Developing a model for innovation and process improvement in the service industry

by

DORIEN BADENHORST
26132827

Submitted in partial fulfilment of the requirements for the degree of

BACHELORS OF INDUSTRIAL ENGINEERING

in the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

UNIVERSITY OF PRETORIA

October 2009

Executive Summary

Innovation, the introduction of something new, and process improvement, the embodiment of knowledge in processes, is often not granted its full value. It can however lead to vast improvement in operational efficiency and process optimisation, thus overall improving quality.

While process improvement methodologies for manufacturing purposes are commonly found, there is a lack of methodologies for service purposes. Further, since manufacturing process improvement methodologies are well developed and have proven to be rather significant within the manufacturing environment, it would be of great value to employ these methodologies as a basis for improving processes within a service orientated environment.

As a starting point for the literature review, a study of service industry characteristics was done. The literature review was then further expanded with a study of the basic process of innovation as well as well-known manufacturing improvement methodologies. The latter provides a clear knowledge of the concepts of each methodology as to attempt to extract the core ideas which has relevance to the service industry. Further, the approach and conceptual design was discussed after which a universal model for innovation and process improvement within a service environment was created. Guidelines and explanations of the different parts (sub models) of the model were then provided.

It is expected that the developed model will add considerable value to the existing literature on innovation and process improvement in the service industry, while it may also lead to improvements of especially state and semi-state services provided within South Africa.

Table of Contents

List of Figures

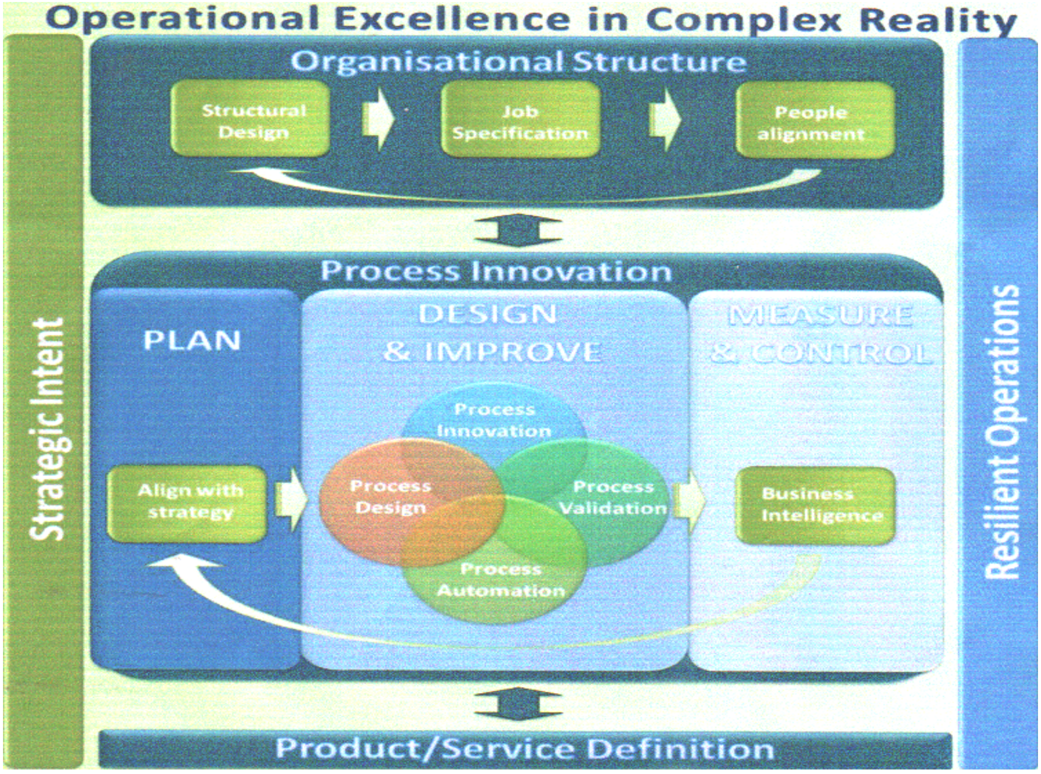
1. Introduction and Background

1.1 Fourier Background

The Fourier Centre of Excellence in Complexity is a Consortium consisting of two organisations namely, Fourier (Industrial Engineering Consultancy) and the University of South Africa (UNISA) and is fully endorsed by the Innovation Hub. These parties joined forces and developed a model and associated methodologies that assist with the design, development, implementation and measurement of operational processes within a complex environment, commonly found in South Africa.

With the creation of the model the Consortium aims at optimising processes and improving operational efficiency within an organisation, specifically, but not exclusively, state and semi-state organisations. A strong focal point of the model is the Design and Improvement phase, as indicated in Figure 1. This phase involves process design, -innovation, -automation and -validation.

Figure 1: Model Diagram



1.2 Current Problem

In the complex reality that exists within organisations today, it is of great importance to apply innovation and process improvement methodologies. The latter consists of methodologies created by the mentioned Consortium as well as other known methodologies of enhancing process improvement. The employment of innovation and process improvement methodologies is vital as to ensure and improve their competitive advantage in the market. In essence, it adds to the substance of a company, without which a company will struggle to survive in the long run.

The current problem becomes known when considering the fact that the vast majority of existing process improvement methodologies (such as Lean Manufacturing and Six Sigma) focuses on a manufacturing environment, while the South African Industry roughly consists of 70% service orientated companies and a mere 30% manufacturing companies. This clearly points out that there is a scarcity in service orientated process improvement methodologies.

Further, since the Consortium specifically focuses on state and semi-state organisations, which provides a large number of services, it would be of great value to have some means of improving service processes, which can then be applied to these organisations. This will also assist in overcoming complexities within a service environment. In addition, it will almost certainly be beneficial for years to come, since it is assumed that the larger percentage of the workforce in South-Africa will continue to be employed in the service industry.

1.3 Project Aim

The aim of this project is to develop a universal model for innovation and process improvement specifically within a service orientated environment.

Objectives acting as a basis for the aim:

- Attempt to marry the concepts used in existing manufacturing methodologies to the service industry on a general basis
- Create the model in such a fashion that it can be applied to as many service types and sizes as possible as to ensure that the development of such a model is justified

1.4 Project Scope

The first part of the project will be concerned with doing an in-depth literature review. This will firstly entail studying and exploring the service industry i.e. what services entail or bring about. Further, the literature review will focus on the basic process of innovation, since innovation is a key part of obtaining a competitive advantage, after which the three most prominent and general methodologies of enhancing process improvement in the manufacturing industry, namely Six Sigma, Lean Manufacturing and Theory of Constrains, will be studied.

During the next part of the project a universal model for innovation and process improvement within a service environment will be developed by selectively using the information obtained during the literature review. This model will consist of a visual component as well as a description to the visual component.

The project scope does not include a practical implementation of the model.

2. Literature Review

2.1 Preface

In the early 1990s, the service sector- long believed to be an unproductive and undesirable source of employment, and an arcane area of economic activities- became a focal point of world-wide attention, after being largely neglected, and have come to play a fundamental role in the creation of jobs and in GDP value added.

The market of today first and foremost demands quality of product *and* service. As a result of continuous advances in technology, the labour intensity of manufacturing companies has reduced considerably. Robotics, automation and advanced information systems are just a few examples of what have led to a decimation of manual labour. Organisations can no longer regard themselves as being purely in manufacturing and hope to survive. This leads to the tendency of manufacturing-originated companies, locally and internationally, leaning more and more towards being primarily service and marketing companies (Basu 2003:112), resulting in declined manufacturing employment and a growth in the service sector. Traditional manufacturing companies have also become more vertically integrated and are now earning an increasingly larger share of their income through their services, such as software and global services. All in all, there has been a gradual shift from an economy of goods to an economy of services. This shift toward services is remarkable mainly in developing countries. Considering what has been mentioned it is easy to understand why the service industry has become as large, and referring to Figure 2 below as an example, why the importance of the service sector cannot be overstated.

Figure 2: Scope and size of US employment (Tien 2008:147)

Industries	Employment (M)	Percent
Trade, Transportation & Utilities	26.1M	19.0%
Professional & Business	17.2	12.6
Health Care	14.8	10.8
Leisure & Hospitality	13.0	9.5
Education	13.0	9.5
Government (Except Education)	11.7	8.5
Finance, Insurance & Real Estate	8.3	6.1
Information & Telecommunication	3.1	2.2
Other	5.4	3.9
SERVICES SECTOR	112.6	82.1
Manufacturing	14.3	10.3
Construction	7.5	5.5
Agriculture	2.2	1.6
Mining	0.7	0.5
GOODS SECTOR	24.7	17.9
TOTAL	137.3	100.0

This expansion of the service industry has developed the need for efficient service processes and although service processes are generally not as intricate as manufacturing processes, it still requires innovation and improvement, in order to be and remain efficient.
As a result of the fact that the application of quality practices in manufacturing companies is more extensive than in service companies, a collection of well-developed manufacturing improvement methodologies are available to serve as a platform for creating the mentioned model for service industry application. In order to use this platform effectively, knowledge of what services entail is vital.

2.2 The Service Industry

2.2.1 Defined

Although service is something very subjective and difficult to define, these definitions might aid in beginning to understand what the service industry entails.

A definition of the service industry:
"That section of the economy which supplies the needs of the customer but produces no tangible goods." (Stebbing 1990:19)

A definition of the service sector:

"It can be considered to include all economic activities whose output is not a physical product or construction, is generally consumed at the time it is produced and provides added value in forms (such as convenience, amusement, timeliness, comfort or health) that are essentially intangible." (Tien 2008:146)

A definition of a service organisation:

"A service organisation exists to interact with customers and to satisfy customer service requirements." (Basu 2003:114)

2.2.2 Description of a Service Organisation

He profits most who serves best.

[Motto for international rotary]
A.F. Sheldon

A service organisation has the objective of serving a customer through a systematic effort, and can thus be seen as a service system, consisting of integrated processes. It can also be viewed as a system-of-systems. A service system describes the route that inputs follow and the manner in which they are organised and used to provide certain service outputs for a specific service organisation (Basu 2003:114).

A service system can be viewed as a combination of the three components (inputs) listed below, each of which is essential to providing the service.

The three essential components of a service system (Tien 2008:151) are:

- People
  - Characterised by knowledge, skills, attitudes, behaviours, values, levels of responsibility, etc.
- Processes
  - Characterized by collaboration, customisation, etc.
- Products

- Characterise by software, hardware, infrastructures, etc.

Given that people are involved in providing the services in most sectors and that people are unlikely to operate as reliably and constantly as machines, no two services will be the same and it is often difficult to measure and control quality. The service and the quality will thus vary depending on who (both employees and customers) is carrying out the activities. As a result of this difficulty to measure the quality, price is sometimes used as a basis for assessing quality and great emphasis are placed on personal information sources. It can thus be said that services are heterogenic largely because of human interaction and all the peculiarity/eccentricity that accompany it.

Services have an intangible nature and are activities, deeds or interactions and not physical objects such as goods. Given this nature, services is said to be perishable, referring to the fact that it cannot be kept as inventory, stored, kept in a warehouse or be reused and mass production may be difficult. As a simple example, a hairdresser cannot store haircuts in order to be prepared for rush hours. Thus, enough opportunities for service delivery at relevant times should be obtainable (Rönnbäck 2008:581).

When considering service types, services can be divided into two main sets namely electronic services (such as banking and airline reservation systems, thus using a digital medium) and traditional services (such as transportation and health care, thus using a physical environment). Electronic services (e-services) have a low level of interaction with customers (since it is generally self-service), whereas traditional services mostly have a high level of "face-to-face" interaction.

Through previous studies, two principles stand out as having a strong relationship in service organisations: process orientation and employee management. This can be explained by the service logic. As customers are co-producers and production and consumption can be viewed as inseparable in the service production process, the interaction between employees and the customer is an essential ingredient in the service experience, thus indicating a strong user–producer link. In the light of this, employee management and process orientation have direct effects on customer satisfaction (Pires 2008:1340).

A good conclusion/summary would be to mention the nine fundamental premises of services according to Sawatani (2007:2764). These premises are categorized as "core elements", "processes" and "systems". Core elements describe key elements of services, such as skills and knowledge. Processes also describe the focus on flows of intangible resources, such as knowledge, skills, and benefits. Systems are support infrastructures for the flow of these services.

- Core elements
    - Operational resources (intangible resources, such as skills and knowledge).

    FP1: The application of specialised skills and knowledge is the fundamental unit of exchange.

    FP2: Goods are distribution mechanisms for service provision.

    FP3: Knowledge is the fundamental source of competitive advantage.

    FP4: All economies are service economies.

- Processes
    - Operational resources (intangible resources, skills, knowledge, and benefits) focused processes.

    FP5: The fundamental process of exchange is indirect.

- Processes
    - Value creation process transformation.

    FP6: The customer is always a co-creator of value.

    FP7: The enterprise can only make value propositions.

    FP8: A service-centered view is essentially customer oriented.

- Systems
    - Integration of macro and micro-specialisations.

    FP9: Organisations exist to combine specialised competences into complex services that are demanded in the marketplace.

Within the service sector as a whole there is much specificity as it is a composite of many sub-sectors each with different levels of technology inputs and whose characteristics are very different.

2.2.3 Service and Manufacturing Comparison

A comparison between manufacturing and services will aid in the process of developing the mentioned model for the service industry, as to guide service organisations towards achieving their key organisational results and strategic objectives.

Equivalent to manufacturing, services can and should be viewed from a system's perspective. While similarities between manufacturing and services, such as demand management and customer relationship management, do exist, there are considerable differences between manufacturing and services.

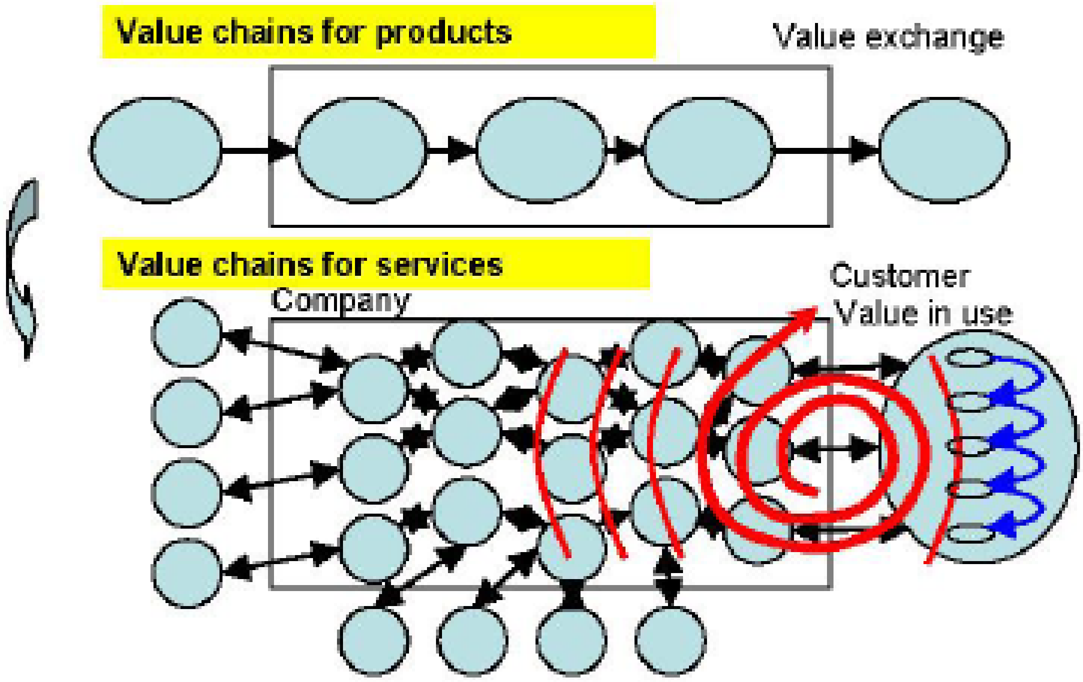
These differences include a shift in focus from mass production, where the specifications are defined by the producer, to mass customisation (in general), where last mentioned refers to a service being produced and delivered in response to the needs stated or implicated by a customer (Tien 2008:146).

While services offer an intangible service that is difficult to measure (subjective) and is based on a close interaction (co-production) between customer and supplier/producer of the service, attributes of manufacturing are tangible, measureable and generally involves no significant interaction with customers. To explain the difference in measurability it should be noted that physical parameters, statistics of production and quality in manufacturing can be more precisely described than in service operations, where the characterisation is inevitably more subjective due to the high human involvement, strong user-producer link and intangibility of services, as mentioned before. Further, where manufacturing generally does not involve much customer interaction, services entail levels of interaction varying between a high- and low level of 'face-to-face' interaction depending on the type of service offered.

Another noteworthy difference between manufacturing and services is that service production and service delivery are so integrated that they can be considered as a single, combined stage, whereas manufacturing includes multiple stages such as supplier, manufacturer, assembler, retailer, and customer (Tien 2008:148).

Further, looking at a value chain model for manufacturing it can be seen that it does not fit for services, which requires more complex value flows including intangible flows, and non-linear factors, such as benefits and knowledge. According to Sawatani (2007:2764) a Value Network may be the mental model that embraces the linear Value Chain Model and that adds an extra dimension to make sense of the complexity that exists in organisations and their environment today. Seeing it from the customer side, many technologies and skills are needed to meet their needs, which require integrating specialised skills. Some of them are procured outside of firms, which leads to a complex value network as seen in Figure 4. This makes it difficult to see the linkages of each resource or component in the service process.

Figure 3: Value chains to value networks (Sawatani 2007:2764)



By baring the mentioned comparisons between manufacturing and service organisations in mind, the process of comprehending and transforming the basic innovation process as well as the manufacturing improvement methodologies for service application is bound to done with less effort.

2.3 Innovation

2.3.1 Introduction

The pace of change continues to increase. What was satisfactory yesterday is either no longer wanted or superseded by something better today. A key factor for organisations to stay afloat in the market of today is to apply innovation on a regular basis since new and improved quality business is an important safeguard against business decline and failure.

Innovation is critical for the development of new products and services and improved organisational processes and models. It delivers competitive advantages and adds value to companies, enhances standards of living for consumers and also leads to environmental efficiency (Kotelnikov 2001).

It is consequently important for organisations to develop a pragmatic approach towards making innovation an integral part of their business processes. Such an approach will help organisations to deliver on the promises of innovation such as competitive positioning and market share.

2.3.2 Innovation Defined

To create to an improved understanding of innovation, the following definitions are considered:

“An innovation is the adoption of a change which encompasses ideas, practices or objects which is new to an organisation and to the relevant environment.” (Knight 1967:478) Thus an innovation does not have to be new to the world, being new to the industry is sufficient.

"Innovation, like many business functions, is a management process that requires specific tools, rules, and discipline." (Davila et al. 2006)

"Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.” (Oslo Manual 2007)

2.3.3 Innovation Barriers

A basic understanding of the subject of innovation is essential for all business leaders whatever their current or intended product, service or processes. Common concerns are how to prepare for innovation, how to carry it out, the inherent risks and ways to reduce them.

Many companies who want to innovate find that they must first increase their motivation and improve their proficiency. Six barriers of innovation are mentioned below; three relating to the motivation to innovate, and three to the difficulties of actually applying it (Beacham 2006).

Motivation:
Failure to recognise change/threats/opportunities
Lack of ambition and vision
Risk aversion

Proficiency:
Lack of market understanding
Lack of expertise in the process
Lack of finance

While proficiency can be fairly easily improved, motivation, which is the key to innovation, is much harder. These barriers should be overcome as it can lead to loss of market, poor integration, bad debts and other undesired outcomes, which essentially results in failure. On the other hand, choosing not to innovate will jeopardise growth.

2.3.4 Innovation Strategy

An important aspect of innovation is to develop a strategy, describing the purpose of innovation within an organisation, from which the direction can be envisaged. This strategy should be clear and consistent with the organisation's corporate strategy and the entire organisation and all processes must then be aligned with it. Employees should also be trained appropriately and a culture of innovation must infuse the entire enterprise. Michael Porter defines strategy as "a combination of the ends for which the firm is striving and the means by which it is seeking to get there". This is applicable to innovation as it is a key business process.

A well formulated innovation strategy will contribute in protecting an organisation's competitive lead in the long term. It is suggested that 'quality gates' would be introduced in such a strategy. These gates determine that the next step in any innovation project only begins when all demands placed on the previous step have been fully met. A further discussion on these 'gates' can be found under the heading 'Innovation Process'.

2.3.5 Research and Development (R&D)

The ability to create new ideas, to evaluate them and to access and use knowledge and skills to develop them is fundamental to business innovative success. Special attention is paid to the process of Research and Development (R&D) which in many cases builds a corner-stone of innovation since the level of competition, production processes and methods are rapidly escalating. As innovation, individualism and quality are key customer demands for today's companies, R&D is decisive in ensuring that organisations meet these high expectations.

Short descriptions of Research and Development are as follows (Beacham 2006):
Research – the creation of explicit knowledge
Development – the application of one or more technologies to produce a desired outcome

Involvement in R&D can provide technology, knowledge and expertise and there is a well-established correlation between R&D-investment and sales growth, market value and value-adding efficiency. It is thus critical to apply in-depth methodological expertise to craft strategy-compliant R&D portfolios. In essence, "research is the transformation of money into knowledge, whilst innovation is the transformation of knowledge into money" (Beacham 2006), making it very important to have the necessary skill to translate and apply the knowledge and technology.

Unfortunately, Research and Development are very difficult to manage, since the defining feature of research is that the researchers do not know in advance exactly how to accomplish a desired result. As a result, higher R&D spending does not guarantee more creativity, breakthrough solutions, higher profit or a greater market share.

2.3.6 Leadership

Innovative leadership can be seen as the art of continuously maintaining a delicate balance between inspiration (creativity and freedom) and perspiration (control and delivery). This responsibility of innovation should rest upon the shoulders of an organisation's management team and it would be wise to establish an innovation steering committee. Inspirational top leadership is critical to successful innovation and the leaders must develop a clear and simple vision as well as the strategy for achieving it. It also needs to provide the people and resources needed, monitor the external environment and adjust the direction as necessary.

In order to successfully do the latter, innovative leaders should also be motivational and have the ability to communicate well to their fellow colleagues. John P. Kotter from the Harvard business school said: "Without credible communication the hearts and minds of others are never captured." (Beacham 2006)

2.3.7 The Innovation Process

"You cannot do today's job with yesterday's methods and be in business tomorrow."

As knowledge and innovation become more critical drivers of business success, it is important to keep innovating. A good example of the innovation process can be obtained by viewing the "Stagegate" model which can be viewed in Figure 4. This model breaks activities down into discrete linear units. Progression only occurs after satisfying certain criteria, designed to ensure that the innovation investment is minimised in the early stages and if necessary the project abandoned sooner rather than later. In this way a portfolio of projects in an "innovation pipeline" can be created, with their progress matched to suit the available funding and resources. According to Robert Cooper the typical stages in such a pipeline are Concept, Feasibility, Development and Implementation, where the Concept stage is preceded by brainstorming, prioritising and outcome-based thinking. Between each stage are hypothetical gates (as mentioned earlier) where the project is assessed against selected criteria to determine whether to allow it to progress (Beacham 2006).

It is ideal for an organisation to always have a living, robust pipeline of innovation projects to ensure sustainability. It would also be sensible to include some redundancy, so that a project that fails to meet the desired criteria can quickly be replaced by another potential innovation project. Pipeline blockage should be prevented and can be done by making decisions as early as possible. Early decisions will also ensure that proper planning around the size and period of the innovation investment can be done in advance, as to ensure that an appropriate commitment is made (Beacham 2006).

Figure 4: Stategate Model (Beacham 2006)

A Simple Stagegate Model

Concept Idea Generation
A very large number of ideas are considered against strategic fit, market need, impact on the company and the chances of technical success, to decide which are worth exploring further.

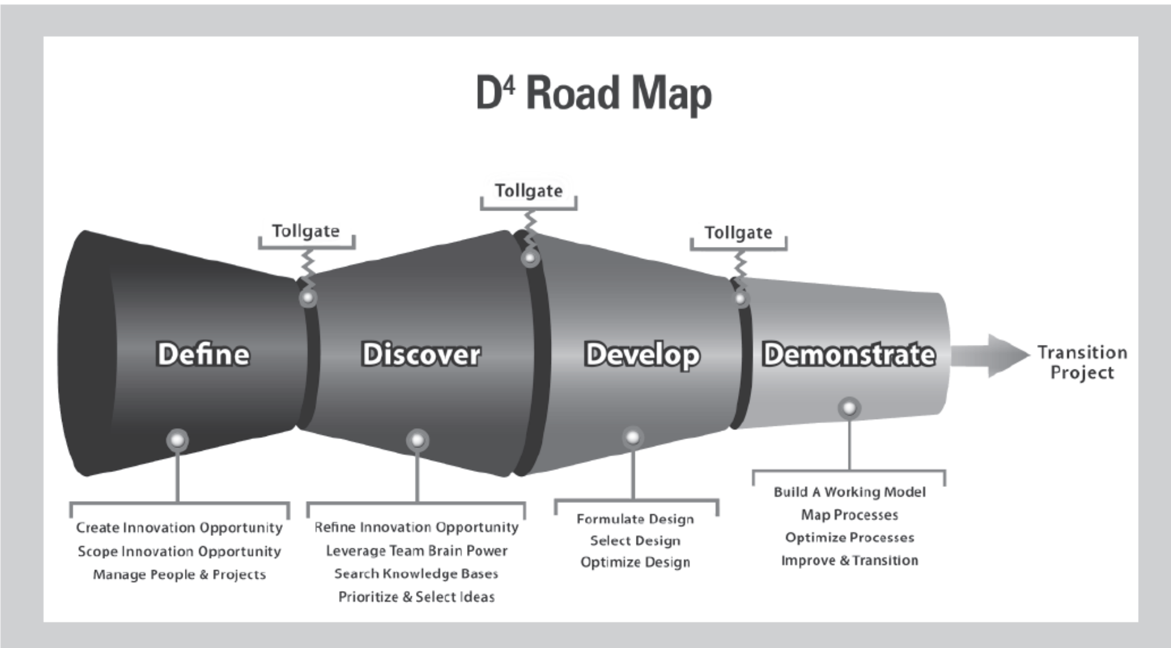
Feasibility Proof of Concept/Principle
Projects to go into development are selected on the basis of market acceptability, achievability of technical requirements, risk/reward criteria, and the availability of the required resources (people, facilities and money).

Development Development, Prototyping and Testing
Progress to market is dependent on satisfactory feedback on the prototype, an assessment of the competitive response, and deliverable strategies on sourcing, marketing and pricing/ margins.

Implementation Marketing and Launch

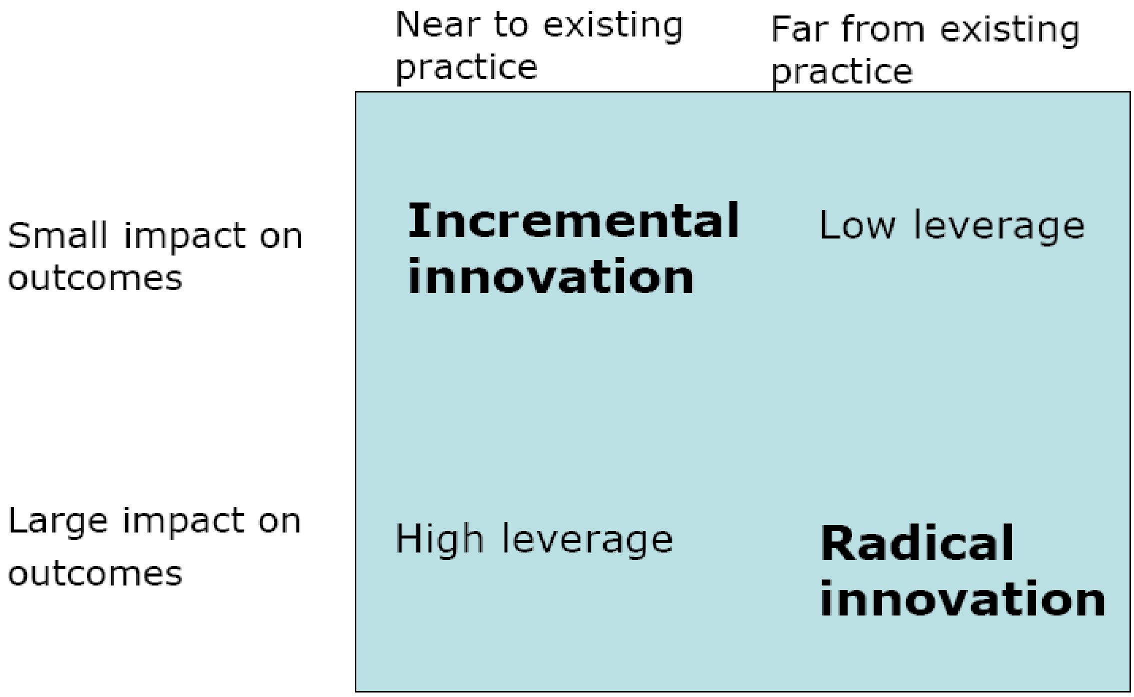
Adding to the Stategate model is another structured innovation process, namely the D4 Process for Innovation (Figure 5). This "roadmap", is in essence equivalent to the Stategate model, beginning with the critical stage of problem definition, moving to idea generation, then onto idea analysis/selection and finally testing, all of which assists an organisation in systematically moving forward with innovation.

Figure 5: The D4 Road Map ("Chief Innovation Officer (CIO) Seminar")



Innovation is not a product of chance or a quirk of fate and therefore needs to be formally addressed by establishing a systematic process to capitalise on creativity. It is essential that organisations foster innovation, resulting in an organisation that is continuously refining its value proposition so that it remains competitive and at the leading edge of the market (Dixon 2004). Such innovation that leads to a competitive advantage can be incremental or radical (as viewed in Figure 6). Although radical innovation has a large impact on outcomes, organisations should not ignore the significance of incremental innovation.

Figure 6: Incremental and Radical Innovation (Hannon 2009)



It is also important to note that innovation should not necessarily be confined to products and processes. The most radical innovations for an organisation can often be those of business processes and management. These are innovations that change the way things are done and usually involve applying new principles and techniques of management, as to develop a culture of innovation that achieves measurable and sustainable results.

2.4 Manufacturing Improvement Methodologies

2.4.1 Introduction

Despite the service sector's growing economic importance in most industrialised economies, the patterns and manners of improvement in this sector have received little attention from researchers to date and are clearly under-represented/neglected in the literature (Pires 2008:1339).

The degree to which generalisations based on the experience of manufacturing firms is applicable to service organisations is uncertain, but the possibility exists of recasting manufacturing in services-related terms. This can be used to deal with problems and issues arising in the services sector, since improvement is a key source of enhanced output performance (Pires 2008:1354). For these purposes a study of the existing manufacturing improvement methodologies is necessary. The most prominent improvement methodologies in the manufacturing environment are Six Sigma, Lean Manufacturing and Theory of Constraints. These methodologies will consequently be studied.

2.4.2 Six Sigma

According to Chakrabarty (2007:195), Six Sigma is often defined as:

“A quality improvement program with a goal of reducing the number of defects to as low as 3.4 parts per million opportunities or 0.0003%.”

From a business perspective, Six Sigma may be defined as:

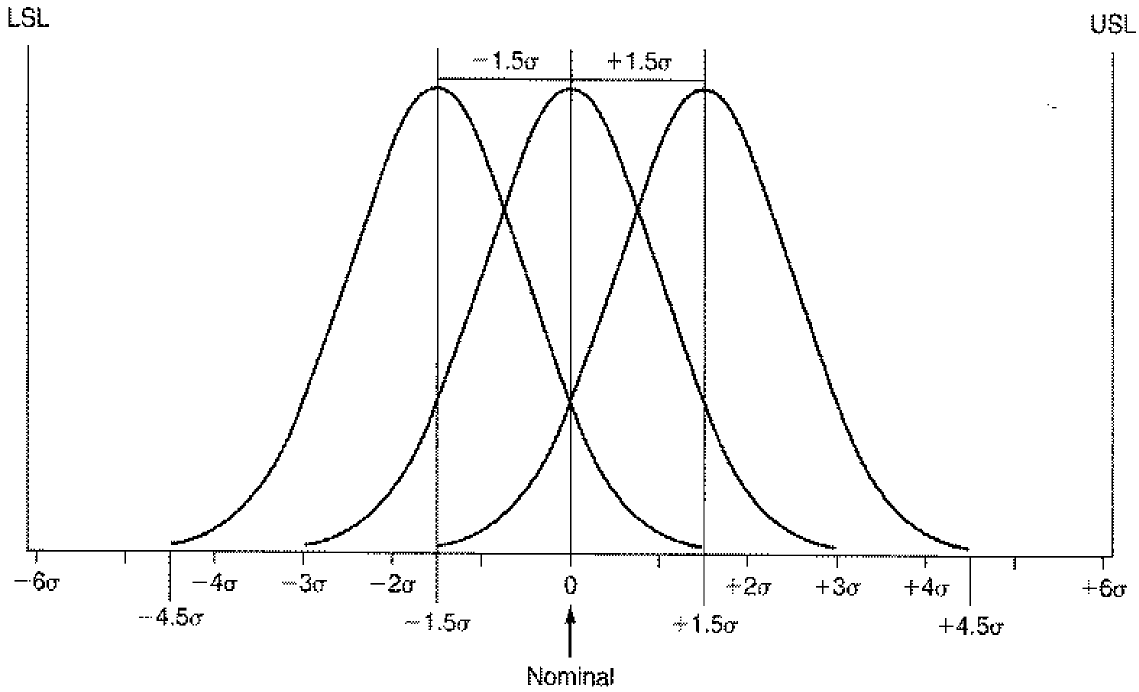
“A business strategy used to improve business profitability, to improve the effectiveness and efficiency of all operations to meet or exceed customer needs and expectations.” (Chakrabarty 2007:195)

The roots of sigma as a measurement standard go back to Frederick Gauss, who introduced the concept of a normal curve or a normal distribution. In 1922, Walter Shewhart introduced three sigma as a measurement of output variation. He stated that process intervention is needed when output went beyond this limit. The three sigma concept is related to a process yield of 99.973 percent or a defect rate of 2,600 per million opportunities. This was adequate for most manufacturing units, at least until the early 1980s when Motorola introduced Six Sigma under the leadership of Bob Galvin (Chakrabarty 2007:196). The concept matured between 1985 and 1986 and since then many companies have adopted Six Sigma, including Honeywell, Sony and Caterpillar, and obtained substantial benefits (Wang 2008:1).

Six Sigma differs from other quality programs in its rigorous pursuit of the reduction of variation in all critical processes that demands detailed analysis, fact-based decisions, and a control plan to ensure ongoing quality control of a process. It is also a long-term commitment and won't work well without full commitment from upper management and a common language throughout an organisation (Wang 2008:1). Six Sigma is a disciplined methodology with the overall goal of achieving virtual perfection and total customer satisfaction (Basu 2003:6).

Sigma is the Greek letter (σ) that is mathematically used to signify the standard deviation from the mean of a distribution. Six Sigma promotes the idea that the distribution of output for a process should take up no more than half of the tolerance allowed by the specification limits, assuming data from a stable and normal distribution whose mean can shift by as much as 1.5 standard deviations on either side of the nominal value. The shift of 1.5 standard deviations in a process's mean over time has been suggested by organisations such as Motorola as a common phenomenon, and it is generally accepted as an industrial assumption (Gitlow 2005:729). Assuming a stable process and a normal distribution where the average process output can shift by as much as 1.5 standard deviations (as explained above), one standard deviation from both sides of the mean will include 68.27 per cent of the total population, two standard deviations from both sides will include 95.45 per cent of the total and three standard deviations will cover 99.73 per cent. If the standard deviation of a process can be reduced such that six standard deviations (Six Sigma) from each side of the nominal value will give the lower specification limit (LSL) and the upper specification limit (USL), 99.99966 per cent will be covered. This means 99.99966 per cent of the process output will be between the lower specification limit (LSL) and the upper specification limit (USL) resulting in 3.4 defects per million opportunities (Basu 2003:34) (Gitlow 2005:729).

Figure 7: Six Sigma Process with 1.5 Sigma Shift in the Mean (Gitlow 2005:730)



The Lower Specification Limit, Upper Specification Limit and the nominal value (referred to as 'm') of the process is called the Voice of customer, while the Voice of the process refers to the process output distribution and average output (mean).

It is critical to note that Six Sigma embraces many methods and techniques, such as the balanced scorecard, cause-and-effect diagram, materials requirements planning method, pareto diagram etc. These methods are usually quite technical since they are mostly of statistical, engineering and mathematical nature. The methods will not be explained, as according to Chapman it would take years to compile an exhaustive Six Sigma study. Six Sigma is therefore very flexible and dynamic with wide usage and it is difficult to fully describe.

The basic starting point when implementing Six Sigma is to decide on the strategy, which is typically termed an improvement initiative. This base strategy is generally focussed on the essential processes; those that are linked to the overall organisational strategy and enable an organisation to add value to processes and products. This focus on the essential processes is because there is little point in measuring and improving processes that have no significant impact. The strategy should include strongly centralised operating structures, since Six Sigma is a top-down methodology.

Following the Six Sigma methodology entails documenting key processes (as mentioned above), aligning these processes to critical customer requirements and installing measurement and analysis systems to continuously improve the process (Olofsson 2009). The latter is important since measuring and monitoring process performance is at the heart of the Six Sigma process. Since Six Sigma focuses on process quality, it is imperative to isolate and quantify undesirable variations in process and product performance and to measure how many defects are in a process. Thereby errors can systematically be eliminated to achieve concrete and measurable results which are close to being perfect.

The theory is entirely logical: understanding and then improving the most important processes will naturally increase efficiency, customer satisfaction, competitive advantage and profitability.

Six Sigma's core model for improvement of a process is called the DMAIC model: Define-Measure-Analyse-Improve-Control (Kollengode 2009). It can be viewed as a way of reinforcing and reminding organisations and team members what needs to be done. This model can be applied to existing processes and the acronym is described below:

Define – In this phase, the problem statement, goal statement, key stakeholders analysis, voice of the customers, high-level project plan and project scope are some of the elements addressed, usually in the project charter. In this phase the scope, goals and outcomes that will be impacted by the project are agreed upon.

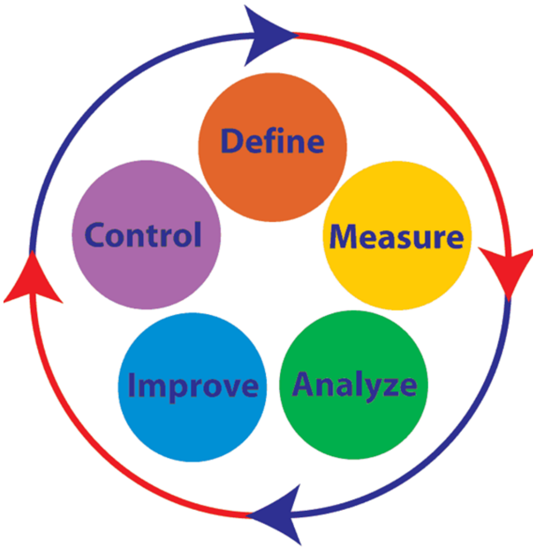
Measure – In this phase baseline data is collected to understand the current process state, develop operational definitions, validate the measurement systems and identify critical inputs and outputs for the process. The goal is to identify waste, inefficiencies, variation, imbalance and cost drivers in a process.

Analyze – In this phase tools such as a cause and effect diagram, failure modes and affects analysis (FMEA) and regression analysis are used to verify and narrow key input and output variables that impact the project. The current performance is thus analysed and potential solutions to solve the underlying problems that adversely affect the outcomes of a process, should be identified.

Improve – This is the point where selected and prioritised solutions are tested to verify the hypothesis and validate the relationship between suspected key inputs and outputs of the process. Applying the successfully tested solutions will then lead to process improvement. This is also the point where a future state vision is developed if current changes are sustained.

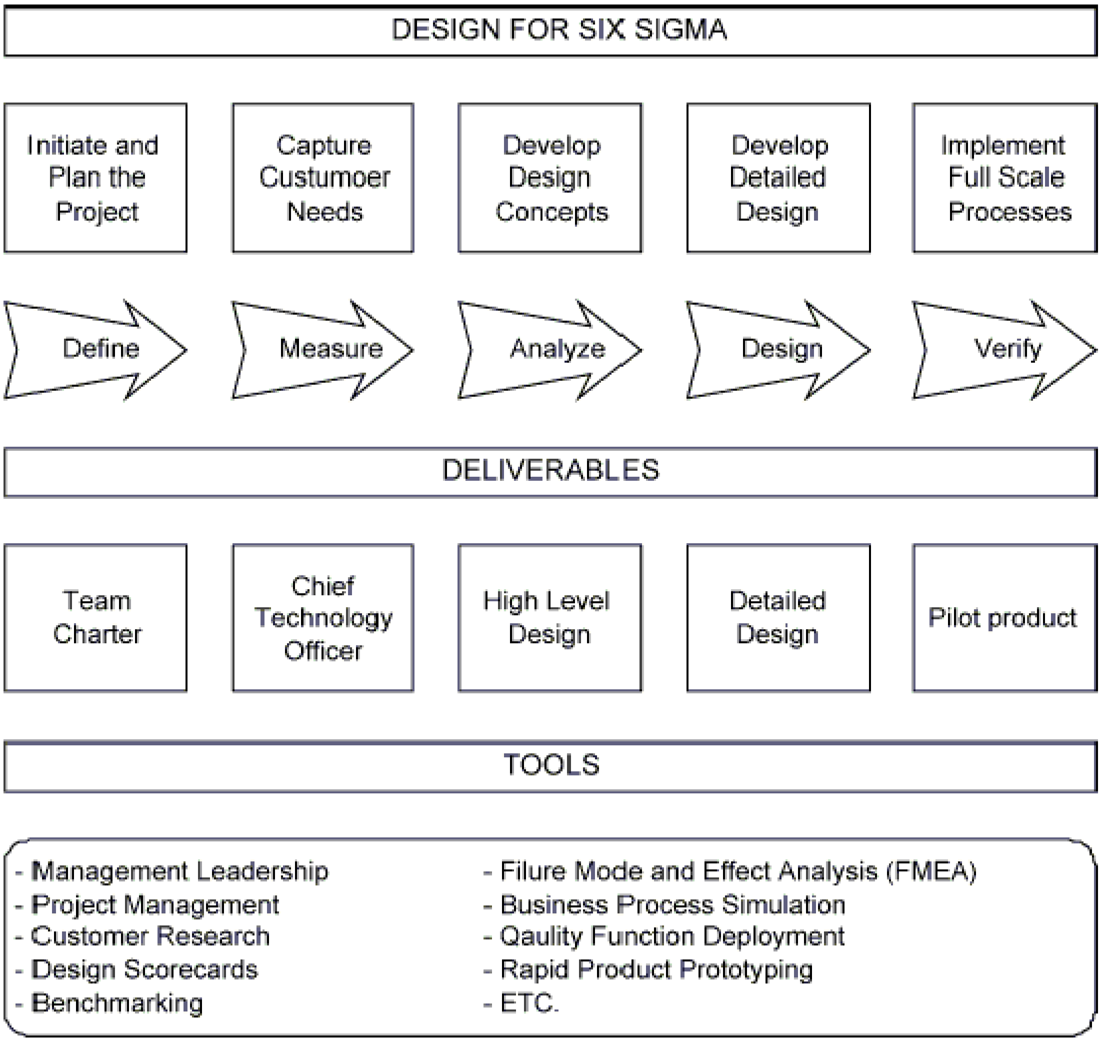
Control - This phase is critical. It ensures that gains are sustained. A monitoring and reaction plan is developed for the "in-control" revised process.

Figure 8: Illustration of the DMAIC process ("DMAIC Picture")



In the case of a new product or process being designed, Six Sigma makes use of the systematic methodology, Design for Six Sigma (DFSS), utilizing tools, training and measurements to enable the organisation to design products and processes that meet customer expectations and can be produced at Six Sigma quality levels (Wang 2008:2). The DFSS process is illustrated in Figure 9 below.

Figure 9: Illustration of the DFSS process (Wang 2008:2)



DFSS is potentially far more effective than DMAIC as its application is in the early stage of new product/process development (Wang 2008:3).

According to Donovan, certain steps should be followed when Six Sigma is applied as a method of solving existing problems. These steps are:

1. Identify a process or product variation which is creating undesirable performance results.
2. Define the scope and parameters of the problem.
3. Develop and apply initial measures (key process measures) of process variability.
4. Collect and organize the data needed to carry out a thorough analysis.
5. Analyze the data to locate the cause or causes of variation.

6. Develop an action plan for improving the process or product and a time frame for full implementation of the action plan.
7. Implement the improvements.
8. Establish control and feedback mechanisms for continuous improvement of the process or product.

These steps essentially suggest the same actions as the DMAIC process.

Wang (2008:4) present the key ingredients for effective Six Sigma introduction and implementation as the following:

1. Management commitment and involvement.
2. Understanding of Six Sigma methodology, tools, and techniques.
3. Linking Six Sigma to business strategy.
4. Linking Six Sigma to customers.
5. Project selection, reviews and tracking.
6. Organisational infrastructure.
7. Cultural change.
8. Project management skills.
9. Linking Six Sigma to suppliers.
10. Training.

In order to apply Six Sigma, it is essential for employees to be trained in Six Sigma's methods. This training mainly involves the use of Six Sigma measurement and improvement tools. However, it also includes communication and relationship skills which are necessary to involve and serve internal and external customer and suppliers that usually form the critical processes of an organisation's delivery chains. The training qualifies people as 'Black Belts' and 'Green Belts', which denote their different levels of expertise and responsibilities for implementing the Six Sigma methods. 'Black Belts' are normally Six Sigma leaders and their team members are people trained up to 'Green Belt' accreditation.

The leaders, as mentioned above, normally 'own' certain processes and are responsible for:

- Identifying and understanding processes in detail
- Understanding the levels of quality (especially tolerance of variation) that is expected

- Measuring the effectiveness and efficiency of each process, particularly its performance in terms of Six Sigma
- Improving process performance

Since Six Sigma is a manufacturing methodology, measurement is typically focused on highly technical interpretations of percentage defects and a deep detailed analysis of processes, involving organizational structures and flow-charts. The methods used depend on what needs to be measured and analysed and on the methods and techniques favoured by team leaders and project statisticians, mathematicians or engineers.

When following the steps mentioned and implementing Six Sigma correctly, a huge financial payoff is realised within a short period of time, as a result of the of the following benefits (Dedhia 2005:572):

- Decreased work-in-progress
  A reduction of inventory can be expected as a result of the elimination of bottlenecks. This also leads to work flowing smoothly and no waiting in line. Equipment and tools are also utilized efficiently with decreased work-in-progress.

- Improved capacity and output
  Due to decreased work-in-process, more can be produced and shipped.

- Improved customer satisfaction and process flow
  On-time shipping and on-time delivery results in happy customers.

- Improved inventory turns
  With decreased work-in-progress and improved output, products will move faster out the door.

- Increased productivity
  Equipment and machinery is used at its capacity and wastage is reduced.

- Reduced cycle time
  Speed is often a good representative for efficiency. Six Sigma creates a sense of urgency (McCarty 2004:6) and because waiting is removed from the system, the process can be conducted within the time specification.

- Increased first pass yield

  Variation and thus defects are reduced. Critical work products pass through the entire process without the need for rehandling and without any errors, more often (McCarty 2004:6).

When considering the significance of these benefits the question of applicability to the service industry again arises. Basu (2003:1) poses the question: “How can we apply Six Sigma methodology, originating from manufacturing operations, to the far larger market of the service sector?” and Hensley (2005:86) suggests that the benefits of Six Sigma that are experienced in a manufacturing environment should be translatable to services. Although this might be true there are certain shortcomings or limitations in terms of applying Six Sigma to the service industry.

According to Hensley (2005:87) research has identified five potential complications to implementing Six Sigma in a service environment as listed below:

1. It is generally considered that it is more difficult to quantify and gather data in service settings than in manufacturing. Measurements of customer satisfaction may be more difficult in services because the interactions between customer and service provider may create complications.

2. 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.

3. 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.

4. It may be argued also that data collection in manufacturing is oftentimes routine and automated, while this is usually not the case in services.

5. Because intangible products are produced through services and direct customer contact is involved, service processes are sometimes not very well understood and controlled.

The emphasis on detail and accuracy is the reason why Six Sigma is mostly used in industries such as manufacturing and engineering.

Further, Chakrabarty (2006:728) suggests that the limitation of Six Sigma in service industries is that the features of service industries are not uniform. This lack in uniformity makes it difficult to focus on detail and accuracy, which is the reason why Six Sigma is mostly used in industries such as manufacturing and engineering. Chakrabarty (2006:732) continues by saying that despite this fact that services are varied, there are several indicators which are common across services. The common KPIs (Key Performance Indicators) identified are:

- Efficiency
- Cost
- Time-to-deliver
- Quality of the service
- Customer satisfaction
- Reduced variation

Thus, irrespective of different services there is some uniformity in KPIs. This finding can be helpful in the wider application of Six Sigma (Chakrabarty 2006:732).

Wang (2008:2) suggests that future research should investigate whether aspects of DMAIC need to be modified to increase its scope, for example for the service sector or non-profit organisations.

Hensley (2005:83) states that the proposition that services are fundamentally different from manufacturing (and that these differences contribute to the increased complexity of service quality) is well accepted, but if service companies can successfully implement and use Six Sigma methods to make process improvements, they should achieve many of the same results as manufacturing companies.

Basically, the Six Sigma concept has a life of its own and is open to a range of interpretations. It can be seen as a production quality metric and a complex science, but also represents a corporate culture.

2.4.3 Lean Manufacturing & Just In Time (JIT)

According to Chase (2006:489) lean production can be defined as follows:

"Lean production is an integrated set of activities designed to achieve high-volume production using minimal inventories of raw materials, work-in-process and finished goods."

Another definition by Dedhia (2005:574) is:

"The Lean principle includes zero waiting time, pull instead of push scheduling, smaller batch sizes, line balancing and shorter process times."

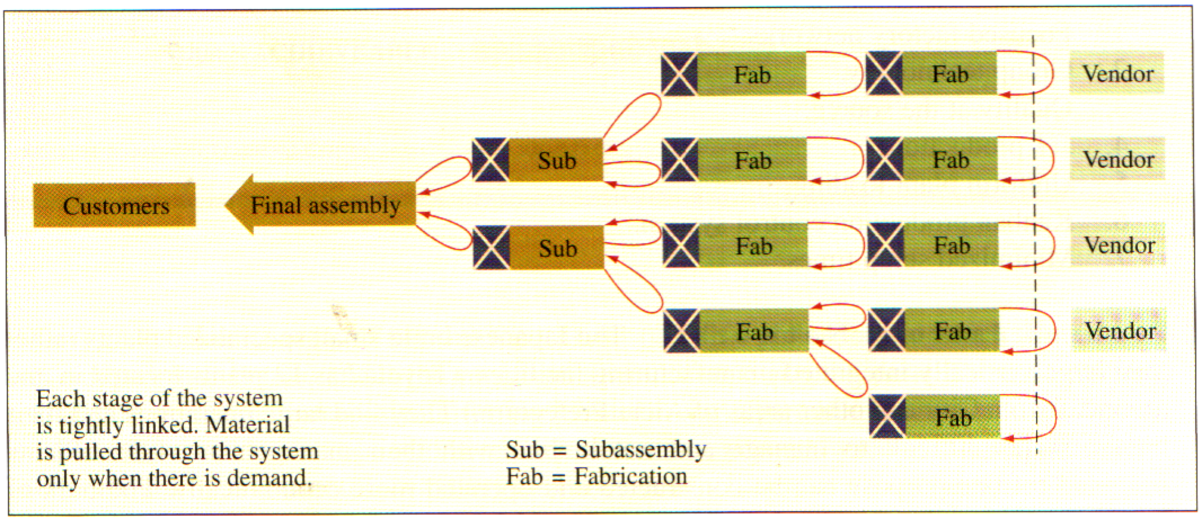
According to Chase (2006:489), JIT is "based on the classical production-consumption model."
Some of the JIT philosophy can be traced back to the 1900s. Henry Ford used JIT as he streamlined his moving assembly lines to make automobiles. Elements of JIT were also being used by the Japanese industry as early as the 1930s and JIT was used by Toyota Motors to take Toyota's cars to the forefront of delivery time and quality.

The Lean philosophy began with Japanese automobile manufacturing in the 1960s and was popularised by Womack and co-authors in *The Machine that changed the world* (1990), which is essentially the story of the Toyota way of manufacturing automobiles (Basu 2003:68). The Lean manufacturing approach is based on the Toyota production system of removing waste and focusing on value. It was actually born with a simple set of concepts and the principle on which lean manufacturing operates is very simple. It identifies the fact that a customer will not pay for the mistakes, but only for the value of a product. This thinking has a vast impact as its leads to the value of a product being defined from the customer's point of view and not from the internal manufacturing point of view ("Lean Manufacturing Concepts").

In the 1990s many companies adopted the term Lean in place of JIT to emphasise the goal of systematically eliminating waste throughout their operations.

When applying Lean, parts arrive at the next workstation "just in time" and are completed and moved through the process quickly. Lean is also based on the logic that something will only be produced when it is needed. Figure 10 below illustrates this process. Production is activated by actual demand for the product. When an item is sold, in theory, the market pulls a replacement from the last position in the system. This activates an order to the factory production line, where a worker then "pulls" another unit from an upstream station in the flow to replace the unit taken. This upstream station then pulls from the next station further upstream and so on, back to the release of raw materials.

Figure 10: Lean Production Pull System (Chase 2006:471)



The main characteristic of Lean manufacturing, sometimes referred to as "Toyotaism", is that materials flow 'like water' from the supplier through the production process and on to the customer with little if any stock of raw materials or components kept in warehouses, no buffer stock of materials or part-finished goods between stages of the manufacturing process and no output stock of finished goods (Basu 2003:69).

The features of Lean manufacturing according to Basu (2003:74) are:

- Integrated production from the supplier through the manufacturing process to the customer.
- Suppliers are chosen on the basis of reliability, delivery on time and to specification, rather than on price alone and are treated as members of the production team.
- Just-in-time delivery of materials from suppliers. This results in the elimination of raw materials in warehouses and buffer stock of materials between stages of production.
- Finished goods are delivered directly to the customer and no stock of finished goods is kept.

With Lean manufacturing the aim is to achieve a "just-in-time" system and there is therefore a strong link between these two concepts. JIT is an inventory strategy that strives to improve a business's return on investment by reducing in-process inventory (since inventory is seen as waste) and associated carrying costs. JIT is focused on getting the right things to the right place at the right time in the right quantity to achieve perfect work flow, while minimizing waste and being flexible ("Just In Time Manufacturing"). Consequently, JIT allows no room for errors in specification or for late delivery, thus the emphasis is on prevention of errors rather than detection of errors by inspection. This prevention is achieved by workers knowing the standards and applying self-testing, rather than relying on independent checkers (Basu 2003:77).

This way of working encourages organisations to eliminate inventory that does not compensate for manufacturing process problems, and to constantly improve those processes in order for them to require less inventory. It also reduces the habit of keeping stock to hide production problems. These problems can include backups at work centers, machine reliability, process variability, lack of flexibility of employees and equipment or inadequate capacity.

Meeting theses JIT objectives requires that materials arrive from dedicated suppliers on the factory floor at the right stage of production (just when required), and when the production is completed it is shipped directly to the customer. Scheduling of activities and resources has to be exact, communication with suppliers must be precise, suppliers have to be reliable and able to perform to exacting timetables, materials have to arrive on time and meet the specification, machines have to be maintained to ensure that there is no down time, operators cannot make mistakes, there is no allowance for scrap or rework and, finally, the finished product has to be delivered on time to the customers (Basu 2003:71).

Further, staff is encouraged to take responsibility for their activities and be proactive and to make suggestions for improvement of processes (more efficient use of time and resources) and enhancement of the value of the product provided to the customer. Teamwork, open communication and flexibility are part of the culture (Basu 2003:75) within a lean manufacturing company. Unlike Six Sigma, which relies on a top down, infrastructure-based deployment model, Lean is generally driven 'bottom up' by operational staff. Lean is also less concerned with methodology and tools and more with principles and approaches, hence it provides companies with a powerful means of empowering staff to change processes and culture in a relatively simple and common sense manner. It requires considerably less training, and hence is generally self-funding as an initiative from the start. It is however important to ensure an understanding of the Lean concept throughout an entire organisation. With Lean, companies are able to identify and implement process improvements within rapid timeframes (action plans of less than 8 weeks) as opposed to more time consuming Six Sigma projects (3 to 6 months).

Essentially, Lean manufacturing aims to provide speed and agility through elimination of the following seven areas of waste, also called the seven mudas (Basu 2003:8):

1. Excess production (no stockpiling of finished goods)
2. Waiting (no buffer stocks between processes, no idle time)
3. Conveyance or transportation (movement is reduced to a minimum)
4. Motion (elimination of unnecessary motion, adoption of ergonomic principles)
5. Process (improvement of inefficient processes)
6. Inventory (materials should arrive when required, go straight into production, and flow like water through the system to the end user)
7. Defects (the aim being zero defects)

According to Basu (2003:74), when looking at Lean for non-manufacturing operations (such as services), it means the elimination of any activity that does not add value to the service provided to the customer. To illustrate these activities in a service operation the example of an administrative service is used, and the wasteful activities are:

1. Excess production – preparing reports that are not acted upon
2. Waiting – processing monthly or in batches and not continuously
3. Transportation – fax machines and printers are at a distance from the workstation
4. Motion – steps and data entry
5. Process – signoffs
6. Inventory – transactions not processed, work waiting to be done
7. Defects – incorrect data entry, typing errors or misfiling

The limitations for the application of Lean principles to the service industry does not seem to be significant as it can fairly easily be applied to a service operation as demonstrated in the example above. Although this might be true, the application can vary greatly from one service type to another and the seven mudas can have different relevance when applied to different services.

Basu (2003:74) suggests that the principles of Lean are equally applicable to service industries. It requires an understanding of where value is being added and which activities is non-value adding. In a manufacturing environment, the suitability of each lean technique and the corresponding work steps depend on the characteristics of the firm's markets, production and equipment technology, skills and corporate culture. Service firms are not different in this aspect (Chase 2006:485).

According to a study by UK's McKinsey Production Centre the most important key to successful implementation of lean is adopting a holistic approach which "transforms not just the technical production system, but also the company's management system using a comprehensive management process."

2.4.4 Theory of Constraints (TOC)

The Theory of Constraints was developed by Eli Goldratt and has taken more than two decades to reach its current usage level in industry (Ricketts 2008:61). Theory of Constraints gets its name from the fact that all enterprises are constrained by something. A constraint limits what can be produced by, for example, a factory as a whole. Everything else is a nonconstraint. The key concept of TOC is that it does not matter how much a nonconstraint can produce, if the constraint cannot keep up. It is also important to realise that a constraint is not necessary the most expensive or highest profile resource. It can actually be a resource with relative insignificance in the hierarchy of an organisation.

Essentially, the Theory of Constraints is based on the principle that the goal of any economic enterprise is to make money, now and in the future, and that a system's constraints determine its capacity to make money (Srinivasan 2007:136).

Goldratt prescribed a five step focusing process to enable a process of ongoing improvement, specifically aimed at the manufacturing environment. The "Five Focusing Steps of Glodratt's TOC" (Chase 2006: 721) are:

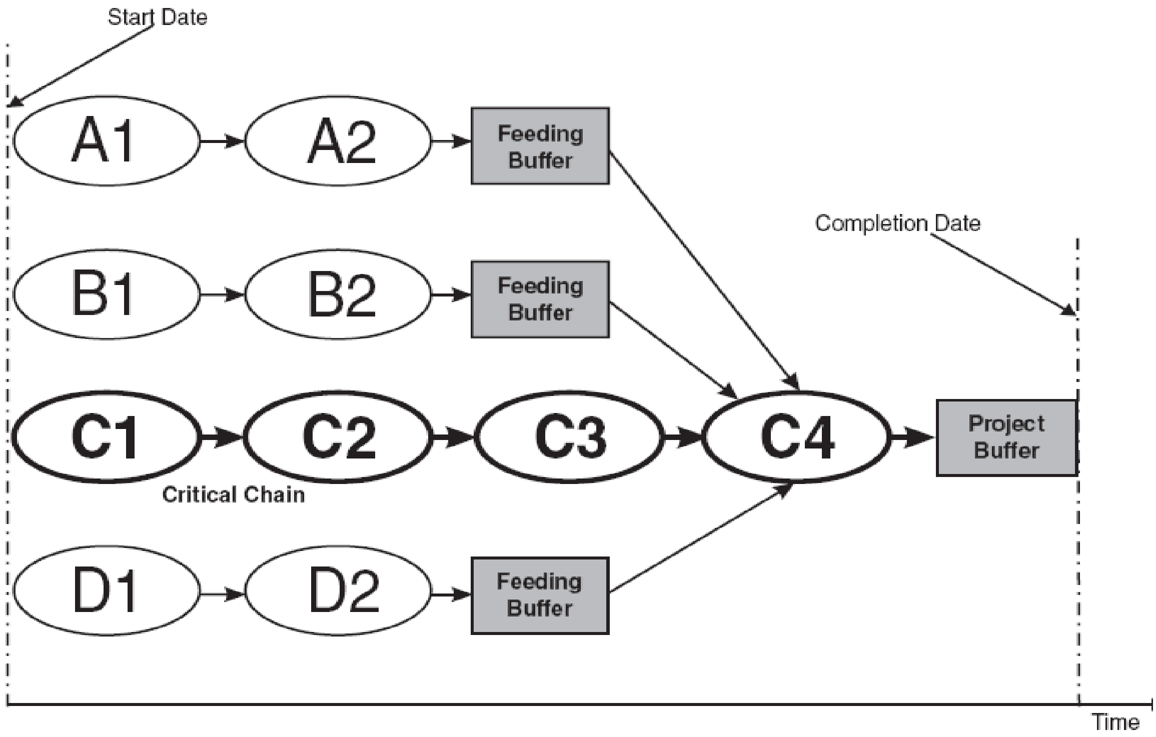
1. Identify the system constraints. (No improvement is possible unless the constraint or weakest link is found.)
2. Decide how to exploit the system constraints. (Make the constraints as effective as possible, utilizing it to its fullest extent.)

3. Subordinate everything else to that decision. (Align every other part of the system to support the constraints even if it reduces the efficiency of nonconstraint resources, or means cutting back production on the nonconstraints.)
4. Evaluate the system constraints. (If output is still inadequate, acquire more of this resource so it no longer is a constraint. Lifting the constraints performance is the only way to lift the performance of a company as a whole)
5. If, in the previous steps, the constraint problem has been solved, go back to Step 1. This is important as the foregoing steps might have caused the constraint to shift. This is a continuous process of improvement: identifying constraints, breaking them and then identifying the ones that result.)

It can thus be seen that constraints play a central role in the overall production of a company, in the sense that it limits the performance of an organisation.

Apart from the 5 step focussing process, Goldratt also introduced the Critical Chain methodology in 1997. The critical path, which is determined by a tool called PERT, is the single longest chain of linked events embedded in the overall process and is thus the major determinant of a project or process completion date. The Critical Chain methodology expands on the notion of the critical path and presents a means of identifying where buffers should be placed to prevent unplanned disruptions from delaying the completion of a project. Figure 11 presents a simple example that illustrates the Critical Chain methodology. This figure represents a project that has four sets of activities that must be completed before a synchronization operation, represented by C4 in the figure, can be completed (Srinivasan 2007:136).

Figure 11: The Critical Chain Concept (Srinivasan 2007:136)



The synchronization operation could be one of a variety of operations. For instance, in a manufacturing setting it could typically be an assembly operation. Further, historical data is analysed to obtain an estimate of the average time for each activity. These are used to compute the average time it takes each series of activities that must be completed before the assembly operation can begin. Suppose it is revealed that the series of activities with the longest average time is C1-C2-C3 (in the figure above). The latter is then called the critical chain and should be monitored the most closely, since any slippage of these items will cause slippage of the overall project or process. The activities along the critical chain, namely, C1, C2, C3, and C4 are termed critical activities. Activities that are not part of the critical chain are called not critical activities - they can slip some and not have the overall project slip, because their completion time is less than the completion of the critical chain.

Buffers

Continuing from the above explanation, the estimate for the project duration (lead time) can be obtained as the sum of the average activity times for the critical activities, plus a safety time, called the project buffer. This basically provides a buffer against any variation in the completion times of activities along the critical chain. The project buffer is based on the variance of the total activity time. An overall measure of this variance is obtained simply by adding the variance (square root of standard deviation) for each activity (Srinivasan 2007:136).

Another buffer used is termed a feeding buffer. This buffer is placed after every non-critical activity that feeds a critical activity, as illustrated in Figure 11. Feeding buffers are determined in a manner similar to the way the project buffer is calculated. It must be noted that the project- and feeding buffers are time buffers and not inventory buffers. Thus, variation is buffered by capacity, rather than inventory. It is important to ensure that the buffers are properly sized as to give the activity along the critical chain that requires inputs from non-critical chain activities a better chance of being able to start as soon as its predecessor task on the critical chain is completed. This leads to reduced average throughput time and also means that there will be less inventory tied up in the overall system of activities (Srinivasan 2007:137).

Drum-Buffer-Rope

Another tool used by TOC is the Drum-Buffer-Rope (DBR) system. The DBR is a pull-scheduling system that releases material based on a signal from the bottleneck. The principle is that orders are released into the production process such that it synchronizes with the production rate of the least capable resource in the process. This least capable resource is referred to as the capacity-constrained-resource (CCR).

If the CCR works at a rate that is less than the rate of output demanded by the customer, then it is the bottleneck. If not, the external demand rate, the market, is the bottleneck. In the DBR model, the production rate of the CCR is referred to as the drum, and the drum beat (production rate of the CCR) provides the pace for production in the system. The rope in DBR refers to the mechanism that releases work into the production process. The rope is essentially a communication device that ensures that raw material is not introduced onto the shop floor at a rate faster than the CCR can handle. If the CCR is not the bottleneck, then the rope ensures that the raw material is not introduced into the shop floor at a rate faster than the customer demand rate. Finally, to prevent the CCR from ever having to wait for work (becoming starved) if it becomes free, a time buffer is placed ahead of the CCR to ensure that jobs arrive at the CCR well in advance before they are scheduled for processing at the CCR. Another buffer, called the shipping buffer, protects the situation where the customer’s order might be delayed. The standard DBR model is presented in Figure 12. The standard DBR model requires specialized DBR software to implement it. When an organisation is not constrained by any internal resource an alternate technique known as the Simplified Drum-Buffer-Rope (S-DBR) model can be used. The drum in the S-DBR is based on firm orders. As orders come in, a quick check is made on the total load on the CCR. If the CCR is not too heavily loaded, the order is accepted and released onto the shop floor for processing. The only buffer maintained is the shipping buffer. The rope is no longer tied to the CCR schedule. Instead, the material release schedule is directly generated by firm orders received. The S-DBR can be viewed in Figure 13 (Srinivasan 2007:140,141).

Figure 12: The Traditional Drum-Buffer-Rope Model (Srinivasan 2007:140)

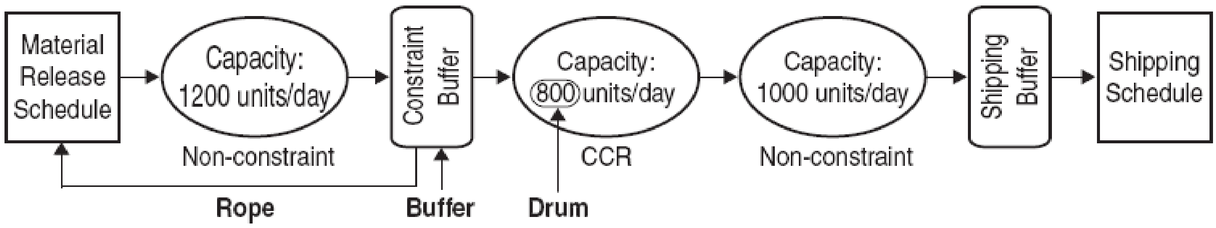
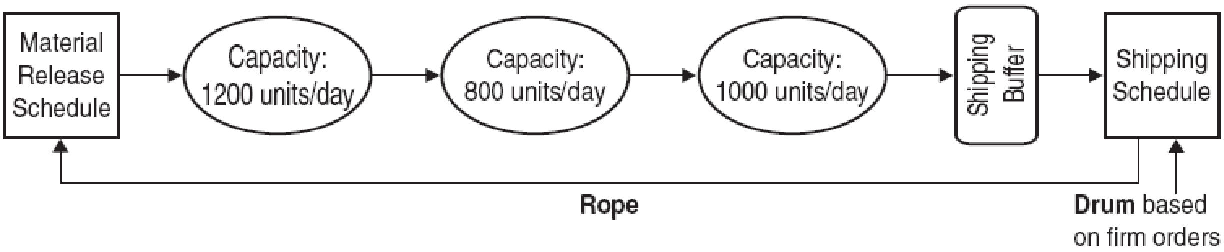


Figure 13: The Simplified Drum-Buffer-Rope Model (Srinivasan 2007:141)



The S-DBR model has some advantages. It does not require any specialized software which can be a significant benefit for organisation that might be unwilling or unable to invest in specialized DBR software. Another advantage of the S-DBR approach is that it does not require two buffers, but needs only one. Finally, the S-DBR approach is more focused on market demand and ties an organization to its customers more directly (Srinivasan 2007:141).

Despite their differences, manufacturing and service organisations all have constraints. Thus, if the standard TOC applications are so useful in the manufacturing industry, it is reasonable to wonder why they haven't seen wider adoption in services (Ricketts 2008:60).

According to Ricketts (2008:61) the reasons for this limitation in service application are:

- TOC is concerned with inventory, but what constitutes inventory in a service organisation is harder to pin down. This is because services are highly intangible and reusable while industrial (manufacturing) inventories are not.
- Services are less repeatable than industry and generally customised. Thus finding the constraint when service steps change often requires more than a little detective work.
- Service organisations that historically operated with an internal constraint more often face a market constraint as technology and competition, making alternatives ample and flexible.
- The degrees of freedom for services are generally more than for manufacturing. Resources with different skills and experiences can sometimes deliver services that are basically interchangeable. Thus, there might not be a fixed pattern for conducting a service and as a result, indentifying constraints might be difficult.

Although TOC has not been formalised in the way most theories are, it offers plenty of testable hypothesis and testimonials by managers and if the above limitations can be managed, reduced or eliminated the possibility of applying TOC principles in the service industry and being successful, is significant.

2.5 Conclusion to Literature

"Don't wait until the "Muse kisses you" and gives you a bright idea - go to work."

The pace of change is increasing, and businesses are continuously being disrupted by external factors (Basu 2003:1). Thus, innovation within organisations has become critical in order to stay afloat in the ever-changing and competitive market of today.
Further, steady incremental improvements are necessary to give an organization the sustained growth it needs.

The manufacturing improvement methodologies Six Sigma, Lean and TOC are about doing things significantly different in order to achieve enhanced performance levels within an organisation and can be seen as structured and systematic improvement methodologies, thus making improvement an integral part of organisational activities. While these methodologies create new dimensions of performance, it requires continuity, commitment and hard work, and is not an instant solution (Kiemele 2009).

Since the basic process of innovation as well as the mentioned methodologies has specific significance in the manufacturing industry, the challenge is consequently to adjust and revise the elements in order for it to be more easily applied to the service industry. By doing the latter, a service organisation can build an innovation and quality improvement program that will have a positive influence on service business performance in the form of improved efficiency, quality and speed, and ultimately increased customer satisfaction.

3. Conceptual Design

3.1 Approach

The approach that will be used to obtain a solution for the discussed problem will be done by using the concepts of the basic process of Innovation in addition to the Six Sigma, Lean Manufacturing and Theory of Constraints (TOC) methodologies. It will be attempted to extract the core ideas of these methodologies and marrying them to the service industry in such a way that a universal model can be assembled from these core ideas, one that can be applied to services of varying sizes and types.

3.2 Method

The method will involve selecting the most relevant concepts from the studied methodologies and adapting them to make sense within a service environment application. These concepts will then be grouped to from a universal model. The model will consist of 5 main sub models explaining Innovation, Continuous Improvement Preparation, Six Sigma, Lean and TOC respectively in terms of application in a service environment.

4. Universal Model

A universal model for service innovation and improvement can be created based on the literature review. This will consist of the different aspects of an innovation process as well as the three discussed improvement methodologies.

The model has two focal points namely:

- Innovation - designed to assist the initiation of new services

- Improvement - designed to assist improvement of current services

Consequently the model will be applicable and useful to new organisations, existing organisations with the need to initiate and provide a new service and also to existing organisations where there is a need for improvement of current service processes.

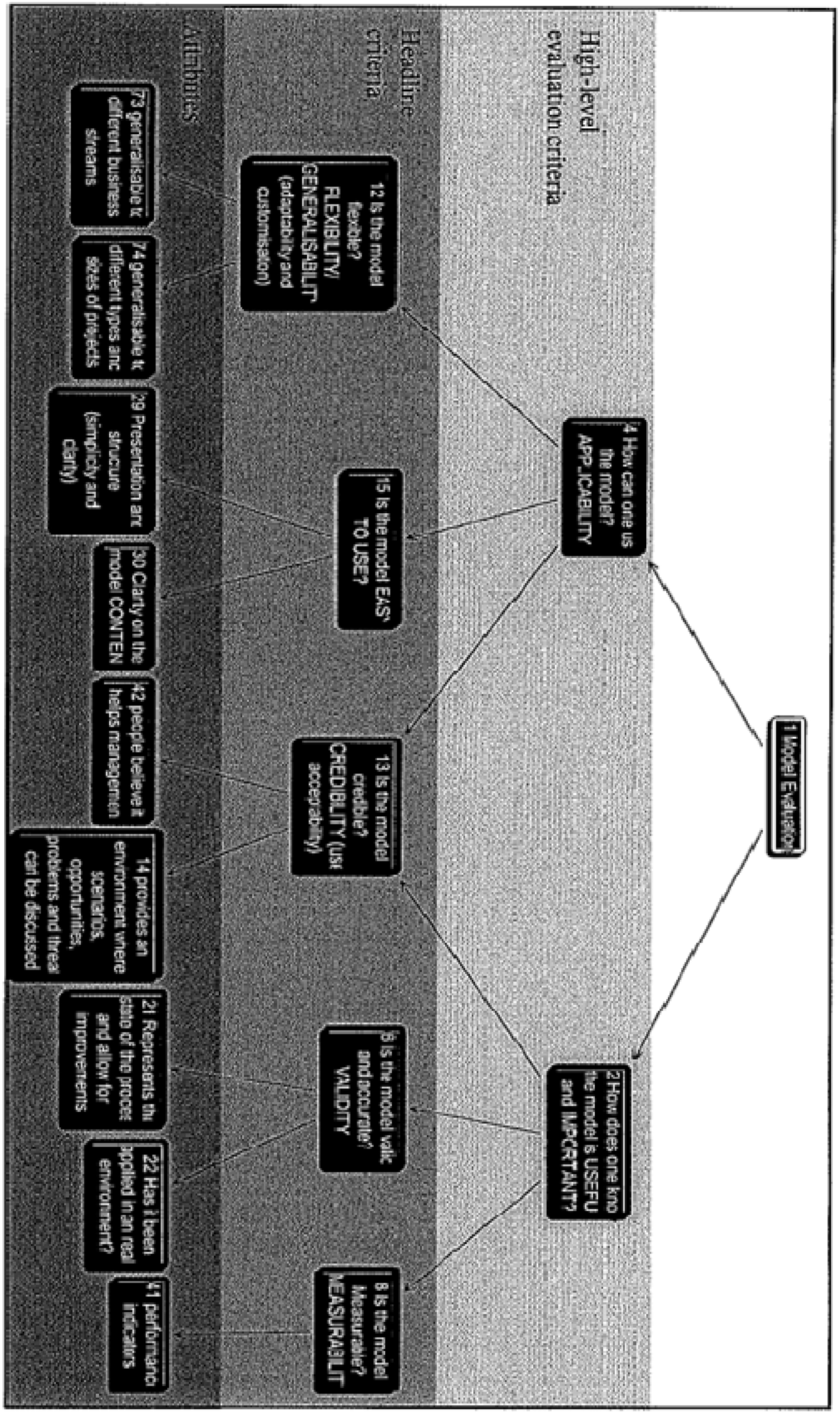
The model specifies universal sequential phases and steps to be followed as well as important elements along the way and thus basically provides a process of guidance.

This model aims to provide a holistic and systemic perspective on innovation and improvement within the service industry. It also strives to create consistency and predictable outcomes for service organisations by following the model. Kagioglou et al. states that a process model should be transparent and defined simply, and this is thus also a focus of the developed model.

According to Cooper et al. the following is important when creating a process model: "The knowledge content of a model should be clearly defined and have an obvious internal coherence, otherwise the model could be perceived as a bundle of loosely related practices. It can be assumed that when a process model lacks a clear definition of its objectives and of the improvement principles included, it will be hard to use." The latter was thus also considered during the design of the model.

Further, a framework by Cooper et al. was used as an overall guide to evaluate the model. This framework can be viewed in Figure 14.

Figure 14: Model Evaluation Framework



4.1 Innovation Sub Model Description

4.1.1 Introduction

Innovation, the successful development and exploitation of new ideas, is critical to ensure improved business performance in the highly competitive and changing markets of today. By employing innovation organisations can defend existing markets and secure new markets, thus making their competitors irrelevant while delivering superior value to their customers.

Innovation can be greatly enhanced with the use of a methodical process. Such a process needs to be carried out in regular intervals and should involve as many of an organisation's employees as possible. Since the core of the innovation process is formed by an organisation and its employees, it is important for an organisation to view innovation as valid work, thus allowing their employees to get involved in the process and thus creating an innovation climate. This sub model can be viewed in Appendix A.

4.1.2 Phases

4.1.2.1 Investigation/Opportunity targeting

In order to successfully develop and exploit new ideas, opportunities for new ideas have to be found in the first place.

Investigation and opportunity targeting involves deliberately searching for new opportunities or areas of potential. This might rise from existing problems, new customer needs, competition or previous unsuccessful ideas.

Problem analysis

Existing problems should be thoroughly analysed in order to discover any opportunity for a new and innovative idea, should it exist. It is important to look for such opportunities instead of only focussing on blaming the responsible party, since this culture of blame can easily lead to suppression of ideas. Senior employees should take ownership of problems from where innovation should move forward.

Recycle bin

The concept of the recycle bin involves examining past unsuccessful ideas by looking for new angles or opportunities (Lawton 2005). This also involves the notion that no idea should be considered as a failure. Ideas that are not useful right away should thus not be rejected.

In order to keep record of ideas, a recycle bin should be created. This should be accessible to everyone in the organisation in a manner that is user-friendly, forming a business resource available for investigation and opportunity targeting. The recycle bin might lead to connections between seemingly unrelated information, which might then give rise to a new idea or solution to a problem. Spontaneous innovation can thus result from someone connecting different ideas and identifying a new service. In addition, the recycle bin can also serve as a basis for determining the best sources of different types of ideas (Howe 2001).

Customer analysis

The satisfaction of certain customers is crucial to an organisation. It is thus important to identify those customers and to determine what will lead to their satisfaction, thus exploring the voice of the customer (VOC). This can take on the form of directly communicating with customers, establishing customer and employee partnerships or even shadowing customers (bringideast2themarket.blogspot.com). The latter is done in order to gather, refine, translate and prioritise customer needs, requirements and problems, while attempting to exactly understand customer perspectives. This leads to elimination of misinterpretation and misunderstanding and might give rise to new opportunities, such as a new service to resolve customer shortcomings ("Our services – Innovation") ("How do I: Develop a Product Launch Strategy?").

Competitor analysis

While it is important for an organisation not to become preoccupied with tracking the actions of its competitors, it is also not wise to completely ignore its competition. Instead, a balanced competitive analysis should be done ("Strategy – Competitor analysis"). Competitive analysis differs between industries and organisations, but is basically done to determine who an organisation's competitors are, what the similarities between the organisation's services and its competitors' services are, what its competitors are doing differently, what the strengths and weaknesses of its own services and its competitors' services are and how the organisation is uniquely suited to compete with their competitors ("Competitive analysis").

All of the above ensures that an organisation stays in touch with its competitors, while it also stimulates a thinking process of improvement which might easily lead to identifying new opportunities or angles for competing with competitors.

4.1.2.2 Idea Generation

When considering idea generation, it is again important to ensure that it is open to every employee and not restricted to certain areas or levels of management. Idea generation requires knowledge of the organisation's processes and practices, but this should not impose constraints to the formulation of new ideas. Employees should thus be given the freedom to explore and seek new ideas.

Structured brainstorming

Although brainstorming is well-known and widely used, it remains a powerful technique for generating new ideas. Brainstorming sessions should be held on a regular basis. During these sessions an atmosphere of freedom (to give ideas and opinions) should be created, and all ideas should be taken realistically seriously (Worswick 2005). It is therefore important for participants to delay their judgement about any of the generated ideas until it has been fully explored (Narducci 2002).

Brainstorming sessions should be limited to fifteen minutes, as these sessions tend to run out of steam rather quickly. It should also involve only a small group of individuals to ensure that the session is manageable (Howe 2001).

Research and scanning

The concept of research and scanning involves systematically and constantly monitoring internal and external environments as to keep track of evolving markets, technologies, trends or any other changes that might give rise to new opportunities ("Our services – Innovation").

Slice and dice

The principle idea behind this concept is that original ideas can result from modifying only a single attribute or feature of an item under discussion or a past unsuccessful idea ("Our services – Innovation").

Internal website (collaborative ideas database)

An internal website (intranet) can be created and should be accessible by all employees. The aim of such a website is to ensure that all employees are encouraged to participate in idea generation and also have sufficient stimulation to want to continue participation. The pages of the website should thus be visually attractive, exiting and should grab attention. It is further important that the website should lead a visitor into a process of decision making, while also encouraging remarks. Such a website can give employees the options of providing a new idea, viewing existing ideas, developing existing ideas or linking ideas together, and can also be used to inform employees of the current progress of ideas (Howe 2001).

4.1.2.3 Initial Screening and Filtering

In order to effectively capture ideas, a filtering process should exist whereby poor ideas can be eliminated from more valuable ideas or ideas with more potential (Worswick 2005). It is important to consider the core concept of a new idea, determine whether it is rich enough to be enhanced by interactive discussion and ascertain whether it is actually translatable to a practical service (Lawton 2005).

Prioritization

Prioritization can be a helpful element during the initial screening and filtering process. A relatively simple way of prioritizing is to compare each generated idea with all other generated ideas individually and then determining which of the two is most important or feasible. It is important to consider all factors that might have an influence on the implementation of an idea, while also considering value against effort that will be consumed. This will help an organisation to identify the ideas which will provide the greatest rewards, and avoid the ideas which will soak up time and resources for little eventual reward.

During the prioritization process every participant should be allowed to give fair input into the process, such that consensus can be reached. Prioritization of ideas should thus be fair and should endeavour buy-in from all participants, thus leading to robust group decisions and a concise list of prioritized ideas ("Prioritization").

Voting

This concept involves the simple process of individuals voting in favour of certain generated ideas. Voting might be necessary especially if consensus could not be achieved during the process of prioritization.

High-level screening and elimination

This concept involves considering whether a certain idea is suitable to pass on to the next stage of the innovation process. The availability of suitable technology and adequate resources (such as labour and finances) as well as the practicality of the generated ideas should be considered. The result of high-level screening and elimination is thus a few ideas that have been successful up to this point. These ideas can now be referred to as concepts.

4.1.2.4 Concept Evaluation

This involves a more detailed and in-depth evaluation process than the initial screening and filtering process. At this stage the majority of ideas should have been eliminated.

Feasibility

The feasibility of each concept should be determined. Different concept feasibility studies exist which mainly involve considering factors such as funding and resource availability, technology availability, technical viability, employee training requirements, duration of development, development costs, market potential, expansion potential and any other constraints ("Concept feasibility studies") ("Business Concept Feasibility Assessment").

Risk analysis

The risks involved in the introduction of a new concept (new service) should be assessed since this could impact most business matters. In order to do this a risk analysis should be conducted for each concept. This entails identifying all potential risks involved in developing and implementing a concept. These risks can be of various natures such as legal, financial, operational, procedural, market, competitive, managerial, technical, natural (environmental) and even political. The effort (in terms of cost and time amongst others) that would be required to eliminate or sufficiently reduce (mitigate) the identified risks should also be considered.

Organisational support

While it is crucial to have buy-in from the necessary people, such as the CEO of an organisation, it is also important to have support towards a concept from an organisation as a whole. Further, the necessary internal support structures should also be in place.

4.1.2.5 Concept Selection

Final selection

Based on the above studies and evaluations conducted, a final concept (winning concept) should be selected.

4.1.2.6 Concept Definition

Once the final concept has been chosen, it should be defined in a detailed manner.

Elaboration

Concept elaboration can be seen as a exhaustive explanation of all elements regarding the chosen concept, thus improving the contents and structure of the concept, while also clarifying the more complex aspects of the concept.

Refinement

Refinement basically involves getting the concept into shape for practical, efficient and effective deployment.

Documentation

Documentation involves organising every piece of information pertaining to the concept in a systematic manner. Every aspect of the concept should be recorded either electronically or manually and should be readily available upon request, unless safety regulations apply, in which case the information and documentation should be properly protected.

4.1.2.7 Planning

Roadmapping

A planning process can be greatly improved by using the technique of roadmapping. A roadmap is a visualization of the future, integrating all relevant business aspects. A good roadmap shows all important and relevant issues, and is documented and presented in several layers of details. In the case where planning regarding a new service concept (as part of the innovation process) is done, the roadmapping technique can assist in ensuring that all aspects of development and implementation remains on track (Muller 2008).

4.1.2.8 Prototype Development

It is usually necessary to create a prototype before implementation.

Explore

Developing a prototype provides an organisation with the opportunity to explore with the elements and characteristics of the designed service that will be further developed and eventually implemented.

Construct

In a service environment, a prototype is a basic working model of the designed service, usually created for demonstration purposes. This ensures that the concept can in actual fact be translated into a service and it also provides an opportunity to locate and resolve problems and errors ("Cognition: Innovation :Process.").

4.1.2.9 Testing and Analysis

Prototype trials

After a prototype is created/constructed, prototype trials should be conducted where the service is tested. After each trial the results should be analysed to determine whether the service performs as expected. If this is not the case, the necessary alterations should be made to the prototype, after which another prototype trial will commence. These trials will continue until an acceptable prototype is achieved.

Ultimately, a final detailed evaluation should be carried out in the light of experience and knowledge gained from the prototype trials. This evaluation should also consider feedbacks from different sources, all to ensure that the organisation can continue and commit to implementation ("Cognition: Innovation :Process.").

Internal feedback

Retrieving feedback from employees within the company can be very valuable especially since they are familiar with the organisations practices and processes. This can be done by a formal process or by using an internal website as mentioned before.

Customer interviews

It is critical to understand the opinion of the users of a service before the service is launched since even a technically superb service can fail if it does not deliver what the customer/user wants. It is thus important to obtain the opinion of potential customers on how well the service meets their requirements. This can be done by involving customers in the prototype trials and/or the final evaluation process.

4.1.2.10 Market Preparation

The importance of the market and of marketing should not be underestimated. Prior to service launch the market should thus be thoroughly reviewed, while the service should be carefully prepared for market launch.

Service refinement

Every outstanding fine-tuning activity should be done to ensure that the service is fully prepared for market launch can be delivered in a sophisticated/elegant manner.

As part of service refinement all regulations and taxations should be double checked. This is because local, national or international regulations (such as building, employment or environmental regulations) as well as general taxation can cause services to fail. It is consequently important to ensure that all regulations and taxations throughout the potential market area, and preferably beyond, are investigated and adhered to prior to market launch ("Cognition: Innovation :Process.").

Marketing

It is important to exploit marketing techniques in such a way as to promote the service, while making potential customers aware of the service, informing them about the service, persuading them to purchase it and constantly reminding them of its existence ("Cognition: Innovation :Process").

4.1.2.11 Market Launch

At this stage an organisation should have a service that is market ready.

Release

Releasing the new service can be the most testing. This is when an organisation should commit to marketing investment and relinquish control to the end user, who will decide between success and failure ("How do I: Develop a Product Launch Strategy?").

Penetration

Penetration involves how the market reacts toward an organisation's newly released service and how the organisation in turn manages the service during its life-cycle ("How do I: Develop a Product Launch Strategy?").

4.1.2.12 Management

Management of a service after its release and penetration is crucial.

Support

Support infrastructure should be in place and managed to ensure that the service can be provided on a constant basis without unnecessary problems or delays.

Performance reviewing

Regular performance reviews should be done to ensure that the service provided remains at the same standard or quality level and that performance does not weaken.

Growth evaluation

Increasing market share is beneficial for any organisation. Opportunities for growth should thus be sought and evaluated on a regular basis.

Retirement evaluation

It is further important for an organisation to be aware of market changes and the possibility of retiring its service if it should become necessary. Keeping and maintaining a fruitless service, could be more harmful to an organisation than retiring and subtract it from the market.

4.1.2.13 Continuous Improvement

It order to remain competitive in the market of today, continuous improvement is indispensable. Continuous improvement can be done by applying the following methodologies: Six Sigma, Lean and Theory of Constraints. As discussed previously, these methodologies were created specifically for application within the manufacturing industry. The possibility of application within a service environment does however exist.

Six Sigma

A model attempting service applicability was created and will be described.

Lean

A model attempting service applicability was created and will be described.

Theory of Constraints (TOC)

A model attempting service applicability was created and will be described.

4.1.3 Innovation Gates

At designated milestones in the innovation process, it should be determined on the basis of certain criteria if a concept should progress to the next phase of the innovation process. This involves decisions such as investment increases, re-alignment or rejection of the concept.

4.2 Continuous Improvement Preparation Sub Model Description

4.2.1 Introduction

Before implementing any of the improvement methodologies, namely Six Sigma, Lean and Theory of Constraints, an organisation should properly prepare itself in order for these methodologies to be implemented correctly the first time. This sub model can be viewed in Appendix B.

4.2.2 Change Environment

The success or failure of an organisation's improvement methodology implementation centres on its employees' willingness to embrace change. It is thus important to apply change management to ensure understanding and acceptance of change at every level of an organisation and thus create an environment that embraces change.

Strategy alignment

An organisation's strategies should be aligned to match the strategies involved in implementing an improvement methodology. Important factors are vision, mission, identification of core values and strategic planning.

It is also important to have a strategic framework in place for the future, and aligning this framework with external frameworks for example technology and market behaviour (Lawton 2005).

Leadership alignment

Leadership should be aligned prior to implementation of an improvement methodology to ensure process improvement become a companywide initiative through empowered and motivated employees. Management should be prepared to be task focussed while creating an environment for others to succeed (McKay 2005).

It is further important for management to obtain the essential skills to increase their leadership capabilities. This will result in an overall organisational improvement of communication, cooperation and commitment, thus pursuing organisational goals while leading the process of implementing improvement methodologies.

The leaders of an organisation should thus be prepared and equipped to achieve the following:

- Change awareness
- Problem solving
- Conflict management
- Group dynamics and team interactions
- Resource management
- Efficient delegation and empowerment
- Decision making
- Constructive communication

Training

Training efforts should be done and should involve entire teams, supervisors, managers and even executives of an organisation. Such training should provide the necessary knowledge, skills and tools to implement and practically apply an improvement methodology. Employees should also be trained on the benefits and use of the improvement methodologies as this will increase their diligence and motivation to succeed. (“Training Curriculum Development”).

After implementation of an improvement methodology, a training cycle should be sustained to ensure effective continuous improvement.

Cultural Readiness

Cultural readiness is key to successful implementation of an improvement methodology. An organisation should create a culture that embraces change, has a team focus and strives towards effective communication and interaction between members in order to harmoniously achieve all goals (“Bring ideas to the market”).

Cultural readiness involves:

- Overcoming resistance to change
- Communication skills
- Providing employee support
- Understanding the dynamics of change
- A focus on prevention rather than detection
- Teamwork and joint efforts

4.3 Six Sigma Sub Model Description

4.3.1 Introduction

The Six Sigma methodology primarily focuses on process variation reduction by identifying the root causes of variation, thus leading to improved quality and reduced defects. Additionally, the methodology is characterised as a team oriented, well-structured, data-driven process that identifies improvement opportunities, analyses current performance, determines capability, identifies productive solutions and finally assures that improvements are implemented and continually controlled and managed.

The main focus of this model is on the DMAIC process. DMAIC is basically a process of constantly searching for problems that might exist. In a manufacturing environment DMAIC is applied in a rigorous and painstakingly precise manner using statistical techniques and detailed measurements. In the case of application in a service environment, it can however not be done in such an exhaustive manner, since services are intangible and service execution cannot be measured precisely. The main concepts of the DMAIC process is thus kept, but it is used in a more accommodating and flexible way to be suitable for a service environment.

The following model description thus aims to provide guidance in applying Six Sigma within a service environment and can be viewed in Appendix C.

4.3.2 Phases

4.3.2.1 Define

The first step is to define what needs to be done, whether a problem exists or general improvements should to be made. This concept involves analyzing the current issues and their impact on an organisation to gain an understanding of where the organisation should be headed. It is important to properly conduct this phase, as it leads to proper course of action further on.

Define improvement goals

This involves finding areas where changes are needed and then defining these changes in terms of improvement goals, while considering the overall strategic goals of an organisation.

Define customers and requirements

It is critical to identify the customers of an organisation and their needs and requirements. This entails developing methods for closely communicating with customers and thus obtaining and evaluating their inputs.

4.3.2.2 Measure

This phase basically involves viewing the current state of the processes within an organisation. To gain an understanding of the current state, a value stream map (VSM) can be employed to allow a high level look at how all processes relates to an organisation. Further, a detailed process map can also be created to outline how processes are operated and to identify potential areas that need improvement. Measuring the current state will also aid in evaluating and revising the defined improvement goals (Diloia 2009).

Develop data collection/measurement process

Since services are difficult to measure, a proper process of measuring processes and collecting data should be developed. This will greatly depend upon the type of services offered by an organisation. Such a process or system should be validated to ensure that the data that will be collected will be valid, useful and understandable, since it is very difficult to identify potential areas for improvement, implement improvements and then proving those improvements, when working with unsound information/data.

Collect data

This involves collecting data under controlled conditions according to the developed data collection/measuring process. Such data involves inputs of processes that might have an influence on certain outputs. The latter should be properly documented for later reference. All data collected should allow a clear understanding of process performance in order to further accurately detect variation in processes.

Evaluate current performance

This concept involves evaluating and analysing the collected data in order to determine how processes are currently performing in terms of certain elements of concern, such as process variation.

Estimate process capability

All data and information that have been gathered thus far should be employed to determine the capability of processes, thus identifying any performance gaps between the current performance and true capabilities of processes.

Identify potential areas for improvements

After the above steps have been completed, potential areas for improvements should be identified by thoroughly examining all documented information. It is important to focus on areas where vital improvements are needed or can be made rather than putting effort into identifying areas where only trivial improvements can be made.

4.3.2.3 Analyse

During the analysis phase, the data collected is systematically analysed to indentify inputs that influence key process outputs. These inputs can be called critical inputs as it affect key process outputs. The significance of the influence of these inputs on the key outputs, as well as on other inputs should further be determined (Diloia 2009).

Identify sources of variation

This step involves determining whether any variation in process outputs exists, after which the data should be analysed to determine where the variation originated from. In a service environment customer inputs will be very valuable in determining whether variation exists.

Determine root causes

During this step the reasons behind the occurrence of variation should be determined, i.e. determining why variation exists and how it is created (Diloia 2009).

Determine improvement opportunities

This step involves bringing the previously identified potential areas for improvements under view, while considering all gathered information regarding variation and its sources and causes. The latter should then be used to determine improvement opportunities.

4.3.2.4 Improve

The end result of this phase can be considered as a reward for the work conducted during the previous phases. The identified improvement opportunities should be developed to formal improvements, which will finally be implemented.

Develop potential improvements

The data from the analysis phase should be used to lead an organisation to practical improvements (solutions). This might involve applying creativity in order to develop effective improvements. This step also includes considerations in terms of available infrastructure and resources.

Experiment

This step basically involves conducting pilot runs of the potential improvements. Pilot runs allow an organisation to view the impact of developed improvements in a controlled environment. It also allows experimentation to be done and changes or adjustments to be made, if needed. The latter might occur many times and should not lead to discouragement.

Assess potential improvements

This involves determining whether the results from the pilot runs match the improvement goals established earlier during the define phase.

Establish management commitment

It is important to establish management commitment towards the improvement/s before implementation commences. Although management commitment is crucial, it is further also important to make an effort to obtain commitment from all other employees, as to ensure the same vision amongst everyone.

Implement improvements

Although there might be a number of pilot runs as mentioned before, it is important not to get caught up in al loop of continually trying to achieve better results during the pilot runs. If the improvement/s works well during a pilot run, it should be implemented completely in order to close the improvement phase (Diloia 2009).

4.3.2.5 Control

This phase involves continually monitoring the process performance resulting from the implemented improvement/s. The steps involved in this phase are critical to Six Sigma success within an organisation.

Develop standards and procedures

Standards and procedures concerning the newly implemented improvement/s should be developed and thoroughly documented. This is needed for the long term success of the improved processes. This also involves familiarising all employees with the changes that have been made, while also explaining why they have been made (Diloia 2009).

Perform before and after analysis

The gains and benefits realised from employing Six Sigma and thus implementing process improvements, should be determined by performing a before and after analysis. This also includes any cultural improvements or valuable lessons learned as a result of employing Six Sigma. This is done to assess the effectiveness of Six Sigma within a specific organisation within the service industry (Diloia 2009).

Monitor performance progress over time

A framework for continuous process improvement should be developed, along with a system of indicators for monitoring progress and success. In a service environment simple metrics can be used for such monitoring purposes. Further, short- and long-term analysis needs to be completed at regular intervals to aid in sustaining benefits and gains, while also evaluating any need for further improvements or opportunities of integrating the improvements to other areas of an organisation (Diloia 2009).

Make needed adjustments

If after a period of time adjustments are needed, it should be made in order to maintain the effectiveness of the implemented improvements.

Institutionalize Six Sigma

In order to sustain and institutionalise the Six Sigma principles and concepts an organisation-wide vision and culture of improvement should be established ("What is Six Sigma?").

4.4 Lean Sub Model Description

4.4.1 Introduction

The Lean principle mainly focuses on elimination of waste (non-value adding activities) in processes. Thus by optimizing employees, resources, equipment, materials, space and even energy Lean implementation leads to improved speed, productivity, efficiency and on-time delivery. In short Lean aims to do more with less, while constantly moving closer to delivering exactly what is required by customers ("Why every government agency should embrace the lean process") ("Lean").

The main phases of this model are based on the Six Sigma DMAIC model. It is however concerned with the principle of Lean thinking.

The following model description aims to provide guidance in applying Lean thinking within a service environment and can be viewed in Appendix D.

4.4.2 Phases

4.4.2.1 Define

Identify customers

Since customer satisfaction is crucial to any service organisation, a key element of implementing the Lean methodology in a service environment is knowing who the organisation's customers are.

Define value

Value in this instance refers to value as specified/defined by the customer. In other words, it is what the customer views as 'value'. In order to define value in this sense it is important to thoroughly understand customer needs and requirements in terms of the service being provided. This is referred to as the voice of the customer (VOC).

It is thus vital to consider value as defined by the customer and not by the organisation. This is especially true since the value of a service as seen by the customer and the organisation respectively, might differ completely, and since the customer is the end user, services should be designed with customer value parameters in mind ("Learning about Lean – What is Value anyway?").

Further, a good clarification of value is presented by Slack (1999), namely "Value is a measurement of the worth of a specific product or service by a customer, and is a function of the product or service's usefulness in satisfying a customer need, the relative importance of the need being satisfied, and the exchange cost to the customer."

4.4.2.2 Identify

Select key service processes

Key service processes should be selected in accordance with the defined value. Thus, an organisation should determine which processes mainly contribute to the value as defined and then choose those as the processes upon which the core focus should be.

4.4.2.3 Analyse

Map and analyse the value stream

The value stream of the identified key processes should be mapped. This is method of visually indicating how all the pieces of the value stream work together towards the current state of performance. This value stream map should then be analysed to identify the 7 wastes involved in the processes, as will be discussed below, after which possible improvements should be identified. The latter then makes it possible to develop a 'future state' map using the mentioned Lean principles. A value stream map also provides an understanding of how individual processes impacts other processes ("Your Roadmap To Success").

Identify where the 7 wastes exist

Similar to manufacturing a product, providing a service involves a series of processes and steps. At each step value can either be added or not. Any activity that does not add value is waste.

Waste can be divided into two categories ("Waste and Value: Basic Lean Concepts") namely:

- Business Value Added (BVA)
  These are activities that do not add value to the service provided to the customer but are non-negotiable. These activities are required to operate the business, such as administrative functions.

- Non-Value Added (NVA)
  These are activities that are not required by the business and do not add value to the service provided to the customer. These activities are referred to as the 7 wastes.

These wastes can be illustrated in terms of a service environment through the following example of an administrative service where the wasteful activities are as follows:

1. Excess production – preparing reports that are not acted upon
2. Waiting – processing monthly or in batches and not continuously

3. Transportation – fax machines and printers are at a distance from the workstation
4. Motion – steps and data entry
5. Process – signoffs
6. Inventory – transactions not processed, work waiting to be done
7. Defects – incorrect data entry, typing errors or misfiling

In addition, improper use of talent can also be considered as a waste. Thus employing certain professionals to perform activities that can be performed by less skilled people can be seen as a waste ("Why every government agency should embrace the lean process").
All activities should thus be closely observed in order to identify waste, specifically of the non-value adding type.

4.4.2.4 Improve

The Lean principle has three main building blocks (means of improvement), as discussed below, which should be practised in harmony in order to improve the processes involved in providing the service.

Improve flow by eliminating waste (non-value adding activities)

The Lean principle aims to improve flow and streamline all activities. As mentioned, waste should be eliminated. However, all waste might not be avoidable and should consequently be minimised or reduced on a continuous basis. This will increase the ratio of value-added to non-value added activities within an organisation's processes and aid in the process of moving towards ideal working conditions ("Why every government agency should embrace the lean process").

Good Housekeeping

The Lean principle also involves achieving and maintaining order and discipline in an organisation. The following five steps of 'good housekeeping' should thus be employed:

- Seiri (organization)
- Seiton (neatness)
- Seiso (cleaning)
- Seiketsu (standardisation)

- Shitsuke (discipline)

Standardisation

It is important to have an agreement on standards. These standards should be maintained and improved on a continuous basis.

4.4.2.5 Manage

Aggressively remove waste as it occurs

Removing waste should be seen as an ongoing process of improvement and should be done on a continuous basis in order to ensure that an organisation's Lean process is sustained.

Pursue perfection

Since the Lean principle involves moving towards perfection it should be pursued on a daily basis, by internalising the Lean principle into daily activities. It should also be understood by all employees that Lean is a never ending philosophy. Further, management should be involved and supportive and should create an open communication framework. In addition, the service provided should be improved when necessary as a result of customer need/requirement changes.

4.5 Theory of Constraints (TOC) Sub Model Description

4.5.1 Introduction

The Theory of Constraints, developed by Eli Goldratt, focuses on the notion of eliminating or reducing constraints within an organisation's processes, since constraints limit the capacity and capability of processes, thus limiting the overall performance of an organisation.

This part of the model is focussed on the five focussing steps of Eli Goldratt's Theory of Constraints. The application of TOC within a service environment can provide some unique challenges, especially since human involvement can easily create constraints, while service buffers can also not be created.

The following model description aims to provide guidance in applying the Theory of Constraints within a service environment and can be viewed in Appendix E.

4.5.2 Phases

4.5.2.1 Identify constraints

This phase is based on the reality that a constraint or weakest link should found in order to make process improvements possible.

Identifying constraints in a service environment can be difficult. This is because services are less repeatable than manufacturing processes and also generally involves customisation. Thus, finding service process constraints while service steps change often will require thorough investigation and commitment from the organisation. A good starting point might be to focus on identifying the most significant constraints within the service processes.

4.5.2.2 Decide how to exploit the constraints

After constraints have been identified they should be utilized in such a way as to gain advantage from them. The constraints should thus be made as effective as possible.

This can be done by either creatively using the constraints as part of the processes (thus indirectly eliminating it), or by improving or replacing it (thus directly eliminating it).

4.5.2.3 Subordinate everything else to the previous decision

During this phase every other part of the system of processes should be aligned to support the way in which the constraints are being exploited. Since the constraints are very critical, this phase of subordination should be done even if it reduces the efficiency of nonconstraints.

4.5.2.4 Evaluate the constraints

Lifting the performance of constraints is the only way to lift the performance of an organisation as a whole. Thus, these constraints should be evaluated to ensure that it no longer has a significant effect on the performance of processes and systems within an organisation. If the constraints are still creating problems, the organisation should further endeavour to eliminate it.

4.5.2.5 If the constraint problem has been solved, go back to the start

The concept of continuous improvement becomes visible in this phase. If an organisation's current constraint problems have been solved, the process should start again, thus creating a continuous loop of improvement: identifying constraints, breaking them and then identifying new constraints that might have developed as a result of breaking the constraints that have been under view.

5. Conclusion

The possibility of applying innovation and the discussed manufacturing process improvement methodologies to a service environment exists. The model created aims to add value to the meagre existing literature on innovation and process improvement within the service industry and should only be used as a guideline to improve on the subject matter.

6. References

Books

BASU, R. & WRIGHT, J.N. 2003. *Quality Beyond Six Sigma*. Burlington: Butterworth-Heinemann.

CHASE, R.B., JACOBS, F.R. & AQUILANO, N.J. 2006. *Operations Management for Competitive Advantage with Global Cases Eleventh Edition*. New York: McGraw-Hill/Irwin.

GITLOW, H.S., OPPENHEIM, A.J., OPPENHEIM, R. & LEVINE, M.D. 2005. *Quality Management Third Edition*. New York: McGraw-Hill/Irwin.

RICKETTS, J.A. 2008. *Reaching the Goal*. United States of America: Pearson plc.

STEBBING, L. 1990. *Quality Management in the Service Industry*. London: Ellis Horwood.

Journals

CHAKRABARTY, A. & TAN, K.C. 2007. The current state of six sigma application in services. *Managing Service Quality*, 2007, vol.17, no.2, p.194-208.

CHAKRABARTY, A. & TAN, K.C. 2006. Applying Six-Sigma in the Service Industry. p.728-732.

DEDHIA, N.S. 2005. Six Sigma Basics. *Total Quality Management & Business Excellence*, 2005, vol.16, no.5, p.567-574.

HENSLEY, R.L. & DOBIE, K. 2005. Assessing readiness for six sigma in a service setting. *Managing Service Quality,* 2005, vol.15, no.1, p.82-101.

KNIGHT, KE. 1967. A Descriptive Model of the Intra-Firm Innovation Process. *The Journal of Business, Oct 1967, vol.40, no.4, p.478-496.*

MULLER, G. Roadmapping. *Embedded Systems Institute.* 2008. Version 1.0. p. 1-17.

PIRES, C.P., SARKAR, S. & CARVALHO, L. 2008. Innovation in services - how different from manufacturing? *The Service Industries Journal*, December 2008, vol.28, no.10, p.1339–1356.

RöNNBäCK, A. & WITELL, L. 2008. A review of empirical investigations comparing quality initiatives in manufacturing and service organisations. *Managing Service Quality*, May 2008, vol.18, no.6, p.577-593.

SAWATANI, Y. 2007. Research in Service Ecosystems. p.2763-2768.

SRINIVASAN, M., JONES, D. & MILLER, A. 2007. Applying Theory of Constraints Principles and Lean thinking at the Marine Corps Maintenance Center. *Defence Acquisition Review Journal*. p.134-145.

TIEN, J.M. 2008. Services: A System's Perspective. *IEEE Systems Journal,* March 2008, vol.2, no.1, p.146-157.

WANG, H. 2008. A Review of Six Sigma Approach: Methodology, Implementation and Future Research. p.1-4.

Websites with Authors

Beacham, J. "60 Minute Guide to Innovation - Turning Ideas into Profit." 2006 http://www.dius.gov.uk (10 Aug. 2009).

Cooper, R., Kagioglou, M., Sexton, M. & Tzortzopoulos, P. "Evaluation of Product Development Process Models Focusing on their Implementation." http://www.iglc2004.dk/_root/media/13095_095-tzortzopoulos-sexton-kagioglou-final.pdf (11 Aug. 2009).

Diloia, S. 2009. "Understanding the phases of Six Sigma" http://www.insyte-consulting.com/Home/Resources (15 Sept. 2009).

Dixon, P. "Innovation: The Big Picture." Dimension Data. 2004 http://www.dimensiondata.com (6 Aug. 2009).

Donovan, R.M." Six Sigma Approach to Quality Manufacturing" http://www.rmdonovan.com (12 Aug. 2009).

Hannon, V., Jackson, D. & Mackay, T. 2009. "Next Practice Innovation: An Applied Research Model for 21st Century Reform." http://www.innovation-unit.co.uk/images/stories/iu_aera_presentation_2009.pdf (9 Aug. 2009).

Howe, L.D. "Innovation for Organisations." 2001. http://www.innovationgame.com/invgame/igpaper.htm (26 Sept 2009).

Kollengode, A. 2009. "The Troubled Healthcare Industry and Six Sigma." http://www.sixsigmaiq.com (8 Aug. 2009).

Kotelnikov, V. "Business Innovation." *Ten3 Business e-Coach.* 2001. http://www.businessinnovation.com (5 Aug. 2009).

Lawton, M., McKay, N. & Worswick, N. 2005. "Cognition: Innovation :Process." http://www.akri.org/cognition/innoproc.htm (30 Sept. 2009).

Narducci, J. 2002. "Who Develops Innovative Ideas? Everybody!" http://www.cornerstonecubed.com/PDFFiles/Ideas.PDF (21 Sept. 2009).

Olofsson, O. "Six Sigma Principles." 2009. http://wcm.nu (10 Aug. 2009).

Websites without Authors

"Bring ideas to the market" http://bringideas2market.blogspot.com (22 Sept 2009).

"Chief Innovation Officer (CIO) Seminar." 2009. http://www.bmgi.eu/cio (15 Aug. 2009).

"Competitive analysis" http://managementhelp.org/mrktng/cmpetitr/cmpetitr.htm (21 Sept. 2009).

"Customer Needs Analysis Technique" http://www.gantthead.com/process/popup.cfm?ID=23404 (22 Sept 2009).

“Concept feasibility studies”
http://www.msctech.com/concept_feasibility.htm (21 Sept. 2009).

“DMAIC Picture.” 2009. http://fe.umy.ac.id/.../Six_Sigma_Phases-DMAIC.gif (10 Aug. 2009).

“How do I: Develop a Product Launch Strategy?”
http://www.scotlandfoodanddrink.org/ (23 Sept.2009).

“Just In Time Manufacturing.” http://www.wikepedia.com (15 Aug. 2009).

“Lean”
http://lsspmp.com/lean.html (19 Sept. 2009).

“Lean Manufacturing Concepts.” 2008. http://www.leanmanufacturingconcepts.com (12 Aug. 2009).

“Learning about Lean – What is Value anyway?” 2008.
http://joeelylean.blogspot.com/2008/03/what-is-value-anyway.html (18 Sept. 2009).

“Our services – Innovation” 2008
http://www.tranxend.co.za/innovation.html (22 Sept 2009).

“Overall Equipment Effectiveness.” http://www.wikepedia.com (15 Aug. 2009).

“Prioritization”

http://www.mindtools.com/pages/article/newHTE_92.htm (20 Sept. 2009).

“Strategy – Competitor analysis”
http://tutor2u.net/business/strategy/competitor_analysis.htm (21 Sept. 2009).

“Training Curriculum Development”
http://www.qualitysystemsservices.net (24 Sept. 2009).

“Waste and Value: Basic Lean Concepts”. 2005
http://www.agileadvice.com/archives/2005/07/value.html (19 Sept. 2009).

"What is Six Sigma?"
http://www.qualitysystemsservices.net

"Why every government agency should embrace the lean process"
http://www.apwa.net/publications/ (19 Sept. 2009).

"Your Roadmap To Success" 2006.
http://www.leanplus.com/process/index.htm (19 Sept.2009).

Other

"Business Concept Feasibility Assessment"
Ewing Marion Kauffman Foundation. 2006.

McCarty, T. 2004. Six Sigma at Motorola. *EuropeanCEO: Leadership Edition*, p.1-7.

Oslo Manual. *OECD Science, Technology and Industry Scoreboard 2007*, Organisation for Economic Co-operation and Development.

SLACK, R.A. 1999. *The Application of Lean Principles to the Military Aerospace Product Development Process.* Master of Science in Engineering and Management Thesis. Massachusetts Institute of Technology.