated to 'Khadamat' or EMS) was created with a capital of AED200m, of which AED50m is to be paid in the first year. EMS is empowered with independent administration and full authority for asset allocation. EMS is also empowered with a vision that calls for the adoption of a corporate ideology and modern risk management techniques to assess investment options.

EMS is mandated to provide its services to all government ministries in addition to other public sector institutions, local governments and federal authorities. It also provides

consulting related to its offerings in the field of services. EMS also supplies tools, equipment, expertise and other peripherals required to carry out its objectives, in addition to its supervisory tasks.

Entrusted with the management of the corporation, the Board of Directors is chaired by His Highness Sheikh Hamdan Bin Rashid Al Maktoum Minister of Finance and Industry, and elected Vice-Chaired by His Excellency Dr. Mohammed Khalfan Bin Kharbash, Minister of State for Finance and Industry. The six members are elected and membership of the board is for three years renewable.

The corporation currently boasts 45 employees located in the main office in Abu Dhabi and branch office in Dubai. Additionally there is an 18,000 strong workforce integrated under the corporation's umbrella of which 11,000 are outsourced via specialized private service providers. Demonstrating EMS's commitment to Emiratisation, nearly half of the 7,000 direct hired workforce is comprised of UAE nationals (3,500) while the remainder is primarily of Asian or Arab origin.

5.3 Business Case

As the major support services supplier for the federal sector in the UAE, EMS had 501 contracts as per June 2006, divided as shown below:

Table 5.1 EMS Service Contracts as per June 2006

Service	No. of contracts	Amount	%
Cleaning	203	85,371,946.85	52.90%
Security	76	20,001,652.56	12.39%
Correspondence	96	11,160,004.55	6.92%
Technical	96	6,702,035.83	4.15%
Management	30	38,145,281.24	23.64%
	501	161,380,921.03	

Table 5.1 shows that cleaning service contracts are covering more than 50% of the total contracts of EMS.

Looking thoroughly into the cleaning contracts, the 203 contracts are divided as follows taking the building type as a criteria :

Table 5.2 EMS Cleaning Service Contracts as per June 2006

Building Type	No. of contracts	Amount	Average
School	55	31,476,770.62	572,304.92
Offices	141	46,175,843.90	327,488.25
Hospital	6	7,666,340.33	1,277,723.39
Other	1	52,992.00	52,992.00
Total	203	85,371,946.85	

In June 2006, all the schools (756 schools around the UAE) terminated their contracts with EMS as the new regulations gave them the authority to deal directly with the cleaning companies and they were not satisfied with EMS's management of the provided services.

This event had a bad impact on the reputation of EMS as the only federal government entity which provides such services.

During 2007 EMS received many requests from different educational zones to manage the services again because of the difficulties they faced with the companies, since they could not manage the contracts or monitor the performance due to lack of staff and experience.

EMS is considering re-providing the service in year 2008, but in order to do the right thing, a detailed analysis of the service management processes followed by EMS must be made. Using the models and methodology proposed in the previous chapters shall assist in defining the aspects of the case in order to guide the optimization process.

5.4 Problem Definition

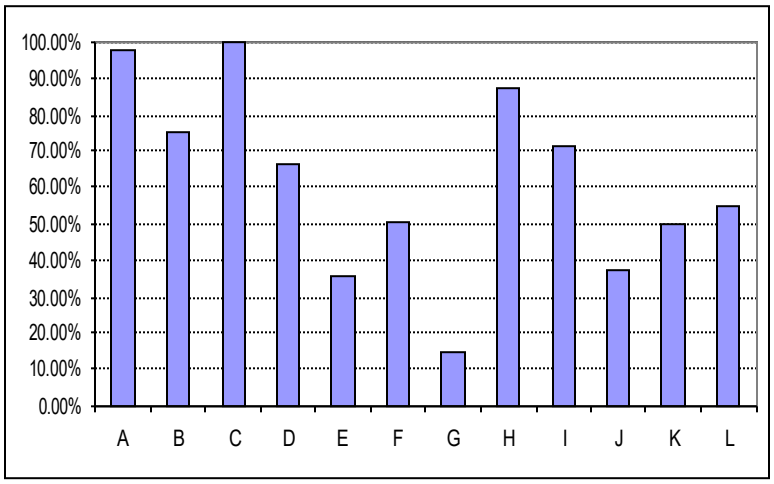
As mentioned before, the first step of the methodology is to define the reason of the study. This can be achieved by defining the problem and goal statements. The problem is the SLA compliance and the target is to improve the compliance level.

Since EMS is a service aggregator, hence having SLAs on both sides with the suppliers and with the clients, our process owner is the services manager within EMS, who takes responsibility of managing the service delivery processes including compliance processes.

5.5 SLA Audit

In order to verify that the related compliance processes do actually exist in the scope of the SLA, and are available for further analysis and optimization, the SLA components are checked against the ones of the Generic SLA Model.

Taking the case of EMS, SLA audit was performed for the whole 501 SLAs. All the mentioned SLAs where analyzed against the generic SLA model, the results were coded in a database, and the analysis results are shown in Figure 5.1:



A	Definitions	97.59%
B	Duration	75.00%
C	Service	100.0%
D	Provider Responsibilities	66.44%
E	Customer Responsibilities	35.77%
F	Performance Control	50.59%
G	Problem Management	14.96%
H	Non-Performance	86.84%
I	Compensation	71.02%
J	Insurance	37.72%
K	Termination	50.0%
L	General Rules	54.67%

Figure 5.1 SLA Audit Results

This auditing process can indicate the gaps or weaknesses of the SLA. And shall provide the service manager with a more focused scope to study and analyze. From Figure 5.1 it is noticed that some components that are not comprehensively identified in the SLA such as:

- Customer Responsibilities (E)
- Problem Management (G)
- Insurance (J)

That is why a thorough optimization analysis of processes related to these components might not be applicable due to lack of available data.

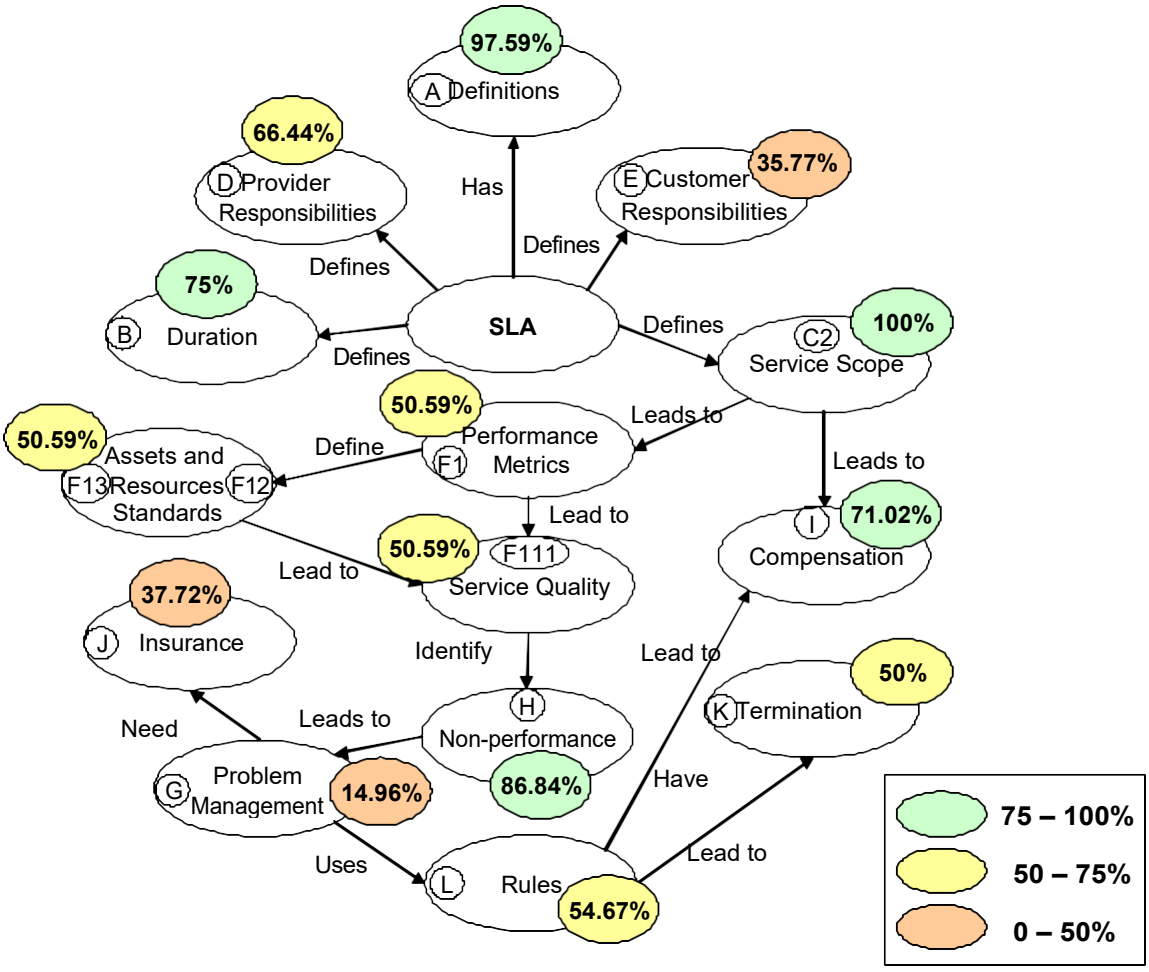


Figure 5.2 SLA Audit Results Analysis

Figure 5.2 reflects the SLA audit results on the SLA Ontology diagram; this shall help in the analysis of the results and identify the weak parts in the compliance processes in general. It is clear that the "Problem Management" is the weakest component, which means that it is not defined well in the SLA. This component is directly related to "Non-Performance" since it is supposed to contain the answers to all Non-Performance instances. The value of this audit is that process optimization efforts can now be directed to the parts related to defining the Service Scope, Performance Metrics, Service Quality and detecting Non-Performance.

5.6 Define Compliance Sub-Processes

The third step in the presented methodology is to define the main compliance Sub-processes. The fastest approach was to arrange workshops with the service managers and quality inspectors of EMS, table 5.3 shows the positions of the employees involved in the study.

Table 5.3 Involved EMS staff

SM1	Executive Officer - Cleaning Service
SM2	Head of Services Section
SM3	Service Manager
SM4	Service Manager
SM5	Service Manager
SM6	Service Manager
SM7	Quality Inspector
SM8	Quality Inspector
SM9	Quality Inspector
SM10	Quality Inspector

The participants where divided into two groups. A workshop was arranged for each group, as shown in Figure 5.3, in order to explain the steps of the methodology and identify the related compliance sub-processes. The results of the workshops are shown in tables 5.4 and 5.5.

Figure 5.3 Participants in workshop No. 1

Table 5.4 Workshop No. 1 (WS1) Results

Workshop No.1 (WS1)	
Compliance Sub-Processes	
1	Monitoring Duration
2	Monitoring Compensation
3	Monitoring Non-Performance
4	Monitoring Service Quality
5	Reporting Non-Performance
6	Reporting Complaints
7	Reporting Service Quality
8	Reviewing Duration
9	Reviewing Service Scope
10	Reviewing Standards
11	Reviewing Penalties
12	Reviewing Compensation
13	Reviewing Responsibilities

Figure 5.4 Workshop No. 2

Table 5.5 Workshop No.2 (WS2) Results

Workshop No.2 (WS2)	
Compliance Sub-Processes	
1	Monitoring Non-Performance
2	Monitoring Assets and Resources
3	Monitoring Service Quality
4	Reporting Non-Performance
5	Reporting Complaints
6	Reporting Service Quality
7	Reporting Assets and Resources
8	Reviewing Penalties
9	Reviewing Responsibilities

After reviewing the results of both workshops and eliminating the recurring sub-processes, the resultant was a consolidated list of 15 compliance sub-processes.

Table 5.6 consolidated Results

	Compliance Sub-Processes
1	Monitoring Duration
2	Monitoring Compensation
3	Monitoring Non-Performance
4	Monitoring Assets and Resources
5	Monitoring Service Quality
6	Reporting Non-Performance
7	Reporting Complaints
8	Reporting Service Quality
9	Reporting Assets and Resources
10	Reviewing Duration
11	Reviewing Service Scope
12	Reviewing Standards
13	Reviewing Penalties
14	Reviewing Compensation
15	Reviewing Responsibilities

5.7 Define Compliance Sub-Processes in terms of Compliance Services

Defining the client's main sub-processes, the methodology leads the client to break down each process into a set of generic compliance services as shown previously in Chapter 3.

EMS service managers and inspectors were gathered again in a third workshop, this time to identify the compliance services related to each of the sub-processes they have defined earlier. The results of the workshop are shown in table 5.7, where the sequence of the compliance services is indicated by the number in the corresponding cell.

Table 5.7 demonstrates that each main process (Monitor, Report, and Review) can have a generic set of compliance services, since it is clear that all the sub-processes of a certain main process have almost the same set of compliance services. That is why a generic Process / Service map can be developed for each one of the main processes as shown in Figure 5.5, Figure 5.6, and Figure 5.7.

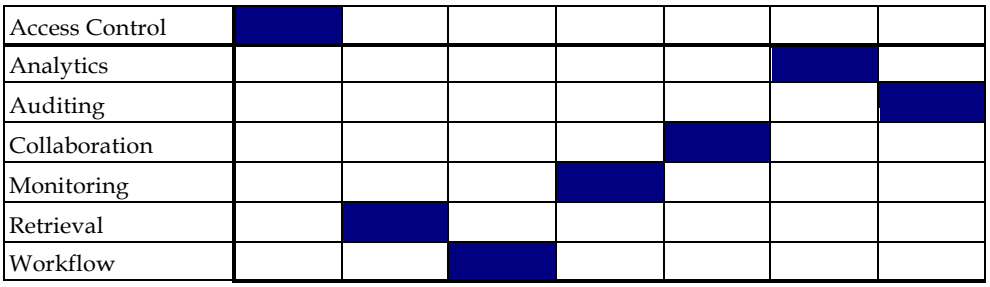


Figure 5.5 Generic Process / Service Map for "Monitoring" Process

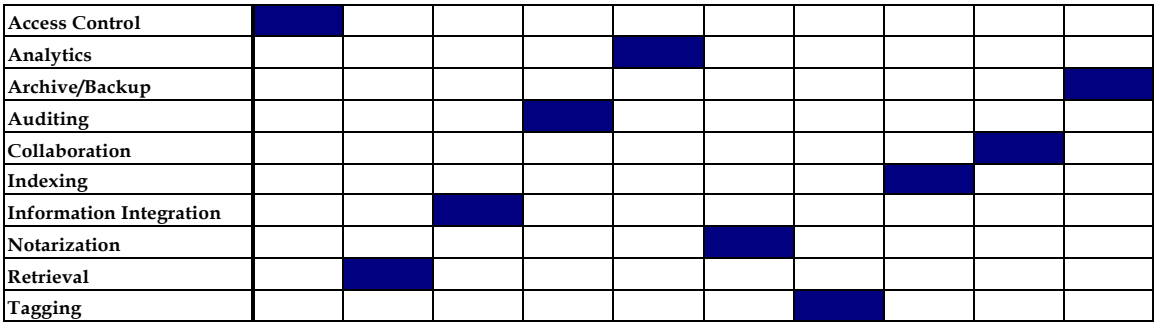


Figure 5.6 Generic Process / Service map for "Reporting" Process

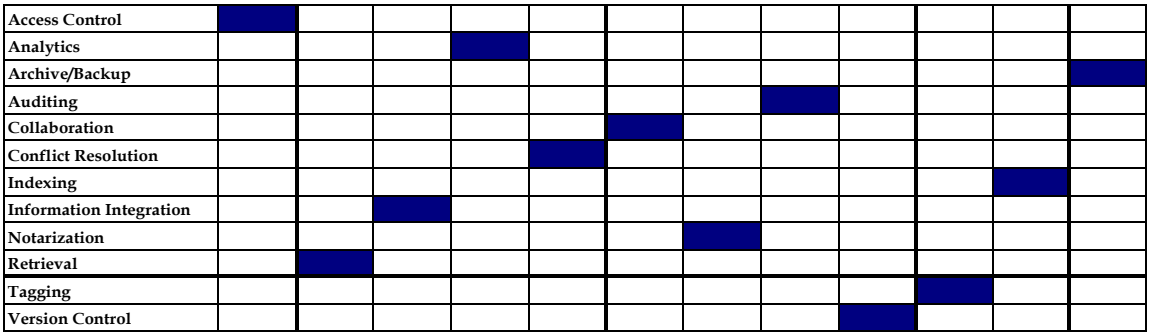


Figure 5.7 Generic Process / Service map for "Reviewing" Process

Table 5.7 Compliance Services for the defined Sub-Processes

		Monitoring Duration	Monitoring Compensation	Monitoring Non-Performance	Monitoring Assets and Resources	Monitoring Service Quality	Reporting Non-Performance	Reporting Complaints	Reporting Service Quality	Reporting Assets and Resources	Reviewing Duration	Reviewing Service Scope	Reviewing Standards	Reviewing Penalties	Reviewing Compensation	Reviewing Responsibilities
Compliance Services	Access Control	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Analytics	4	4	6	5	6	5	5	5	5	4	4	4	4	4	4
	Archive/Backup						10	10	10	10	12	12	12	12	12	12
	Auditing			7			4	4	4	4	8	8	8	8	8	8
	Collaboration	5	5	5	6	5	9	9	9	9	6	6	6	6	6	6
	Conflict Resolution										5	5	5	5	5	5
	Destruction															
	Disposition Management															
	Indexing						8	8	8	8	11	11	11	11	11	11
	Information Integration	3	3				3	3	3	3	3	3	3	3	3	3
	Monitoring			4	4	4										
	Notarization						6	6	6	6	7	7	7	7	7	7
	Policy Engine															
	Process Registry															
	Retention															
	Retrieval	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Tagging						7	7	7	7	10	10	10	10	10	10
	Version Control										9	9	9	9	9	9
	Workflow			3		3										

5.8 Develop Process Maps

Having the main generic processes already defined in the first step using the ITIL and SLA Ontology. These processes can be now mapped to identify the main parties involved (clients and suppliers) and the main (inputs, outputs, and processes).

Using the generic table in Appendix A, a SIPOC map can be easily developed for each of the mentioned sub-processes. The following are examples of the mentioned SIPOC maps for sub-processes each related to one of main processes (Monitoring, Reporting, and Reviewing).

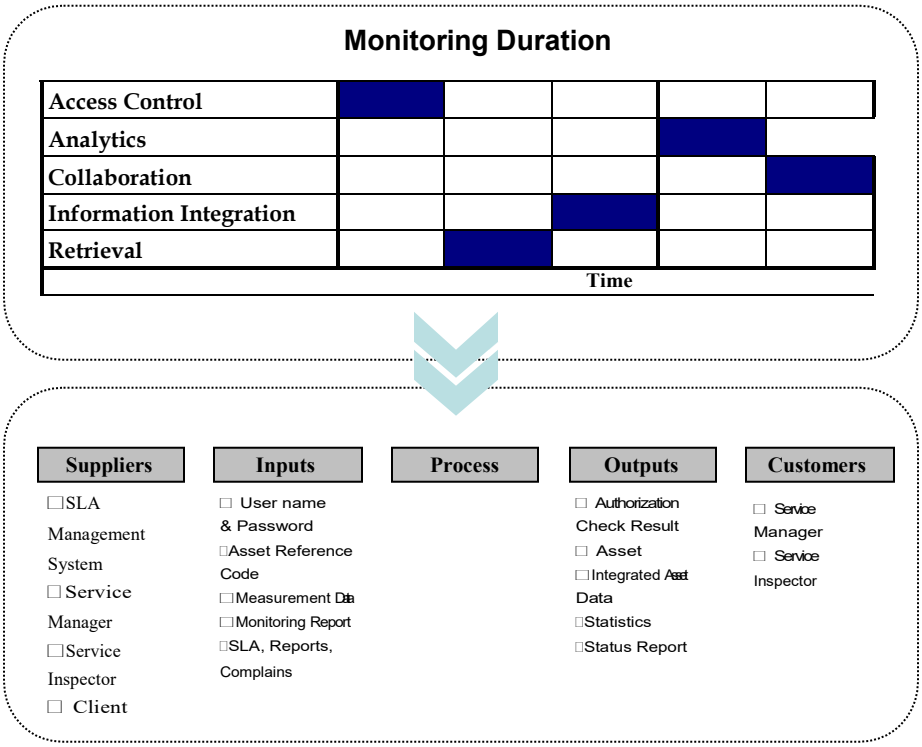


Figure 5.8 SIPOC map for "Monitoring Duration" Sub-process

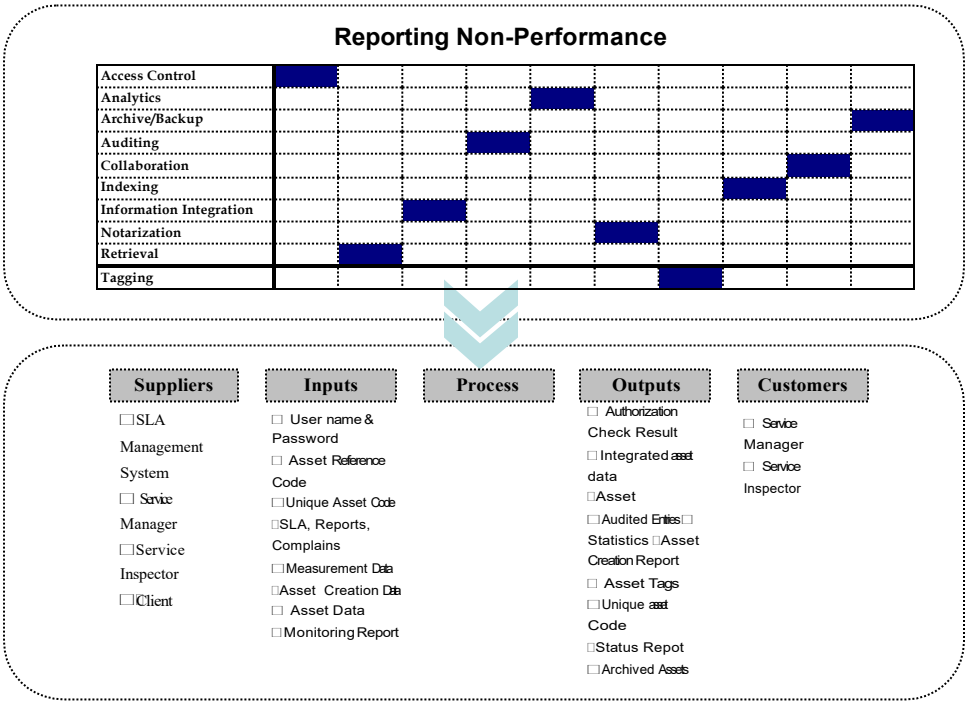


Figure 5.9 SIPOC map for "Reporting Non-Performance" Sub-process

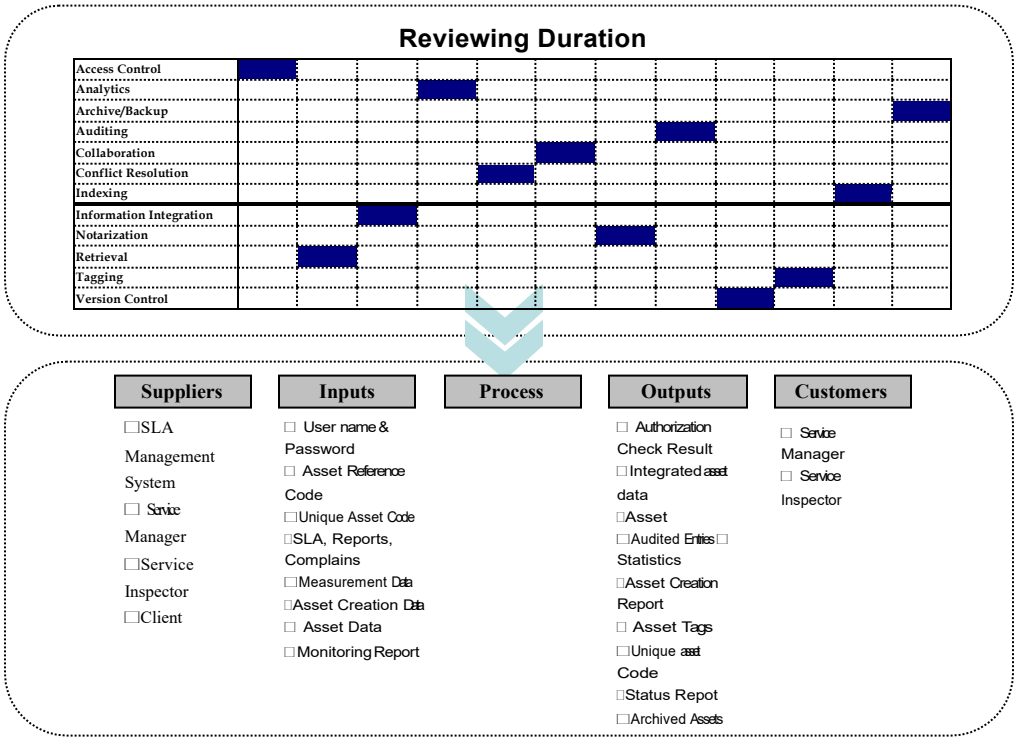


Figure 5.10 SIPOC map for "Reviewing Duration" Sub-Process

5.9 Defining Voice of Customer (VOC)

Having defined the required processes, service managers can now move to the next step in which they identify the required quality attributes of the chosen processes. This can be achieved by crossing each of the chosen compliance processes with one or more attribute of the GSQA.

EMS service managers and Inspectors were requested to list the most important quality attributes for each of the defined sub-processes in order to construct the customer needs list shown in table 5.8.

Table 5.8 Defined VOC

s	Sub-Process	SQA 1	SQA 2
1	Monitoring Duration	Accountability	
2	Monitoring Compensation	Business Integrity	
3	Monitoring Non-Performance	Reliability	Accountability
4	Monitoring Assets and Resources	Reliability	
5	Monitoring Service Quality	Tangibles	
6	Reporting Non-Performance	Confidentiality	
7	Reporting Complaints	Responsiveness	
8	Reporting Service Quality	Confidentiality	
9	Reporting Assets and Resources	Accountability	
10	Reviewing Duration	Reliability	
11	Reviewing Service Scope	Business Integrity	
12	Reviewing Standards	Tangibles	
13	Reviewing Penalties	Business Integrity	
14	Reviewing Compensation	Business Integrity	
15	Reviewing Responsibilities	Empathy	

5.10 Develop Kano Questionnaires

The customers' needs resulted from the previous step are going to be classified into satisfiers (One dimensional), dys-satisfiers (Must-be), and delighters (Attractive) according to the Kano survey results, which should also provide us with the competitive evaluation of each customer need. Since identified requirements may not be of equal importance to all customers, Kano analysis can help to classify different client requirements to determine which have the highest priority.

The Kano survey shown in Appendix C, is designed to provide 3 questions for each customer need to cover the functional and dysfunctional dimensions, and to rate the current satisfaction level.

The results of the Kano survey are shown in the following table where column X gives the average answer rate for the dysfunctional form question, and column Y gives the average answer rate for the functional form question.

Table 5.9 Results of Kano Questionnaire

CN	Customer Need	X	Y	Rate	Class
CN1	The Accountability of Monitoring duration	1.60	3.80	2.90	A
CN2	Business Integrity of Monitoring Compensation	2.40	3.20	2.80	A
CN3	The Reliability of Monitoring Non-Performance	3.20	2.20	2.80	M
CN4	The Accountability of Monitoring Non-Performance	3.40	2.20	**1.90**	**M**
CN5	The Reliability of Monitoring Assets and Resources	1.80	3.00	2.90	A
CN6	The Tangibles of monitoring Service Quality	2.20	3.00	2.00	A
CN7	The Confidentiality of Reporting Non-Performance	3.20	2.20	**2.00**	**M**
CN8	The Responsiveness of Reporting Complaints	1.60	2.80	2.80	A
CN9	The Confidentiality of Reporting Service Quality	3.40	2.80	2.60	M
CN10	The Accountability of Reporting Assets and Resources	2.40	2.60	2.60	I
CN11	The Reliability of Reviewing Duration	1.80	2.20	3.40	I
CN12	The Business Integrity of Reviewing Service Scope	1.20	2.80	3.60	A
CN13	The Tangibles of Reviewing Service Standards	1.60	3.00	2.70	A
CN14	The Business integrity of Reviewing Penalties	1.60	2.20	2.80	I
CN15	The Business Integrity of Reviewing Compensation	2.00	2.80	3.00	I
CN16	The Empathy of Reviewing Responsibilities	1.60	3.00	3.00	A

The "Class" column indicates the class of the customer need based on the methodology exp lained in table 4.1 earlier in Chapter 4.

Using the results data in table 5.8, a Kano graph can be easily developed as follows:

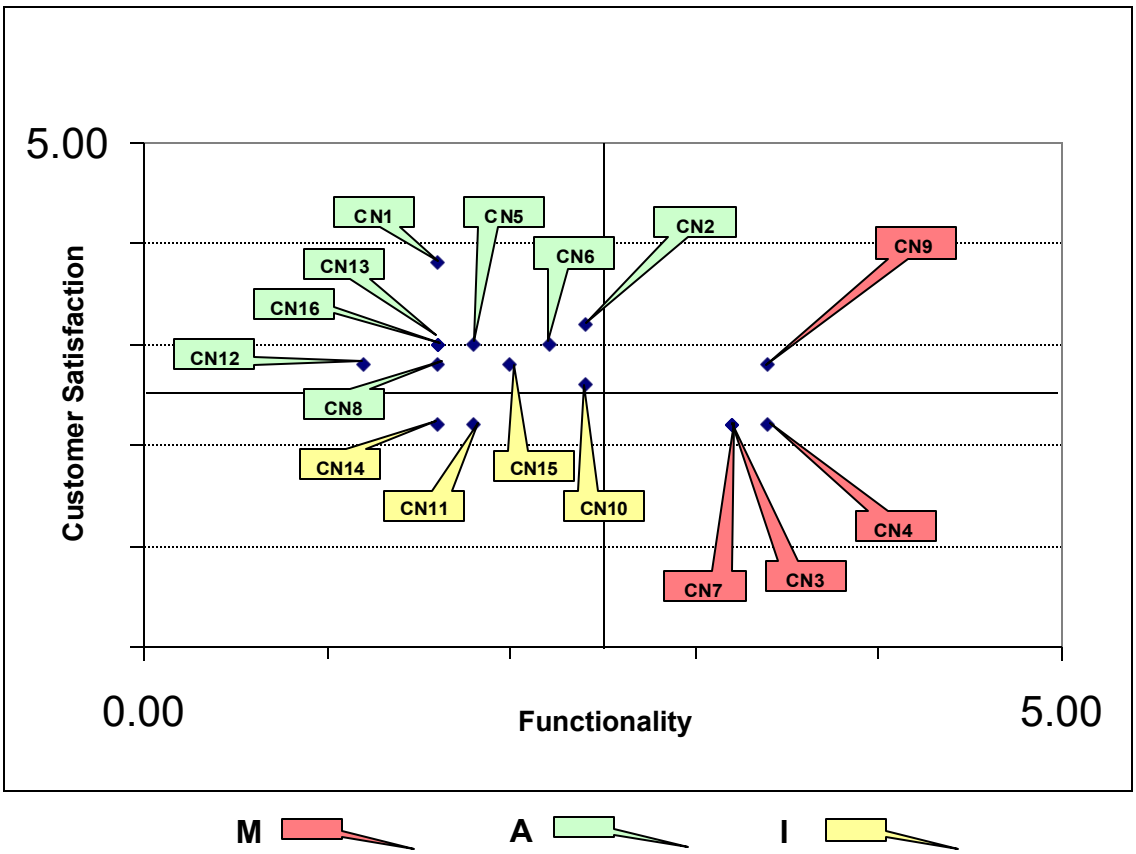


Figure 5.11 Results of KANO questionnaire

5.11 CTQ Trees

For each defined customer need, a set of performance drivers is defined and related to the selected SQA in table 3.1. Then the related CTQs for each driver are selected from the generic CTQ table in Appendix B.

The mentioned generic CTQs shall help the service manager to provide metrics and KPIs to assess the required performance level of the selected customer needs.

For the 16 selected customer needs, instead of drawing the CTQ trees for all of them, the generic CTQs for all the needs can be taken directly from the generic CTQ table after eliminating the columns related to the unused Service Quality Attributes and the rows related to the unused compliance processes, the new table is shown in table 5.9. The CTQ trees can be developed in the next step after prioritizing the customer needs.

Table 5.10 CTQs for the selected compliance processes

		Service Quality Attributes						
		Reliability (REL)	Responsiveness (R	Empathy (E)	Tangibles (T)	Confidentiality (C)	Accountability (AC)	Business Integrity (
Compliance	Access Control	authorization list	Access granted in less than time X	Unique list for each client	encrypted folder (password), safe room (ID)	Authorized employees Information kept safe, or Encrypted	Log kept for each entry	Access check < X time
	Analytics	accurate measurement error < 2 %	taking measurement in < X time	specified ..	advanced measuremnt tools	measurement data kept safe	who took the measurement	2 measurement trials
	Archive/Backup	list data type/ archiving place	whith in X time	unique archive for each service manager	Modern Backup system	Safe Backup Storage / Safe Archives	Log kept for each entry	backup validation check
	Auditing	required fields check list	record data with in X time of approval	generate review report	advanced data check system	auditing data kept in confidence	Log kept for each auditing process	daily auditing variations report
	Collaboration	responsible employees list > 2	cummunication in time < X	Training & Experience	Advanced Cummunications (cell, e-mail, …)	cummunications details kept in confidence (Secured channels)	communication log	communication cancelled after X trials
	Conflict Resolution	detailed process requirement list	conflicting process requirements identified before process begins	available support? (defined)	Advanced comparison system	comparison results kept	log of all detected conflicts	clear detaild requirement lists for all related parties
	Indexing	Unique Index for each asset	Index created before archiving in X time	Standard indexing system	Computerized indexing process	indexing rules kept in confidence	indexing log	Standardized indexing rules
	Information Integration	Unique Primary Key for records related to the same asset	Pre-designed integrated data forms	custom designed forms	modern system	integration data kept in confidence	Information edit log	ability to integrate more records
	Monitoring	Detailed Service Scope check list	assessment recorded in X time	Named Inspector(s) for each SLA	Professional inspectors	monitoring data kept in confidence	monitoring Log	Frequency > = 2 per month
	Notarization	required fields list	Automated process	ability to add special fields	modern system	fields are kept in a database	defined asset types per user	require client's approval
	Retrieval	Unique Tagging and index Reference	Asset retrieved in X time	SM Training	advanced retrieval system	Indexing tables kept	Data retrieval Log	clear browsing and searching steps
	Tagging	Predefined required metadata	Tagging in Time < X	SM can add special tags	advanced Tagging system	Tagging rules kept safe	Asset Tagging Log	Standardized Tagging rules
	Version Control	Unique iteration code	Automated process	SM can add iteration description	Standardized System	iteration data kept safe	iteration Log	approval of involved parties
	Workflow	Last successful approved procedures	process list retrieval	SM can update workflow	advanced workflow system	Workflow data kept safe	iteration Log	approval of involved parties

5.12 QFD

In this step, the house of quality will be constructed by listing the findings of the Kano analysis for the selected customer needs against the defined CTQs.

First, to establish the priority of the customer needs, the services managers where invited to another quick workshop. The reviewed the results of the KANO analysis, and started to assign the priority of each customer need using a 1 to 5 priority scale. The following table shows the results of the workshop, where the last column indicates the priority assigned to each customer need.

Table 5.11 Customer Needs Priority

CN	Customer Need	Rate	Class	Priority
CN1	The Accountability of Monitoring duration	2.90	A	2
CN2	Business Integrity of Monitoring Compensation	2.80	A	2
CN3	The Reliability of Monitoring Non-Performance	2.80	M	4
CN4	The Accountability of Monitoring Non-Performance	**1.90**	**M**	5
CN5	The Reliability of Monitoring Assets and Resources	2.90	A	3
CN6	The Tangibles of monitoring Service Quality	2.00	A	4
CN7	The Confidentiality of Reporting Non-Performance	**2.00**	**M**	5
CN8	The Responsiveness of Reporting Complaints	2.80	A	3
CN9	The Confidentiality of Reporting Service Quality	2.60	M	4
CN10	The Accountability of Reporting Assets and Resources	2.60	I	3
CN11	The Reliability of Reviewing Duration	3.40	I	2
CN12	The Business Integrity of Reviewing Service Scope	3.60	A	2
CN13	The Tangibles of Reviewing Service Standards	2.70	A	3
CN14	The Business integrity of Reviewing Penalties	2.80	I	3
CN15	The Business Integrity of Reviewing Compensation	3.00	I	3
CN16	The Empathy of Reviewing Responsibilities	3.00	A	3

Setting the priority of the customer needs, the service managers decided to start with optimization process with 5 customer needs that are highest in priority, these needs are shown in table 5.11:

Table 5.12 The 5 highest priority customer needs

CN	Customer Need	Rate	Class	Priority
CN4	The Accountability of Monitoring Non-Performance	**1.90**	**M**	5
CN7	The Confidentiality of Reporting Non-Performance	**2.00**	**M**	5
CN3	The Reliability of Monitoring Non-Performance	2.80	M	4
CN6	The Tangibles of monitoring Service Quality	2.00	A	4
CN9	The Confidentiality of Reporting Service Quality	2.60	M	4

At this stage and before moving forward with the analysis of the selected customer needs, a quick check should be done to make sure that the SLA components related to these needs (Non-Performance and Service Quality) have passed the SLA audit done earlier in section 5.5 in order to make sure of the availability of data for the processes before running the optimization process on them. The results shown in Figure 5.1 show that both SLA components have scored 50% and above in the SLA audit, since Non-Performance is resembled by letter "H" which scored Over 80%, and Service Quality is under the Performance Part indicated by the Letter "F" which scored only 50% meaning that the data might not be sufficient for running the optimization analysis on that customer need.

Using the generic CTQ table in appendix B, the CTQs of the selected 5 customer needs can be listed as follows:

Table 5.13 CTQs of CN4

CN4: The Accountability of Monitoring Non-Performance	
Compliance Service	**CTQ**
Access Control	Daily Log kept for each entry
Analytics	Author ization list for measurement taking > 2
Auditing	Log kept for each auditing process (Availability: Yes/No)
Collaboration	Daily updated communication log
Monitoring	Daily updated monitoring Log
Retrieval	Data retrieval Log updated every X hours
Workflow	Monthly Updated Workflow iteration Log

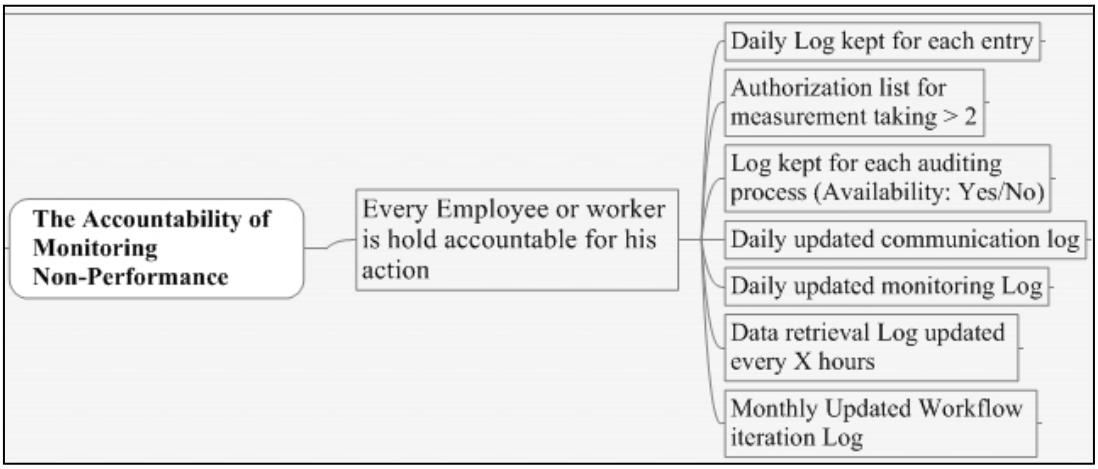


Figure 5.12 CTQ Tree for CN4: The Accountability of Monitoring Non-Performance

Table 5.14 CTQs of CN7

CN7: The Confidentiality of Reporting Non-Performance	
Compliance Service	**CTQ**
Access Control	Authorized employees Information kept safe, or Encrypted (Yes / No)
Analytics	Measurement data kept safe (Authorization list >2)
Archive/Backup	Safe Backup Storage / Safe Archives (Authorization list > 2)
Auditing	Auditing data kept in confidence (Authorization list > 2)
Collaboration	Communications details kept in confidence (Secured channels: Yes/No)
Indexing	Indexing rules kept in confidence (Authorization list > 2)
Information Integration	Integration data kept in confidence (Authorization list > 2)
Notarization	Fields are kept in a database (Yes / No)
Retrieval	Indexing tables kept safe (Authorization list > 2)
Tagging	Tagging rules kept safe (Authorization list > 2)

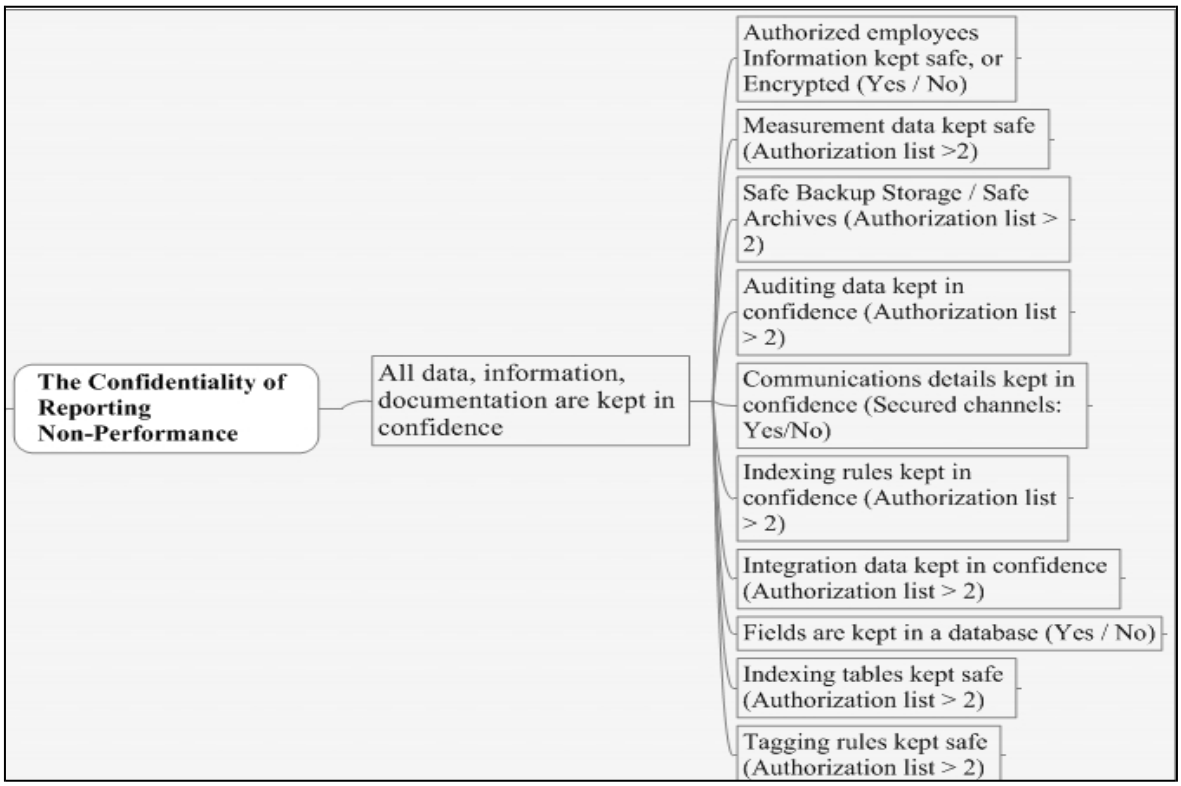


Figure 5.13 CTQ Tree for CN7: The Confidentiality of Reporting Non-Performance

Table 5.15 CTQs of CN3

CN3: The Reliability of Monitoring Non-Performance	
Compliance Service	**CTQ**
Access Control	authorization list
Analytics	accurate measurement error < 2 %
Auditing	required fields check list
Collaboration	responsible employees list > 2
Monitoring	Detailed Service Scope check list
Retrieval	Unique Tagging and index Reference
Workflow	Last successful approved procedures < 3 months

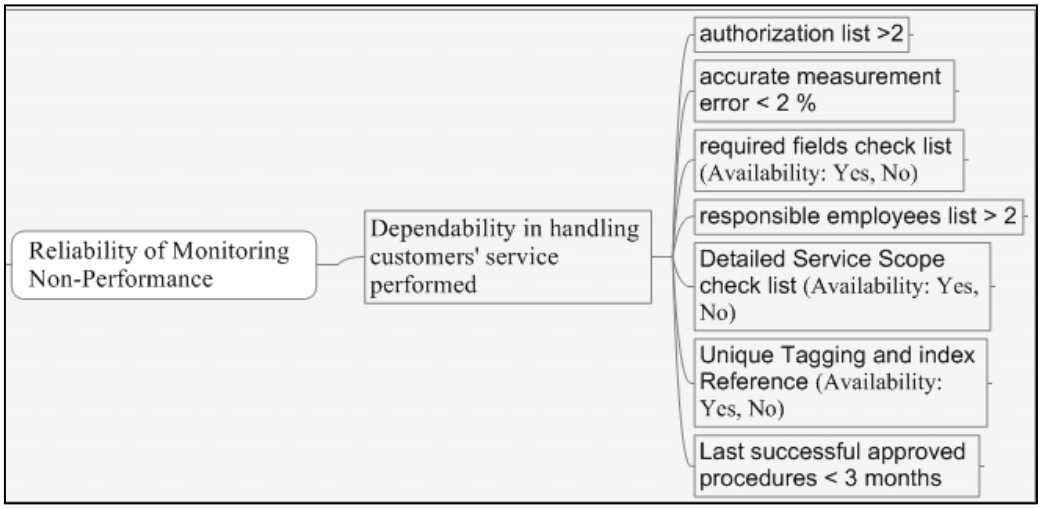


Figure 5.14 CTQ Tree for CN3: The Reliability of Monitoring Non-Performance

Table 5.16 CTQs of CN6

CN6: The Tangibles of monitoring Service Quality	
Compliance Service	**CTQ**
Access Control	encrypted folders (password), safe room (ID-Pass)
Analytics	advanced measurement tools (Yes / No)
Auditing	advanced data check system (Yes / No)
Collaboration	Advanced Communications (cell, e-mail, …)(Yes / No)
Monitoring	Professional inspectors > 3 years Experience
Retrieval	advanced file retrieval system (Yes / No)
Workflow	advanced workflow and automation system (Yes / No)

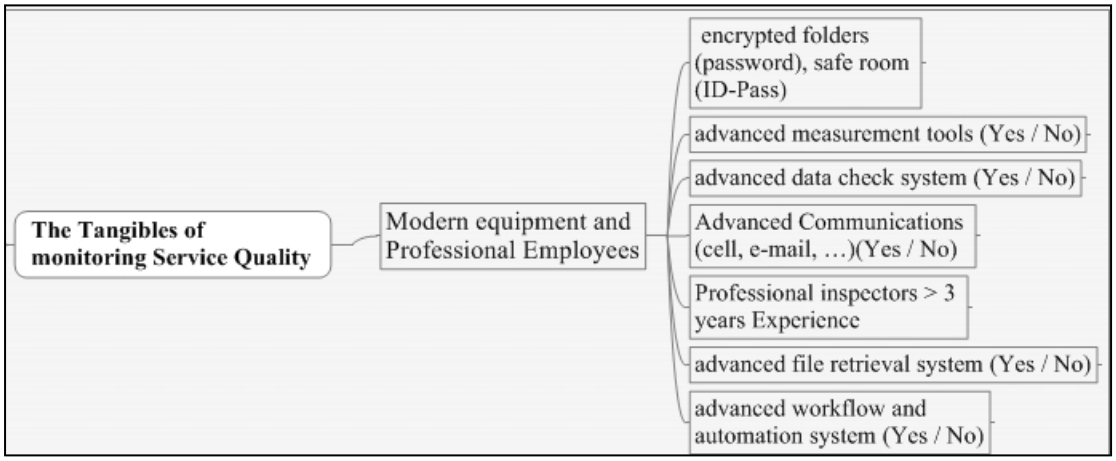


Figure 5.15 CTQ Tree for CN6: The Tangibles of monitoring Service Quality

Table 5.17 CTQs of CN9

CN9: The Confidentiality of Reporting Service Quality	
Compliance Service	**CTQ**
Access Control	Authorized employees Information kept safe, or Encrypted
Analytics	Measurement data kept safe (Authorization list)
Archive/Backup	Safe Backup Storage / Safe Archives (Authorization list)
Auditing	Auditing data kept in confidence (Authorization list)
Collaboration	Communications details kept in confidence
Indexing	Indexing rules kept in confidence (Authorization list)
Information Integration	Integration data kept in confidence (Authorization list)
Notarization	Fields are kept in a database (Authorization list)
Retrieval	Indexing tables kept in confidence (Authorization list)
Tagging	Tagging rules kept safe (Authorization list)

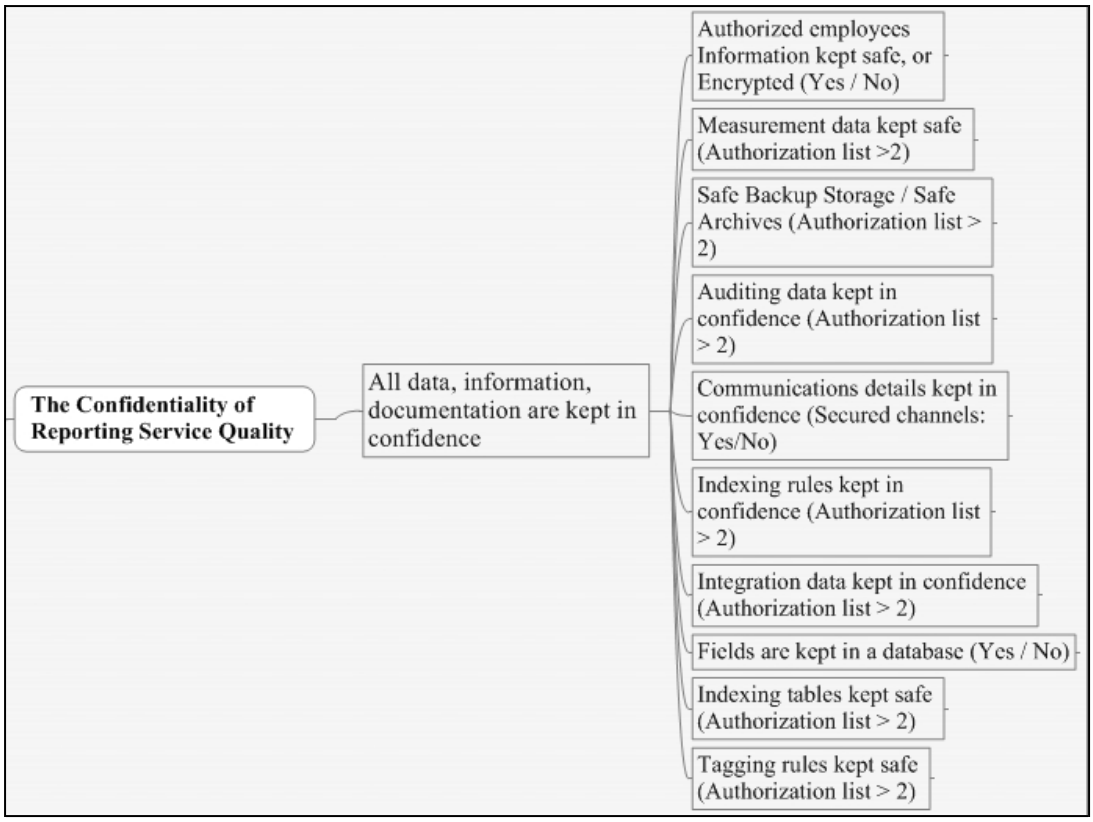


Figure 5.16 CTQ Tree for CN9: The Confidentiality of Reporting Service Quality

Since a lot of the CTQs are common between the sub-processes, a final list of the required CTQs is given by the table below:

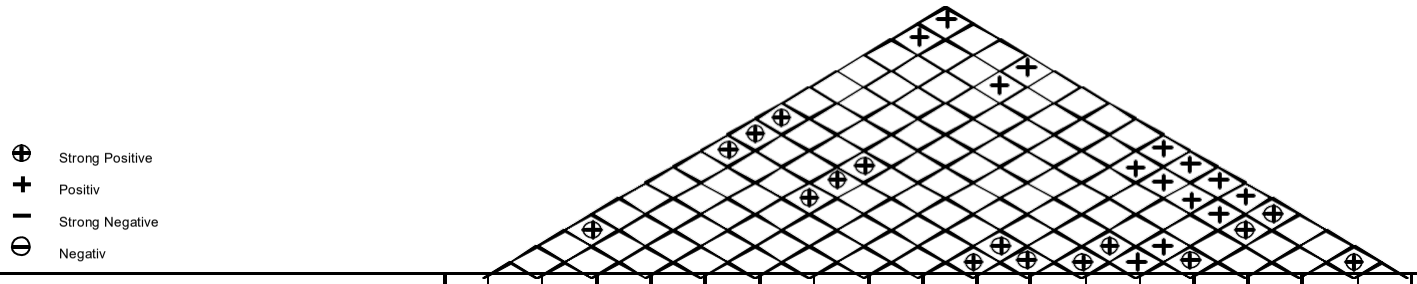
Table 5.18 Final common CTQ List

S	CTQ
1	Process authorization list > 2
2	Accurate measurement error < 2 %
3	Required fields check list (Availability: Yes, No)
4	Responsible employees list > 2
5	Detailed Service Scope check list (Availability: Yes, No)
6	Unique Tagging and index Reference (Availability: Yes, No)
7	Last successful approved procedures < 3 months
8	Authorized employees Information kept safe, or Encrypted (Availability: Yes, No)
9	Measurement data kept safe (Authorization list > 2)
10	Safe Backup Storage / Safe Archives (Authorization list > 2)
11	Auditing data kept in confidence (Authorization list > 2)
12	Communications details kept in confidence (Authorization list > 2)
13	Indexing rules kept in confidence (Authorization list > 2)
14	Integration data kept in confidence (Authorization list > 2)
15	Fields are kept in a database (Availability: Yes, No)
16	Indexing tables kept in confidence (Authorization list > 2)
17	Tagging rules kept safe (Authorization list > 2)

In order to construct the house of quality, the technical difficulty of realizing the CTQs and their correlation need to be identified, which can be obtained from the service managers. That is why a quick meeting was held, and the service managers rated the technical difficulty of each CTQ using a 1 to 5 scale. They also estimated the relations of the CTQs with reference to the metric required.

While the competitive evaluation can be obtained from customer satisfaction part of the survey shown in the "Rate" column in table 5.10.

Having constructed the "House of Quality", Service managers can now choose what CTQs they need to improve depending on the resultant importance rating.



	Customer Needs	Priority	Process authorization list > 2	Accurate measurement error < 2 %	Required fields check list (Availability: Yes, No)	Responsible employees list > 2	Detailed Service Scope check list (Availability: Yes, No)	Unique Tagging and index Reference (Availability: Yes, No)	Last successful approved procedures <3 months	Authorized employees Information kept safe, or Encrypted (Availability: Yes, No)	Measurement data kept safe (Authorization list > 2)	Safe Backup Storage / Safe Archives (Authorization list >2)	Auditing data kept in confidence (Authorization list > 2)	Communications details kept in confidence (Authorization list >2)	Indexing rules kept in confidence (Authorization list > 2)	Integration data kept in confidence (Authorization list >2)	Fields are kept in a database (Availability: Yes, No)	Indexing tables kept in confidence (Authorization list >2)	Tagging rules kept safe (Authorization list > 2)	Competitive Evaluation (1-Low, 5-High) 1	3	5
1	CN4: The Accountability of Monitoring Non-Performance	5	5	1	2	5	2	3	3											U		
2	CN7: The Confidentiality of Reporting Non-Performance	5	5			5				2	3	2	2	3	2	3	4	3	3	U		
3	CN3: The Reliability of Monitoring Non-Performance	4	4	5	5	3	4	4	4												U	
4	CN6: The Tangibles of monitoring Service Quality	4	3	2		1	2		3											U		
5	CN9: The Confidentiality of Reporting Service Quality	4	5			5				2	3	2	2	3	2	3	4	3	3		U	
Technical Evaluation		5																				
		4																				
		3		U	U			U								U	U					
		2	U			U	U				U	U		U								
		1							U	U			U		U			U	U			
Target Value			Min. 2 Names (SM, SI)	Error < 2%	(Availability: Yes, No)	Min. 2 Names (SM, SI)	(Availability: Yes, No)	1 Main ref . code	Updated in < 3 months	(Availability: Yes, No)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)	(Availability: Yes, No)	Min. 2 Names (SM, SI)	Min. 2 Names (SM, SI)			
Technical Difficulty (1-Low, 5-High)			2	4	3	2	4	4	4	4	2	2	2	3	2	4	3	2	2			
Importance Rating			98	33	30	86	34	31	43	18	27	18	18	27	18	27	36	27	27			

Figure 5.17 The House of Quality for EMS selected customer needs

5.13 Reflection

Following the proposed methodology, the main SLA compliance sub-processes , check the comprehensiveness of the SLA could be systematically identified, specify the process owner's needs from the processes, develop generic KANO questionnaires, run the KANO analysis, list the required improvement CTQs, and construct the House of Quality.

All that was done in a relatively short amount of time, since all the steps where clearly defined and guided by the generic models presented by the methodology.

More over, the implementation of the methodology made it easier to cover all the aspects of the required processes, since each step is based on well established generic models.

This shall indicate the added value of the methodology, where it enhances the efficiency and completeness of identifying, analyzing, and prioritizing the customer needs related to the SLA compliance processes.

Here are some comments related to the practical implementation of each step of the methodology:

1. **Problem Definition**

   Since the ge neric problem is already defined which is "SLA Compliance", this step establishes the core of the analysis, and keeps the methodology user focused on the main point through out the exercise.

2. **SLA Audit**

   One of the most important steps in the methodology and is considered the key point to guide the direction of the whole analysis. It boosts the efficiency and value of the methodology.

   Performing the SLA audit on EMS's 501 SLAs took more than 2 weeks, since it required digging in the file archives in order to retrieve and copy the SLAs. The computer system could only provide a list with the agreements numbers, supplier name, customer name, and the type of service provided. EMS Service Managers where extremely interested with the Ontology and the SLA audit. The results did not only direct the optimization process, but also identified some serious weaknesses in the SLA it self.

3. Define Compliance Sub-Processes

The value of this step is that it gives the user a variety of options to define compliance sub-processes, which contributes to the completeness of the methodology.

Working on the EMS case, a preliminary session was held to introduce the three basic models of the methodology. After that, Service Managers where split into 2 groups in order to define the compliance Sub-Processes that they think are most important for their work.

4. Define Compliance Processes in terms of Compliance Services.

The value of this step is the standardization of the compliance processes, since each sub-process is constructed using the standard COA services. With EMS Service Managers the situation was not easy in the beginning, yet after getting the idea of the use of standardization and defining the compliance sub-processes in terms of generic services, things started to move faster.

5. Develop Process Maps (SIPOC)

The methodology made developing SIPOC maps an easy straight forward task, since it is based on the defined compliance services and the provided generic SIPOC table. In order to encourage the Service Managers to use the provided generic table, a brief introduction was required on how the table was developed.

6. Defining Voice of Customer (VOC)

The 11 attributes provided by the SQA model cover almost all the service requirements of any generic customer. This also contributes to the completeness of the methodology. Using the GSQA Model in defining customer needs require the methodology user to focus on the real customer of the optimization process, who is the Service Manager in this context. Using Table 3.1, in order to get a clearer sense of what each quality attribute stands for, made it easier for EMS Service Managers to list the compliance related need.

7. Develop Kano Questionnaires

The provided approach makes generating KANO questions a simple and quick thing to do since the questions templates are available, and each customer need is provided with a generic description related to the selected quality attribute. EMS Service Managers

were asked to answer the KANO questionnaires first, and then they were introduced to the KANO analysis concept. They thought that is was a complex approach to classify customer requirements and that there are other ways to do the same in an easier manner.

8. Develop CTQ Trees

Having a generic CTQ for each possible combination of a compliance service and a SQA makes the development of CTQ trees a matter of only listing the related CTQs under the predefined generic driver related to the defined customer need. Service Managers of EMS followed this approach, but they felt that the predefined CTQs are limited. They agreed that these CTQs can be considered as the first level of defining process related KPIs, but other lower levels might be developed when required.

9. Construct QFD

This step puts together the results of all the previous steps, and can provide the conclusion of the whole analysis process. At this point the methodology user should clearly decide what customer needs are going to be optimized and how.

5.14 Evaluation

In order to get the feedback of the service managers who participated in the implementation of the methodology, an evaluation survey was conducted. The survey results are shown in table 5.19. Service Managers where gathered in a last workshop in order to get their feedback in the proposed methodology.

Figure 5.18 Illustration Workshop

Table 5.19 Evaluation Survey Results

Step	Strengths	Weaknesses
1. Problem Definition	Focuses the analysis efforts on a certain problem	
2. SLA Audit	Covers the main SLA elements	
3. Defining Compliance Sub-Processes	Help to clarify the main processes	
4. Defining Compliance Processes in terms of Compliance Services	Standardizes the Processes	
5. Developing Process Maps	Easy to Perform Using the generic tables	
6. Defining Voice of Customer (VOC)	Covers the most important customer needs	
7. Developing KANO Questionnaires	Straight forward	KANO is a complicated and time consuming approach
8. Identifying related CTQs	Good Starting point	Limited KPIs
9. Building QFD	Effective	

The weaknesses mentioned in table 5.19 were related to two steps only:
Step 7 (Developing KANO Questionnaires) and Step 8 (Identifying related CTQs). The weakness of step 7 was its complexity, since the users felt that there are other easier and faster approaches to classify and prioritize the needs of the customer, especially if the people involved were technically experienced in the domain. In step 8, the discussion with the service manages led to the agreement that the proposed generic CTQ table can be considered as a good starting point to identify the performance drivers and the critical

aspects to measure, yet the table is limited in providing KPIs, which requires the person who implements the methodology to spend more time in defining more detailed KPIs.

Although the mentioned weaknesses, Chapter 5 clearly demonstrated how the proposed methodology and its generic models could serve as a guide for the optimization of compliance business processes using the Six Sigma DMAIC techniques. Applying the methodology gave the user a clear vision of the status of the related compliance processes, and directed the efforts towards the processes that are most efficient to optimize.

CHAPTER 6

6 CONCLUSION

6.1 Conclusion

In the dynamic nature of the economy today and since services are unique and heterogeneous, the SLA compliance processes will always require continuous optimization.

The SLCOM (Service Level Compliance Optimization Methodology), is a process definition and analysis methodology for service level compliance that helps in applying the Six Sigma process optimization techniques to the SLA compliance processes.

The proposed methodology is based on the new models presented in Chapter 3, which were developed using distinguished concepts and bodies of knowledge such as ITIL, SOA, SERVQUAL, Service Trustworthiness Model, and IBM's SLA Action Manager (SAM). The three generic models are:

- SLA Ontology.
- Compliance Oriented Process Maps
- Generic Service Quality Attributes (GSQA).

The methodology is built of a cluster of sequential steps in order to ensure the completeness and efficiency of defining the main process elements. The steps are:

1. Problem Definition
2. SLA Audit
3. Define Compliance Processes
4. Define Compliance Processes in terms of Compliance Services.
5. Develop Process Maps (SIPOC)
6. Defining Voice of Customer (VOC)
7. Develop Kano Questionnaires
8. Develop CTQ Trees
9. Construct QFD

Chapter 5 demonstrated how this methodology and its generic models could serve as a guide for the continuous improvement of compliance business processes using the Six Sigma DMAIC techniques. Applying the methodology gave the user a clear vision of the status of the related compliance processes, and directed the efforts towards the processes that are most efficient to optimize.

The results of the illustration demonstrated clearly that the application of the proposed methodology had a major impact on the efficiency and completeness of identifying and analyzing the customer needs related to the SLA compliance processes.

In conclusion, the originality of this methodology lies in its generality, since it can be applied to non-IT services although it is mostly based on IT concepts such as Information Technology Infrastructure Library (ITIL), Service Oriented Architecture (SOA), and IBM's SLA Action Manager (SAM).

6.2 Limitations

Since methodology validation could not be based on one illustrative study, as the case mentioned in Chapter 5, more studies are still required, where the methodology is tested against various business cases and the data and results are analyzed for factual validation purposes. The results should demonstrate the methodology's impact on the efficiency and completeness of the outcomes of the "Define" phase of the service level compliance continuous improvement process.

Further work can be done to enhance the proposed generic tables, especially the CTQs. Moreover, an extended methodology that covers the five DMAIC phases can be much useful for the continuous improvement process.

REFERENCES

[1] Tadahiko Abe. "What is Service Science?" *The Fujitsu Research Institute, Economic Research Center*, Tokyo, Japan, Research Report No. 246, December 2005

[2] Daan Marks. "Reconstruction of the Service Sector in the National Accounts of Indonesia, 1900-2000: Concepts and Methods1". *ASEAN Economic Bulletin*. Singapore: Vol.23, Iss. 3; pp. 373- 391, Dec. 2006

[3] Anna-Karin Jonsson Kvist and Bengt Klefsjo. " Which service quality dimensions are important in inbound tourism? A case study in a peripheral location." *Managing Service Quality,* vol.16, pp. 520-537, No. 5, 2006.

[4] G. Fogarty, R. Catts, & C. Forlin. "Identifying shortcomings in the measurement of service quality." *Journal of Outcome Measurement,* 4(1), pp. 425-447, 2000.

[5] Paula O'Reilly. "Involving service users in defining and evaluating the servicequality of a disability service." *International Journal of Health Care Quality Assurance*, Vol.20, pp. 116-129, No.2, 2007.

[6] V. John Peters. "Total service quality management ". *Managing Service Quality*, Volume 9 pp. 6-12, Number 1, 1999

[7] Bo Edvardsson. "Service quality: beyond cognitive assessment." *Managing Service Quality,* vol. 15, pp. 127-131, No.2, 2005.

[8] Kehal, S. Harbhajan. "*Outsourcing and Offshoring in the 21st Century : A Socio-Economic Perspective.*" Hershey, PA, USA: Idea Group Publishing, 2006. p 2.

[9] Douglas Brown. *Black Book of Outsourcing : How to Manage the Changes, Challenges, and Opportunities*. Hoboken, NJ, USA: John Wiley & Sons, Incorporated, 2005. p 1.

[10] Andrew N. Hiles, "Service level agreements." *The TQM Magazine,* 6, pp. 14 – 17, 1994.

[11] M. J.Buco, R. N. Chang, L. Z. Luan, C. Ward, et al. "Utility computing SLA management based upon business objectives." *IBM Systems Journal,* 43, pp. 159 – 178, 2004.

[12] Mark Mayne. "How to reach the right agreement" *Revolution,* pp.54 – 56, February, 2005.

[13] Tom Weston. "Cutting costs through better customer service." *Management Services* 47, pp.18 – 19, January, 2003.

[14] Terence T. Burton. *Six Sigma for Small and Mid-Sized Organizations*. Boca Raton, FL, USA: J. Ross Publishing, Incorporated, 2004. p ix.

[15] Jiju Antony ."Six sigma for service processes". *Business Process Management Journal*, Volume 12, Number 2, pp. 234-248, 2006.

[16] Karen L. Hartley. "Defining effective service level agreements for network operation and maintenance". *Bell Labs Technical Journal*, pp: 139 – 143, February, 2005.

[17] Huang, Jenny. "eTOM and ITIL. " *Business Process Trends*. January, 2005.

[18] Rick Freedman. "Standards-Based IT Consulting". *Consulting to Management*, pp: 31 – 34, December, 2004.

[19] Stephen O'grady. "SOA Meets Compliance: Compliance Oriented Architecture". *RedMonk*. August, 2004

[20] Michael S, Pallos. "Service-Oriented Architecture: A Primer". *eAI Journal.* December, 2001

[21] Sidney Hill Jr.. "Service-Oriented Architecture: What you don't know about SOAs could hurt your business". *Manufacturing Business Technology*, vol. 23, pp:48 – 49, October, 2005

[22] Rhonda L. Hensley, Kathryn Dobie. "Assessing readiness for six sigma in a service setting". *Managing Service Quality*, Vol. 15 No. 1, pp. 82-101, 2005.

[23] Gi-Du Kang. "The hierarchical structure of service quality: integration of technical and functional qua lity." *Managing Service Quality*, vol.16, pp. 37 – 50, 2006.

[24] Gomez-Perez, Asuncion, Mariano Fernandez-Lopez, and Oscar Corcho.*Ontological Engineering*. Springer. 2004.

[25] Kassem Saleh, Imran Zualkernan, Ibrahim Al Kattan."A Roadmap for Delivering Trustworthy IT Processes." *Information Science Reference*. 2007

[26] Peter S Pande. *Six Sigma Way Team Fieldbook : An Implementation Guide for Project Improvement Teams*. Blacklick, OH, USA: McGraw-Hill Trade, 2001, pp: 89.

[27] Pyzdek, Thomas. *Six Sigma Handbook.* Blacklick, OH, USA: McGraw-Hill Trade, 2003. pp: 121.

APPENDIX A: SIPOC Generic Components Table

		SIPOC			
		Supplier	**Input**	**Output**	**Customer**
Compliance Services	**Access Control**	SLA Management System	User Name & Password	Authorization check result	Service Manager
	Analytics	Service Manager , Inspector , computerized system	Measurement, Data	Statistics	Service Manager , Inspector
	Archive/Backup	Service Manager , Inspector , Clients	SLA, Reports, Complains	Archived assets	Service Manager
	Auditing	Service Manager	SLA, Reports, Complains	Audited Entries	Service Inspector
	Collaboration	Service Manager, Inspector, Client	Monitoring Report, Complaint	Status Report	Service Manager
	Conflict Resolution	Service Manager , Inspector , computerized system	Conlficted requirements List	Approved requirements List	Service Manager
	Destruction	Service Manager , Inspector , computerized system	Assets to destruct	Asset destruction report	Service Manager
	Disposition Management	Service Manager , Inspector , computerized system	Asset Type	List of disposition requirements	Service Manager
	Indexing	Service Manager, computerized system	Asset	Unique Asset Indexing Code	Service Manager
	Information Integration	Service Manager, computerized system	Asset Reference Code	Integrated Asset Data	Service Manager
	Monitoring	Service Manager , Inspector , computerized system	Measurements and Notes	Monitoring report	Service Manager
	Notarization	Service Manager , Inspector	Asset creation Data	Asset creation report	Service Manager
	Policy Engine	SLA Management System	Policy requirements	Rules and Instructions	Service Manager
	Process Registry	SLA Management System	Problem Type	Related Processes List	Service Manager
	Retention	SLA Management System	Asset Type	Asset Lifespan	Service Manager
	Retrieval	Service Manager , Inspector , computerized system	Unique asset Code	Asset	Service Manager
	Tagging	Service Manager , Inspector , computerized system	Asset Data	Asset Tags	Service Manager
	Version Control	Service Manager , Inspector , computerized system	Updated Asset Data	New version code and fields	Service Manager
	Workflow	Service Manager , computerized system	Process Name	Required Tasks Sequence	Service Manager, Inspector

APPENDIX B: Generic CTQ Table

		Service Quality Attributes										
		Reliability (REL)	Responsiveness (RES)	Assurance (AS)	Empathy (E)	Tangibles (T)	Confidentiality (C)	Integrity (I)	Availability (AV)	Accountability (AC)	Privacy (P)	Business Integrity (BI)
Compliance Services	**Access Control**	authorization list	Access granted in less than time X		Unique list for each client	encrypted folder (password), safe room (ID)	Authorized employees Information kept safe, or Encrypted	employees previllages shared for certain authorized people	access check 24x7	Log kept for each entry	Service manager can view his log file	Access check < X time
	Analytics	accurate measurement error < 2 %	taking measurement in < X time	accurate Employees (Training) (Experience)	specified ..	advanced measuremnt tools	measurement data kept safe	Authorization list	timing ?	Authorization list for measurement taking	Service manager can control his data	2 measurement trials
	Archive/Backup	list data type/ archiving place	whith in X time	written procedure	unique archive for each service manager	Modern Backup system	Safe Backup Storage / Safe Archives	Who can Archive? (list)	service availabe on click / certain timing for stores	Log kept for each entry	Service manager can control his data	backup validation check
	Auditing	required fields check list	record data with in X time of approval	accurate Employees (Training) (Experience)	generate review report	advanced data check system	auditing data kept in confidence	authorised auditors list	when ? Timing (from >> To)	Log kept for each auditing process	Service manager can control his data	daily auditing variations report
	Collaboration	responsible employees list >2	cummunication in time < X	alternative contacts	Training & Experience	Advanced Cummunications (cell, e-mail, ...)	cummunications details kept in confidence (Secured channels)	Authorization list	when ? Timing (from >> To)	Daily updated communication log	Service manager can control his communications data	communication cancelled after X trials
	Conflict Resolution	detailed process requirement list	conflicting process requirements identified before process begins	Process Starts if only requirements are matched (status check)	available support? (defined)	Advanced comparisonsystem	comparison results kept	Authorization list	when required ?	log of all detected conflicts	Service manager can control his data	clear detaild requirement lists for all related parties
	Destruction	Detailed tasks destruction list	required time for each asset type	Qualified Employees (Training) (Experience)	Granting client's approval	modern tools or facilities	destruction reports kept in cofidence	Authorization list	daily ? Weekly? Monthly?	Log all destructions	Service manager can control his destruction data	Done in time < X
	Disposition Management	detailed process requirement list	requirements list retrieved in X time	Trained Staff	Granting client's approval	tools specifications	disposition reports kept in cofidence	authorized entities list	duty time	requirements list auditing	SM can control his disposition Req. List	signed req. lists from related parties
	Indexing	Unique Index for each asset	Index created before archiving in X time	Checking System	Standard indexing system	Computerized indexing process	indexing rules kept in confidence	Authorization list	automated system	indexing log	SM can filter his own indexes	Standardized indexing rules
	Information Integration	Unique Primary Key for records related to the same asset	Pre-designed integrated data forms	data check for duplication	custom designed forms	modern system	integration data kept in confidence	Forms authorization list	all time	Information edit log	SM can modefy his froms	ability to integrate more records
	Monitoring	Detailed Service Scope check list	assessment recorded in X time	Trained Staff	Named Inspector(s) for each SLA	Professional inspectors	monitoring data kept in confidence	data retrieval authorization	daily ? Weekly? Monthly?	Daily updated monitoring Log	Service manager can control Monitoring data	Frequency >= 2 per month
	Notarization	required fields list	Automated process	field auditing	ability to add special fields	modern system	fields are kept in a database	data retrieval authorization	duty time	defined asset types per user	SM can filter his own assets	require client's approval
	Policy Engine	predefined templates	Automated process	check rule conflicts	ability to define new rule	approved standards	Approved Policies are kept in a safe database	Policy retrieval authorization	duty time	Log process editing	SM can combine rules	Detailed policy building manual
	Process Registry	Unique problem references	Automated process	View all related services	Provide case description	advanced search engine	Directory Kept safe	Process retrieval authorization	all time	Log for new case entry	SM can make new groups	Agreed on standards for case mapping
	Retention	Detailed asset lifespan table	periodic check (monthly)	Pre-destruction report	approval of related parties	advanced follow up system	Asset lifespan data kept safe	data retrieval authorization	Weekly	Retension Data retrieval Log	SM can filter his own assets	Standardized lifespan rules
	Retrieval	Unique Tagging and index Reference	Asset retrieved in X time	Indexed archives	SM Training	advanced retrieval system	Indexing tables kept	data retrieval authorization	all time	Data retrieval Log updated every X hours	SM can retrieve his own assets data	clear browsing and searching steps
	Tagging	Predefined required metadata	Tagging in Time < X	Tag check before archiving	SM can add special tags	advanced Tagging system	Tagging rules kept safe	Tagging Authorization list	all time	Asset Tagging Log	SM can filter his own assets	Standardized Tagging rules
	Version Control	Unique iteration code	Automated process	Version Code check before archiving	SM can add iteration description	Standardized System	iteration data kept safe	iteration authorization list	all time	iteration Log	SM can edit his assets data	approval of involved parties
	Workflow	Last successful approved procedures	process list retrieval	process sequence check	SM can update workflow	advanced workflow system	Workflow data kept safe	iteration authorization list	all time	iteration Log	SM can update workflow data	approval of involved parties

APPENDIX C: KANO Questionnaire

Questionnaire

(Customer needs for Service Level Compliance)

Name

Position

Introduction:

Since customer needs are not all of the same kind, not all have the same importance, and are different for different populations; the optimization process shall require a further analysis for these needs, in order to prioritize them based on their impact to customer satisfaction.

This questionnaire is a tool which can be used to classify and prioritize customer needs. The results can be used to prioritize your effort in satisfying different customers.

I would like to express my gratitude and thanks for your participation in this questionnaire. Your opinion and experience shall be most helpful in clarifying and prioritizing the customer requirements of the SLA compliance process.

Once again, I'd like to thank you for taking time from your busy schedule to attend these questions.

Regards,

Essam O. Al Disi

P.S. the Service Quality Attributes table attached might help in understanding what is intended by each attribute.

APPENDIX C: KANO Questionnaire

	Attribute	Description
1	Reliability (REL)	Performing services right the firs time
		Providing services at the promised time
		Dependability in handling customers' service performed
2	Responsiveness (RES)	Prompt service to customers
		Willingness to help customers
		Readiness to respond to customers' requests
3	Assurance (AS)	Making customers feel safe in their transactions
		Employees who are consistently courteous
		Knowledgeable employee to answer customer questions
4	Empathy (E)	Giving customers individual attention
		Employees who deal with customers in caring fashion
		Having the customer's best interest at heart
		Employees who understand the needs of their customers
5	Tangibles (T)	Modern equipment
		Visually appealing facilities
		Employees who have a neat, professional appearance
6	Confidentiality (C)	All data, information, documentation are kept in confidence
7	Integrity (I)	information and knowledge shared only with authorized entities
8	Availability (AV)	Service is available when required
9	Accountability (AC)	Every Employee or worker is hold accountable for his action
10	Privacy (P)	Client is able to control his company's data collected by the process delivering the service
11	Business Integrity (BI)	keeping the interest of the client and the organization in balance
		requests from service clients are handled ethically
		Service is provided in a reasonable amount of time

APPENDIX C: KANO Questionnaire

1	How do you feel if a certain employee was responsible for Monitoring SLA Duration	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
2	What's your opinion if the interests of both the client and the organization were kept in balance when monitoring compensation ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
3	How do you feel if Monitoring Non-Performance was done right the first time?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
4	How do you feel if each employee was held responsible for his part of Monitoring Non-Performance?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
5	What's your opinion if the monitoring assets and resources was performed right the first time?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
6	How do you feel if you had an advanced system for monitoring service quality?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
7	What's your opinion if all the data related to reporting non-performance were held in confidence?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
8	How do you feel if complaints where reported promptly?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	

APPENDIX C: KANO Questionnaire

9	How do you feel if all the data related to reporting service quality were kept in confidence?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
10	What's your opinion if each employee was held responsible for his part of reporting assets and resources?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
11	How do you feel if reviewing duration was performed at the promised time ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
12	What's your opinion if both organization's and customer's interest were kept ion balance in reviewing service scope?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
13	How do you feel if there was a modern system to review the service standards?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
14	What's your opinion if both organization's and customer's interest were kept ion balance in reviewing penalties?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
15	How do you feel if reviewing compensation was performed in a reasonable amount of time ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
16	What's your opinion if each customer was given individual attention when reviewing responsibilities?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	

APPENDIX C: KANO Questionnaire

17	How would you feel if Monitoring SLA Duration wasn't assigned to a certain employee ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
18	What's your opinion if the interests of the client and the organization weren't kept in balance when monitoring compensation ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
19	How do you feel if Monitoring Non-Performance wasn't done right the first time?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
20	How do you feel if employees didn't take responsibility for their parts of Monitoring Non-Performance?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
21	What's your opinion if the monitoring assets and resources wasn't performed right the first time?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
22	How do you feel if you didn't have an advanced system for monitoring service quality?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
23	What's your opinion if the data related to reporting non-performance were not held in confidence?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
24	How do you feel if complaints where not reported promptly?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	

APPENDIX C: KANO Questionnaire

25	How do you feel if all the data related to reporting service quality were not kept in confidence?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
26	What's your opinion if each employee wasn't held responsible for his part of reporting assets and resources?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
27	How do you feel if reviewing duration was not performed at the promised time ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
28	What's your opinion if both organization's and customer's interest were not kept ion balance in reviewing service scope?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
29	How do you feel if there wasn't a modern system to review the service standards?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
30	What's your opinion if both organization's and customer's interest were not kept ion balance in reviewing penalties?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
31	How do you feel if reviewing compensation was not performed in a reasonable amount of time ?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	
32	What's your opinion if no individual attention was given to clients when reviewing responsibilities?	Like	
		Must	
		Do not care	
		Can live with it	
		Dislike	

APPENDIX C: KANO Questionnaire

33	How do you rate the accountability of monitoring SLA duration currently?	Rate (1 - 5)	
34	How do you rate the current Business Integrity of monitoring compensations?	Rate (1 - 5)	
35	How do you rate the reliability of monitoring non-performance currently?	Rate (1 - 5)	
36	How do you rate the accountability of monitoring non-performance?	Rate (1 - 5)	
37	How do you rate the reliability of monitoring assets and resources ?	Rate (1 - 5)	
38	How do you rate the tools and facilities used in monitoring service quality ?	Rate (1 - 5)	
39	How do you rate the confidentiality of reporting non-performance ?	Rate (1 - 5)	
40	How do you rate the responsiveness of reporting complaints?	Rate (1 - 5)	
41	How do you rate the confidentiality of reporting service quality?	Rate (1 - 5)	
42	How do you rate the accountability of reporting assets and resources?	Rate (1 - 5)	

APPENDIX C: KANO Questionnaire

43	How do you rate the reliability of reviewing SLA duration?	Rate (1 - 5)	
44	How do you rate the BI of reviewing service scope?	Rate (1 - 5)	
45	How do you rate the tangibles of reviewing standards?	Rate (1 - 5)	
46	How do you rate the tangibles of reviewing standards?	Rate (1 - 5)	
47	How do you rate the BI of reviewing compensation?	Rate (1 - 5)	
48	How do you rate the empathy of reviewing responsibilities?	Rate (1 - 5)	

VITA

Essam Omran Al Disi has chosen the field of Business Processes Auditing and Optimization, IT Project Management, and Service Level Quality Assurance for his career, he joined Emirates Management Services Corporation (EMS) in 2002 as a Network Engineer, and made his way up in the company where he is working now as the Manager of the Quality and Business Excellence Unit. His career choice was supported by relevant education when he began his higher studies in 2004 at the American University of Sharjah (AUS) as a student in the Engineering Systems and Management program (MSESM) and graduated in December 2007. Being a holder of bachelor degree in "Communication Engineering" Mr. Al Disi has the technical background and the analytical skills that enriched his structured result-oriented approach of judgment.

Mr. Al Dis i was born in 1980 in Abu Dhabi were he lived and received his school and university education.