Otto-von-Guericke-Universität
Faculty of Business Informatics

Master Thesis

Optimizing Service Operations of Organizations through Business Process Management

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Acknowledgments

Mainly my acknowledgment goes to my parents without them I would not have possibility and courage to take this and many other steps in my life.

Secondly I would like to express my gratitude to my supervisors in Stemmer Company and in the university, especially for Prof. Dr. Hans-Knud Arndt and any other Supporting Prof. for their support, consultations and supervision during and after my work on the thesis.

Declaration

Hereby, I declare that this thesis is my original and my own unaided authorial work. All references, sources and literature used in this work or excerpted during elaboration of this thesis are properly cited and acknowledged in reference to the due source.

Wajeh Soufan

Abstract

Today's competitive market makes businesses more dependent on their ability to react to changes, and adjust their processes to the new requirements and continuously improve their processes. In this environment, it is a major challenge for organizations to transform their operation and reach their goals easily when facing the different challenges.

In order to achieve this, many organizations try to improve their Business Process continuously from different aspects. In this context, Business Process Management supports organizations in optimizing, controlling and maintaining organization's business processes and way of work.

Since Business Process Management is a wide topic influenced by many other concepts and encompasses various approaches that determine its constancy. Process improvement is one of them.

This thesis concentrates on process improvement utilization within Business Process Management, and how to successfully implement the appropriate environment for process improvement.

Although the available literature specified to improving the Business Processes and the critical success factors of improving the Business Processes suggests that the literature is still researching for new factors that ensures the application of the Business Process Improvement, where some studies have shown that companies still fail in applying a process improvement tool.

This study will form a Framework based on the new founded critical success factors, where this framework aims at showing how the new founded success factors can be integrated and used within the company and with the basic factors already in the literature.

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List of Abbreviations

BP	Business Process
BPI	Business Process Improvement
BPM	Business Process Management
BPMS	Business Process Management System
BPS	Business Processes
CSFS	Critical Success Factors
CSF	Critical Success Factor
CI	Continuous Improvement
CM	Change Management
DM	Data Management
HW	Hardware
IM	Information Management
KM	Knowledge Management
LM	Lean Management
LSS	Lean Six Sigma
PI	Process Improvement
QM	Quality Management
RM	Risk Management
SW	Software
VM	Variance Management

1. Introduction

1.1 Problem Statement

In the meantime the market is facing fast and rapid changes based on the changing requirements of customers and the technology continuous development, where organizations should be able to keep up to these challenges by improving and measuring their performance, which means that the organization should have a continuous improvement (CI) environment and a customer oriented methodology to face these challenges. Currently there are different tools/programs which are used to continuously improve the business processes (BPS) of the organization, but some organizations fail to implement these programs.

Organizations should use Business Process Management (BPM) at its best for optimizing their Service operations, and also should successfully implement a Process Improvement (PI) program within the BPM system (BPMS) in order to optimize and influence their overall service operations.

Based on the popularity of the success of different PI programs such as (Lean, Six sigma… which will be introduced in this thesis), many companies started implementation of these programs, some companies did it successfully while other companies faced challenges and failed in implementing the program.

The implementation and preparations of a BPMS in which the PI program will be utilized and implemented is critical for the success of optimizing and managing the quality of the services in organizations towards its customers and its service strategy.

The thesis studies the critical success factors (CSFS) of implementing PI programs in organizations to optimize their service operation. In an organization when there are no attempts or preparations made towards implementing a PI program, the improvement program will mostly fail for not having its CSFS implemented in the organization.

1.2 Objectives

Based on the available literature the basic CSFS of implementing a PI program are already identified, but the thesis proves that other factors than the literature identified CSFS are critical and should be taken into consideration when implementing a PI program. The thesis mentions the challenges faced in the service industry and based on these challenges and difficulties the factors that solve these challenges will be identified and proved as CSFS for the PI program.

Additionally, other factors that contribute to the benefit of the implemented PI program, will be considered to be effective and as CSFS for the implementation of the PI program.

Thus, the scientific question of the thesis is: how can organizations successfully implement a PI program in their BPMS? , so the main purpose of the thesis is to add and prove that new factors other than the basic ones should be considered as CSFS for implementing the different PI programs.

The thesis is connected to various scientific areas. For example with Business Administration, where generally processes are categorized and utilized in different organizational hierarchies, for instance processes exist in a managerial level and in the core operations of the company, furthermore, process management is a major part of business management.

In addition, the second mentioned scientific area is Business information systems, for instance to be able to apply process management at its best, the assistance of IT tools to model processes is an essential part of process management.

Finally but not least another scientific area is considered which is statistics. Many of the PI programs are data driven and uses this data for statistics in making decisions and controlling processes by using some charts (i.e. Pareto chart, run chart…).

1.3 Case Study Introduction

Throughout the thesis, a case study is investigated for an IT project in BT Stemmer GmbH Company (1), where processes have been identified, modeled and integrated with the company's standard process to form the current state of the project.

The company will be introduced in chapter 4. The case study sheds light on how to model business processes (BPS) for the current situation and how processes can be analyzed and optimized using different methodologies and tools to reach the optimized state and continuously improve processes.

1.4 Thesis Contributions

The thesis contributes to both sides theory and practical, as stated in the following part:

For the practical side: This study tries to model the current state of the BPS of the study case company and optimize them by using a PI program to reach the desired state.

Through the analysis of literature available in this field this thesis contributes to the literature by providing new CSFS for implementing a PI program. Where these factors are proven to be critical by

- Adding advanced solutions that ensure the implementation of the PI program.
- Also by providing solutions that help the service industry face the challenges when improving processes.

(1) Will be referenced as Stemmer.

1.5 Thesis Methodology

For this thesis a comprehensive and extensive literature review on Service operations, BPM, PI programs and Performance Measurement was conducted.

For identifying the current PI program CSFS literature review was conducted on different PI programs such as (Six Sigma, Lean management, Lean six sigma and TQM).

For identifying the new PI CSFS in this thesis an extensive and a comprehensive literature review was conducted on the CSFS of project management and the factors that are fundamental for the operation of the company, as well as the factors that the company depends on to make changes.

The main goal of this thesis study is providing companies with all CSFS they need to utilize and implement a PI program so the research data must be gathered and the findings must prove to be critical and beneficial for implementing the PI program. To demonstrate this the thesis were structured in the following order, in chapter 2 of this thesis the study begins with defining the meaning of a process and what are BPS and their different types as well as which form they represent in organizations.

Afterwards in chapter 3 the management of the Business Process (BP) will be introduced and each stage of the BPM will be discussed in details. Chapter 4 introduces a study case in a service providing company which used a PI program for a project and demonstrates how effective the program was.

Chapter 5 introduces the tools/programs that are utilized in the improvement phase of the BPM. Furthermore, the challenges that companies face while operating / improving their services are introduced. According to the introduced challenges the chapter introduces the factors that will face the challenges and will be added to the CSFS. Eventually a framework will be demonstrated to show how the CSFS are integrated within the company's operating framework.

1.6 Research Methodology

In the literature there exists two strategies of conducting a research one is inductive and the other is deductive. The inductive strategy (bottom up approach) is an approach which depends on participant's research data and views to generate a theory (i.e. generating a general idea from particular data).

On the other hand deduction strategy (Top down) is about testing theories by moving from theory to hypotheses and then to data.

Additionally, there exists two research approaches one is qualitative and the other is quantitative, the qualitative is an approach for exploring and understanding the values or meanings provided by objects related to a specific problem or research area. On the other hand the quantitative approach is an approach that examines the relationship among variables to test objective theories. These variables can be measured and analyzed using statistical methods.

(1)

This research's main objective is to develop a Framework that shows the service industry which CSFS to implement when implementing a PI program. Hence, to achieve this the research refers to literature existing basic CSFS and studies the challenges and issues of BPM and PI to come up with the new CSFS. Thus, an inductive strategy and a qualitative approach is used.

(1) (Creswell, 2013)

2. Business Processes Illustration

This chapter concentrates on identifying and defining the business processes and their types. Serving as an introduction to the BPM chapter.

Goals of this chapter

- Define business processes.
- Discuss the different types of business processes.

2.1 Business Process Terminology

Organizations exist in different categories, some organizations aim to profit by meeting the customer needs, and there are governmental and health care organizations that exist to serve the people's needs, and in each type of organization there exists processes that are executed on a daily basis to produce services/products. Each organization consist of different departments that interact by the means of these daily BPS/functions. (1)

The definition of a process can vary but still have the same aim or understanding, according to James Chang in systems engineering a general definition of a process "a sequence of events that utilizes input to produce outputs". (2)

A process has a closed content (specific input and specific produced output), it is also temporary which means has a starting and ending point of time, and it is a sequence of a logical activities in which a group of ordered activities are executed to produce the needed output. Based on these characteristics a definition of a process is adopted and defined as following "A process is the closed, temporal, and logical sequence of activities that are needed to handle a business object". (3)

A BP attributes follow the standard attributes of a normal process, but for the BPS, the output is a value for the customer, which can be either a product or a service.

A specific definition of BPS can be illustrated with the following clarification "A BP is a special process that serves the fulfillment of the top goals of the company (business objectives) and describes the central business area (3)".

(1) (Damij, 2014) P. 15,16

(2) (Chang, 2006) P. 2, 3

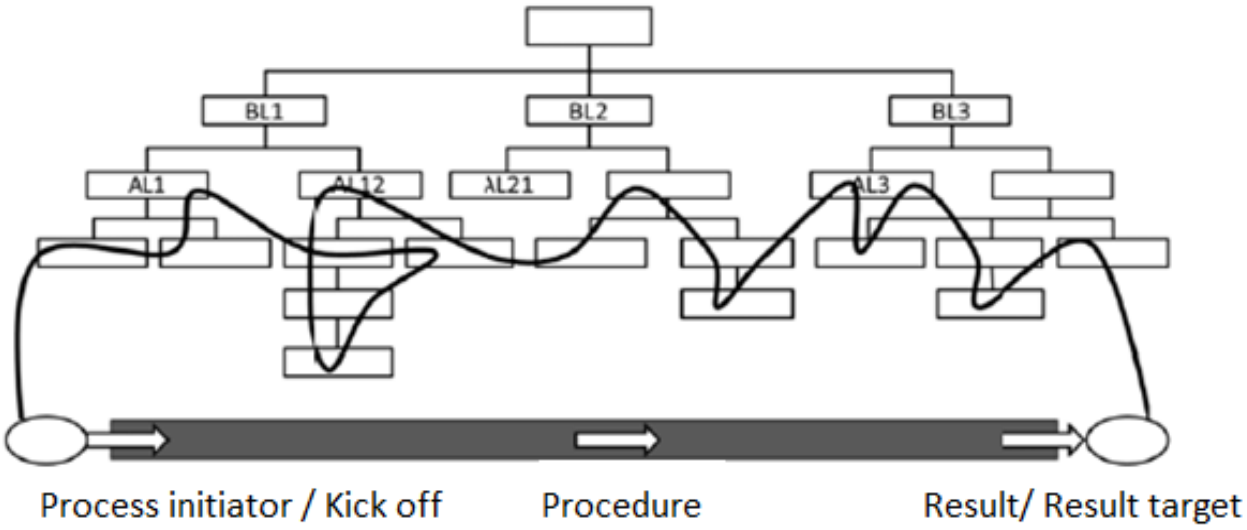
(3) (Jörg Becker, 2012) P. 6

Additionally, BPS need execution constraints and a specific order, for this point another definition of a BP from Davenport states that a BP is “a set of logically related tasks performed to achieve a defined business outcome for a particular customer or market.” (1)

BPS also are interconnected between organizational departments, and they exist to meet the request/ need of a customer, Davenport adds to his definition „business processes have customers (internal or external) and they cross organizational boundaries, i.e., they occur across or between organizational sub units." (1).

An example of a simple illustration of how processes interact within departments is that when different inputs enter a certain department, which will cause the operation of the business functions, and this produce the output that can be a needed input to processes in other departments. This process work flow in a department continues until the output is passed to another department, and the complete process work flow continues until the company’s final output (Product/Service) is available. (2)

This example of the process procedure is explained in the following figure (**Fig 2.1**)



(3)

Fig 2.1. Flow of processes between organizational departments

(1) (Weske, 2007) P. 5.

(2) (Damij, 2014) P. 16.

(3) (Stefan Obermeier, 2014) P. 5.

According to Mathias, a BP definition is derived from the characteristics defined from Davenport, he states, "A business process consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal. (1)"

Further definitions of Processes and BPS are introduced in the following table. (**Table 2.1**)

Author	Definition	Type
Harrington (1991)	*„(. . .) any activity or group of activities that takes an input, adds value to it, and provides an output to an Internal or external customer".*	P
Davenport (1993, S. 5)	*„A process is (. . .) a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a Structure for action. "*	P
Turowski (1996, S. 211) in reference to Rosemann (1996)	*"A process is the closed, temporal, and logical sequence of activities that are needed to handle a business object"*	P
Österle (1995, p. 62/63)	*"A process is a set of tasks that are performed in A predetermined sequence of procedures. In addition, it is supported through applications of information technology. Its value is created through The services to process customers. "*	P
In reference to Becker and Vossen (1996, p. 19)	*An operational process describes the closed content, temporal and logical sequence of activities, that are operated to continuously process a business relevant object (for example, purchase order, invoice, Customer order, goods, etc.).*	P
Hess (1996, S. 13)	*"Process (...) as a subsystem of the process organization, its elements are tasks, task manager and resources, and its relations are flow dependencies between these elements."*	P
Schwickert and Fischer (1996)	*"The process is a logically connected chain of sub processes that are aim to reach a particular target. Triggered by a defined event, the Input will be transformed to output through the usage of tangible and Intangible goods considering certain rules and the company's internal and external factors."*	P
Rüegg-Stürm (2000, p. 30)	*"Under the term process, we understand a set (Or a system) of tasks, which are to be completed in a more or less standardized sequence (chain of tasks), and can be supported by an information system. "*	P
DIN ISO 9000:2000 (2000) Ch. 3.4.1	*A process is understood as ". . . a set of interactions of tasks that switch Inputs into results. "*	P
Fischermanns (2006, P.12)	*A process has a defined start event (input) And a result (output) and serves to create a value for customers*	

(1) (Weske, 2007) P. 5

Table2.1 (continued)

Author	Definition	Type
Hammer und Champy (1994)	„We define a process as a collection of activities that takes one or more kinds of input and creates an Output that is of value for the customer. “	BP
DIN ISO 9000:2000 (2000) Ch. 3.4.1	*A process is understood as ". . . a set of interactions of tasks that switch Inputs into results. “*	P
Fischermanns (2006, P.12)	*A process has a defined start event (input) And a result (output) and serves to create a value for customers*	
Hammer und Champy (1994)	„We define a process as a collection of activities that takes one or more kinds of input and creates an Output that is of value for the customer. “	BP

Table 2.1. Further definitions of processes and business processes

From the definitions mentioned above, we can derive that a process basically starts by inputs, these inputs can be from different resources, for instance raw materials, supplier products, information and components. The inputs will be handled through the sequence of activities, which are ordered and defined, the final phase is the transformation to the desired output that can be offered to customers as a service/product. **Fig 2.2** illustrates further with examples the view of a process flow.

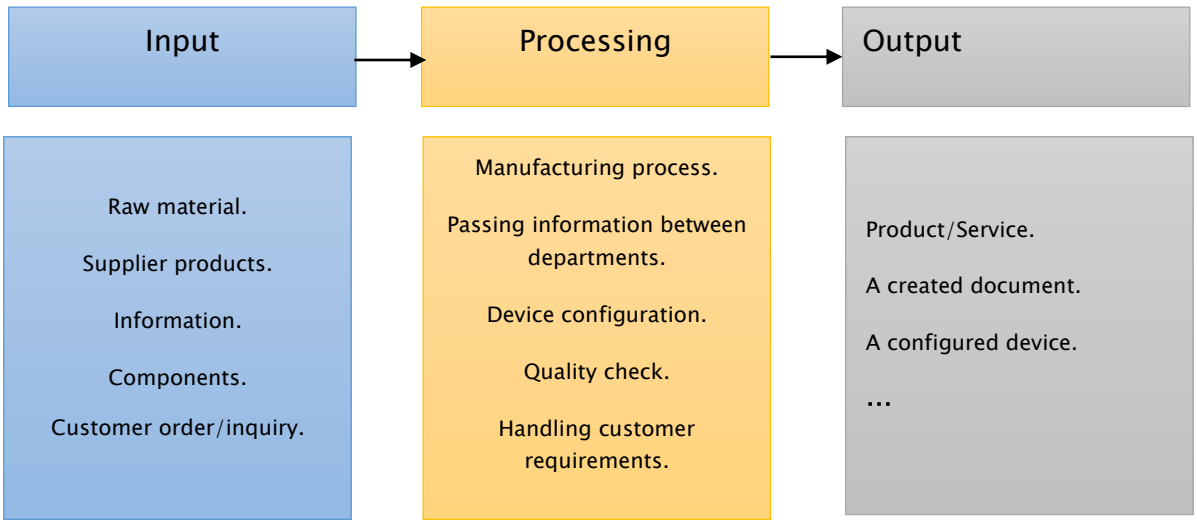


Fig 2.2. Examples of processing inputs to outputs. (Self-made presentation)

(1) (Fischermanns, 2006) P. 12 ; (Zellner, 2003) P. 42 F

2.2 Business Process Types

In the previous part of the thesis the meaning of BPS was defined, in this part the different types of BPS and their hierarchy in organizations will be discussed further and identified.

Generally, in process management two types of processes exist, in some companies they are called functions or activities, these are the primary and support processes. Primary Processes are the ones that contribute directly to the service/Product produced from the company to the customers, which means they are the company's core business operational activities, and they are oriented towards external customers. (1, 2, 3)

Additionally, the support processes are essential for the primary processes, because they provide the environment in which the primary processes can execute and exist. These processes are the company's internal processes that support the primary BPS, and they are oriented towards internal customers. (1, 2, 3)

Many authors classified process types to primary and support processes, but some authors like (Ould, 1995) mentioned management processes alongside primary and support processes, in which he defines management processes as processes that manage the primary and support processes, or they concern themselves with planning at the business level.

Furthermore, primary and support processes can be illustrated in the organization's value creation chain. The value chain was introduced by Michael Porter in 1985 in his book "Competitive advantage". A value chain contains all list of activities (Primary and secondary) performed by a firm to produce a valuable product / service for the market and reach its goal (4). In other words, it shows how a firm transfer its inputs to outputs. The value creation chain is modelled in the following figure

(1) (Damij, 2014) P. 18

(2) (Weske, 2007) P. 42

(3) (Koch, 2011) P. 5

(4) (Weske, 2007) P. 41

(Porter, 2000) P. 66

Fig 2.3. Structure of value chain

Secondary activities exist in all main activities and provide their support for the operation of all primary activities.

A brief explanation of the primary activities of the value chain is as follows: (1)

- *Inbound Logistics:* Business activities that ensures that materials, goods and information are available to produce Services/Products.

- *Operations:* Operations summons business activities, which produce added-value products that can increase the revenue of the company.

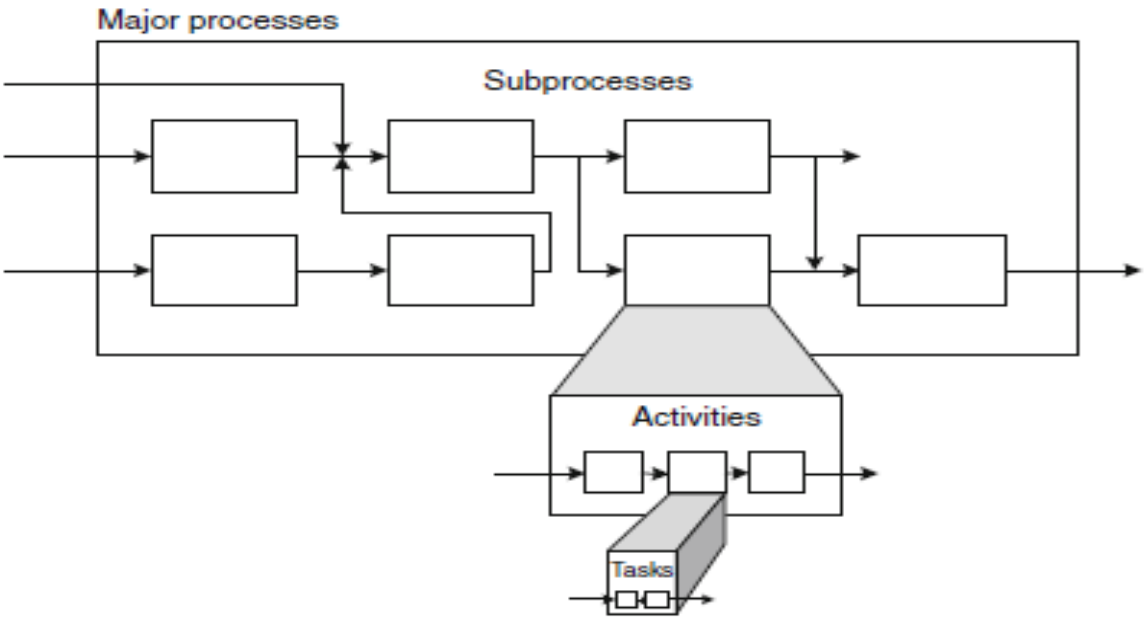
- *Outbound Logistics:* the process of distributing finished products to other suppliers so they can be further distributed to customers.

- *Marketing and sales:* Organizing the business functions for marketing the company's products and selling them in the competitive market.

- *Services:* after selling the product/service, a customer service needs to be available to solve problems and to further improve the products/services

(1) (Weske, 2007) P.43

As mentioned early processes have different types, but they also have a specific hierarchy, which is explained in a top-down approach as in **Fig 2.4.**



(1)

Fig 2.4. Business Process Hierarchy

A Process as defined in part **2.1.1** is a logical, related, sequential set of activities that transform input to output.

From the figure above it can be derived that a **major process** is a process, which involves more than one function within the organizational structure.

A **sub process** is a part of a **major process** that aims to achieve an objective to complete the major process.

Activities are what happen inside a process or sub process.

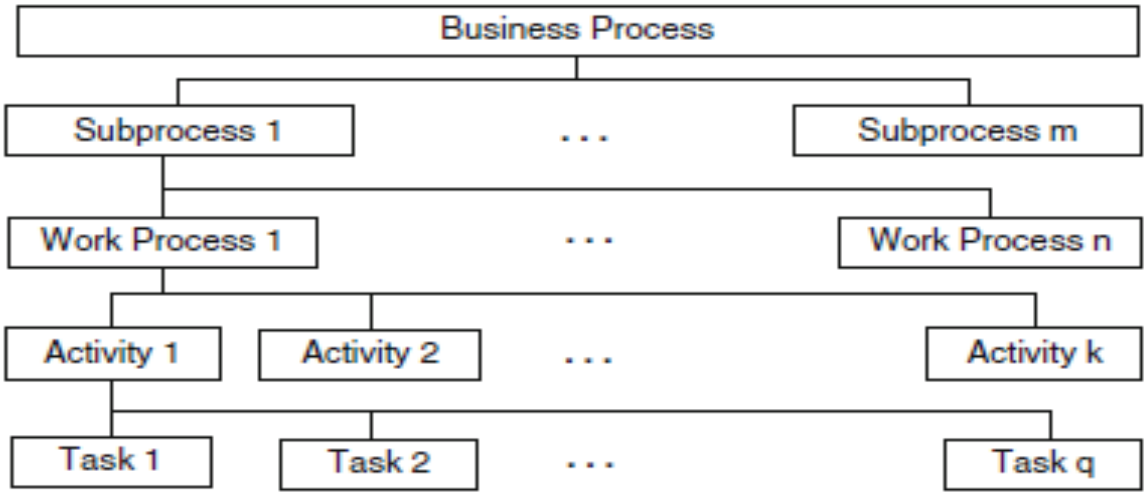
Tasks are elements and/or subsets of an activity (elementary work performed in the workplace).

(2)

(1) (Harrington, 1997)

(2) (Damij, 2014) P. 19

The already mentioned Process hierarchy can be used for all processes specially the complex cross-functional processes, to understand the complexity and the hierarchy of the process, the process can be summarized into other sub processes, and then it can be further shown more in details in work processes. Additionally, a work process will be composed of a set of activities, where each activity have elementary work processes. This methodology can be shown in **Fig 2.5**



(1)

Fig 2.5. Business process structure decomposition.

Processes can also be classified according to the area of utilization, for example:

- ***Company-wide BP:*** is the process that performs through multiple processes, where the input / output crosses the company's line.

- ***Cross-functional BP:*** is a process which is performed within a company but operate between different operational functional units (departments). The input and output of these processes will be utilized internally.

- ***Interdisciplinary BP:*** is a process, which takes place within a company department or a group.

(2)

(1) (Damij, 2014) P. 22

(2) (Koch, 2011) P. 5,6

3. Business Process Management

According to Professor Mary J. Benner of University of Pennsylvania and Professor Michael L. Tushman of Harvard University, a definition of process management is as following “Process management, based on a view of an organization as a system of interlinked processes, involves concerted efforts to map, improve, and adhere to organizational processes.” (1)

After the introduction and definition of Business Processes and their types in chapter 2, the methodology of Business Processes management will be introduced and discussed, to show how management of Business Processes influences organizations, and how it can optimize the service operations of organizations.

Goals of this chapter

- Introduce and discuss the basic principle of Business Process Management
- Discuss the utilization of Business Process Management in organizations.
- Discuss the influence of Business Process Management on organizations.

(1) (Chang, 2006) P. 3

3.1 Business Process Management Basics

BPM is a continuous iterative mechanism. It consists of different stages, which are interconnected and operate sequentially, demonstrated in the following figure **Fig 3.1**.

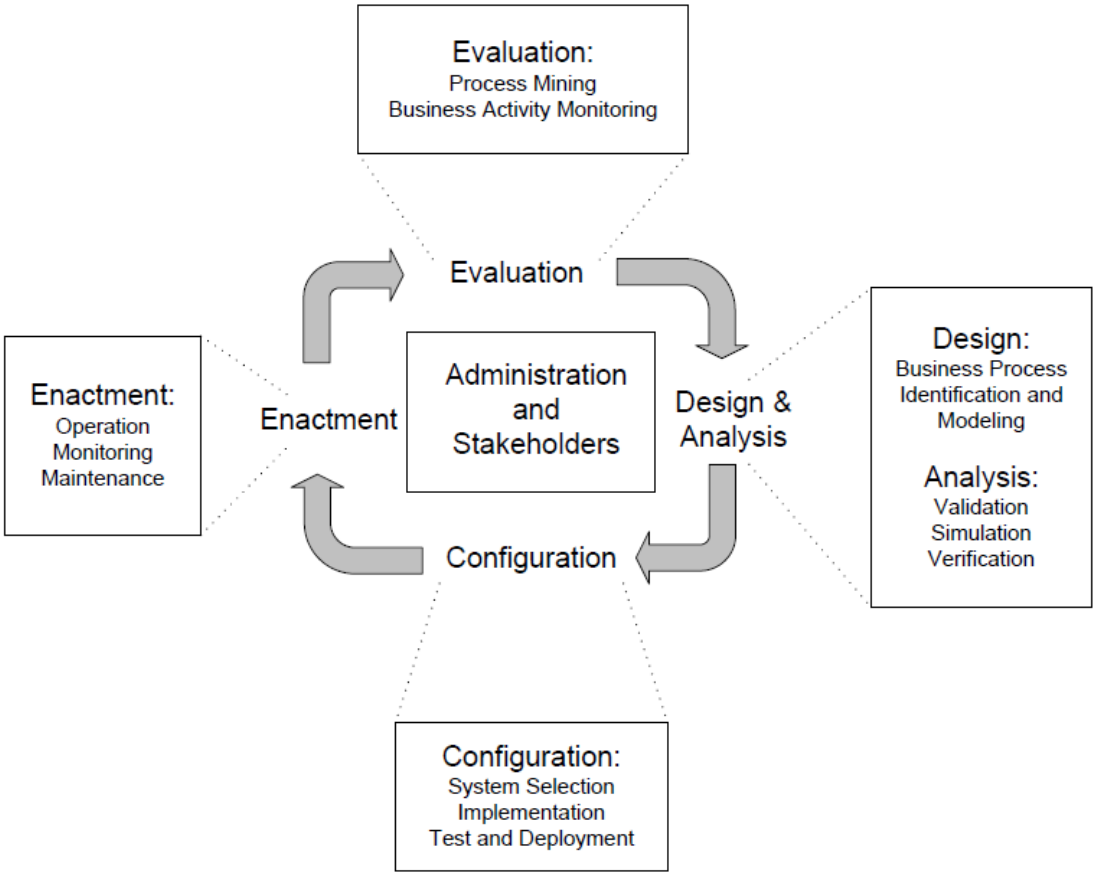


Fig 3.1. BPM life cycle

(1)

These stages will be introduced and further discussed in the following sections. The sections are ordered sequentially according with the stages of BPM.

(1) (Weske, 2007) P. 12

3.1.1 Process Design & Analysis

The first stage of BPM consists of two approaches (Design & Analysis). (1)

1. Design

The Design approach consists of two phases, the first phase is:

- **Business Process Identification:** (2)

Through inspection of BPS and their related environments and dependencies. This can be accomplished by using different methods (surveys, interviews, or documentation). The process also aims to discover the organizational and technical environment of the process.

In this stage, the organization's strategy and structure should be understood, to have a better knowledge and view of the BPS. To achieve this a number of interviews should be carried out with the management of every level in the organization.

The first step of this method is analyzing the organizational documents and carrying out a number of interviews with the management at the top level in the organization. The following information should result from the interviews:

1. The goals and plans of the organization, and their way of doing business.
2. Information of the organization's structure should be understood by mapping the management of the strategic, business and operational levels. In order to establish a plan of interviews with each level management in the following steps.

The second step is carrying out interviews with the management of the business level with the aim of identifying the organization's BPS and to select which processes need to be analyzed and improved. As a result of this step:

- A list of selected BPS that need analysis and improvement is created.
- Each process in the list should contain detailed information of its environment to identify through which departments the process passes.
- Employees of departmental / operational level should also be interviewed.

(1) (Weske, 2007) P. 11

(2) (Damij, 2014) P. 126, 127

After identifying the BPS the flow of the identified BPS between the organization's business units and departments should be identified. This means we have to identify how each BP acts as a link between a set of work processes under different departments.

To determine the flow of BPS further interviews have to be arranged with the operational level management to gather the needed information for the process flow.

(1)

The second phase of the **Design** approach is:

- **Business Process Modeling:**

BP modeling is the representation step using different languages to express the model of a BP.
The informal information gathered from the previous step can be formalized through modeling the BPS. (2)

To perform BP modeling, interviews should be arranged with the management at departmental level, followed by carrying out detailed interviews with the employees in each department where the BP flows, this should be carried out for each defined process in the previous step. (3)

The process model developed is then analyzed and improved by implementing different improvement ideas and necessary changes.

BP modeling should be achieved in a way to show how the organization is achieving its business goals or how a project is providing its value, this can be done by designing a value chain diagram.

The value chain diagram (developed by Michael Porter) is a top-down approach to organize high-level business functions and to decompose them to low level activities. The value chain diagram also shows how the business functions are related to each other, providing an understanding of how a company operates / how a specific project is carried out.

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(1) (Damij, 2014) P. 128, 129

(2) (Weske, 2007) P. 12

(3) (Damij, 2014) P. 131, 132

A diagram of a value chain is shown in the next Figure.

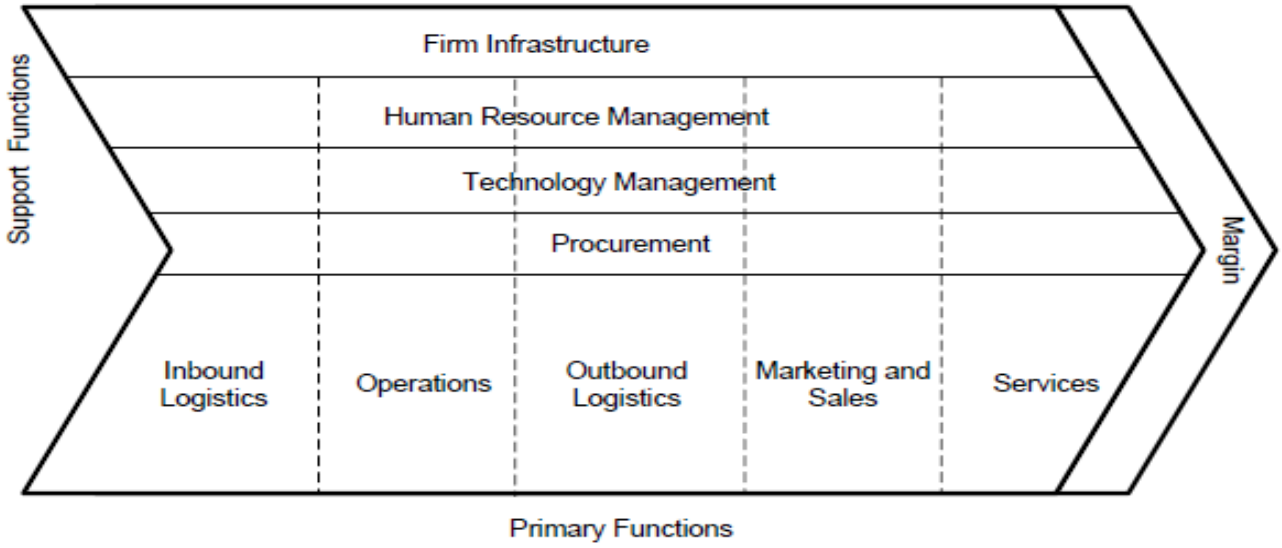

Fig 3.2. Organization's Value Chain Diagram

As described earlier in chapter 2, primary functions shown in Fig 3.2 contribute directly to the competitive advantage of the company while the support/secondary functions provide the environment for the operation of the primary functions. In summary both functions will contribute to the success of the company.

For in detail description of the functions in the value chain diagram please refer to (Weske, 2007) P 42.

After modelling the value chain diagram, all activities done within BPS should be captured and accordingly mapped. Given that, a clear understanding of the processes is required. By modeling the processes, it is necessary to identify the involved parties as well as their activities. The process of modeling defines the necessary steps to create a proper model by using a modeling language.

Such as:

- Flow chart
- UML
- Business process modelling notation (BPMN)
- Event driven process chain (EPC)
- Architecture of information systems (ARIS)

2. Analysis

The second approach of the first stage in the BPM after the **Design** approach is the **Analysis** approach. This approach consists of 3 Sequential steps as seen in Fig 3.1 which are validation, simulation and verification, the three steps are essential to secure an optimum state of the model effectiveness, efficiency and completeness.

- **BP Validation:**

A meeting / workshop with the employees should be arranged, these are the employees of the departments in the process flow. This step is essential to validate whether the model demonstrates the real flow of the company's BPS.

(1)

- **BP Simulation:**

After validating the processes in the business model, the execution sequences of the business activities need to be examined, hence this step is considered as a support step for the previous one. The simulation step is used for the purpose of showing failures in the process model and suggests counter actions to remove them. Furthermore, it checks whether the flow indicates the desired behavior of the BPS. (2)

The results of the information after the simulation of process execution and resource usage are quantitative, time-based and cost-related, e.g. waiting and throughput times, completed processes, resource consumption or cost per instance. (2)

- **BP Verification:**

After validating and simulating the BPS, the BP model should be verified for correctness. A business model correctness can be verified using different properties. An important property is the data dependency within a business model, a data dependency is represented by the data flow between the BPS. Data dependency have a strong influence on the way how the activities are ordered, considering that some activities can only be started when the data input is passed from the previous activity as an output, this is a sample of a data dependency between activities. If the activities are out of order a state of a Dead-lock can be reached. (3)

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(1) (Damij, 2014) P. 55 ; (Weske, 2007) P.12,13

(2) (ARIS)

(3) (Weske, 2007) P. 268,269

After verifying the data structure of the BP model, the structure soundness of the model should be verified, for this phase the work flow nets could be used. Where it defines the process model as structurally sound when

- There is only one starting and ending node.
- Each node in the model is on the path from the starting to the ending node.

Many soundness criteria can be used for the verification phase, these criteria are introduced in details in (Weske, 2007) Chapter 6.2 → 6.6

3.1.2 Process Configuration

After the design and verification of the BP model, the BPS should be configured within the company. The configuration of the BPS can be done manually through a group of rules and procedures that the employees need to follow, or it can be done automatically with the help of a BPM system.

The configuration phase has three major steps which are: BPMS development, system testing, and system integration

1. BP Management System Development :

The configuration of the BPMS should comply with the BPS and the organizational environment of the company. Where it should take into consideration two points one which is how the employees will interact with the system and the other one is how the existing systems of the company will be integrated with the BPMS.

The configuration of the BPMS could include transactional aspects. Transactions are a familiar concept used in database technologies, where they follow the ACID principle: Atomicity, consistency, isolation, and durability.

For instance the atomicity property at BP level is realized as a group of process activities which form one business transaction in a way that either the whole group is executed or none.

Other transactional properties could not be applied in BP level such as isolation where in this property access to data objects is locked, and locking objects of processes is an unacceptable option.

(1)

(1) (Weske, 2007) P.13,14

2. BP Management System Testing :

The testing step ensures that the system in all of its phases have the same function of the considered BPS, where it checks whether all activities of the BPS are included and tested. The testing should also include each level of the processes (work process, sub process, and the BP).
(1)

3. BP Management System Integration :

After the successful completion of step 1 & 2 the new system should be integrated with the existing systems in the organization, so possibilities for this integration should be studied, and training of employees could be required.

(1)

(1) (Damij, 2014) P.56

3.1.3 Process Enactment

The process enactment is the phase of running the BPS to fulfill the business goals, this phase is initiated after the configuration phase is successfully completed.

This phase consists of three major sub phases, which are operation, monitor and maintenance.

1. *Operation:*

In this phase instances of the BPS are initiated and executed through the BPMS.

The operation phase ensures that the execution of the process instances should be the same as the real BPS. The execution of the process instances is measured to ensure that the results meet the company's requirements.
(1)

2. *Monitor*

The BPMS should provide a monitoring service, which can be used as an indicator for the status of any BP from the beginning till the end of the process life cycle.
This property also helps the organization's management to have a better visualization of the BPS and act pro-actively to problems by measuring and analyzing processes by collecting process information, this information is also valuable to respond to customer inquiries about the current process state.
(1)

3. *Maintenance*

For maintenance purposes of the BPMS information of events execution data should be assembled in a log file, these are the events that occur during the execution of a BP till the end of its activity.
This information is essential for BPM that it plays a role in the evaluation of processes in the next step of the BP life cycle, additionally, it supports the system developers with its maintenance.
(2) (3)

(1) (Weske, 2007) P.14

(2) (Weske, 2007) P.15

(3) (Damij, 2014) P.57

3.1.4 Process Evaluation

The evaluation step is essential to enhance the BP models and their processes.

The phases (Monitoring and Maintenance) of the previous step (Process Enactment) are essential for process evaluation, because they provide the business management system with the results needed for the evaluation step.

Two methods can be used to evaluate the provided results, one of them is business activity monitoring and process mining techniques. These results support the system developers with identifying weak points / errors, so these problems can be analyzed and counter actions can be taken.

The output of the evaluation shows which performance problems, bottlenecks and costs exist in the BP, these subjects should be optimized by the responsible business managers.

Furthermore, the process evaluation phase also evaluates the BPM system to ensure that it supports the quality of BPS.

(1) (2)

(1) (Weske, 2007) P.26

(2) (Damij, 2014) P.57

3.2 Utilization of Business Process Management in Organizations

To understand the functioning of a company, how it creates business and how it conducts work, we have to understand how it is organized. Organizations exist with different structures either functional or process oriented, but lately the business requirements requires organizations to follow the principle of process oriented structures in order to optimize their performance. On the other side, functional type of organizations, where each department thinks of its own performance rather than considering or influencing other departments, which can cause different problems to the firm. (1)

In this part of the thesis both structures will be explained and discussed further, to better understand how BPM can optimize the performance of the organization, and how organizations utilize them.

3.2.1 Functional Organization

A functional organization is also called a vertical organization, this type of organizations is formed into functional departments, where each department is a special independent unit of the company, which means the work that is executed in any department is isolated from the work of other departments (i.e. an artificial border is created between all departments) causing the department to be independent from other departments.

This type of order causes different problems within the organization like the disability of following the life cycle of a BP, also managers of a department have no influence on the work flow performed in other departments. This causes the diversity of the work flow between the organizational departments, where the work flow of the organization as a whole is invisible.

(2)

This type of organizations slows down the work flow of the company and consumes from the company's resources and time, which can cause customer dissatisfaction and long production life cycle and difficulties in tracking causes of failures

(1) (Damij, 2014) P. 17

(2) (Damij, 2014) P.16

To be customer-oriented and satisfy customers different requirements is a difficult task for functional organizations, where the different requirements need to be handled differently which means the flow of processes varies for each project, this kind of work needs a flexible and a visible work flow within the organization.

To overcome the difficulties and failures caused from the functional organization another type of organization can be followed which is the process-oriented.

3.2.2 Process-oriented Organizations

Any organization goal is to provide its customers with its products and services with reducing their operational costs and to optimally and economically consume the available resources. The organization as a whole shouldn't have a complex and invisible work flow as shown in the functional organizations because the operational processes are cross functional, so the work flow between departments should be clear and unsophisticated.

The principle of process-oriented organization could be used to overcome the already mentioned problems caused by the functional organization and to easily reach the company's goals, where this principle is an easy to follow & understand principle, because the work flow of the BP connects different areas of the company and it is visible.

(1)

A process organization represents the necessary interaction between the company elements to achieve the desired result. It shows how the individual organizational elements work together the requirements of the overall system to handle its business and customer requirements.

Following the principle of process-oriented is considered a major success factor for the company because the company is flexible to adjust to the different requirements by the customers, and the production life cycle can be shortened. (2)

(1) (Koch, 2011) P.11

(2) (Damij, 2014) P.17,18

3.2.3 Functional and Process-oriented Organizations Summary

After discussing both principles the following summary can be derived in the shown table (**Table** 3.1)

	Functional organization	Process-oriented organization
Structural Orientation	Vertical alignment	Horizontal orientation
Way of work	Strong work division	work integration
Operational orientation	performance	object editing
Structure	hierarchical	Flat hierarchy
Concentration	Departmental goals	process goals
Objectives	Cost-effectiveness	customer satisfaction, productivity
Controlling	Central external control	Decentralized self-controlling
Operation	Redundancies in the processing	Continuous improvement
Visibility	Complex	Concentration on value creation & transparency

Table 3.1. Summary of functional and process-oriented organizations

(1)

(1) (Koch, 2011) P.12

3.3 Business Process Management Benefits

A company that implements BPM is a Process-oriented organization and can have various benefits to the organization when utilized correctly, the following list demonstrates the benefits of BPM:

- Promotes adapting to changeable and upcoming business needs and customer requirements, by making the company's processes or service operations flexible and easier to control during changes. (1)

- Improves communication and collaboration between tasks in diverse functional areas. For example by connecting IT and Business through involving the BP owners with IT, where the BP owners are able to design their requirements through BPM tools which automatically generates code without IT help. Furthermore, IT developers can use the business people designed processes to insert IT logic to them. (1) (2)

- Performance measurements are aligned with process goals. (1)

- The company will have the ability to integrate people and systems that participate in BPS (i.e. process-centric) which is the integration of each object that is process related like people, systems, and data. (2)

- BPMS gives business people the ability to simulate BPS to design the most optimal processes for implementation. (2)

- BPMS provides the company with the ability to monitor, control, and improve BPS in real time. Plus the ability to effect change on existing BPS in real time without an elaborate process conversion effort, where the old model of BPS exist and can be modifies easily. (2)

(1) (Chang, 2006) P 21

(2) (Chang, 2006) P 50-55

3.4 Business Process Management Challenges and Issues

Away from the benefits gained from BPM, this study also discusses the challenges faced by BPM where the solution of these challenges supports the idea of CSFS, some of the challenges are presented in this chapter while others will be discussed in chapter 5 to show how some CSFS can solve these challenges.

BPM Challenges are: (1)

- **Lack of governance:**
  When first implementing BPM the biggest challenges will be around stakeholder alignment, requirements prioritization and scope definition. Sometimes this phase can take long period leading to a loss of confidence in BPM as a transformation tool. To avoid this the company's environment should be accepting and open to new changes as a learning company.
  Thus adopting a PI methodology or a transformation tool like BPM within an organization faces the challenge of accepting to apply the tool/method from the management area, because it is seen as a threat to their way of doing things.

- **Lack of employee buy in:**

  Employee buy-in is effected by the lack of a common understanding of BPM, this is caused by
  - No knowledge of BPM.
  - Another reason is the different understandings of BPM.

  This creates confusion and disagreement on the benefits and expectations of BPM. As a solution the company should provide its employees with the proper BPM education, where past BPM success studies show the importance of appropriately skilled personnel and BPM education for successful implementation.

  Still another main reason for the issue of a non-supporting employees is a non-collaborative middle management for BPM programs, where the top management support is the solution to this problem which by itself is a barrier that was already mentioned.

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(1) (Bandara, et al., 2007)

4. BT Stemmer GmbH Company Study Case

This chapter introduces two scenarios one is Stemmer Company and the way they work, second is the case study of using a PI program in Stemmer Company and it shows in details the results of each step in BPM for a project in this company.

Throughout this chapter some private information of the company and their operations will not be shown in detail rather just in results, due to the **non-disclosure agreement** (**NDA**) with the company. Additionally, these private information will have no effect on the thesis work.

Goals of this chapter

- Introduce the study case and its company.
- Show the effectiveness of the PI programs.

4.1 Stemmer as a Company

Stemmer is considered a medium sized company with different locations in Germany, where its main office is in Olching (Munich). Operating since 1973, Stemmer has been providing support to its clients in international and national IT projects.

Since then Stemmer supported large and medium-sized companies in the creation and operation of their IT systems. Through providing their services and solutions in various IT areas:
IT and data center services, IT security solutions, unified communications and collaboration. (2)

Stemmer provides its services collaboratively with third party manufacturers such as Cisco and NetApp, where they take part in most of Stemmer services.

In chapter 2.2 the standard value chain of an organization was presented, the value chain diagram of the case study of Stemmer Company is shown in the following figure

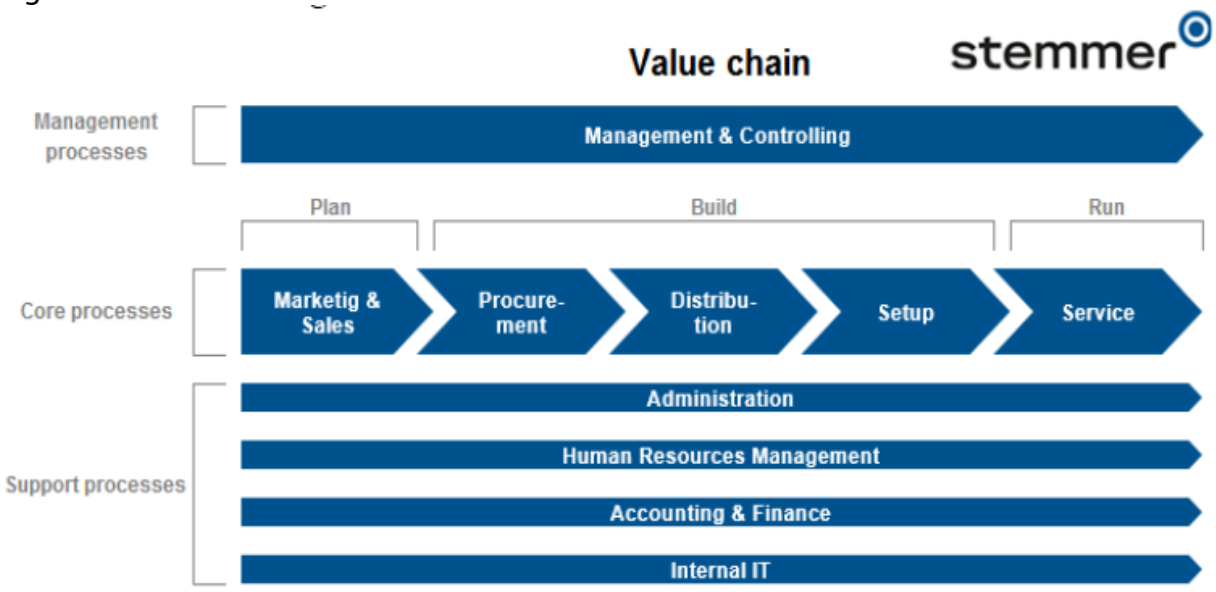


Fig 4.1. Stemmer Value Chain Diagram

Stemmer functions are decomposed to management, core and supporting processes. As shown in **Fig 4.1** the primary functions are the management and the core functions, and the secondary functions are the supporting functions. The flow of the functions in the core processes is from left to right and under 3 phases (Plan, build, run) as shown in **Fig 4.1.**

The next part will discuss how the IT project in Stemmer was optimized and moved from its current state to the desired state.

4.2 Stemmer Case Study Project

4.2.1 Project Introduction

The project is about a service provided by the company to its customer by buying the hardware (HW) from its partners, then configuring and building the HW to form the IT infrastructure of the client.

The life cycle of the service should end with a time period of 100 days maximum after meeting with the client, one of the issues was that the service sometimes took longer than 100 days, additionally, the processes of the service were not documented and controlled, which also caused conflicts to monitor and maintain any issues, eventually this caused the disability to inform the client of the status of the service.

So the summary of the issues are listed below:

- Inadequate user and system documentation.
- Project deadline not met.
- No control over processes

Thus to face these issues the company implemented BPM for this project, in the next section the study highlights each step applied of BPM with this project.

4.2.2 Project Life cycle

In order to implement BPM for this project, the company had to prepare for the initiation phase by examining any related documents and the recorded processes graphically and in documents. Afterwards the problem was discussed, the objectives were defined and the project group was formed.

After the preparation for implementing the BPM, the company followed the footsteps of the stages of the basic BPM, which were identified in chapter **3.1**. The management of the BPS can be summarized in the following phases:

4.2.2.1 Process Design & Analysis:

The first step in the design phase is identifying the BPS and their relationships between each other, which was done through the available documents of the project and through meetings with the employees who are directly related with the project. This step aims at identifying the organizational dependencies.

After this step interviews were conducted with each department and management of different levels in the organization to understand the structure of the organization and their way of doing business to be able to form the BPS.

After identifying the BPS the flow of the identified BPS between departments were identified by conducting meetings with the operational level management.

To determine the flow of BPS further interviews had to be arranged with the operational level management to gather the needed information for the process flow.

The second phase after identifying the BPS and their flow, is the modeling of the current state of the processes, the modeling language used in Stemmer Company is BPMN, BPMN objects are presented briefly in the following table:

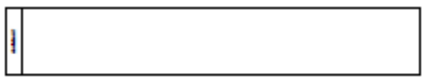
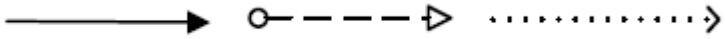
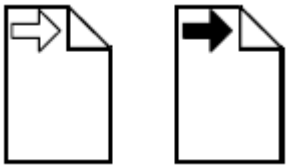
Object name	Symbol
Pool	
Event	
Activity / sub processes	
Connectors	
Gateways	
Data objects	
Database	
Messages	

Table 4.1. BPMN objects

BPMN has altogether 21 symbols. These symbols will be illustrated in details, for instance the pool, which represents an organizational department within the company. Furthermore, five events are required for the events, including the start, intermediate, and end events. In addition, the timer element is present as a starting event and as an intermediate event in order to characterize periodically running activities.

The basic forms also include the activities as well as sub-processes. Sub processes merge several related activities into one module. The purpose of the sub processes is not to overload the character with too many characters.

Three connecting arrows are possible to identify the relationships between individual elements, pools, or external parties.

The first arrow in Table 4.1 refers to the normal sequence flow, that is, it indicates the direction in which the process proceeds. This arrow can only be used within a pool in this standard. Message flows between pools are displayed with a dashed arrow. They are intended primarily to illustrate the interfaces and communication paths.

Thirdly, association lines are used to connect data objects, databases and messages with an activity. Data objects can be used as input (light arrow) or as output (dark arrow) for example forms.

Three different gateway types are used for decisions within a process flow. It is intended to visualize "Either / or" decisions by means of an exclusive gateway, parallel activities through a parallel gateway and "and / or" decisions by an inclusive branch. Finally, the symbols for the grouping and the text annotation are selected for the artefacts. If essential details or important information are to be included in the graphic, this is written in the text note. The grouping illustrates the co-operation of organizational units in a task. It is also used to connect several organizational units involved in a sub process.

Stemmer uses BPMN for modeling the BPS which were identified with their flow in the first phase, after modeling the processes they should be analyzed by the responsible departments, to implement improvement ideas. In the analysis phase. This phase was conducted using validation and simulation of the modeled BPS.

- **BP Validation:**

Meeting with the employees were arranged, these are the employees of the departments in the process flow. In this step it was validated whether the model demonstrates the real flow of the company's BPS.

- **BP Simulation:**

After validating the processes in the business model, the execution sequences of the business activities were examined. Failures in the process model were recognized and counter actions to remove them were suggested.

4.2.2.2 Process Configuration

The model of the current state of the processes were configured in the setup of the company. The configuration of the BPS were done automatically with the help of Stemmer standard BPMS which is Viflow, it complies with the BPS and the organizational environment of the company.

Viflow is a product from ViCon GmbH. ViFlow Enterprise is distinguished by the additional possibility of modeling with multiple users. The special feature is that it uses the MS Visio program as a basic graphics tool, which means that at least one Visio standard license must be installed in order to use it. ViFlow offers special features for the BPM, like working in a database. While Visio has a static drawing function, ViFlow makes it possible to save all BP models in one data file.

4.2.2.3 Process Enactment

The process enactment is the step of running the BPS to fulfill the business goals, it is initiated after the successful configuration of the processes. It consisted of three steps:

Operation:

In this step instances of the BPS are initiated and executed through the BPMS. Where the execution of the process instances is measured to ensure that the results meet the company's requirements.

Monitor

Employees can follow the status of any BP from the beginning till the end of the process life cycle with the help of ViFlow. This property also helped the project owners to have a better control over the BPS this control was also valuable to respond to customer inquiries about the current process state.

Maintenance

For maintenance purposes of the BPMS information of events execution were collected, to support the next step of analyzing and summarizing the weak points and issues that occur during the execution life cycle of a BP.

4.2.2.4 Process Evaluation

The results needed for the evaluation step are provided by the previous step. Two methods were used to evaluate the provided results, one of them is business activity monitoring and process mining techniques.

These results supported the BP managers with identifying weak points / errors, so the problems faced in the project can be analyzed and counter actions can be taken.

The identified failures are connected with different areas:

- Stemmer way of work
- Stemmer operations department
- Stemmer IT systems
- Customer side
- Other

These problems caused delay in the 100 days deadline, as shown in the following table:

Location	receiving customer request	Stemmer offer sent	final offer sent	Customer order received	HW sent to customer	Goods received	calendar days from receiving the first request till sending the goods
2016							
Location 1	3/23/2016	3/31/2016	5/2/2016	5/23/2016	7/7/2016	7/10/2016	106
Location 2	5/3/2016	5/9/2016	5/20/2016	6/16/2016	7/25/2016	7/28/2016	83
Location 3	5/11/2016	5/25/2016	7/6/2016	7/28/2016	9/16/2016	9/20/2016	128
Location 4	3/2/2016	3/4/2016	3/30/2016	4/15/2016	6/10/2016	6/24/2016	100
Location 5	4/8/2016	4/21/2016	5/13/2016	7/5/2016	8/4/2016	8/16/2016	118
Location 6	5/10/2016	5/17/2016	7/19/2016	8/10/2016	9/14/2016	9/23/2016	127
2015							
Location 1	6/29/2015	7/1/2015	7/22/2015	7/2/2015	10/7/2015	10/21/2015	100
Location 2	4/8/2015	4/10/2015	7/13/2015	9/15/2015	11/9/2015	11/20/2015	215
Location 3	5/18/2015	5/21/2015	6/15/2015	6/16/2015	7/19/2015	7/3/2015	62
Location 4	8/24/2015	9/7/2015	10/9/2015	12/18/2015	1/27/2016	2/10/2016	156
Location 5	11/12/2015	11/16/2015	12/9/2015	1/4/2016	2/22/2016	3/7/2016	102
Location 6	10/2/2015	10/30/2015	11/18/2015	12/15/2015	2/2/2016	2/16/2016	123
Location 7	6/15/2015	6/18/2015	7/21/2015	8/10/2015	8/24/2015	9/18/2015	70

Table 4.2. Stemmer project results before optimization

Stemmer way of work:

- Some documents were filled late, and were not controlled if correct, which could cause issues to other tasks which should be done in a short period of time.

- No standard communication method with delivery companies.

Stemmer operations department:

- The operations department in the company faced different issues, such as manual creation of documents, where some of the customer documents needed to be added to the system automatically through the utilization of a tool, which did not exist, this issue could cause failures in the orders of customers, even if the documents were checked multiple times.

- No synchronization between the company's IT programs and the ones in the supplier side, which could cause misunderstandings with the customer.

Customer side:

- The customer side needs a long period of time to confirm a bill, which could have a big influence on the 100 days deadline, thus, stemmer should include and inform the customer to solve this problem.

- Some information is not provided by customers, which should be available so stemmer management can take decision on the project, for instance the customer has not provided info about the delivery address.

Stemmer IT systems:

- Stemmer ERP systems had no integration with the supplier tools, so any changes in the supplier side are not synchronized with stemmer's system.

Other

- No standard HW configuration document is available.

After identifying these issues and facing them, and then continuously improving the processes and monitoring them we can derive that the PI program used by the company is TQM by following Deming's Cycle PDCA which is introduced and described in this Study in chapter 5.1.1. Additionally, the support of lean management was also used to remove any non-value adding activities. Lean management is discussed in chapter 5.1.3.

The result of improving these process resulted in improvement which can be seen in the next table compared to the above shown table.

Location	receiving customer request	Stemmer offer sent	final offer sent	Customer order received	HW sent to customer	Goods received	calendar days from receiving the first request till sending the goods
2017							
Location 1	3/23/2017	3/31/2016	5/2/2017	5/2/2017	6/28/2017	7/10/2017	97
Location 2	5/3/2017	5/9/2017	5/20/2017	5/26/2017	7/25/2017	7/28/2017	83
Location 3	5/11/2017	5/25/2017	6/6/2017	6/12/2017	8/12/2017	8/20/2017	93
Location 4	3/2/2017	3/4/2017	3/30/2017	4/15/2016	6/10/2017	6/24/2017	100
Location 5	4/8/2017	4/21/2017	5/1/2017	5/5/2016	7/4/2017	8/16/2017	87

Table 4.3. Stemmer project results after optimization

5. Service Quality Improvement

This chapter introduces the different quality improvement programs used within organizations, furthermore, the critical success factors of each program will be introduced and referenced in the final thesis framework beside the advanced critical success factors.

Additionally, the challenges & issues that companies face while operating and optimizing their service quality will be mentioned. And in the final chapter the solutions to these issues will be used to develop and design the framework which consists of all CSFS for implementing the PI program.

Goals of this chapter:

- Discuss service quality improvement and the different tools/programs that are available.
- List the PI programs critical success factors.
- Service quality improvement challenges and the solutions.
- Develop the service quality improvement framework.

The Quality Management (QM) practices that have become essential for survival in the rapidly changing world marketplace have been described under a variety of names. One of those names is the BP improvement/optimization or quality improvement.

PI have different primary goals, these are:

- To reduce costs and increase efficiency.
- To be able to keep up with the fast changing market and customer demands.
- To be able to face the high competition and satisfy the customers.
- Last but not least is reaching the company's goals more effectively.

When these goals are reached this will eventually increase profit by creating customer loyalty and satisfaction towards the company.

This research is oriented towards the service industry and optimizing their BPS. BP improvement is one step in BPM that eventually will optimize the service quality of a company, because services are results of the company's activities/processes.

Thus this part of this study will introduce and explain the service industry and its characteristics, the service Industry can be distinguished from the manufacturing industry based on five key characteristics which are intangibility, inseparability, heterogeneity, perishability, and lack of ownership (1):

The table in the next page explains these characteristics in detail:

(1) (Clemes, 2000)

Characteristic	Manufacturing industry products	Service industry services
tangibility	Tangible: Physical products are displayed for customers	Intangible: A service is made and delivered on spot and hence it cannot be measured as easily as a tangible product.
Inseparability	Separable: The production of a product is separable from its consumption	Inseparable: The service consumption cannot be disconnected from its production.
Heterogeneity	Homogeneous: The production companies provide products that are consistent and alike to variety of its customers.	Heterogeneous: Contradicting the manufacturing industry, services should meet different needs and requirement for many customers
Perishability	Long living: Products can be saved and stored	Perishable: services cannot be stored nor saved or stored
Lack of ownership	Ownership: By paying for the tangible product, the consumer owns and have access to the product.	No ownership: The consumer pays for a service to use it, which means it is an access for the intangible service rather than owning it.

Table 5.1. Differences between services and products.

Due to these characteristics of services and since the cost and quality of services provided by service providing companies can vary, customers will have different desires which makes them pay for different components of services; such quality, speed, degree of variety, etc. Thus better management of processes that exist within a service system will lead to greater profitability for the organization. In order to manage a service system, an efficient BPMS is needed. Therefore, the improvement of BPS is critical to the success of BPM and must be studied.

To improve processes in an organization it is essential to have a culture that adapts and accepts improving processes of the organization to be able to improve processes without facing the barrier of refusal. Furthermore, improving process should be oriented towards the company's strategy, where the strategy defines the business, the position that the organization hopes to hold in the industry or market, and the means by which it is to compete, thus, to benefit from PI on the long run, PI should be aligned with the company's strategy.

There are number of varieties that are used for the PI phase which are used in the manufacturing and the service industry. In this chapter the different PI programs will be discussed and compared these include Six Sigma, Lean Management, Lean Six Sigma and Total Quality Management. These programs and their CSFS will be discussed in the next part of this chapter.

5.1 Service Quality Improvement Programs

Service Quality is a composite of People, Processes, Information and Technology and when a customer interacts with a service, one of the main things that is perceived is quality. Quality has a long term impact on the satisfaction of customers.

BPI leads to quality improvements, service enhancements, cost reductions, and productivity increases of a business activity or process. Many companies embark on a BPI program in an effort to improve their operational performance and drive competitive advantage in the marketplace.

The next topic will introduce the different available PI programs.

5.1.1 Total Quality Management

TQM should be considered the "mother of all" of the more recent PI methodologies. The ideas of TQM were not new, they were developed by William Edwards Deming, Joseph Juran, and Kaoru Ishikawa starting in the mid-1940s. Each one of them contributed in developing the TQM concept where Deming focused on organizational practice and behavior to achieve quality with his 14 points, which are:

1) Create constancy of purpose for improving products and services.
2) Adopt the new philosophy.
3) Cease dependence on inspection to achieve quality.
4) End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier.
5) Improve constantly and forever every process for planning, production and service.
6) Institute training on the job.
7) Adopt and institute leadership.
8) Drive out fear.
9) Break down barriers between staff areas.
10) Eliminate slogans, exhortations and targets for the workforce.
11) Eliminate numerical quotas for the workforce and numerical goals for management.
12) Remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system.
13) Institute a vigorous program of education and self-improvement for everyone.
14) Put everybody in the company to work accomplishing the transformation.

Furthermore, Deming introduced an iterative cycle which can be used as a management method in business for the control and continual improvement of processes, this cycle consists of four steps (Plan- Do- Check- Act -> PDCA): (1)

1) PLAN: plan the goals and activities to deliver the expected results.
2) DO: in this level the plan is implemented where processes are executed. Afterwards results data is gathered in charts to do analysis in the following steps "CHECK" and "ACT".
3) CHECK: the results in the previous step are studied to compare against the expected results to find any inconsistencies. The data collected in charts enables us to see trends over several PDCA cycles and support converting the collected data into information. Where this Information is what we need for the next step "ACT".
4) ACT: If the previous step shows that the results of the data collected in the CHECK step is as expected, then the PLAN becomes the new standard (baseline) for how the organization should ACT going forward. Otherwise, if the CHECK shows that the resulted data from the implemented PLAN is not as expected, then the existing standard (baseline) will remain in place.

Additionally, Juran contributed to the quality improvement by

- Showing the importance of senior management in quality improvement.
- Adding quality improvement to the BPS.

Kaoru Ishikawa introduced the concept of the quality circle organization, CI philosophy, and bottom-up analytical methods such as cause and effect diagrams.

With TQM, the PI movement began, and the notion of CSFS entered the conscious of management.

(2)

While there is no standard approach for applying TQM (3) .TQM led to a revolution in managerial thinking and was embraced internationally. But after two decades, the market and the way business work has changed and TQM did not cover the complete requirements of the business, thus, Six Sigma, lean management, lean six sigma and other programs have emerged into the market and will be introduced in the next chapters.

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(1) https://en.wikipedia.org/wiki/PDCA

(2) (Chang, 2006) P 7

(3) https://en.wikipedia.org/wiki/Total_quality_management

5.1.2 Six Sigma

Six Sigma is a data-driven PI methodology set of techniques and tools for PI, which seeks to reduce variations in all BPS. Sigma, σ, is Greek letter used by statisticians to measure the variability in any process. The performance is measured by the sigma level of the processes. Traditionally, companies accepted three or four sigma performance levels as the norm, despite the fact that these processes created between 6,200 and 6,700 problems per million opportunities. The Six Sigma standard of 3.4 problems per million opportunities is a solution to the continuous customer requirements and the increasing complexity of new products and processes. (1)

(Pyzdek, 2003) Defines Six Sigma as "a rigorous, focused and highly effective implementation of proven quality principles and techniques. Incorporating elements from the work of many quality pioneers, Six Sigma aims for virtually error free business performance"

(Hayler, 2007) Illustrate the history of Six Sigma "originated at the Motorola Corporation in the United States in the mid-to-late 1980s and were subsequently expanded at GE and other leading firms during the 1990s." The authors go on to explain that over the last 15 years or so, Six Sigma has been increasingly recognized as a powerful approach to achieve BP improvements in both manufacturing and, more recently, service and transactional industries.

The use of Six Sigma is not limited to manufacturing companies. Many service companies have also successfully implemented Six Sigma programs. As an implementation methodology, Six Sigma provides a tool kit and a structured framework for companies to implement.

(1) (Pyzdek, 2003)

Six sigma follows two methodologies each methodology consists of iterative five phases. (1)

A. DMAIC is the first methodology which stands for (Define, Measure, Analysis, Improve, and Control). This methodology is used for projects aimed at improving an existing BP. Under this methodology, an improvement program starts with

- **Define**: define the system, the customer requirements, the problems and the project goals, specifically.

- **Measure**: to quantify the problem measure key aspects of the current process and collect relevant data; calculate the 'as-is' Process Capability.

- **Analyze** detailed analysis of relevant processes to identify the root cause of the problem by cause-and-effect relationships.

- **Improve** or optimize the state of the current process based on analyzing data by using techniques such as design of experiments, poka yoke, and standard work to create a new future state process.

- **Control** the future state process to ensure that the problem does not occur again implement control systems such as statistical process control, and continuously monitor the process. This process is repeated until the desired quality level is obtained.

(1) (Chang, 2006)

B. DMADV or DFSS the DMADV project methodology, known as DFSS ("Design for Six Sigma"), is used for projects aimed at creating new product or process designs.

It features five phases: (1)

- **Define**: form the goals that match with the customer demands and the enterprise strategy.
- **Measure** and determine the CTQs (characteristics that are Critical to Quality), measure product and production process potentials, and measure risks.
- **Analyze** to develop and design alternative solutions.
- **Design** an improved alternative solution based on the analysis in the previous step.
- **Verify** the built design, implement the production process.

Six Sigma requires from companies to have Six Sigma practitioners. Where there are three types of Six Sigma certifications: green belt, black belt, and master black belt.

- Green belt holders are familiar with the basics of Six Sigma and its philosophy. They are the project leaders on Six Sigma projects. They flow the Six Sigma philosophy to the entire organization. Even though they are usually not involved full time with Six Sigma implementation.

- Black belt holders receive significant training in different areas such as
  - Statistical techniques
  - DMAIC skills
  - Interpersonal, and project management skills.

(1) https://en.wikipedia.org/wiki/Six_Sigma#Methodologies

5.1.3 Lean Management

Lean management (LM) is another approach for PI implemented in companies that support CI. LM seeks to eliminate different kinds of any unnecessary resource consumption by removing any non-value adding activities/processes.

As (Womack, 1990) established the term "lean" in the 1980s, describing its main objective as increasing efficiency through minimizing costly non-value-adding activities while retaining customer perceived value.

On the contrast from the Manufacturing industry the service industry has its production operations oriented towards different kinds of customers, the costs related to work that adds no value the customer's eyes ("non-value-add") is higher than in manufacturing, in both percentage and absolute dollars, therefor the LM is essential for the service industry.(1)

Lean is a philosophy oriented towards production (originating from the Toyota Production System), lean focused on improving efficiency in mass production (2). Furthermore, before LM the main focus in companies was on quality costs and delivery. After lean production the focus was shifted to value rather than cost issues, which shows that LM requires strategic management rather than tactical one. This change creates a shift from a concrete concept which focuses on methods and tactics to a more abstract concept oriented towards strategy. This could enable lean application to other sectors than the manufacturing such as services.

For manufacturing companies quality of productivity is perceived to be constant, where productivity is assumed to be focused on internal side and efficiency. On the contrary service quality is diverse and variable, where each customer has his own perceived quality based on individual preferences, therefore, companies need to improve both their efficiency and the quality of their different services, where only improving efficiency could decrease profit due to low customer satisfaction.(3)

According to the available literature LM has different principles which are listed in the following table:

(1) (George, 2003)

(2) (Womack, 2003)

(3) (Per Carlborg, 2013) P7

Lean principle	Literature	Meaning	Implications
Define value	(Womack, 2003) (Pettersen, 2009) (Shah, 2007)	Value is always created by the provider, even though value is defined by the customer	What is not adding value – waste – must be reduced by minimizing resources that do not contribute to customer value
Define value stream	(Womack, 2003) (Pettersen, 2009) (Shah, 2007)	Mapping every step involved in the production process	Actions are mapped into different categories – those that create value, as perceived by the customer, and those that do not
Flow	(Womack, 2003) (Shah, 2007)	Focuses on the object (such as a product, a customer, or information) running through the value stream	Instead of looking at the resources available and how to use them efficiently, flow focuses on the process and how to optimize the flow of elements through the process
Pull	(Womack, 2003) (Pettersen, 2009) (Shah, 2007)	Not producing prior to an order	Capacity becomes a critical issue
Standardization	(Pettersen, 2009)	Setting standards to achieve platforms that enable improvements	The functionality from different units can be controlled and compared with different measures
perfection	(Womack, 2003) (Pettersen, 2009) (Shah, 2007)	The absolute goal of lean	The outcome of lean if all other lean principles are fulfilled

Table 5.2. Principles of lean management
(1)

(1) (Per Carlborg, 2013) P6

5.1.4 Lean Six Sigma

Lean Six Sigma (LSS) is a methodology that combines both approaches LM and six sigma, where principles from both approaches are implemented to gain the most benefit from both approaches.

As already described LM focuses on optimizing the speed of the process and the efficiency of products delivery to customers by eliminating non-value adding activities and by consuming fewer resources during the assembly of the products. Additionally, Six Sigma (6σ) is a quality improvement method that seeks to reduce variations in the production process that can be measured, controlled and improved by applying statistical process control.

On one hand the LM cannot bring a process under statistical control, while 6σ alone cannot dramatically improve the speed of the production process and reduce invested capital. Therefore, a combination between the two methods is required. The two concepts are complementary.

The philosophy of LSS uses the Six Sigma DMAIC phases. A project that implements LSS comprise aspects of both LM by removing non-value activities and Six Sigma by reducing variations. The LSS DMAIC approach comprises all the Lean and Six Sigma tools. Furthermore, LSS training is similar to the Six Sigma belt training as mentioned earlier. (1)

When implementing LSS there are different CSFS to consider, which when not applied means that the program stand with a little chance to succeed on the short and long term, this also applies for other PI programs, because each method has CSFS. In the next chapter this study discusses the CSFS when implementing different PI programs, which were discussed in this chapter.

(1) https://en.wikipedia.org/wiki/Lean_Six_Sigma.

5.2 Literature CSFS of Service Quality Improvement Programs

Companies should take into consideration many factors to implement the different PI programs successfully, where ignoring these factors, will directly lead the PI program to fail. Each of the already mentioned PI programs have many CSFS some of them are in common and some of them have their own.

In this part of the study the CSFS of all PI programs will be introduced and their role and importance will be discussed. The available literature of the CSFS of PI programs states that the search for new CSFS is still a continuous task with importance to the literature and practices of operations management.(1)

The general CSFS of the different PI programs are listed in the following table in the next page.

(1) (Netland, 2014) P 5

Literature reviews	Saraph et al (1989)	Sila & Ebrahimpour (2003)	Karuppusami & Gandhinathan (2006)	Nitin et al. (2011)	Motwani (2001)	Schroeder et al. (2008)	Coronado & Antony (2002)	Brady & Allen (2006)	Kwak & Anbari (2006)	Ahuja and Khamba (2008)	Ramarapu et al. (1995)	Näslund (2008)	Netland & Aspelund (2014)	Marodin & Saurin (2013)	#
Improvement programme / CSF	TQM	TQM	TQM	Quality awards	TQM	Six Sigma	Six Sigma	Six Sigma	Six Sigma	TPM	JIT	Lean, Six Sigma, JIT, TQM	Lean, XPSs	Lean	
Management commitment and involvement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
Training and education	X	X	X	X	X	X	X	X	X	X		X	X	X	13
Employee participation and empowerment	X	X	X	X	X	X	X	X		X	X		X	X	12
Alignment to strategy and long-term plan		X		X			X	X		X	X	X		X	8
Managing cultural change							X	X	X	X		X	X	X	7
Supplier involvement	X	X	X		X	X	X				X				7
Customer involvement		X	X	X	X	X	X								6
Teamwork		X	X			X		X				X	X		6
Process management	X	X	X	X	X	X									6
Structured approach and project prioritizing				X			X	X	X					X	5
Benchmarking and knowledge transfer		X	X		X							X	X		5
Cross-functional integration		X	X		X	X								X	5
Quality data and analysis	X	X	X	X		X									5
Project management skills							X	X	X			X			4
Performance measurement					X			X				X		X	4
Organisation infrastructure			X				X			X		X			4
Sustain continuous improvement		X								X			X	X	4
Quality control and robust processes	X	X		X							X				4
Use of tools, techniques and technologies							X	X			X				3
Communication							X					X		X	3
Rewards and recognition				X						X				X	3
Job security and social responsibility		X												X	2

Table 5.3. Critical success factors reviews from the improvement program literature. (Netland, 2014) P 4

The importance of each CSFS in the introduced table are ranked downwards and it can be noticed that the most important CSFS within the different PI programs are

- Management commitment and involvement.
- Training and education.
- Employee participation and empowerment.
- Aligning the improvement program to the business strategy and to creating long-term plans.
- Managing cultural changes.
- Customer and supplier involvement.

5.2.1 Management Commitment and Involvement

Top management involvement and commitment is considered as the most important CSF in the literature. This indicates that the management team of an organization should participate and learn the principles of the PI program the company wants to implement. Furthermore, the management should provide the appropriate training and resources for the implementation of the PI program. Management commitment towards the PI program will lead the employees to understand the importance and priority of the new project.

This eventually will lead to total employee involvement, through a clear vision and mission, which is supported by the top management.

(1)

Also PI programs such as Six Sigma there exists interlinked factors that are connected and support each other, these factors are called hard and soft factors, the management commitment is considered one of the soft factors that support the hard ones (organizational infrastructure, project management, process management, and statistical tools). (2)

The commitment and involvement of the top management is essential throughout the complete implementation life cycle not only during the implementation phase of the PI program rather before, during and after implementing it. Also without the management commitment the employee's commitment towards implementing a PI program will be weak. (3)

(1) (Ibrahim Alhuraish, 2014) P 6

(2) (Khan, 2005) P iii, 50

(3) (Khan, 2005) P 45 ; (Antony, 2002) P 93

5.2.2 Training and Education

When implementing a PI program it is crucial that all employees have an idea of how to deal with the program, which means a proper training and education sessions should be carried out within the company, where this helps people understand the necessary knowledge for the implementation phase components, in which they understand:

- Fundamentals.
- Tools.
- And techniques.

Of the specific PI program. Training and education is considered part of the communication factor which is listed in **Table 5.3,** where training ensures that managers and employees apply and implement the PI techniques effectively

(1)

When the employees receive the proper training and knowledge of the program then they will be willing to work and contribute towards the implementation of the PI program and as a result benefits can be achieved. Because employees are considered one of the major keys to change in organizations. Training and education factor is, thus, one of the most important CSFS of implementing a PI program (or quality tool).

(2)

To shed light on the importance of training and educating the employees an example of companies applying training and education will be briefly introduced. The company GE decided to implement the Six Sigma program where every exempt employee at GE was trained in Six Sigma methodologies. In 1998, GE spent US$400 million on Six Sigma (most of it for training) and profited about US$1.2 billion in as a result.

(3)

(1) (Ayon Chakrabarty, 2007) P 200

(2) (Zahid Abbass Shah, 2016) P 914

(3) (SASTHRIYAR, 2006) P 18

5.2.3 Employee Participation and Empowerment

To be able to see the long term benefits of changing the way a company operates or when a company changes its PI program it is required to involve the goals of this plan/PI program on the individual level, which also means that individual actions should be taken into consideration to reach the desired outcome and the expected behavior from each employee.

(1)

5.2.4 Aligning the PI Program to the Business Strategy

The implementation of a PI program must be aligned with the business strategy of the company, for many reasons and one of them is to not hinder the operation of the business strategy of the company, because a business strategy which is critical for any organization and equally important is having a mechanism which is the PI program which will translate that strategy into action. Because every organization within every industry develop a strategic plan for their performance cycle. Based on the business strategy organizations define both their goals and objectives. (2)

Thus the implementation of the PI program should be treated as a critical and major activity, because it requires a full attention and complete utilization rather than using simple tools. (3)

(1) (Antony, 2002) P 97

(2) (SASTHRIYAR, 2006) P 9

(3) (Antony, 2002) P 95

5.2.5 Managing Cultural Changes

What culture means is the norms of behavior and shared values among a group of people. Culture involves three components

- People thoughts
- Their actions
- And the material products they produce.

As a result it can be concluded that mental processes and employee's beliefs, knowledge, and values are parts of culture. A successful introduction and implementation of a PI program requires some changes in the culture of the organization and a change in the attitudes of its employees. Employees have to be motivated and accept responsibility for the quality of their own work. Where for example the history of Six Sigma application in General Electric showed that Employees created a burden during the introduction of six sigma, due to a misunderstanding that six sigma is only a statistical toolset. Currently Six Sigma within General Electric is how employees do their job.

Any PI program requires the right mindset and attitude of every employee, where the need to change should be understood by all employees. The successful way to manage change and tackle resistance to change is through

- Communication
- motivation and education

(1)

(1) (SASTHRIYAR, 2006) P 16,17

5.2.6 Customer and Supplier Involvement

One of the main objectives of the PI program is to satisfy the customers, thus, linking the PI program towards the customer is an important element of the success of the PI program. Projects are basically driven by customer requirements and should be oriented towards them.

A good understanding of the organization and its linkage to various business activities has a major impact of linking the PI program towards the customer clients. The process of linking the PI program to the customer is divided into two main steps:

1. Identifying the core processes, defining the key outputs of these processes and defining the key customers that they serve.
2. Identifying and defining the customer needs and requirements. An. Quality function deployment is a powerful technique to understand the requirements of customers and translate them into design or engineering requirements. In the service industry, the customer requirements are often ambiguous, subjective and poorly defined.

(1)

Beside the involvement of customers suppliers also must be involved because it can lead to strengthen the connection between the supplier and customer which eventually improves the quality of the services/products. This requires the fine tuning of the supply chain management for the above mentioned relationship for the implementation of the PI program. (2)

The key element of the successful integration of suppliers into the PI program is obtaining the top management acceptance and support from the supplier firm side. (1)

(1) (SASTHRIYAR, 2006) P 21- 23

(2) (Zahid Abbass Shah, 2016) P 914

Despite mentioning the basic CSFS of the different PI programs and describing the benefits that come along with these factors and their influence for the PI program, there are still some challenges which the service industry is facing and these challenges are not covered by the basic CSFS, these challenges will be mentioned in the next chapter, and then the factors that solve these challenges and issues will be considered as a CSFS for the implementation of the PI program.

5.3 Challenges of improving Service Quality within the Service Industry

In this part of the study, the different challenges and issues that the service industry faces will be introduced, and based on these challenges new factors will be derived:

- Every organization whether a manufacturing or a service provider sees its main goal is furnishing customers with quality products. Thus, to be able to compete with other organizations, a company must utilize its resources (material, labor, money, information) in the most efficient way to gain the output in the form of a product or a service, a manufacturing company is oriented towards standardization where manufactured goods are generally standardized, and the Operations management in the manufacturing industry typically has only one thing to say about variability: It must be eliminated. It is learned as the enemy of quality.
  Services, by contrast, are oriented towards the satisfaction of the specific needs of a customer, where the challenge is providing a standardized service and in the same time a customized service due to the high variance of customer demands.

  The current challenge for many service companies is to develop a service that is flexible and open in a way for tailoring (service variability) to fit the specific requirements and customization of customers and at the same time achieves efficiency through standardizing processes. (1)

  Keeping in mind the CSF of linking the PI program to customer, when the company take this factor into consideration then it comes face to face with this challenge and needs to face it.

(1) (Frei, 2006) P 2 ; (Per Carlborg, 2013) P 8

- Business and technology are having rapid dynamic changes in a fast rate, but to consecutively apply these changes is a very challenging task for companies. Organizations should adapt to such transformation, where the organization should have a strategy and environment which supports the continuous change, and the Technology and Employee knowledge to support it which indicates that any change could require implementing a new PI program, which could lead to changes in many aspects of the company (i.e. change in culture, infrastructure, operations…).

  When change management (CM) is not implemented in a company the following issues will arise: (1)

  In projects it is essential to manage the people side of change, when not managed then the following costs arise:

  - Project will postpone, and deadlines will not be met.
  - Furthermore, milestones will also not be met.
  - Project will go beyond the specified Budget.
  - Rework required on design Loss of work by project team.

  And the following risks will be faced:

  - Resistance – active and passive from the people of the project.
  - Project put on hold.
  - Lack of resources.
  - Project team will face unplanned obstacles.
  - Project fails to deliver expected results.
  - Project is fully abandoned.

  Normally organizational success is based on the production and sale of products but also on the ability to cope and handle the fast pace of dynamic changes in the market. So to ensure the survival of a business in a dynamic environment, it is necessary for an organization to manage changes. One of the main reasons for a failure of a project is the poor Preparation and management, so CM should be considered and implemented for a project to succeed.

(1) http://blog.prosci.com/the-costs-risks-of-poorly-managed-change

A main point on the topic of changes is how BPM could adapt to these changes, where a complete reset of the entire chain of BPS is possible. For BPM to adapt to changes an organization could do the following tasks:

- At the organizational level all processes as a complete set should be observed, controlled and optimized.
- Bottlenecks should be noticed and every task that has a negative impact on the client service should be eliminated and the re-modeling of its main process is required.
- Real time performance dashboard and Key performance indicators data could be analyzed for the future re-modeling of the entire BPS chain.

(1)

- As mentioned in the previous point BPM should also adapt to organizational changes but BPM greatest challenge is making it part of the culture and getting employees passionate about it as well to remove the resistance of change. To achieve this a culture of CI should be present in a company but when a company still did not implement a culture of CI is due to the following reasons.
  - One is that the organization is still young and, therefore, education and awareness are both required to propagate the CI culture. (2)
  - Or the organization is already mature and feels that it has already done everything possible to remain efficient. Both scenarios represent a barrier to adopting a true culture of CI. (2)
  - Creating a culture of collaboration and involvement can be hindered by controlling styles of management.

The organizations strategy & environment should support the CI and be a learning environment where the company could easily improve itself to adapt to any new change or customer need.

(1) (Panagacos, 2012) P 20-23
(2) (Mendez, 2015)

- When organizations want to implement a PI program the upper management needs all information to support their decision if they should implement a PI program and which PI program to implement, which suits the way the organization works (1). Thus companies should manage their information because when not implemented could lead to taking wrong decisions and missing success opportunities. Furthermore, not managing information could cause the following:

    - No control over document repositories by giving documents versions results in complexity and difficulty over which is current, compatibility problems and other issues that disrupt progress.
    - When no appropriate tools for organizing and managing information is implemented it will cause a loss of key information or a loss of control.

  (2)

  Also, organizations fail in implementing BPM strategies due to

    - The lack of understanding of the actual goals and expectations.
    - The ability to implement the methodologies and the enormous number of currently existing methodologies.

  (3)

- When implementing a new project companies should consider assessing all kind of risks that could arise and implement plans to face these risks, because any critical risk could lead to the failure of the new project if the solution plan is not available, if implemented companies could react to all risks efficiently and effectively. Thus risk management should be implemented and given importance.

- Prior to implementing a PI program, management should select the projects that will suite the selected PI program and give projects priority, because when a PI program is implemented within projects without studying the compatibility between the PI program and the project, could lead to loss of time and resources of the company and eventually failure of improving the project. (4)
  Furthermore, companies should have the compatible IT tools with the implemented PI program, where each program may need specific tools and Software (SW).

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(1) (George, 2003) P 183 , 256
(2) http://calleam.com/WTPF/?page_id=2338
(3) (André Cristiano Silva Meloa, 2009) P 306
(4) (George, 2003) P 249 ; (Snee, 2010) P 12, 13

- Organizations need to follow a standard framework to implement a PI program, to use it as a guideline, but a standard framework to implement the PI programs does not exist. For example LM and six sigma still have no standard implementation method or framework. And the literature is still searching the factors that influence the application of these practices. (1)

- When companies lack the implementation of the above mentioned points means there is a poor preparation for the implementation phase of the project. This poor preparation is one of the main reasons why projects fail, thus, companies must have a clear picture of what they need to do, in advance – as much as possible, to be able to manage the project successfully. (2)

To overcome the issues and challenges of BPM (mentioned in chapter 3.4 in this study) and the challenges of implementing a PI program, the CSFS of the PI program should be implemented, but many companies still fail in implementing the PI program due to the uncovered challenges by the literature basic CSFS, these challenges will be covered by the advanced CSFS founded in this study, which are

- Variance management (VM)
- Change management (CM)
- Knowledge management (KM)
- Risk management (RM)
- Project selection/prioritization

In addition to the above mentioned CSFS there are other factors that add benefits and could support the QM of the organization one of these factors is:

- Information technology

Further and more detailed explanation of each factor, and which values and importance it brings to both project side and company side will be discussed in the next part of this study

(1) (Kamran Moosa, 2010) P 754 ; (Dr. Alexandros Psychogios) P 3 , 4 ; (Netland, 2014) P 2

(2) https://project-management.com/top-10-main-causes-of-project-failure/

5.4 Service Quality Improvement CSFS

In the previous chapter the challenges and issues for implementing a PI program were mentioned, plus the factors that could help remove these issues were summarized. Eventually this chapter shows how these advanced CSFS could be applied to the structure or the operations of an organization to create the appropriate framework.

This framework is shown in the following figure.

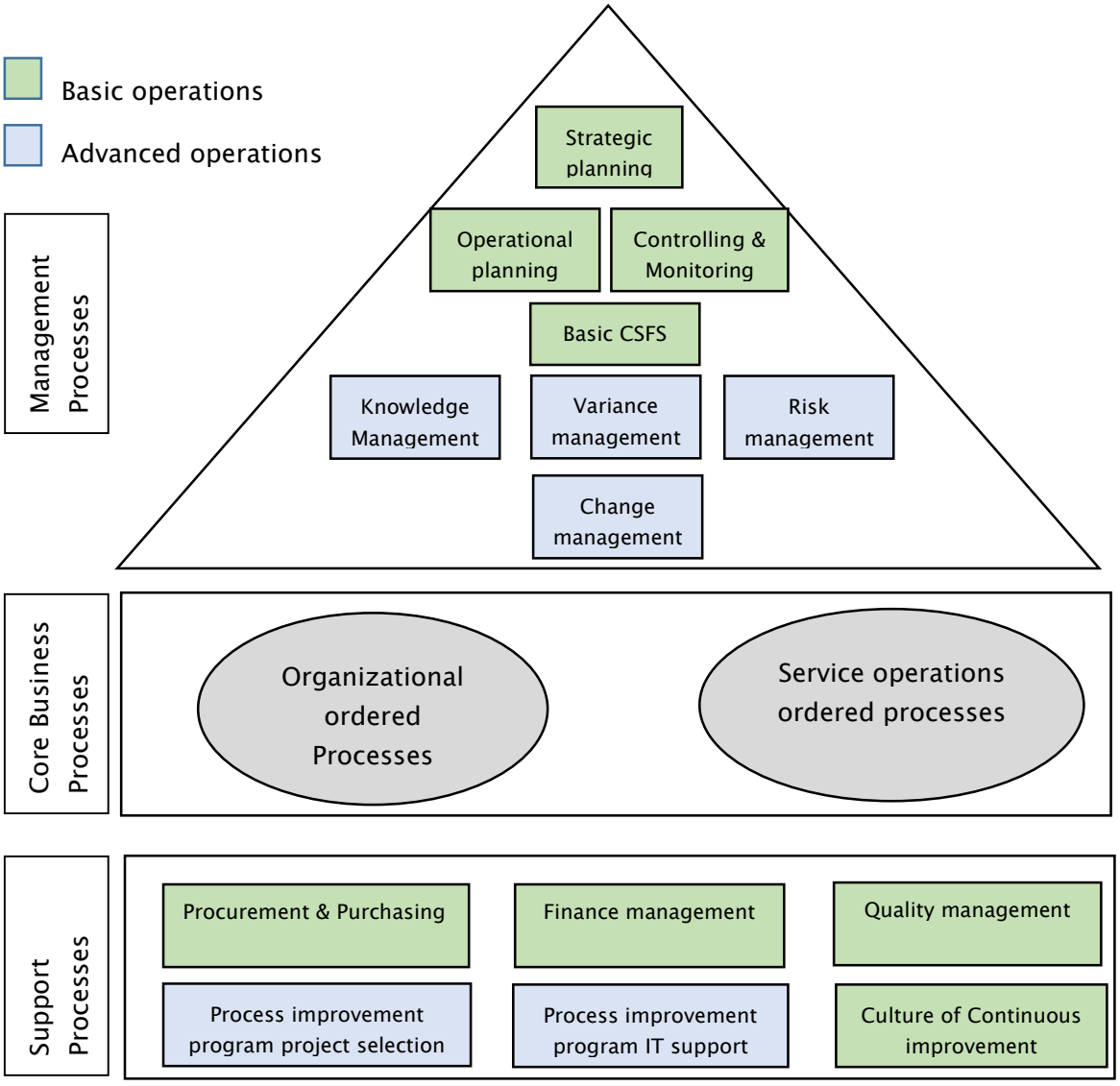

Fig 5.1. Service Quality improvement CSFS framework

The role that is played by each factor when implementing a PI program and how these factors contribute to each other will be introduced in the next part of the study, additionally, which benefits they bring along when implementing them will be introduced next.

5.4.1 Knowledge Management

Knowledge management (KM) in an organization is the creation, sharing, usage and management of the knowledge and information (1). It is also referred as a multidisciplinary approach to achieving the main objectives of an organization by using the available knowledge at its best (2).

Knowledge have components which are information and data, these components have a hierarchical relationship between each other, where from data information can be extracted and eventually this information forms the knowledge as a result. (3)

(Venkatraman, 1994) Offered a solution and a simple arrangement of ideas that categorized data management (DM), information management (IM) and KM together:

1. Data that is maintained in IT infrastructure has to be interpreted in order to render information.
2. The information in our information systems has to be understood in order to emerge as knowledge.
3. Knowledge allows managers to take effective decisions.
4. Effective decisions have to lead to appropriate actions.
5. Appropriate actions are expected to deliver meaningful results

These major five steps form the following model: (4)

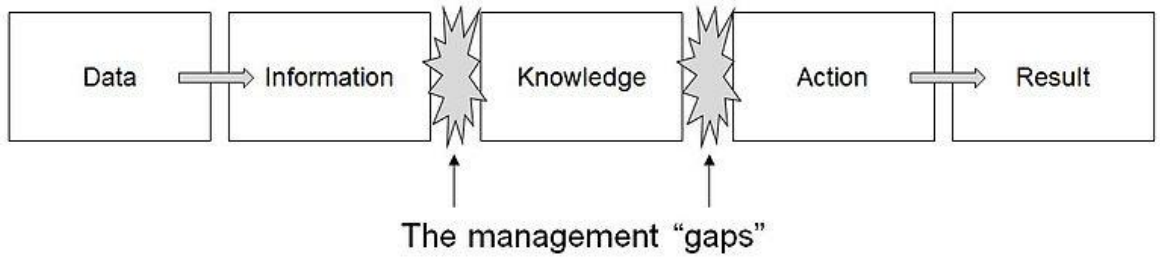

Fig 5.2. DIKAR Model

(1) https://en.wikipedia.org/wiki/Knowledge_management
(2) (Carolina, 2007)
(3) (Elaine Mosconi, 2013) P 69
(4) (Ward, 2002) P 207

The DIKAR model stands for: Data, Information, Knowledge, Action and Result, (1) it gives an illustration of the layers involved in aligning technology and organizational strategies.

After defining the relationship between KM, IM and DM, the study introduces IM in the next part.

IM is a series of organizational activities which are the following:

1. Information is acquired from one or many sources
2. The information is observed and deployed to those in need of it.
3. The information is either archived or deleted.

IM contains of the basic concepts of management including:

- Planning
- Organizing
- Structuring
- Processing
- Controlling
- Evaluation and reporting

Of needed information activities to meet the requirements of employees that depend on information. (2)

KM Benefits to some the basic CSFS mentioned in Table 5.3 will be connected to KM in the next part:

(1) (Venkatraman, 1996)
(2) https://en.wikipedia.org/wiki/Information_management

5.4.1.1 KM impact on basic CSFS:

1. KM connection with Top Management Commitment and Involvement:

IM could be used when considering the top management factor in applying six sigma, to convince them to apply six sigma, and to help them get feedback during six sigma implementation. (1)

enhancing decision-making at all levels by providing better quality, more relevant, and more timely data and information, delivered to the right people at the right time. (2).

2. KM connection with Business Strategy:

Some of the basic CSFS When aligning the PI program with the basic CSF (Alignment with business strategy) KM could be used to better understand the strategy when doing the alignment. (3)

Furthermore, when KM supports organizational analysis strategies to help BPM it is considered a master key to include intellect as a reliable resource to help gain better efficiency, flexibility and customer service. (4, 6)

Could help to align the basic CSF (IT) with the business strategy, where data as shown in the DIKAR model is maintained in the IT infrastructure, this data is further used to extract information and knowledge. (5)

3. KM connection with Customer Involvement

When aligning Six Sigma with the customer (Six sigma CSF) IM could help with understanding customers and their needs. Thus, IM could be utilized in this step. (6)

Improving the combination and coordination between employees and customers by connecting them in new ways over far geographic areas and organizational boundaries. (2)

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(1) http://www.businessdictionary.com/definition/information-management.html
(2) (GAO, 1994) P 11
(3) https://en.wikipedia.org/wiki/Information_management#Aligning_technology_and_business_strategy_with_information_management
(4) https://en.wikipedia.org/wiki/Information_management#cite_ref-Venkat2_5-0
(5) (André Cristiano Silva Meloa, 2009) P306
(6) http://tdan.com/information-management-a-key-for-creating-business-value/12829

Also KM supports aligning business goals and client's needs by developing the business strategy which requires information from both factors internally and externally:

- Internal factors :
  (Operational capacity, available capabilities, employee cooperation, management styles).
- External factors:
  (Governmental policies, environmental issues, economic conditions).

Handling and processing this great volume of data helps to obtain this information, which eventually will support alignment towards customers, and involve them. (1)

4. KM connection with Continuous Improvement

Supports continuous and systematic PI based on KM strategies, where using the strategy in the figure aims at enabling continuous learning and, at the same time, promoting CI of processes.

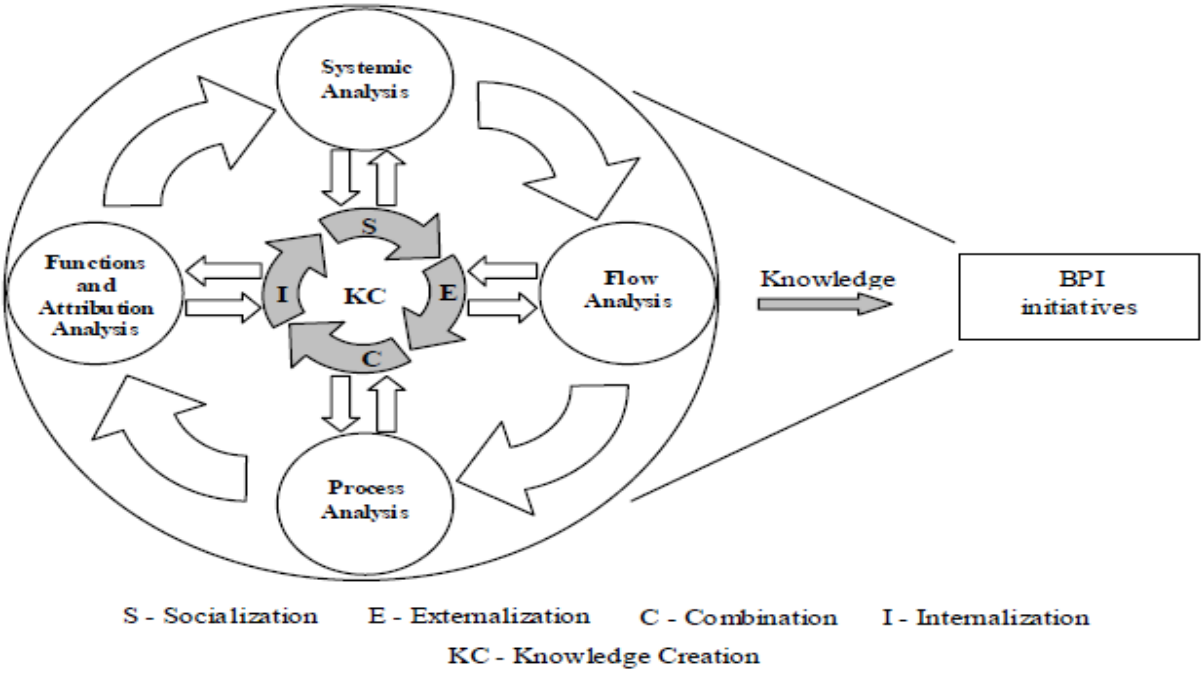

Fig 5.3. Knowledge generation cycles for BPI
(2)

(1) (André Cristiano Silva Meloa, 2009) P 306

(2) (André Cristiano Silva Meloa, 2009) P 312

As in the upper Figure, the methodology combines an external cycle with an internal cycle for knowledge generation. The internal cycle steps are: (1)

1. Socialization: information exchange through meetings and informal talks among employees in charge of the service, the key factor in this step is the participant's experience.

2. Externalization: Employee's current knowledge is formalized resulting from their discussions and thinking together, this knowledge is transformed into models, figures and other structured forms of knowledge to deploy it in the organization.

3. Combination: the knowledge defined in the previous step is exploited by combining it with other forms of combined literature knowledge (re-engineering, process analysis and modeling etc.), the generated knowledge is analyzed from other point of views, which is external to both the department responsible for the service and to the organization itself, and can be combined with the available completing and compatible knowledge. In this way, the knowledge becomes a greater value to the organization.

4. Internalization: it is the step of spreading the knowledge in the form of redesigned processes, procedures, instructions, rules, documents, strategies to be able to utilize the new technologies. Where in this step the – explicit and capitalized – knowledge is combined, which is now ingested to everyone who's directly and indirectly involved. This step is performed by going through interviews in the form of (talks, forums and workshops) to discuss the subject and to create documentations about it.

The external cycle shapes an analysis of the organizational performance levels that can be associated with the basic steps of knowledge creation mentioned above and in the KM model. To better comprehend the firm performance levels, we define four major stages for analysis.

1. Systemic analysis: it is the firm-level organizational performance.
2. Flow analysis: extends to all performance levels
3. The last two (process analysis and functions and attribution analysis) relate to the process and activity levels.

(1) (André Cristiano Silva Meloa, 2009) P 312,313

The successful implementation of the methodology requires:

(a) Commitment by top management:

Where the top management should make clear the need to assist performance improvements as a means to reach an advantage in competition or survive business, this is considered a key factor for successful implementation of the stages of the methodology.

(b) Area representative selection:

For each area involved, a representative should be selected this representative is responsible for:

- Motivating and directing all employees related to the service in question to the importance of obeying with the requirements of this methodology.
- Be able to interface with related areas of knowledge.

(c) Indirect participation by professionals:

From other decision levels/ other organization areas, these professional could be outside consultants /researchers, they will pass knowledge to the participants about the service weak points.

One of the CSFS of applying a PI tool is that the organization should be a learning organization (i.e. have an environment of CI) so one of the main objectives in a company is to treat knowledge as a valuable resource as condition for the learning enterprise. (1)

Hence when not applying KM the organization faces the risk of not being a learning organization.

(1) (S. Jablonski, 2001) P1

5.4.1.2 KM impact on advanced CSFS

1. KM connection with VM.

As this study has already described the service industry having different customers with high variety in demand, VM is also influenced by KM where Adoption of IM opens up a set of opportunities for enterprises by creating communication channels with customers the new market opportunities can be identified. (1). IM can help business not only understand its customers but also their behaviors and their preferences; thus, it directly gives business the opportunity to foster their customers better and keep them.

When IM is not adopted it can be a high risk to the organization. Since IM is vital in understanding the customer, not adopting it could potentially mean business is jeopardizing the customers.

2. KM connection with CM.

KM Paves the way to appropriate culture of change and innovation in the organization, by creating communication channels to exchange information in the organization's internal and external environments (suppliers, partners, stakeholders and customers). (1)

Furthermore, when utilizing KM in the organization level and in processes and activities so that decisions made in middle and top management both do not cause conflicts within processes and cause distortion with the main goals and the company's vision.

As a result KM supports CM, because it promotes realization when such PI opportunities will bring realization and motivation in the organization for the need for change and what is needed for change.(2)

(1) (André Cristiano Silva Meloa, 2009) P 311

(2) (André Cristiano Silva Meloa, 2009) P 307

3. KM connection with RM.

RM is influenced and supported by KM where past and current information could be used to identify triggers for risks and as a solution for risks. (1)

Performance improvement opportunities must be supported by a knowledge base (goals, critical factors, obstacles, solutions and implications), thus, obstacles (risks) should be supported by KM.
RM consider KM processes as enablers for improvement in assessing the risks and sharing a common decision. (2)

(1) https://www.experiencematters.com.au/uncategorized/3-benefits-of-effective-information-management/

(2) (Jaw-Kai Wang, 2006)

5.4.1.3 KM application with BPM

KM could be used to support BPI, where knowledge consists of a network of information and is not stored in repositories (i.e. Databases/Documents), rather what is saved in these repositories is information. Actually knowledge is the summary of this information, and this collection of information forms the knowledge base. (1)

The knowledge base is very diverse offering different kind of information, some of these informations can be oriented towards BPs. The approach of applying KM in BPM should be creating a process oriented KM (2).

The approach which should be followed should be comprehensive, this comprehensiveness should cover two areas to go along with process orientation.

One area is the state of the process description: should include any process relevant information:

- process steps
- control and data flows
- organizational structures
- application systems
- other relevant ingredients of a process

The second area of the approach is the domain of process composition which is not limited by the company's organizational or technical boundaries, rather it is content related which means it is composed of anything relevant.
(3)

Furthermore, KM runs in parallel with BPS or pass between them. This is the knowledge that is essential during the execution of a BP and that can be generated as an output from the BP execution (4)

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(1) (S. Jablonski, 2001) P1
(2) (S. Jablonski, 2001) P2
(3) (S. Jablonski, 2001) P5
(4) (Boris Wyssusek, 2001) P3

5.4.1.4 KM impact on the PI Program

To benefit from the knowledge available at the company when improving BP through utilization of a PI program, all kind of knowledge in the information should be managed at its best by implementing a KM system, and through this system the PI program could benefit for instance when analyzing the root causes of issues in BPS by using Ishikawa tool or other tools.

The following figure shows a framework for implementing a KM system, which will explain in details how to benefit from the available information.

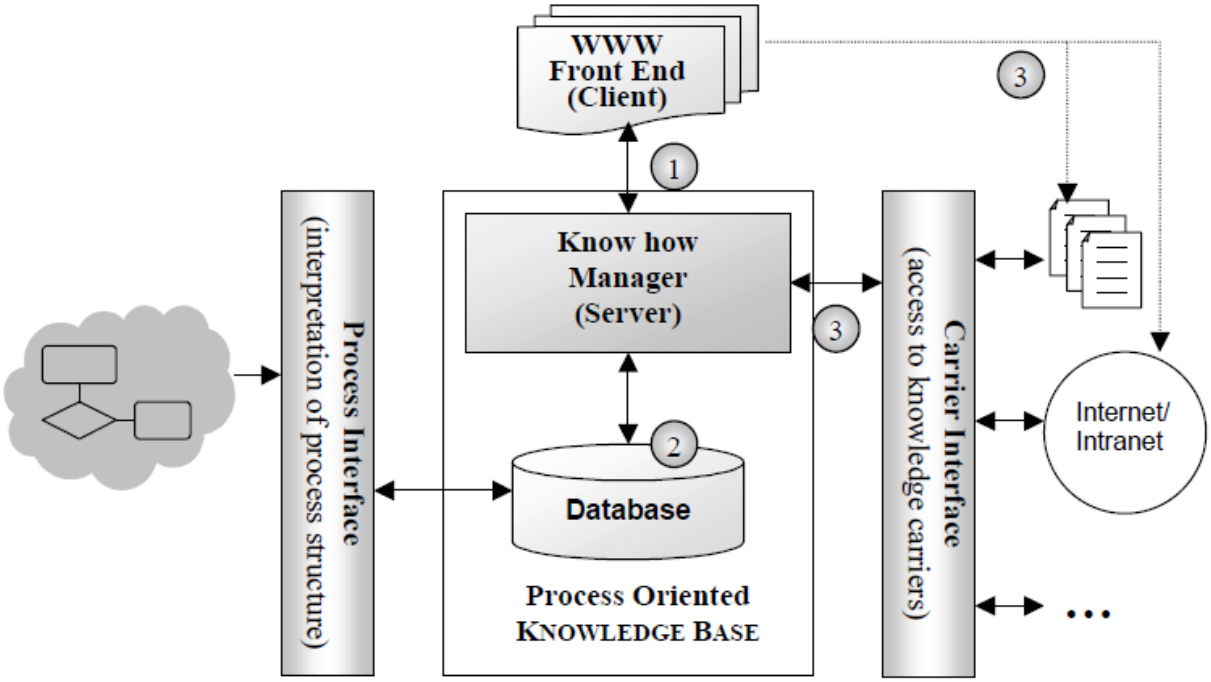

Fig.5.4. Knowledge management system
(1)

The system's core component is the Know-how Manager. The Process Interface passes processes to the Know-how Manager by forming a dimension in the knowledge base as shown in the figure. Through the Process Interface a process structure is fed into the system; it is used as dimension for the knowledge base. Since only structural information of processes is needed an internal representation of the process trees is stored in the database of the knowledge base. (2)

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(1) (S. Jablonski, 2001) P 13

(2) (S. Jablonski, 2001) P 11,12

On the other hand Knowledge carriers are passed to the knowledge base – either physically or by reference through the Carrier Interface. Knowledge carriers can be from different sources for instance the World Wide Web, a file system or a document management system.

A World Wide Web (WWW) front end provides wide access to the knowledge base which means the company can have access to this information in its intranet. Which means it acts as the interface with the knowledge base, where many users in the front end component can access the know-how manager concurrently and this needs synchronization. The WWW front end also incorporates a special administration interface. Additionally, through this interface users can define dimensions of the knowledge base in addition to the process dimension which is created by the Process Interface as mentioned before.

The non-functional requirements of a KM system are met by the above mentioned framework, these are ubiquity, availability, usability and extensibility, and these attributes are mainly handled by the WWW front end.

WWW achieves ubiquity by providing access all over the world. The know-how manager ensures the availability of information. Furthermore, the client-server relationship between the users in front end and the know-how manager makes of all knowledge carriers available to the front end users.

Also usability is achieved by having a simple and easy design of the front end. Last but not least extensibility is achieved by generating information from different kinds of resources.

(1)

When the KM system is implemented, the Information within can be used to support employees when implementing the PI program in different ways, for instance the six sigma PI program different belts holders the information of the target project or the company operational information should be organized and managed to be used to identify weak areas, Furthermore, when training employees for the utilization of six sigma information of the BPS could be used to ensure the best application of six sigma or any other PI program in the company.

(1) (S. Jablonski, 2001) P 12

5.4.2 Variance Management

PI programs such as Six Sigma and other programs were basically developed for manufacturing companies (1), which means that they handle a limited amount of variance in processes, but service companies have high variance in Customer demands (2), which means the improvement tool should be supported by a methodology which supports the management of variance of customer demands.

PI principles are useful to increase efficiency and customer satisfaction for services with low diversity and low customer participation, on the contrary services that are customer oriented with high diversity and customer participation make the application of PI principles increasingly difficult, where different PI programs depend on standardization and automation of activities.

To manage the variance in demand from customers we should understand the different forms it can take. Customers introduce their demand variance to operations in different five factors: (3)

1. Arrival variability:
   Each customer want their service at specific time. The classic way to address arrival variability is to assign appointments and deadlines.

2. Request variability:
   Customers will not have a standard order, rather each customer can have his own special request

3. Capability variability:
   Service companies have different customers with different capabilities, this capability is based on the customer's:
   - Knowledge
   - Skill
   - Physical abilities, or resources,

   The capability variability is very important for the service industry where customers have high participation in the production and delivery of a service. It can be the case that a service may do its work and have no real interaction with the customer. But in other services it could be the case that a customer have a direct impact on the service.

(1) https://en.wikipedia.org/wiki/Six_Sigma

(2) (SASTHRIYAR, 2006) P 22

(3) (Frei, 2006) P 2

4. Effort variability:

   Customers will give different efforts to a service, each effort will have a different influence on the service.

5. Subjective preference variability.
   Customers have different preferences about treatment from a service

These five forms of variability can be sequential because they reflect the sequential process of a service transaction, where for instance a customer arrives, makes his request, contributes in the process requiring some level of capability and effort, and rates the experience according to his/her personal priorities. Operational issues in the service industry Problems can be created by customer-introduced variability which can be traced by the analysis mentioned above. But before managers take their decisions they must diagnose which variability factor is causing the issue, because each variability factor has its own strategy.

Managers in service businesses can either accommodate customer's various demands at high cost or refuse to accommodate variability and risk customer satisfaction. But this study will introduce other options which let companies offer a high level of accommodation at low cost or reduce variability without damaging the service experience.(1).

Fig 5.5. Service accommodation levels (2)

(1) (Frei, 2006) P 6
(2) (Frei, 2006) P 7

According to the figure above there are four possibilities to deal with customer demand variability:

1. Low-cost accommodation approach
2. Uncompromised reduction approach
3. Classic accommodation approach
4. Classic reduction approach

Accommodation strategies take different forms, depending on the business and type of customer-introduced variability, each approach will be briefly introduced: (1)

Low-cost accommodation approach:

When the customer is responsible for much of the work, companies persuade customers to serve themselves. When customers serve themselves, companies are letting each customer have his own service experience which meets his capability and effort (accommodating capability and effort variability) and giving customers control of the service environment (accommodating subjective preference variability). Using this method is effective for variability in high arrival or request.

Uncompromised reduction approach:

A company can reduce the effect of customer variability on it without risking the service experience by targeting customers on the basis of variability type. For example, companies can target audience with the same standard, the customers get the benefit of a good service and the company can reduce variability, plus the customers are not required to adjust to the service.

Classic accommodation approach:

Companies will accommodate the variable requirements from customers, but will have high costs, thus, a trade-off between cost and service quality is faced.

Classic reduction approach:

Companies that deny some of the variance of customer demands will have a trade-off between cost and service quality, where the complexity of the service operation is reduced but also may reduce service quality.

(1) (Frei, 2006)

5.4.3 Risk Management

Effective RM strategies allow you to identify different aspects in the project, these cover the following aspects: strengths, weaknesses, opportunities and threats. By preparing and planning for every event expected or unexpected, you can be ready to respond if they arise. To ensure the success of a project, you should define how to handle potential risks to identify and avoid problems. RM is important, because achieving a project's goals depends on planning, preparation, results and evaluation that contribute to achieving strategic goals.

RM plans contribute to project success by establishing a list of all internal and external risks. This plan typically includes the identified risks, probability of their occurrence, potential impact and suggested actions. Risks are categorized into three levels (Low, Moderate and High); Low risk events usually have little or no impact on cost, schedule or performance. Moderate risk results in some increase in cost, interruptions in plan or decrease in performance. High risk events cause a considerable increase in the budget, interrupt the schedule or performance issues.

Importance of RM:

- Minimizing and eliminating negative risks so projects can be finished on time. This enables you to stay within the budget and fulfill defined goals.

- When RM is not implemented, the project get exposed to problems and become vulnerable.

- Saves resources by improving the company's chances to plan and respond to risks. In turn, this saves you working hours and resources away from the main efforts of your business

RM when not implemented it's a failure to think ahead and to foresee and address potential problems that could arise during the life cycle of a project. Thus when considered as an independent activity rather than an integral part of the planning/ development process of a project, can lead to the failure of the project, due to handling unexpected events without pre planning or preparation.

(1) (Jeffrey K. Pinto, 1990) P 269, Table 1 in P 270

5.4.4 Change Management

As defined by Wikipedia CM is "*a collective term for all approaches to preparing and supporting individuals, teams, and organizations in making organizational change. It includes methods that redirect or redefine the use of resources, BP, budget allocations, or other modes of operation that significantly change a company or organization.*"

Organizational success is based on the production and sale of products and having a dynamic environment that easily deals with the fast pace of changes in the industry. So to ensure the survival of a business in a dynamic environment, it is necessary for an organization to be able to handle the fast, large and unpredictable changes (1), plus organizations behave differently in different circumstances at different point of times, and even at different locations, so CM is critical to the success of any project (2)

Top management support for CM has a major influence on the successful implementation of CM, top management should consider CM as necessary and should provide their personal commitment and leadership. (3, 4, 5)

CM provide different benefits for organizations, these benefits are introduced in the next part of this study.

5.4.4.1. CM impact on the Process and Human Side of Change:

For a successful change in organizations two sides play a major role these are process side and employee/human side, both of them are critical and should be given attention.

The "process" side is connected with project management related activities required for moving from the current to desired state (e.g. develop plans, build the infrastructure, change processes or systems, redefine job roles).The "human" side of change includes is helping employees understand the coming change and add it to their job (e.g., remove employee resistance, meet training needs, secure buy-in). (6)

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(1) (Boris Wyssusek, 2001) P 2

(2) (Jeffrey K. Pinto, 1990) P 274

(3) (Jeffrey K. Pinto, 1990) P 270

(4) https://www.thebalance.com/executive-support-and-leadership-in-change-management-1917803

(5) (Raymond Young, 2008) P 3

(6) http://qiroadmap.org/change-management/

An organization may have full employee support for the coming change but the necessary resources are not sufficient to support the change. Or, sufficient resources can be available but employees remain resistant to the change. Thus both sides should be combined and run simultaneously.

5.4.4.2. CM impact on Employees Participation and Managing Culture Change

CM creates a smooth implementation process, where change can occur in an organization in different ways:

- Strategic change
- Leadership changes
- Technology changes

Companies see CM as a critical factor when new technology is implemented. Employees could have the fear that this new technology will start to take over the workplace. This often causes resistance to change in organizations that are looking to implement new technologies.

But CM helps employees better understand change, you create an environment that is more open-minded and accepting to change. A formal way of communicating is used with employees to define why change is happening, what it will look like from their perspective, and how it will ultimately benefit them in the end. To ease the transition and shorten its time employees should be always informed from the start. So employees will accept and work with the change, and will be more engaged in the process of making it happen. Which results in a fast transitions which will not consume much of the organization time and resources.

Thus CM can help ease this tension by creating a smooth implementation process. Also organizations will be able to respond to new customer demands much quicker, as businesses will have a proper system in place for doing so.

Eventually CM helps in overcoming any changes affecting the organization and its service processes, in a way that it helps to manage the new change for the benefit of implementing the new PI program.

5.4.4.3. Change Drivers

Change is driven by different reasons either from inside of the organization or outside, so this study categorizes these changes to both sides internally and externally.

The internal factors are:

- CI and business increase: this factor is driven by poor service quality and high costs, where the change aims to reduce costs and increase quality.
- Management decision to increase shareholder value.
- Increase company's innovation and flexibility to the market's needs.

The external factors are:

- Competitor pressure.
- Low customer satisfaction.
- Economic conditions.
- Political factors.
- Technological changes.

5.4.4.4. CM impact on the PI Program

Creation of a Culture of Quality and CM:

CM is essential to sustaining a culture of quality, where implementing CM makes the culture of the company flexible and complying to any new changes.

Additionally, Quality improvement (QI) is basically making changes to system and processes which will lead to operational and organizational improvements, in which the company will follow the concepts of quality with their values, goals, practices, and processes.

Changes occur as mentioned above from different reasons internally or externally (E.x. could be a project requirement or a transformation in the company). In all cases, structural and process changes are introduced and CM is key to facilitate employee transition to the new state.

Paves the way for implementing the new PI Program:

When the organization implements the new PI program changes will be all over the organization, thus, managing this change is essential to the success of the PI program. (1)

(1) (U.S. Department of Health and Human Services, 2011) P 10, 14

5.4.5 Information Technology

Information technology is often referred to as IT, which is the usage of technology to work with data in different ways: (1)

- Storage
- Studying
- Retrieval
- Transmit
- and manipulation

The corporate IT functions must be tightly coupled to enterprise processes and the organization's information needs, when using IT in QM processes can have a major impact which results in improving operational performance measures such as

- Reduction of production cost.
- Delivery Acceleration.
- Improving flexibility.
- Reducing cycle time.

According to (Dewhurst, 2003) who concluded that IT was found to support TQM a summary of the benefits of IT is listed below:

- Improving costumer and supplier relationship;
- Increasing process control;
- Facilitating teamwork;
- Facilitating inter-departmental information flow;
- Improving design process and skills.
- Applying preventive maintenance;
- Measuring quality costs.
- Improving the decision process in quality departments.

(1) https://en.wikipedia.org/wiki/Information_technology

Explicit information about the impact of IT on QM based on the literature can be found in the following table

Author(s)	Potential benefits of IT on QM
(Dewhurst, 2003)	IT can be used to support the leadership role of senior management; to facilitate the dissemination of TQM values; and manage information on quality
(Freund, 1997)	Control of work processes can be enhanced by the use of IT. For example, automation helps to reduce process variance because machines usually demonstrate less variability than workers and increases the speed of production processes with a significant quality enhancement
(Gong, 1997)	Statistical process control can no doubt be optimized by the introduction of IT, through the automated measurement of product and process
(Ward, 1998)	IT can be of much help in the process of implementation of QM systems, such as the ISO 9000 series and QS-9000
(Dimancescu, 1992)	IT promotes continuous quality improvement, since it is a fact-based management technique in which the use of up-to-date data is a prerequisite for identifying problems, their root causes, and the solutions
(Sa´nchez-Rodrı´guez, 2006)	An empirical investigation conducted in Spain on IT use in supporting TQM initiatives revealed that the sampled firms make considerable use of IT to support their TQM initiatives and that overall such efforts generate significant positive gains on operational and quality performance

Table 5.4. IT impact on QM

IT supports organizations with their operation management by using a BPMS, Where BPMS enable streamline and integrate different RM systems that may be involved in a BP. By providing an overall framework for the BP, BPMS enable smooth flow of BPS across different departments, functions and back end RM systems. They also provide monitoring and reports that can help a Lean PI effort with measurement before and after improvement efforts.

5.4.5.1. IT impact on PI Programs

IT provides the appropriate tools to be used during the implementation of a PI program such as Six Sigma that is based on DMAIC roadmap, which stands for define, measure, analyze, improve, and control as defined in chapter 5.1.2. IT plays a significant role in each level in the six sigma methodology, where in the define phase the problem is identified and customer requirements are determined, The one IT application that incorporates all the DEFINE tasks into one comprehensive study is known as Quality Function Deployment (QFD), where all information about the customer requirements are iteratively refined to increasing levels of detail and specificity.

For the measure phase the typical IT tools include determining:

- Measuring/calculating Cost of Poor Quality (COPQ).
- Pareto charts
- Run charts
- Histograms (frequency plots)
- Process flow diagrams, and control charts.

(1)

Furthermore, for the analyze phase the goal is to use tools and techniques to analyze data and processes, to ease identifying and verifying root causes of the problem. The IT tools that support this phase are Design of Experiments (DOE) and Failure Mode Effect Analysis (FMEA). DOE tests simultaneously multiple factors that affect a process, service, or product. Where FMEA identifies and eliminates potential product or process failures by reviewing all possible components, assemblies, and subsystems to identify failure forms, and their causes and effects. (2)

(1) (Chang-tseh Hsieh, 2007) P 4, 5

(2) https://en.wikipedia.org/wiki/Failure_mode_and_effects_analysis

For the improvement phase the planned Design of experiments is also utilized, and for the control phase two control tools used in IT are run charts and Statistical Process Control (SPC) charts, to follow the performance and key performance indicators.(1)

Additionally, Document management systems allow an organization to run BPS in a standard way in any place. They allow employees in different countries to work simultaneously on BP and data is saved in an ordered fashion so changes are not lost. Hence employees can work on the same version of a document simultaneously and document management systems saves the organizations time of manually coordinating these changes made to the same document. (2, 3)

5.4.5.2 IT impact on Basic CSFS:

IT Alignment With Business Strategy:

Companies should understand that the implementation of IT alone or the business strategy alone will not stand in the face of the market competition and will not bring the expected benefits, thus, it is very essential for organizations to align IT strategy with the business strategy, to be able to direct the organization as a whole towards its customers and follow the strategy. (4)

IT Alignment With Process Management:

In addition, IT sometimes assists employees in the performance of a BP which is called process automation. IT cannot replace all the tasks, where some of them need human interaction and some of them can be half automated. Automated BPS have different benefits these are:

- Processes performance Improvement
- Enabling enterprise-wide monitoring and coordination, which means more control and analysis over process performance.

These advantages bring the company faster processes with less cost. A drawback of this is that the development of such system can be very costly.
(5)

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(1) (Chang-tseh Hsieh, 2007) P 6

(2) https://www.isixsigma.com/methodology/lean-methodology/ten-key-technologies-lean-process-improvement/

(3) (Sumner, 1999) P 298 -> Point 7

(4) (Trkman, 2010) P 127, 128

(5) (Trkman, 2010) P 130

5.4.6 Project Selection/Prioritization:

(Cameron, 2004) Point out one of the reasons for failure in BPI is the various number of BPI methodologies, which makes it difficult to select the most appropriate one for the company goals and projects.

When implementing any PI tool for specific projects, companies need to assess the applicability of this PI program to these projects, where sometime for instance the usage of six sigma is more convenient than LM or any other tool and vice versa, where different tools and techniques may be more suited to a specific project, depending on the nature and characteristics of the project process. Hence using the wrong PI tool can lead to catastrophic results and results in leaving the PI program. Thus project selection is a critical component of success.

(1)

Organizations usually fall in the trap of starting with selecting the right employees before selecting the projects and their appropriate PI tools. However, the process of project selection should start before starting the project, where the right staff and tools are selected to implement the right approach for improvement, this principle gives the selection of the project & the appropriate PI program priority over staff selection, because staff selection comes as a second step after selecting the appropriate PI program for the project. This enhanced project selection process should identify the right projects, those that will (2):

- produce the highest value in relation to business goals;
- improve performance of processes that are producing the pain; and
- improve flow of materials and information while reducing waste and cycle time

Basically PIs projects typically result from three major types of projects: (2)

1) Quick-hit projects can be accomplished immediately and when they fail the cost of time and resources.
2) Kaizen projects, sometimes called rapid improvement projects, are typically completed in 30 days or fewer.
3) Six Sigma projects are completed in three to six months.

(1) (Laureani, 2012) P 7

(2) (Snee, 2010) P 12,13

The following figure shows a reliable approach how to select the right projects, when they contain both elements of Lean and Six Sigma, as shown in the following figure all different PI programs mentioned above originally result from business goals or performance gaps. In the figure a top-down approach make use of business goals to create projects, on the other hand the bottom-up approach addresses the operations performance gaps. (1)

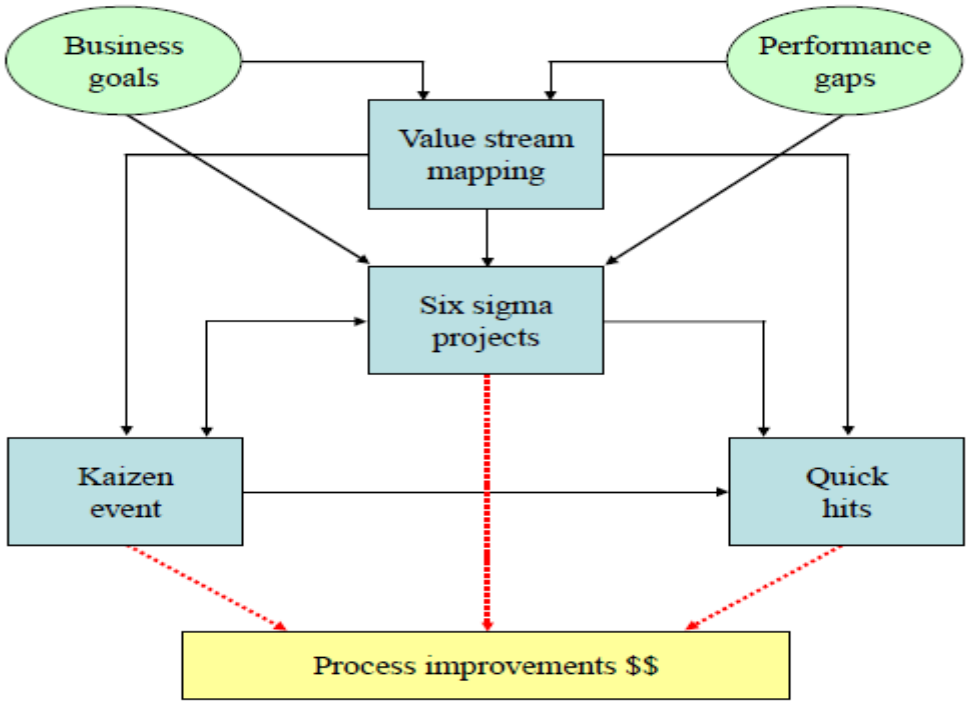

Fig.5.6. Process Improvement Project Selection
(1)

The elements of the above figure will be briefly explained as shown above a **Kaizen event**: is any action whose output is intended to be an improvement to an existing process. On the other hand a **quick hit** is a win/ benefits from applying the PI program.

Traditionally the business goals and performance gaps generate projects that need PI programs (i.e. Six Sigma, Lean management…) but additionally goals and gaps can provide inputs for **Value stream mapping** (VSM). For example from the inputs in VSM the result is the appropriate PI program for instance Six Sigma is used to solve complex problems with unknown solution is. If VSM uncovers non-value-added activity where lean tools are appropriate, then a Kaizen event might be convened to brainstorm solutions. (2)

(1) (Snee, 2010) P 12,13

(2) (Snee, 2010) P 14

According to the explanation of the above figure it is derived that a kaizen project could run in parallel with the Six Sigma project.

To select the appropriate PI program such as Six Sigma and LM to better face and solve the faced problem, the following figure distinguishes between Six Sigma and LM objectives:

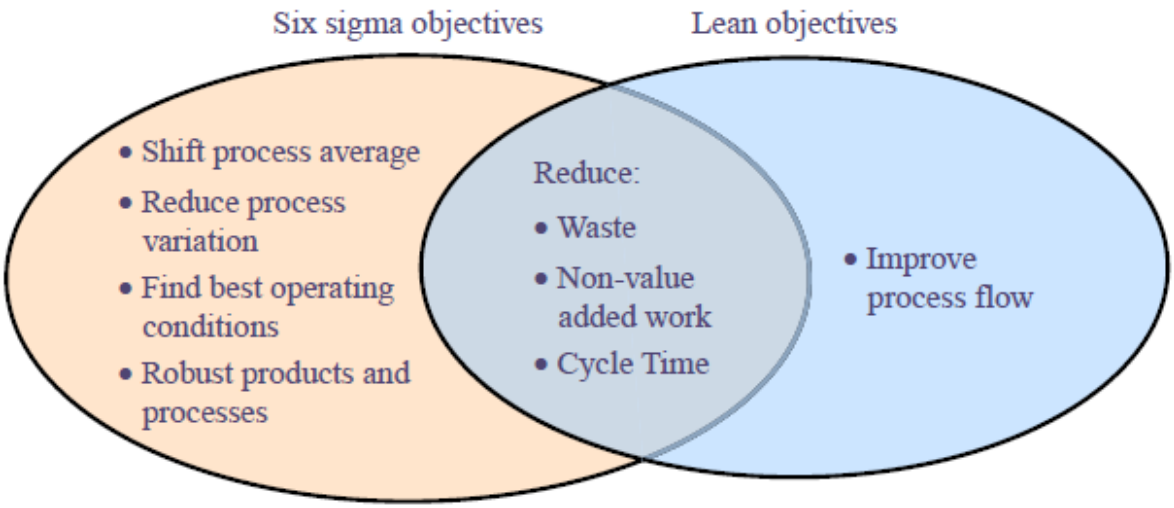

Fig 5.7. Six sigma and lean management objectives

(1)

(1) (Snee, 2010) P 14

5.5 Service Quality Framework overall impact on the Organization

How the Framework has an effect on the overall company operation, companies start with high-level business strategies to implemented BPS. These levels are described in Figure 5.6.

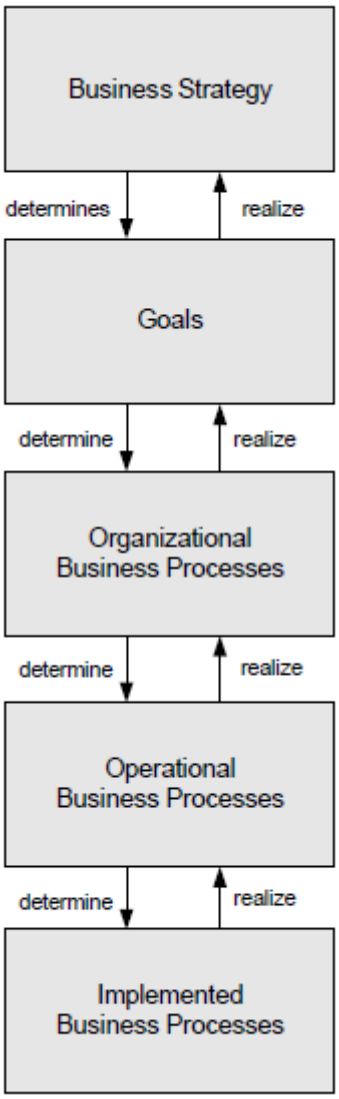

Fig 5.7. Connection between business strategy and BPS
(1)

When a company implements the introduced framework shown in Fig. 5.1 in chapter 5.4 within their business strategy it can have an overall effect on the company going through the Business strategy and goals, the organizational and operational levels, and the applied BPS. This effect is shown in the figure above which shows the connection from top of the company to the activities carried by the employees.

(1) (Weske, 2007) P 18

The figure shows every level in an Organization, beginning with the highest level which is the business strategy of the company, which describes its long-term concepts to have a stable approach and be able to develop a competitive advantage in the market.

At the second level, the business strategy is decomposed to operational goals. These goals are categorized into a set of sub goals.

At the third level is the organizational BPS which are based on the operational goals. Organizational BPS are specified by their inputs, outputs, expected results, and their dependencies on other organizational BPS. (1)

On the fourth level the following points are specified

- Operational BPS
- The activities
- Relationships of operational BPS and the activities

However the implementation aspects of the BPS are not considered in this stage. Furthermore, the operational BPS are presented by BP models.

On the fifth level are the BPS which are implemented based on the operational BPS. The implemented BPS contain information on the critical factors for the execution of the processes:

- Process activities.
- The technical and organizational environment for the execution of the processes.

In summary the described above dependency between each level of the organization shows that when considering the basic and critical CSFS of implementing a PI program in the company's business strategy it will have an overall effect on the organization, which will result in improving the performance of the BPS, thus, resulting in the improvement of the service operations of the company.

(1)

(1) (Weske, 2007) P 17

6. Conclusion

This research study implements a framework that guides the service based companies to handle the challenges faced when implementing a PI tool and how to successfully implement a PI tool, furthermore, it supports companies in choosing which PI program is most suitable for the running project.

Adopting BPM is a change in the company which needs to be implemented in the best way to not lose hopes in it. Furthermore, BPM and the thesis framework contribute to each other where BPM enables organizational work flow to be more effective and efficient while continuously improving support for business goals and objectives by changing processes. The framework, in turn, supports organizations and processes throughout the transformation process to embrace and sustain ways of working with the PI program. Additionally, BPM has some issues and difficulties some of them can be managed by implementing the success factors of the PI tool.

Services are produced from the company's business processes, thus, when correctly applying BPI, which is one of the steps in BPM, it will optimize the service quality of a company. Ultimately from this we can derive that BPM is vital for improving the services of an organization and plays an important role.

In addition, the BPI project to be successful, it must not be a standalone project in an organization but one that is complimentary and works as one with the employee's everyday responsibilities and the company's work. Furthermore, implementing the PI program without following the CSFS of the PI methodology, this results in the failure of improving the BP's which causes the failure of the BPM implementation.

To improve the company's overall service not only management commitment is needed but also trained employees and their commitment is essential for the success of the implementation.

7. Further Research

This research study is general for the service industry and not for a specific service sector (i.e. telecommunications, transportation, information industry…) where each industry operate differently and have different varieties of characteristics and requirements, this thesis study can be further investigated and validated for a specific sector in the service industry.

Additionally, this research study could be further tested for application internationally if it could be applied as a standard in every region worldwide.

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