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Applying Lean Six Sigma in an Improvement Project
- Raising the customer self-service rate at an IT Service Company

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The purpose of this study was to improve the customer self-service rate at a large international IT Service Company in Finland by using Lean Manufacturing and Six Sigma methodologies. The customer self-service rate in Finland has been significantly lower than in other countries and management of the company wanted to review the respective process as a higher customer self-service rate would lower the total costs of service delivery. The project was commissioned by the service delivery organization within the company.

Research data was collected by applying Lean Six Sigma tools to the existing process and by working with key stakeholders. Potential root causes for the low customer self-service rate in Finland were identified, such as the lack of training and communication about the process in the organization and the unique service structure in Finland compared to the other countries where the company operates. This knowledge was used to prepare the improvement activities. Quantitative research data was used to establish a measurement baseline and to choose the correct metrics for being able to track, monitor and evaluate whether the changes would result in controllable and sustainable results. Improvement actions and process changes were implemented in the organization and call centres, for example increasing training, creating supporting material and implementing monitoring and control procedures that were previously unavailable.

The outcome of this project was the improvement of the self-service rate in Finland by 19 percent, which resulted in cost savings for the company. Based on this project, the Lean Six Sigma methodology provides a good framework and set of tools for process improvement. The tools are useful for establishing a baseline, collecting and analysing potential root causes and prioritizing and implementing changes in a controllable manner for achieving sustainable results. In order to sustain the good self-service rate in Finland, the author recommends that the IT Company should continue with the improvement actions, especially focusing on communication, training, monitoring and control activities within the service delivery organization.

Keywords	customer self-service, Lean Six Sigma, tools, process improvement, communication, training, monitoring, control

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1 Introduction

1.1 Case Company

This research was done as part of an improvement project for a large international Information Technology (IT) company operating in Finland that provides products, technologies, solutions and services to consumers and businesses.

The improvement project and case research was done for the service delivery organization within the company that provides technology services such as call handling, direct support and services to the customers. The majority of the people involved in project were from the service delivery organization and working directly in service, account delivery or project management functions. The actual support delivery is being mostly handled by business partners or external subcontractors together with the customer call centres being located in Europe or offshore in another region. The project and research were done anonymously. Some of the data elements or details about actions taken have been omitted from this research or discussed only in general terms by the request of the company.

1.2 Business Problem, Objective and Outcome

The purpose of this research and improvement project was to find ways to improve the customer self-service rate in Finland and to lower the total costs of service delivery. Customer self-service is a process where a specific spare part is delivered to the end customer who performs the needed repair and exchanges the part himself. It is an alternative service delivery method to phone service, where no spare part is replaced or onsite service by the company or a partner engineer, where an engineer comes to perform the repair or exchanges the parts needed. Customer self-service is a fast, flexible and a cost effective method of service delivery for the company, which is why self-service and phone service are the preferred delivery alternatives over direct onsite services.

The customer self-service rate in Finland has been historically lower than in the other Nordic countries where the company operates. The management in the service delivery organization commissioned the improvement project to review the respective process

and to identify improvement opportunities. A higher customer self-service rate would decrease the need for onsite services, which in turn would also lower the total costs of overall service delivery.

The objective for the project was to improve the customer self-service rate by 20% and in turn lower the overall number of onsite service requests by a respective amount within the calendar year in 2015. The objectives for the research were to define the project objectives and goals; select key metrics to use; identify potential root causes to prepare an improvement plan and to execute the required changes by using Lean Production and Six Sigma methodologies and tools.

The outcome of this project and research was the improvement of the self-service rate in Finland, cost savings and improvement actions that facilitated the change that could potentially be applied more widely in the organization. This would help the company improve processes and to drive continuous improvement by the application of the research findings as well as documenting Lean Six Sigma best practices.

1.3 Scope, Approach and Structure

Within the service delivery organization one of the goals is to drive continuous process improvement, innovation and development activities to improve the customer satisfaction and quality of service. Lean Six Sigma is one approach and set of tools chosen in the organization for optimizing work and capacity. A way for improving cycle times and reducing process variability by providing a structured framework for process improvement activities. This project was chosen to be done using Lean Production and Six Sigma principles as a part of Lean Six Sigma Green Belt training.

The scope of this research and project work was limited to individuals working within the company. No external service delivery partners outside the company were involved in this project. The majority of the research and project work performed was done within the company service delivery organization and the call centres abroad. Although the context is based on one particular IT company; the findings, approach, tools and concepts researched can be used more widely within the industry. Lean Production and Six Sigma are well known and established theories and methodologies that are widely applied in manufacturing and a range of other industries, from services to health care.

This study focused on a particular process improvement project and the application of Lean Six Sigma tools and concepts in practice. The research was not aimed to serve as an in-depth analysis of Lean Production, Six Sigma or Lean Six Sigma theories but rather an introduction to the key concepts, tools used and general application of Lean principles in practice. Not all Lean Six Sigma tools were used during the project and only the ones relevant to the improvement project are described in this research. General project management concepts and methods are touched upon but they are not the primary focus of this research.

The outcome of this research is therefore limited to findings within one company and one improvement project. The practical application of Lean Six Sigma and the tools used during the improvement project that can serve as a guideline or set of best practices within the company or more widely in the industry.

2 Research Process and Methods

2.1 Research process

The thesis will have six main chapters.

1. The first chapter is the introduction providing the company and research context as well as objectives and goals.
2. The second chapter will detail the research process and methods used.
3. The third chapter will provide a general overview of key Lean Production and Six Sigma concepts as well as Lean Six Sigma approach used in the research.
4. The fourth chapter will provide some details in regards to the project framework and the particular Lean Six Sigma tools used during the project.
5. The fifth chapter will present the project documenting each step taken during the improvement project.
6. The sixth chapter will present the results and ideas for further development.

The research was mainly performed by utilizing qualitative as well as quantitative data. This helped to form a valid baseline and gain enough understanding about the current state. This information was then used to identify and analyse potential root causes for the low customer self-service rate. The author interviewed key stakeholders involved in the process as well as the call centre team leads and individual agents who are working

directly with the customers. The information gathered formed the basis for the proposed improvement plan and required actions to be taken.

Measurement baseline data was acquired from the internal reporting tools so that the project team was able to evaluate past performance and choose the correct metrics to utilise during the project. A six month period was chosen before the project start to act as the baseline for past performance. The average six month utilization rate for customer self-service (or share of total service) acted as the main baseline for the improvement project. A six month period was deemed sufficient for the project purposes as it was long enough to reliably assess the current state as well as account for any monthly or seasonal variation.

2.2 Literature Review

Most of the literature used during the research comes from the training material provided by the company as a part of the Lean Six Sigma training. This training material is a compilation of known Lean Six Sigma theories, concepts and tools used. It was a requirement to use the provided Lean Six Sigma training material and tools during the project to be certified by the organization. Specific project and process related information was sourced internally through the delivery organization. Most of the information about Lean Six Sigma tools and methods utilized were provided by the Lean Six Sigma project management office (PMO) as part of the training. This served as the main source of information in regards to the research, concepts and tools used. Additional business literature in regards to Lean Production and Six Sigma were used to compliment the research as well as other articles and websites.

3 Lean Six Sigma & Best Practices in IT Process Development

It can be said that companies nowadays are driven by fulfilling the needs of their customers while trying to gain competitive advantage over their competitors. Customers everywhere demand better quality, shorter waiting times and lower prices – essentially getting more with less. This can be achieved by providing additional value to customers be it with improving quality, reducing costs or shortening lead times. Keeping these customers satisfied, loyal and content is critical to any businesses continued success in the

marketplace. In general, poor or inconsistent quality in products manufactured or services offered will affect customer satisfaction and loyalty negatively, while potentially increasing lead times and product returns, which eventually will lead to reduced revenues. Lean Production and Six Sigma are concepts and methodologies that aim to provide businesses with a framework and set of tools to better drive cycle time reduction, optimizing capacity while reducing variability and improving overall quality, in manufacturing as well as services. This in turn can lead to increased revenues and more satisfied customers.

3.1 Origins of Lean

In the “Brief History of Lean” the Lean Enterprise Institute (2000) states that Henry Ford was one of the first people in manufacturing to create something what he called as “flow production” or integrating an entire production process in sequence with the birth of the assembly line during the 1920s. This was a breakthrough in manufacturing where individual parts were earlier produced by different general-purpose machines and then assembled into a finished product after quite a bit of tinkering and subassembly needed at possibly different locations and workshops. The inherent problem with this new production process was the inability to provide variety as the famous Model T car was limited to just one colour as well as one essentially identical model. Later when other automakers started to provide more models with different options this resulted in more complex production systems that had more process steps. Larger, faster and more complex machines were eventually able to somewhat lower the costs per these process steps, but at the expense of growing inventories and throughput times which again increased costs for the companies.

Modig and Åhlström (2013) describe how the concept of efficiency is traditionally understood only to mean resource efficiency. Resource efficiency being in this context, the most efficient use of any value-adding resources that can be gained through, for instance, with economies of scale. How much can a machine produce or how many calls can a call agent process within a certain time period? Flow efficiency on the other hand focuses on the process output or the individual unit being processed and the efficiency of the process flow of this unit within the organization. In services, this unit usually means the customer and the process flow starts from the time a customer need is identified and only stops when the need is finally fulfilled. An example in this case, would be how fast

(or how well) can the company resolve a customer problem when a problem occurs or when a call is placed to the call centre?

Basic Lean principles can be said to derive from the Japanese automotive manufacturing industry, specifically Toyota with their invention of the Toyota Production System (TPS). Lean being short for “Lean Manufacturing or “Lean Production”, which basically could be described as a systematic method for the elimination of unwanted elements in the manufacturing process or removing the unnecessary steps, the “waste” in the process. After World War II Japan had scarce resources and was technologically behind the western countries which forced local companies to look elsewhere for efficiency. The mass production methods used by the US automobile companies were not adaptable to the Japanese market situation, where Japan at the time relied heavily on importing; there was not a lot of free space or skilled workforce readily available. The engineers at Toyota focused on a few key things, the needs of its customers and optimizing manufacturing to meet those needs. They found out that with a series of simple innovations, they were able to improve continuity in their process flow and offer a wider variety in their product offering. (Lean Enterprise Institute, 2000)

The Toyota Production System in essence shifted focus from individual machines and their level of utilization to the flow of the individual product itself throughout the total process. This is also in line with the just-in-time philosophy, which at Toyota resulted in reduced inventories and production that better matched customer demand. (Lean Enterprise Institute 2000) (Modig and Åhlström, 2013)

Toyota concluded that by right-sizing machines for the actual volume needed, introducing self-monitoring machines to ensure quality, lining the machines up in process sequence, pioneering quick setups so each machine could make small volumes of many part numbers, and having each process step notify the previous step of its current needs for materials, it would be possible to obtain low cost, high variety, high quality, and very rapid throughput times to respond to changing customer desires. (Lean Enterprise Institute, 2000)

Western observers took interest in what Toyota was doing and this concept of lean manufacturing or Lean production was first described in the book “The Machine That Changed the World” (1990) by James P. Womack, Daniel Roos and Daniel T. Jones. It was further explored in their follow-up book “Lean Thinking” (1996) by James P. Womack and Daniel T. Jones and these books have served as the main sources for Lean knowledge and research to the modern day.

3.2 Core Lean principles

Womack (2007) described three fundamental business issues that should guide the entire organization on Lean transformation:

- Purpose: What customer problems will be solved?
- Process: How will value streams be assessed to make sure each step is valuable, capable, available, adequate, flexible and linked by flow, pull and levelling?
- People: How can the organization ensure that value streams are continually evaluated in terms of purpose and Lean process and actively improved?

Lean Enterprise Institute (2000) defines that the core idea of Lean is to create more value for customers with fewer resources. In different terms, maximize customer value while minimizing waste. Tuominen (2010) says that Lean is not an end state that you aim for but rather a process for continuous learning and development. It is all encompassing and travels through all the levels in the organization and its processes. It is based on two main principles:

- Firstly, the creation of an uninterrupted flow of material, information and resources in all business processes. This is achieved by the use of Lean tools.
- Secondly, the management needs to be committed to invest in the employees and continuous improvement in the company. It is not about copying or mimicking the use of certain well-known lean tools or principles but rather developing such principles that fit the business requirements of the organization applying Lean. To attain high performance and providing better value to the customers.

According to Kouri (2000) and the Lean Six Sigma training material (2014), an activity adds value when it transforms or shapes raw material or information to meet the customers' needs or requirements. Some activities, such as moving materials or information during production are necessary, but do not add real value in the eyes of the customer. In a production environment, such as with Toyota; the categories of waste identified were:

- Overproduction
- Waiting time (idle time)
- Conveyance (unnecessary transport of parts/products)

- Processing (unnecessary work/overwork)
- Excess Inventory (more stock then needed)
- Motion/Transport (time spent looking for parts or information, people/resources)
- Correction (rework/overlap/error correction)

George (2003) describes lead time as how long it takes you to deliver a service or a product once an order has been initiated. Any activity that adds value in the eyes of the customer is called “value-added” work and any activity that is of “no-value” or the customer would prefer a supplier without these costs can be deemed a “non-value added” activity (or categorized simply as waste). Waste being any activity that takes up time, resources, or space but does not add real value to the product or service being provided.

In a non-production environment different types of waste are comparable to the production environment with a few differences; Overproduction (performing work before required), waiting time (for information/approval), motion (non-value add movement of people/paper), transport (non-value add movement of work), inventory (obsolete stock, supplies), defects (time spent correcting defect) or under-utilization (people/skills under-utilized) are all forms of waste in a service organization.

Basic lean principles are customer centricity, where the customers are the ones that define value. Flow are waste-free processes that provide material and information without interruption. Pull, where products are created as the customer needs them and Takt, where cycle time and production is aligned to the customer demands (similar to just-in-time). Defect-free products, services and driving customer satisfaction with continuous improvement. (Lean Six Sigma training material, 2014)

As per Lean Six Sigma training material (2014) the core of Lean focuses on ways to maximize process velocity, the speed and efficiency in any process by finding ways to eliminate the non-value added work or waste; anything that is slowing the process down. It provides the tools for cost and lead time reduction, analysing the process flow and measuring the delay times at each individual activity step within the process. Tools on how to map a process and collect data for each individual cycle time for better calculating process efficiency. How to measure delay times per each activity that contributes to the overall process length and eventually being able to create a truly Lean process by removing all the non-value adding elements.

Most processes are said to be “un-Lean” or with a Process Cycle Time (PCT) or Process Cycle Efficiency (PCE) below 10%, where PCE equals Value-Add Time divided by Total Lead Time, time from entry into a process until exit. Process steps that are thought to be essential can be found unnecessary and the time and costs associated with these steps can be removed after the application of Lean tools and Lean thinking. Traditionally, companies are trying to find ways to perform actions more efficiently with, for example, training or improving processes to better handle the overall increase in complexity, while Lean approaches the same problem with questioning “is everything done currently even necessary?” (Lean Six Sigma training material, 2014) (George, 2003).

Matti Torkkeli, the vice president of Lean5 Europe states that *“Traditionally efficiency is sought by trying to do things faster. You lose sight of the real problem. The idea is not that a doctor has to perform a diagnosis faster. The purpose is not to run faster, but to walk a shorter distance”.* (Semkina, 2015)

So Lean focuses on quantifying and eliminating the cost of complexity, the separation of what can be called as “value-added” activities from the “non-value added” activities and the elimination of these root causes for any non-value added work and the related costs. It is said that only 20% of the activities can cause 80% of the delay so it is very important to focus particularly on these non-value added activities. Key goals being reducing or controlling work in progress, increasing throughput and process efficiency, eliminating variation in lead time based on data. (Lean Six Sigma training material, 2014)

As per George (2003) Work-In-Progress or Work-In-Process (WIP) is material or inventory that has begun the manufacturing process and is no longer considered as part of the inventory, but is not yet a complete or finished product. In Lean Manufacturing, excessive or large amounts of WIP are considered waste or a by-product of bottlenecks in the process. It ties up resources that would generate higher returns elsewhere. This is especially important in services. Exit Rate (throughput) is the output of manufacturing or a process over a period of time. WIP divided by exit rate equals cycle time. Process efficiency is the performance indicator of how efficiently the process is converting work in process into exit rate. It represents the percentage of value add time along the critical process path equalling value add time divided by cycle time.

A lean process is categorised by George (2003).

- *Operates at a Process Cycle Efficiency (PCE) of >20%*
- *Has a maximum cap on WIP to control velocity*
- *Uses a Pull system where new work is released into the process only when work has exited to the next process.*
- *Uses visual controls to manage and monitor the process (e.g. by showing the status of various items or service in-process, and a list of additional lead-time reduction ideas)"*

At its core, Lean is really about continuous improvement and driving customer satisfaction. As stated, it is the end customers that define value and not the company. The process flow should be as much waste- and defect-free as possible, the products and services aligned with customer demands and created as the customer's need them (just-in-time). Error proofing is one structured approach to ensuring quality all the way through the work process by taking pre-emptive steps to prevent errors from occurring. Total Productive Maintenance (TPM) is a series of methods that ensures every piece of equipment is always able to perform its required tasks so that production is never interrupted, the main idea being to have processes and methods to keep the tools always working and minimize any process down time. (Lean Six Sigma training material, 2014)
Lean is leading "customer-first", about valuing people, developing and performing together. It is about continuous learning and improvement. (Semkina, 2015)

As a final note, Modig and Åhlström (2013) state that the understanding about Lean production or the concepts of Lean can really differ from person to person. Some see it directly tied with Toyota manufacturing, some view it as a philosophy or as a set of quality tools and some view it as an all-encompassing source for everything that is good or done correctly in the organization. It is understandable for people to reduce Lean to a set of tools or concrete step of actions that makes it easier to comprehend and apply in practice. This results in a very narrow focus for its application or potential, although it can be said that just striving for flow efficiency can be generally more useful than just focusing on the efficient use of resources. Another danger is to tie Lean too closely with Toyota Production Systems or their application of the tools and potentially seeing it as irrelevant for any another operating environment. Focusing on how the tools are used instead of asking why these tools are used as Lean is very relevant and applicable to a wide range of industries.

It is a problem when Lean is seen as a method but not as a goal or strategy. Modig and Åhlström (2013) see Lean as an operational strategy that is tied to the business environment, as a high-level concept that can be applied more widely if it is tied to an overall business strategy, goal or purpose. Not trying to emulate what Toyota did or focusing on just the tools or increases in flow efficiency but understanding on a deeper level why Lean is applied. By definition, Lean should not be seen as something where its benefits can be considered as self-evident. It is not a static goal or end state but a dynamic roadmap for continuous improvement within the organization.

3.3 Origins of Six Sigma

Six Sigma or 6 Σ can be described as a technique or set of quality management tools that is aimed at process improvement and reducing variability with the goal of reaching near perfection in terms of quality. It is associated with manufacturing or the manufacturing process where the goal is to achieve “six sigma” level of operations (striving towards six standard deviations between the process mean and the nearest specification limit where practically no item will fail to meet specifications). It comes from the relationship between the variation in a process and the customer requirements in relation to that process. To achieve Six Sigma, a process must not produce more than 3.4 defect per million opportunities where a defect is categorized as anything outside customer specifications as detailed in the below table (Table 1.). The more the distribution fits within the specification, the higher the Sigma level. (iSixSigma, 2000), (George, 2003)

Sigma Level	Defects per Million Opportunities	Yield
6	3.4	99.9997%
5	233	99.977%
4	6.210	99.379%
3	66.807	93.32%
2	308.537	69.2%
1	690.000	31%

Table 1. Sigma levels (George, 2003)

So in summary, a six sigma process is one where 99.99966% of all opportunities can be expected to be free of defects or 3.4 defective features per one million opportunities.

Six Sigma is a measurement-based, data-driven discipline or methodology that is aimed at identifying and eliminating defects and minimizing the variability in manufacturing or business processes. Part of its quality management methods is to create a hierarchy or an infrastructure of people in quality management functions within the company who are experts in the use of these tools and methods such as “Yellow Belts”, “Green Belts” and “Black Belts” as per level of experience and proficiency. Each Six Sigma improvement project carried out will follow a certain sequence of steps with a clearly defined and measurable value target. Examples can be reducing process cycle times, reducing costs or increasing customer satisfaction. (iSixSigma, 2000)

3.4 Core Six Sigma principles

Six Sigma emphasizes the need to recognize opportunities and eliminate defects as defined by the customers. It is a customer focused philosophy of data-based decision making and process excellence. It provides a structured framework for achieving sustainable process improvement. It renews focus on statistical tools to drive decision making and for making significant reductions in variation and the number of defects. Delivering high quality services is hindered by variation and Six Sigma employs this data-driven decision making into a comprehensive set of quality tools set and building a cultural infrastructure that is aimed at reducing variation. (George, 2003)

To put it simply, the outcomes of any processes are the results of everything what goes into that process, “Y is the function of X” that relates an output (Y) to inputs of different process variables (Xs):

$$Y = f(X1, X2, X3,\ldots)$$

Any output, like growth or profits will be dependent on the different process variables (Xs) that can be quality, lead time, non-value added costs etc. that go into the process. In order to improve this or to get a better output (Y), one needs to identify and focus on the individual variables, the critical Xs that affect the final outcome. (George, 2003)

The core elements of Six Sigma adoption are according to Lean Six Sigma for Service: How to Use Lean Speed and Six Sigma Quality to Improve Services and Transactions by Michael George, 2003:

1) CEO & Managerial Engagement
2) Appropriate resources (staff & time) to high-priority projects.
3) Everyone involved in Six Sigma should receive some level of training
4) Variation has to be eliminated

GE (2015) states that Six Sigma in their company revolves around a few key concepts:

- Critical to Quality – the attributes most valuable to the customer
- Defects – Failing to delivery what is valuable to the customer or what the customer wants.
- Process Capability – What your process can deliver
- Variation – What the customer sees and feels
- Stable Operations – Ensuring consistent and predictable process performance
- Design for Six Sigma: Designing to meet customer needs and process capability.

In summary, Six Sigma is a customer-focused philosophy and a statistical standard of data-based decision making aimed at process excellence. It provides a structured framework for achieving sustainable results with focus on statistical tools to drive decisions on reducing variation and the number of defects.

3.5 Fusion of Lean and Six Sigma

As stated earlier, the roots of both Lean Manufacturing and Six Sigma reach as far back as the 1980s and beyond, when the needs for quality and speed were mainly present in a manufacturing environment. Lean Manufacturing or Lean Production arose as a methodology for optimizing automotive manufacturing while Six Sigma evolved as a quality initiative aimed at eliminating defects by reducing variation in the processes for the semiconductor industry. (George, 2003)

Lean Manufacturing and Six Sigma can be utilized independently but there are benefits in integrating the two principles. Better focus, synergy and utilization of limited resources under one improvement strategy in the organization. It is true that Lean and Six Sigma principles can be viewed as more contradicting rather than complimentary disciplines, although both enable the reduction of the cost of complexity.

- Six Sigma is said to focus on quality and elimination of variation, while paying little attention to identifying waste and non-value add steps or improving process speed and flow.
- Lean being focused on speed does not really address critical customer needs or the effects of variation like the inherent benefits of bringing a process under statistical control with a culture and infrastructure needed to be able to sustain it.

Reducing defects or lead times alone will bring some gains but to achieve the absolutely lowest cost one needs to simultaneously improve both quality and speed at the same time. By combining the strengths of these two disciplines, one can achieve the best of both worlds with Lean Six Sigma rather than relying on its individual components. Lean Six Sigma incorporates Lean's principles of speed and action into the Six Sigma improvement process, which in turn reduces cycle times and variation, uniquely battling the hidden costs of complexity while increasing velocity of improvement projects as well as the results. (George, 2003)

In summary, Lean Production tools drive cycle time reduction while optimizing capacity while Six Sigma aims at improving quality and reducing variability. Lean's focus on speed does not generally hurt quality because Lean practices try to eliminate the non-value add activities that make up most of the overall processing time, any waiting time or queues and the overall time spent between the value-add activities. Six Sigma tools help reduce the amount of defects which in turn can also help speed up the overall process.

3.6 Lean and Six Sigma in a service organization

George (2003) describes a service organization so that it can encompass everything except, the direct manufacturing process i.e. the physical making of goods or articles by hand or machinery. Lean Manufacturing, Six Sigma or Lean Six Sigma can be applied in a service organization just as efficiently as in any manufacturing organization. Even in manufacturing, it can be said that only 20% of product prices can be attributed directly to manufacturing with 80% coming from service or support functions like design, finance, human resources, product development, engineering etc.

Lean Enterprise Institute (2000) tries to correct the popular misconception that Lean is suited only for manufacturing. Lean can be applied to every business and every process

as it is not a tactic or a short-term cost reduction program, but more of a way of thinking and performing actions in the entire organization.

In transactional environments, for people working in customer facing service functions, people find that most of the steps they follow in their processes do not add real value to the final service in the eyes of their customers. It can be said that service processes are usually slow or lengthy processes, which tend to mean that they are also expensive processes. Lean tools are not designed just for manufacturing environment but as a set of principles that can accelerate the speed of all processes across the whole enterprise in which they are applied. Wasted time or costs can be just as efficiently cut by reducing lead times and streamlining processes in the aim for produce better quality or better service as in any standard manufacturing environment. Lean tools help by reducing complexity while increasing quality, speed and customer satisfaction. (George, 2003) *"Empirical data have shown that the cost of services are inflated by 30-80% waste – that is, the processes are riddled with activities that add no value from the perspective of the customer... Work that adds no value in your customers' eyes typically comprises 50% of total service costs"* (George, 2003, pp. 12-13, 3)

One might ask that if there are so large cost and lead time opportunities in service organizations, why Lean Six Sigma is not applied more widely in the industry or in every service organization. This is mostly due to the fact that rather than in a production line or a manufacturing organization, the work being performed in services is largely invisible or very hard to quantify properly. This does not just concern simple work flow processes but especially the amount of work-in-process, which is why detailed value stream- or process flow maps need to employed and this is harder to do in service organizations than in purely manufacturing facilities.

It is not however impossible as the examples by the City of Espoo and the Finnish central hospital in Northern-Karelia demonstrate. By applying lean principles, social welfare applications that took earlier over 7 days to process, are now finalised in under 2 days by the City of Espoo (Nurmi, 2015). With a one-time investment of 5 500 euros into warehousing practices and applying Lean and *Kanban* (just-in-time) methods a central hospital in Northern-Karelia was able to release 5 000 hours of yearly working time for nurses that were earlier spent on organizing and storing hospital supplies. (Puolakka, 2015)

4 Lean Six Sigma Improvement Process and Project Tools

PMI (2008) describes a project as a temporary endeavour to create a unique product, service or result that has a definite beginning and an end. The end is reached when the project objectives have been achieved or when the project is terminated prior to it being finished. Project management is the application of knowledge, skills, tools and various techniques to activities to meet the project requirements. A project lifecycle usually comprises of five process groups or stages: Initiating, Planning, Executing, Monitoring and Controlling and Closing.

As per previous chapter, Lean Six Sigma is a structured, streamlined and focused approach to process improvement. Improvement is about making changes that lead to a new direction or to reach performance levels not previously attained. All improvement will require change, but not all change will result in improvement. (Lean Six Sigma training material, 2014). This chapter will detail what kind of structure or framework a Lean Six Sigma project can follow from start to finish and what tools can be utilised during the different stages of the improvement project.

4.1 Framing the Business Problem

One can begin with three questions to frame the business problem and to start drafting the improvement plan. These questions can provide an initial structure for the overall process of making quality improvements and these questions will also eventually tie into the final improvement plan. This can also be used to formulate an Accelerated model of Improvement (AMI) chart which can help define the key areas and metrics. (Lean Six Sigma training material, 2014)

- **What are we trying to accomplish?**

The initial goal should be short, clear and concise and able to guide the improvement effort. You can identify expected results but the goal does not have to be defined explicitly at this stage. You can address the problem or opportunity, the aim for the project and why is it important to the business by aligning it with the organization's overall strategic plans. You capture the scope, aim and estimated business or customer impact.

- **How will we know that a change is an improvement?**

What is known of the project at this stage, past performance or baseline to start from? How has past performance been and what is the desired outcome? If changes are made and results get better over time one can most likely conclude that the change has led to an improvement. How can one determine this, record and assess the changes made? Here you determine project measurements, baseline and a data collection plan.

- **What changes can we make that will result in an improvement?**

Is there variation in the process due to material or human error? Can one address any of the factors that lead to these errors or influence the process with the improvement efforts? Identifying and prioritizing top causes and success factors. Drafting an improvement plan and making the required changes.

As per Lean Six Sigma training material (2014) there are three categories of improvement.

1) Eliminating quality problems such as failing to meet customer expectations or requirements. Removing errors or long waiting times.
2) Optimizing systems or getting lean by reducing costs and increasing speed while maintaining quality. This can be reducing non-value adding work in the process or streamlining the overall workflow, i.e. doing more with less.
3) The third is expanding on customer expectations by providing higher value to customers. This can be new and better products or services, innovations or new solutions to already existing problems.

The DMAIC framework (Define-Measure-Analyse-Improve-Control) can be used as the baseline guideline for the overall project management life cycle. Within each of these phases, one can apply structured PDSA (Plan-Do-Study-Act) cycles to perform quick actions that will result in better sustainable improvements. During each of these individual PDSA cycles one can utilise a variety of process improvement tools to try and achieve the desired results. The DMAIC model and PDSA cycles will be looked at in more detail during the next sections. (Lean Six Sigma training material, 2014)

4.2 PDSA Cycles

The PDSA cycle (Figure 1.) or Deming Cycle is a continuous improvement cycle consisting of a systematic series of phases or steps (Plan, Do, Study and Act). It is an iterative quality improvement tool that can help provide structure to the work being performed during each of the larger DMAIC stages by using smaller sequential cycles of action or improvement within each stage. (Lean Six Sigma training material, 2014)

- In the “Plan” phase, the objective of the cycle is stated, questions and predictions are recorded as well as the plan for what is being performed during the cycle, including a plan for collecting data.
- During the “Do” phase, the plan is carried out, any problems encountered are documented as data is collected and analysed.
- During “Study” phase, the predictions made are compared to the data collected to summarise what was learned.
- In the final “Act” phase, the learnings are put into use by either repeating the PDSA cycle again with incremental updates or moving forward to the next PDSA cycle in the improvement plan.

Overall, the learnings improve as you go along and by conducting small-scale tests as often as needed, it increases the likelihood of implemented changes resulting in improvements.

The PDSA cycle model closely mirror the action research process where the overall research follows a cycle of constructing, planning action, taking action and evaluation that is repeated throughout the research process as long as needed (Coghlan & Brannick, 2014)

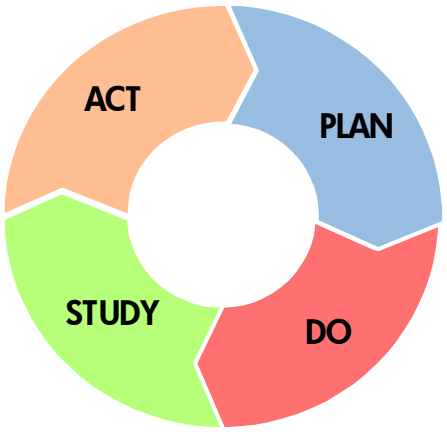


Figure 1. PDSA Cycle

4.3 The DMAIC Model

The project followed the DMAIC model (Figure 2.) for improvement that is used for improvement, optimization and stabilization of business processes. The DMAIC improvement cycle or DMAIC framework consists of five improvement steps or stages, the Define, Measure, Analyse, Improve and Control stages. It is a data-driven improvement process road map and one of the core tools used for Six Sigma projects. (Lean Six Sigma training material, 2014)

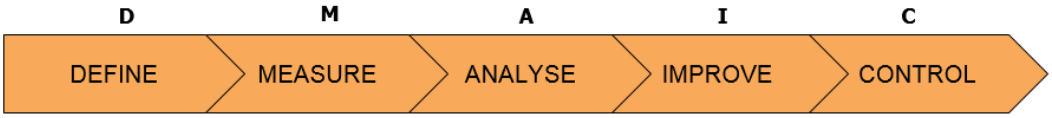


Figure 2. DMAIC Model

- The purpose of the first stage, the Define step, is to identify the business problem, define the objectives, goals, resources, scope and timeline for the project. To define the opportunity for improvement from both business and customer perspective.
- During the Measure stage one starts to understand the process, its performance to establish a baseline for improvement.
- During Analyse stage, one can identify how the key factors or process inputs (Xs) affect the process outputs (Ys). What has the biggest impact on process performance and what are the underlying root causes for improvement.

- The Improve stage is to develop potential improvement solutions, to test and implement these solutions to the original business problem or the critical factors or inputs (X's) in the process.
- The final Control stage is reached after implementing the solution, to institutionalize any process changes and for establishing control procedures.

By progressing through each DMAIC stage, executing multiple PDSA cycles and by applying Lean Six Sigma tools at each stage, you can filter or narrow down from all the different possible variables that could affect the process to just the few critical key factors that are most relevant or have most impact on the original business problem (Figure 3.).

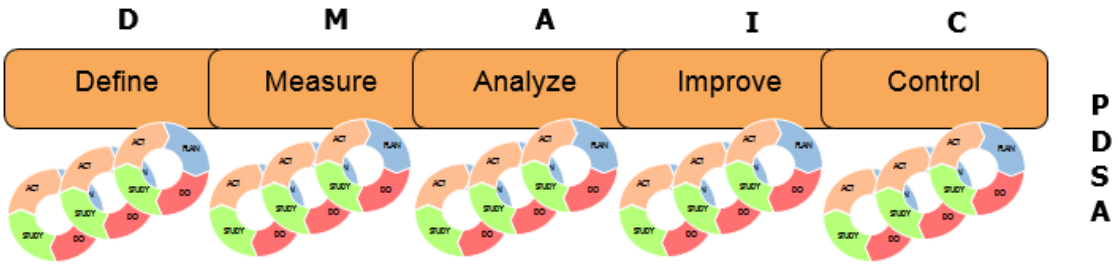


Figure 3. DMAIC model and PDSA Cycles

4.4 DMAIC - Define

As per Lean Six Sigma training material (2014) during the define stage the problem needs to be identified. Usually this is done through a formal project selection process where the business leadership identifies an area of business opportunity or an area of improvement. A project charter is formalised, key metrics and scope are defined and a project plan gets sponsor approval before the project is validated. The team members are selected and the project is formally started. Activities include mapping the business process or value stream and identifying owners. Identifying customer requirements or "Voice of the Customer", such as a combination of cost, quality or speed. A high-level baseline is established and realistic goals are set with the aimed financial benefits understood and documented. (Lean Six Sigma training material, 2014)

4.4.1 Project Charter

Martin (2014) states that the project charter is used to determine the scope, problem statement, objective, financial justification and the required resources or members of the project team. It forms the basis of the project; the purpose and objective for everyone involved in the project that strive for a shared goal. A goal can be an answer to a customer need or a general one, to improve “quality” for instance. A customer is any person or organization that receives a product or service (output) from the work activities (process) and they are the ones that define what “quality” is as per previous chapter. One key action is to translate these customer needs into measurable requirements that are specific and relate directly to an attribute of the product or service provided. Once these requirements are understood and agreed upon, you can validate the learnings into a project charter or an initial improvement plan.

Importantly, a project charter should contain a clear, quantifiable problem statement and how it is aligned with strategic goals. It contains start- and end dates, project team members and sponsors, scope, key risks and dependencies. Key objectives, context and business impact are defined. The expected project benefits are also valued against the time it will take to complete the actions to see if the project is worth the effort or the resources that will be tied to it for the duration of the project. (Lean Six Sigma training material, 2014)

4.4.2 SIPOC

The SIPOC (Supplier-Input-Process-Output-Customer) Chart (Figure 4.) is one of the tools in process improvement that helps summarize these process inputs and outputs in a visual form in their own separate columns. This helps identify clearly the actual process outputs and the end customers for these outputs. It can give people who might be unfamiliar with a certain process a high-level view or help reinforce and define key process areas for the people who are already familiar with the process. (Lean Six Sigma training material, 2014)

Suppliers – Internal or external suppliers to the process
Inputs – Inputs to the process i.e. work, material or information.
Process – One process flow representing the entire process from end to end
Outputs – Outputs to the internal or external customers, for instance, communication

Customers – Internal or external customers of the process receiving the output

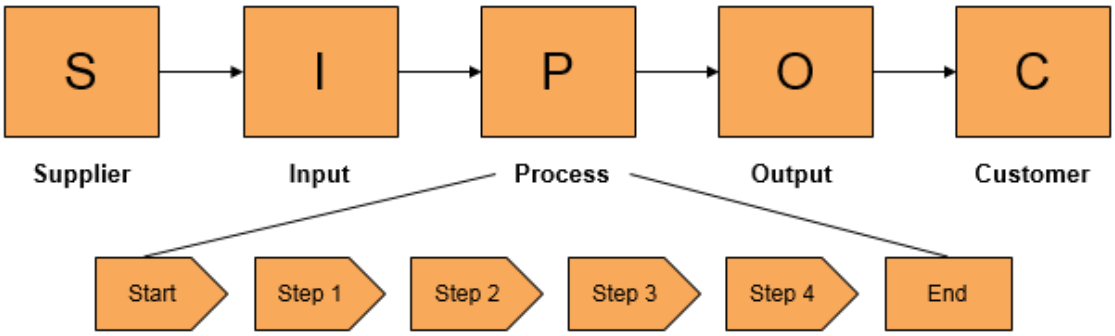


Figure 4. SIPOC Model

4.4.3 Team Building

One model for group or team development identified in the Lean Six Sigma training material (2014) is forming, storming, norming and performing. This model for group development or teaming was introduced by Bruce Tuckman in 1965 who outlined that these four stages or phases are all necessary for any team to go through on their way to improved performance; to be able to solve challenges and problems; to be able to come up with solutions and implement work and finally, to deliver results. Understanding this model can help a new team become more effective faster, when the different stages are taken into account while the project is progressing.

Forming

The independent team members meet and learn about the project, challenges and goals. Each person acts according to their own behaviour and their motivation varies, some are positive and excited, others anxious to start or do not know what is yet expected from them during the project. Initial views are formed and team members start slowly working together as a team rather than individuals when progressing through the next stages.

Storming

Team members start forming opinions about each other. They start voicing opinions and questions. Disagreements can arise and personalities can clash that should be resolved before teams can move out from this stage, sometimes it can be that teams never leave this stage. Tolerance and patience are required to minimize any disruptiveness to the

project as a whole. Supervision and direction is needed for everyone to be able to continue working effectively.

Norming

People start co-operating and resolving their differences. They start working towards a shared common goal and tolerating other team members better.

Performing

During the final stage, the team should be motivated and efficiently working together. They can revisit earlier stages should there be any changes in team dynamics but generally, the team members can now work more effectively without the need for close supervision.

4.4.4 The RACI Chart

As per Lean Six Sigma training material (2014) the responsibility assignment matrix or RACI chart is used to describe the roles or participation by people in the organization for completing tasks or deliverables for a given project or business process. It is used for clarifying roles and responsibilities within a team or process, especially in cross-functional projects and processes that involve people from different business areas and/or departments.

Responsible – Responsible for work/task to be performed.
Accountable – One accountable/approver for work/task/deliverable to be performed
Consulted – Asked/consulted for opinion, a subject matter expert.
Informed – Those who are kept up-to-date on progress/task completion

4.4.5 Stakeholder Analysis & Commitment Map

A stakeholder is any person or organization that is affected or impacted by a proposed change or is involved in the process. Stakeholder analysis is the process for identifying and sorting groups or individuals that are affected by project actions or proposed changes. It is used in preparation to assess attitudes or commitment to potential

changes, identify potential risks or key stakeholders who are crucial to the project or could have adverse effects to the project progress. (Lean Six Sigma training material, 2014)

4.5 DMAIC - Measure

As per Lean Six Sigma training material (2014) the ability to assess the performance of anything one wishes to improve is only as good as the ability to measure it. Sometimes just improving the ability to measure a process results in improvements. In general, the measurement system must be in control or variability of the measurement system must be very small in relation to process variation as well as compared to the specification limits.

During this phase, it is determined what needs to be measured during the project. A measure being a quantified evaluation or actual performance based on observable data such as time, number of defects, sales or attributes such as gender or customer type if applicable. Key inputs, process and output metrics are identified. What data is needed and how to measure it. A data collection plan is developed and a measurement system validated. Baseline data is collected for being able to measure baseline process performance. Baseline data is also used to determine whether any improvement has been made at the end of the improvement project. (Lean Six Sigma training material, 2014)

“Quick Win” opportunities are identified where a solution idea is already developed and can be quickly actioned upon based on careful risk assessment and impact. These low risk “quick wins” can be immediately implemented, saving time and effort and attaining cost savings earlier in the project, bypassing the Analysis Phase altogether. Examples can be process step elimination, procedure change, a delivery simplification or a simple communication improvement. This can provide important momentum in the project and drive value and confidence during the early stages of the project.

There are two types of measurement variation that usually needs to be taken into consideration. Reproducibility (or operator variability) where different individuals can get different measurements for an identical activity. Repeatability (or equipment variability), where an individual gets different measurements for an identical activity between successive or repeated measurements (Lean Six Sigma training material, 2014).

4.5.1 Process Mapping

Process mapping is one of the most effective improvement tools in Six Sigma, Lean production and business process management. Mapping the process or making a graphical representation of the process flow identifying each step in the process helps selecting what to measure, and where (and how) to find the gaps between strategic focus and actual process. You can identify suppliers, process inputs, customers and process outputs to help with the decision making. Process mapping also helps to visualize the process and help with value analysis, eventually helping pinpoint potential defects and lags in cycle time when supplemented with baseline data. (Lean Six Sigma training material, 2014)

4.5.2 Data Collection

Data collection can be done in many ways. There can be an official data collection plan consisting of many different metrics or then there are just only a few key metrics that are followed during the project. In a Lean Six Sigma project, the key is to be able to determine process performance or capability. Comparing the existing data to the requirements or goals, to assess the improvement opportunities. Data collections starts with key metrics and developing the operational definitions for each metric. Ensuring metrics are aligned with the process and to understand the dependencies between them. (Lean Six Sigma training material, 2014)

4.6 DMAIC - Analyse

Root cause analysis is an iterative process going from observations to hypotheses to tests and back to observations again. Hypotheses for current-state performance are made. This list is sorted and filtered down by determining that some hypotheses are unrealistic or impossible to validate. Determining if there can be established a measurable relationship between potential critical factors or root causes. Validating these hypotheses by any statistical methods possible and estimating their impact on a performance metric. Quantifying and prioritizing root causes for improvement, be it financially or by business impact. (Lean Six Sigma training material, 2014)

4.6.1 Pareto Chart

The Pareto principle states that for many events, roughly 80% of the effects come from 20% of the causes. This helps with separating relevant issues from trivial ones and provide focus on where efforts or resources should be allocated. To identify one or two situations or categories where most problems occur and what should be worked on first. (Lean Six Sigma training material, 2014)

4.6.2 Brainstorming

Usually coming up with ideas and solutions takes time and effort. Existing assumptions, boundaries or paradigms must be challenged and evaluated. Process steps can be reorganized and “outside the box” thinking applied. Brainstorming can also be a structured method for generating ideas or solutions. You can produce many ideas in a short time frame and this can help facilitate the creative thinking process within the team or organization. (Lean Six Sigma training material, 2014)

4.6.3 The 5 Why’s

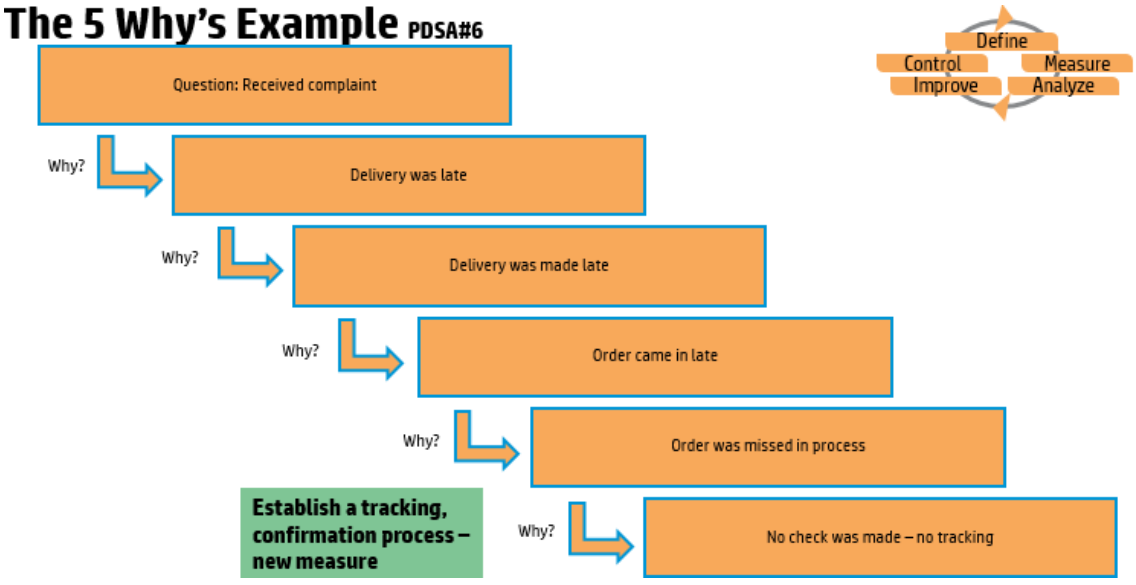


Figure 5. The 5 Why’s

The five why’s is an iterative technique used during analyse phase for root cause analysis or to explore cause-and-effect relationships in regards to a problem. It is good in its

simplicity, as it can be completed without a heavy data collection plan or statistical analysis. An example of this exercise can be seen above (Figure 5.). At its core, it is just repeatedly asking the question “Why” or “Why did the process fail?” five or more times, where you can peel away the layers of symptoms which in turn can lead to the root cause of a particular problem. Sometimes this can leady to another new series of questions related to another root cause. One important thing to remember is that the uncovered “real” root cause should point towards a process that is either not working or non-existent rather than a broad general answer that is out of the respondent’s control, such as lack of time, investment, resources or just “human error”. (Lean Six Sigma training material, 2014)

4.6.4 The Affinity Diagram

Brainstorming exercises and root-cause analysis can lead to a large number of potential root causes. Affinity diagrams allows sorting a larger number of ideas into smaller groups that only contain related ideas. It can help to identify main categories for potential root causes to help with later review and analysis exercises. (Lean Six Sigma training material, 2014)

4.6.5 Cause and Effect Diagrams

Cause and effect diagrams are used in quality management to identify root causes likely to be causing or having an impact on a problem. It allows to see linkages between groups and detailed potential root causes that come up in brainstorming sessions. (Lean Six Sigma training material, 2014)

Causal diagrams, also known as Ishikawa or fishbone diagrams, are tree-diagrams that show the causes of a specific event. Each cause can be an imperfection or source of variation and these are typically categorized into people, methods, machines, systems, measurements or environmental factors depending on the process.

4.6.6 Value Analysis Prioritization

Brainstorming, affinity maps and cause and effect diagrams are good at collecting problems and potential solutions for improvement. The Value Analysis Prioritization (VAP) or a VAP chart can help us prioritize on what actual improvement actions to take.

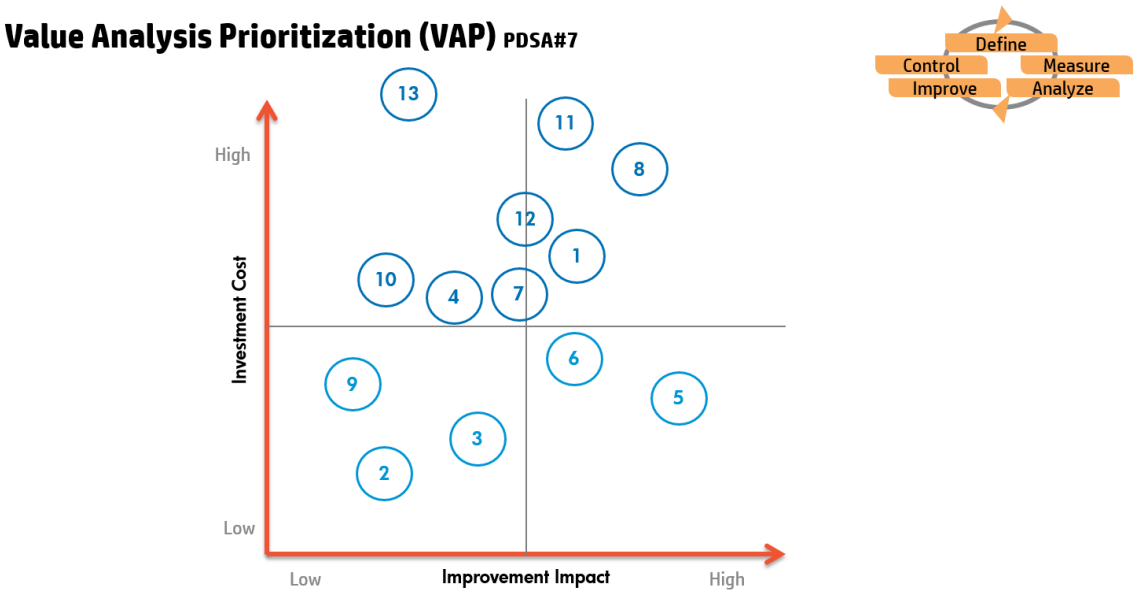


Figure 6. VAP Chart Example

The VAP chart (Figure 6.) can help with understanding the relationship between the business benefit that a solution or implementation can deliver and the effort or cost required to facilitate that change. You can assign numbers to each solution and place them into a matrix with the Y axis representing business benefit or Return on Investment (ROI) and the X axis representing degree of difficulty with the implementation required. Another way is to look at investment cost and improvement impact. This way you can position and rank all the solutions or changes. This helps categorize and visualize more easily what can be immediate priority, second priority, what needs additional resources and what actions can be most likely abandoned due to time or resource constraints. (Lean Six Sigma training material, 2014)

4.7 DMAIC - Improve

There are two types of improvement, transformational and incremental. Exponential or transformational improvement challenges original process assumptions and then designs the process to a higher capability altogether. Incremental changes are smaller in

nature and progress step-by-steps via smaller changes that eventually lead to a higher capability. There is an inherent benefit in generating as many potential solutions as possible for each of the root causes identified that can be later in the process narrowed down or combined into one overall solution or a combination of different solutions that address the original business problem. (Lean Six Sigma training material, 2014)

To-be process maps and high-level implementation plans are usually drafted and piloted. Usually picking the most obvious, simple and easiest solutions to implement first. Testing solutions via performing quick Plan-Do-Study-Act cycles and finally implementing and verifying the final solutions and changes.

4.8 DMAIC - Control

The final control stage is for establishing control measures and monitoring the improvements in an effort to ensure sustainable results, to being able to “sustain the gain”. A control plan is usually created and any documentation, process or training material is updated. Financial and other benefits are calculated for review. (Lean Six Sigma training material, 2014)

4.8.1 Control Charts

As per Lean Six Sigma training material (2014) volume and trend charts are an easy way to measure project success. With the correct measures put in place it will be easy to say if the changes have resulted in an improvement and whether the project goals were met. A stable, predictable process is a requirement for achieving and maintaining quality.

The definition of variation is the measurable difference in values or characteristics that vary over time or location. Understanding of variation is necessary for troubleshooting and problem resolution. Causes for variation can be inherent in the process affecting everyone working in the process and affecting the outcome of the process. This is called common cause variation. Variation can also arise from specific circumstances that are called special cause variation. A stable process that meets requirements can have some variation, if only emerging from common or system caused causes, and the variation is

predictable, remains essentially stable over time or within statistically established specification limits. A process where both common and special causes are rampant can be described as an unstable process and is detrimental to the overall quality of the process.

Control charts are statistical tools used to help assess process performance or examine variation in a process. To be used as a guide to improving a process and whether potential variation is caused by either common or special causes. They can be used to demonstrate process stability and predictability over time or to show process instability and level of variation present. Control charts can help answer questions like how does a process measure vary over time, is the process stable or unstable, is it within control limits and did the changes match predictions or potentially cause a process to become more unstable? (Lean Six Sigma training material, 2014)

The construction of a control chart, for example like an individuals and moving range chart (I-MR) starts with

1) Selecting a process characteristic to measure or control
2) Collecting data
3) Establishing control by finding and eliminating any special causes
4) Constructing the control chart
5) Using them as part of control purposes and activities moving forward.

5 Improving Customer Self-Service rate in Finland

This chapter focuses on the practical application of the Lean Six Sigma improvement process and the project framework as well as the tools described in the previous chapter. How these tools were used in the Customer Self-Service improvement project.

5.1 Current State Analysis

This section focuses on the case organization and evaluating the current state and the business problem.

5.1.1 Case Organization

This improvement project was done for a large international Information Technology (IT) company operating in Finland that provides products, technologies, solutions and services to consumers and businesses.

5.1.2 Problem Statement & Target

The purpose of this project was to improve the customer self-service rate in Finland and lower the total costs of service delivery. This was aligned with the overall organizational goals and targets.

5.1.3 Measurement & Data Collection

Case reports were used to assess the baseline performance. A period of six months prior to project start was chosen to be used as a baseline. This measurement period was assessed to be long enough to account for any variation and long enough to determine the baseline performance reliably. A six month period one month after project start was decided to be the start of the measurement period to see if improvements were made. This also provided us with a comparison to the earlier baseline that could be used in the final report.

The six month average for onsite- and customer self-service rates were measured. The overall number of cases were needed to be able to calculate actual business impact in euros. During the project it was also introduced that customer satisfaction should be measured although not a metric that the project success was measured on. By performing any changes during the project, it was important to make sure that it did not inadvertently impact customer satisfaction negatively.

5.2 Project charter

As stated, improving the self-service rate in Finland was aligned with the overall strategic goals in the service delivery organization for increasing automation, providing remote

services and reducing onsite service delivery costs. An accelerated model of improvement or AMI chart (Figure 7.) was used to create the project charter and formalize the improvement project by answering three questions.

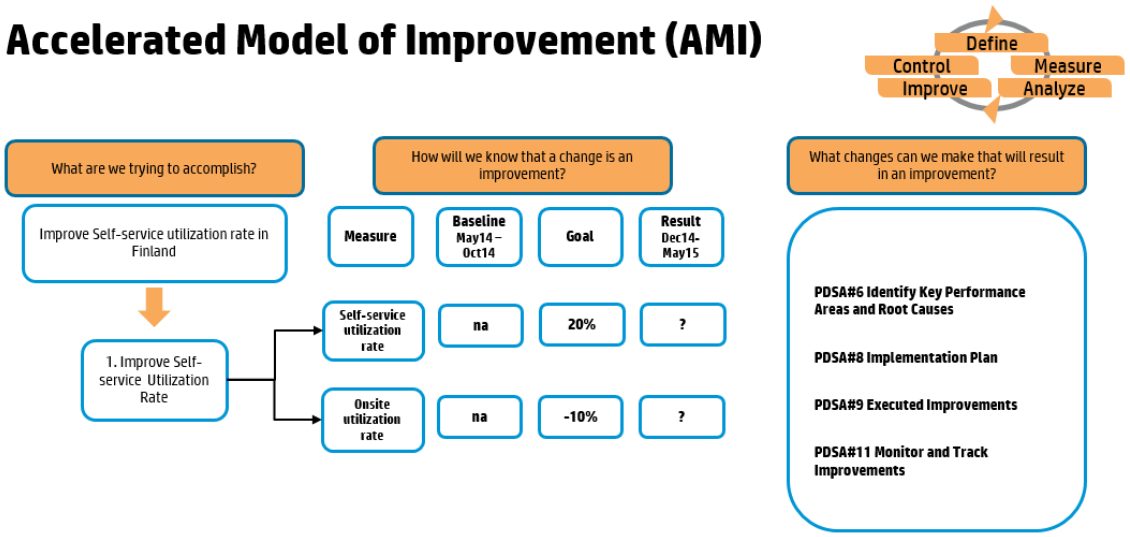


Figure 7. Accelerated Model of Improvement (AMI)

- **What are we trying to accomplish?**

Improve the self-service rate and decrease the number of onsite service requests which in turn will result in cost savings for the delivery organization. Achieving this without affecting customer satisfaction negatively. The goals were set to increase self-service rate by 20% and reduce onsite rate by 10% within the calendar year.

- **How will we know that a change is an improvement?**

The requirement was to measure the self-service and onsite service delivery ratios in regards to overall delivery portfolio that also includes remotely resolving customer issues via phone assisted service. The baseline must be known to be able to measure whether the changes implemented will result in an improvement.

- **What changes can we make that will result in an improvement?**

After forming the core team and completing the project charter work started following an 11 step PDSA improvement plan (Figure 8.).

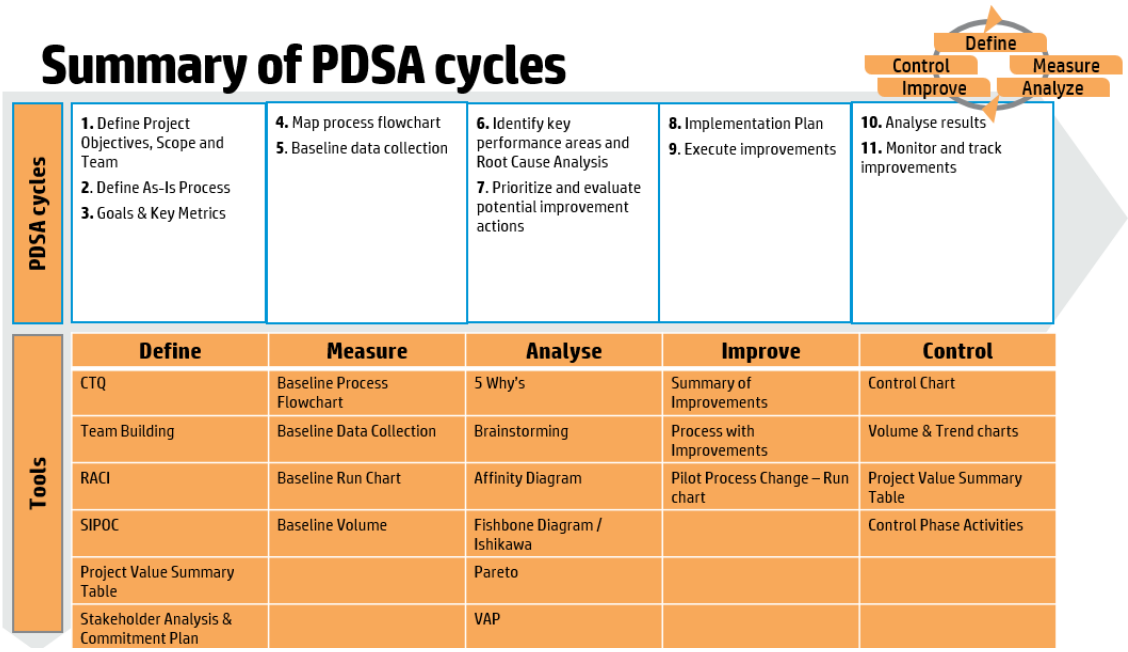


Figure 8. Summary of PDSA Cycles

The project followed the DMAIC framework with a simple PDSA structure spanning the whole project end to end as follows:

- Defining goals and key metrics
- Data collection
- Identifying key performance areas and analyzing root causes
- Evaluating potential improvement actions to take
- Formulating this into an implementation plan
- Performing changes
- Analyzing and tracking results up until project closure and handover.

This was not a linear process as some of the PDSA cycles overlapped each other, some actions were redone and some, if not most tools, were revisited throughout the project.

5.3 Team Building

The core project team was formed from the people actively working in the service delivery organization. The teams in charge of receiving customer support calls were involved early during the project initiation as well as other key stakeholders. A kick-off meeting was organized to review goals and objectives. Team requirements were identified and

the key stakeholders who would need to be involved. Workshops for brainstorming activities together with the local business leads were organized and call centre agents contacted directly for feedback and further improvement ideas.

RACI and Team Building exercises were performed, mirroring the team performance and key activities against Tuckman's model for the different stages of Forming, Storming, Norming and Performing. After the team was formed, the RACI (Figure 9.) helped define clear roles and responsibilities for everyone and to establish a communication path in the organization.

RACI CHART

Project Name — Improvement Project

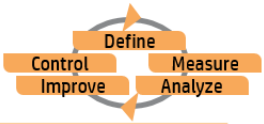
Responsible — Person who performs the action/work
Accountable — Person who is the owner, accountable for action (R) to be completed and/or has to approve
Consulted — Person who is consulted, contributes or has the information necessary to perform action
Informed — Person who is informed of action or needs to know of progress & results

	ACTION	Project Lead	Support Mgr	Call Center Mgr	Call Center Mgr	Call Center Mgr	Sponsor
1	Draft Project Charter & initiate project	A / R	C				C
2	Review current process and status	A / R	C	C			C
3	Establish roles & responsibilities for team	A / R	C	R	C	C	I
4	Map current process and baseline	A	C	R	C	C	
5	Discuss and brainstorm improvement opportunities	A / R	R	R	R	R	
6	Work with stakeholders on improvement solutions	A / R	R	R	R	R	
7	Establish measurements, monitoring and pilot changes	A / R	C	R	R	R	
8	Assess and review results of pilot	A / R	C	R	R	R	
9	Document and compile findings	A / R	C	C	C	C	
10	Create process brief for any proposed changes	R	A	C			
11	Create any new work instructions	R	A	C	C	C	
12	Train team leads on new process	C	C	A	R	R	
13	Business end users trained	C	C	A	R	R	
15	Implementation, Change Management & Communication	R	C	A	R	R	
16	Monitor status	A / R	I	R	R	R	
17	Closure of project & Certification	A / R	I	I	I	I	I

Figure 9. The RACI Chart

Stakeholder Analysis (Figure 10.) was also performed to identify all stakeholders affected by the process and also key stakeholders involved in the process activities. A stakeholder commitment plan was also used to establish criticality to the project success and for potential actions needed to gain support or convert key stakeholders. End customer was identified as a key stakeholder as it was deemed important not to negatively impact customer satisfaction by any of the changes implemented the call agents were identified as another key stakeholder – customer facing, gatekeepers for improving the self-service utilization rate. The rest of the stakeholders were identified that they can support the project but do not have a great influence, positively or negatively on its success.

Stakeholder Analysis PDSA#2



Stakeholder	Current Level of Support (H,M,L)	Level of Influence (H,M,L)	Communication Requirements	Who? How often?
End Customer	L	H	Keep informed about any process changes	External communication, sales communications
Call Agent	M	H	Responsible, follow up on process – team leads accountable	Dispatch Agents Team Leads
Service Manager Community / Sales Team	L	M	Consult, Keep Informed	Internal / External communication packages
Supply Chain Management	H	L	Consult, Keep Informed	Internal communication
External Service Delivery Partners	L	M	Keep Informed	External communication, appeasement
Finland Management	H	H	Consult, Keep Informed	Internal communications

Figure 10. Stakeholder Analysis

The SIPOC (Figure 11.) was used to break down the existing process steps into a more streamlined flow. Suppliers, inputs, outputs and end customers were used to better capture Voice of Customer requirements. This data was also used for the previous Stakeholder analysis. As no major system related issues were identified the in the process at this stage, focus was placed on the particular process steps.

SIPOC PDSA#2

Customer Self-Service Improvement Project

Suppliers	Inputs	Process	Outputs	Customers
Service Delivery Service Managers Call Center Logistics Sales End Customers	Serial Number Product Number Entitlement Part Number Part Flag A, B, C Customer Request	* Inputs Ok, no system issues	Self-Repair Event Onsite Support Phone Assistance Customer Satisfaction	Call Agents Qualification agents Partner Subcontractor End customer

* Basis for Stakeholder Analysis

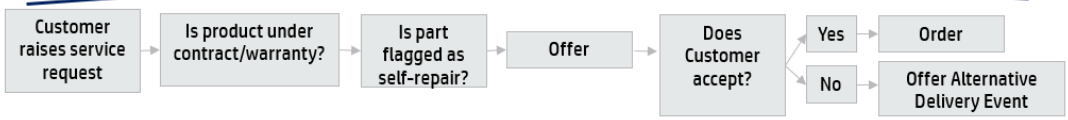


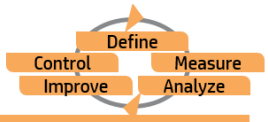
Figure 11. SIPOC

5.4 Establishing Baseline

The process was defined as per the existing process documentation available from the call centres and focus was placed on the final steps in the process. This also coincided

with the SIPOC findings from earlier. Focusing on the steps when the call agent or qualifier offers self-service to the customer and whether the customer accepts or declines this offer. As the self-service process is globally followed, there was no reason such a large difference in performance between the other countries and Finland has been exhibited. So the process did not necessarily need major changes, but it was needed to make sure that the process was correctly being followed or properly enforced within the call centre teams. Also some local root cause analysis was needed and for this a baseline to start working from was required. A data collection plan was created (Figure 12.).

Baseline Data Collection PDSA#5



Data was gathered from Case Volume Reports and individually run case reports. Frequency varies from monthly to weekly reports.

What	Where	When	Frequency / Instances	How
Volume Reports Category 1	Delivery Alternative Volume Reports	Baseline: Q1 FY14	Quarter	Excel spreadsheets
Volume Reports Category 2	Delivery Activity Reports	Baseline: 05/2014 through 10/2014	Month	Excel spreadsheet
Case volume and customer refusal	Delivery Reports	October 2014	Month	Excel spreadsheet, manual checking of OPT cases
Part Categories and volume	Delivery & Part reports	February 2015	Weekly	Excel spreadsheet, manual check for parts; Minitab control chart

Key Learnings: Structured data collection plan established for supporting project objectives and goals
Next actions: Start Baseline Data Collection

Figure 12. Baseline Data Collection

The self-service utilization baseline average was measured during a six month period which was aligned with the overall performance in the year. The call centre agents also provided information regarding earlier cases where self-service was not correctly offered that was gathered from past cases from which a Pareto chart was prepared to identify key defects (Figure 13.).

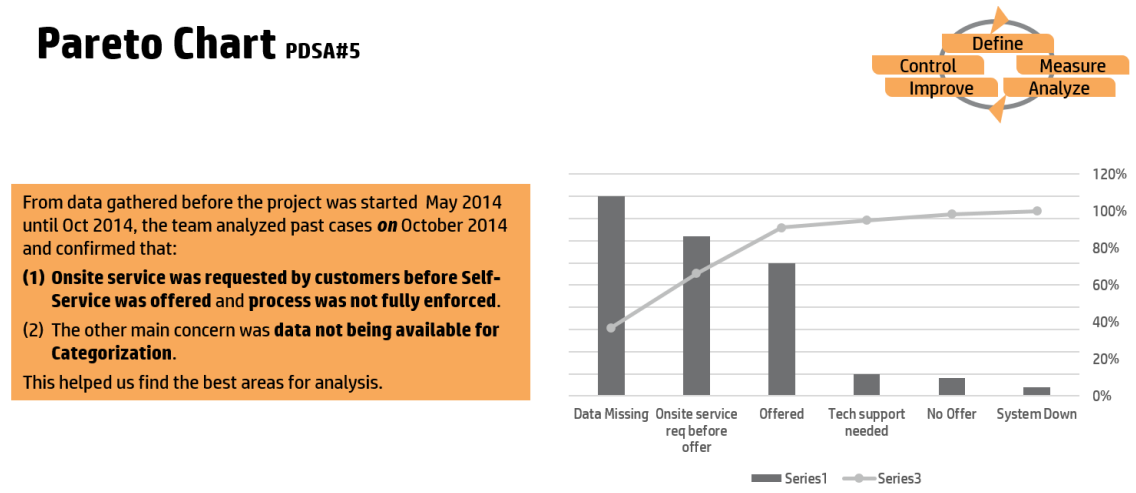


Figure 13. Pareto Chart

Key defect areas identified were onsite services being requested and provided before self-service was offered and reasons for customer refusal of self-service not being available, meaning that this information was not available or recorded in case notes as per established process. This made root cause analysis more difficult. Potential reproducibility measurement variation (e.g. human error) with data was identified due to individual agents going through case histories but deemed not substantial or not something that would invalidate the overall findings.

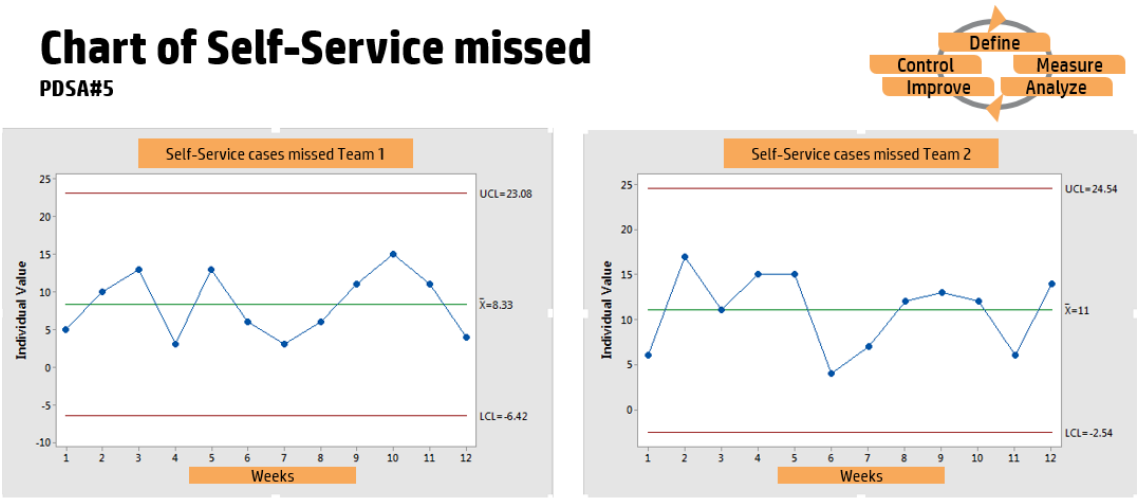


Figure 14. Self-Service Control Chart Baseline

After establishing call baseline for utilization a new measure and chart was introduced for tracking self-service missed cases and variation to see whether any changes implemented would be able to bring this process to a more stable level (Figure 14.). A certain group of calls was categorized under specific criteria as “missed” as these calls should

have been handled as self-service but were delivered as onsite instead. A minimum of 12 data points (12 weeks) was chosen to form enough of a baseline to try and measure the variation in the process to be able to later compare the baseline situation to after when the changes were implemented.

5.5 Preparing the improvement plan

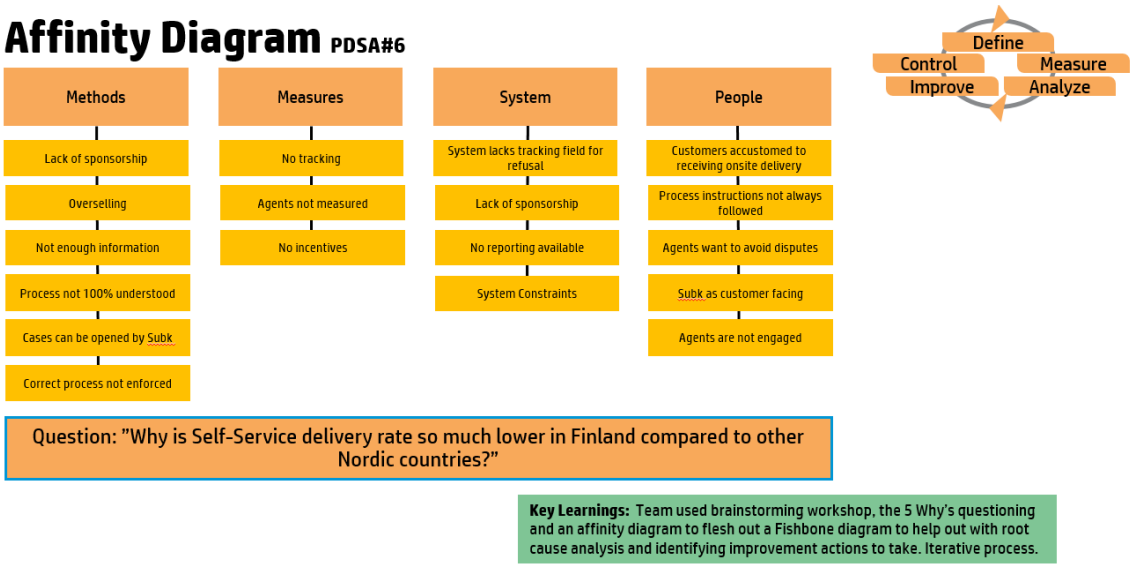


Figure 15. Affinity Diagram

Brainstorming sessions were arranged with the team and key members. Combined with the 5 why's line of questioning the team started to gather good ideas for potential root causes on why the self-service utilization rate was lower in Finland than in other countries. Also key persons outside the team and outside of Finland provided valuable input as outsiders to the process. These ideas were used to form categories that were eventually combined into an affinity map (Figure 15.) that was formulized into a cause and effect diagram.

Some ideas proved very valuable and helped understand the historical reasons behind the low self-service rate in Finland: The service delivery structure being different from other countries with no real company presence and the overreliance on partners as customer facing. Customers were used to receiving onsite service and were very familiar with the external service partners. It should also be noted that the incentives for the subcontractors were different from the company engineers. The company engineers might see benefits in training the customer to replace some parts themselves in simple situations instead of always asking for onsite assistance. The subcontractors on the other

hand might even persuade the customer to always request onsite service, even when the customer would have the skills necessary to perform the repair.

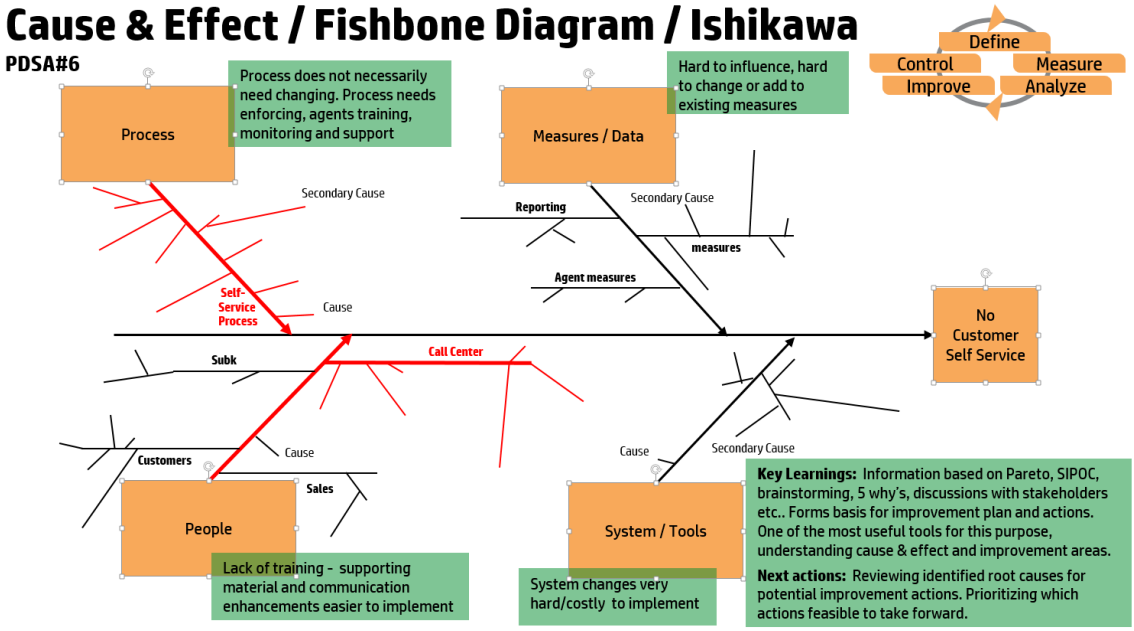


Figure 16. Cause & Effect Diagram (Specific data elements removed)

The results of the previous activities like brainstorming with different stakeholders, applying 5 why exercises, drafting affinity diagrams and Pareto charts were combined into the final cause & effect diagram (Figure 16.). This proved the most useful tool in this project for determining the reasons behind the low self-service utilization rate. The most important paths identified that felt were the major root causes were the customer self-service process within the call centres and how the people involved, the CSC agents were following this process and how they felt about their role for promoting self-service delivery. The cause and effect diagram formed the basis for the different improvement actions the team could pursue during the project. These improvement opportunities were gathered into a table, formulized and then selected for VAP analysis.

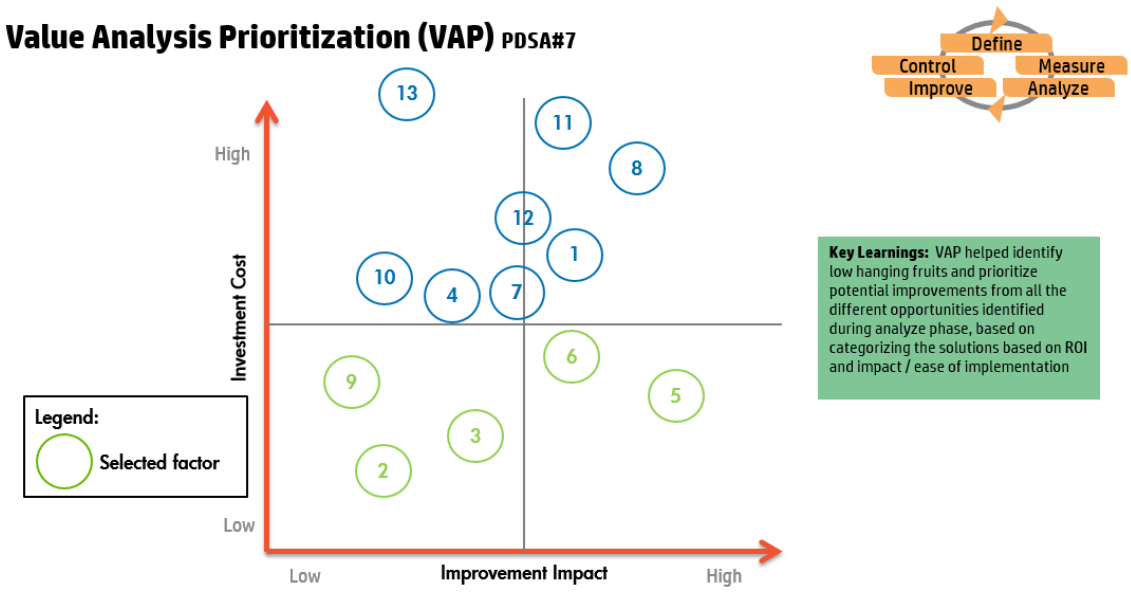


Figure 17. VAP Chart

Value Analysis Prioritization or the VAP chart (Figure 17.) was used to be able to identify and prioritize the best and most feasible improvement actions to take. The team identified "low hanging fruit" or opportunities that were easy and quick to implement. Also based on Return on Investment and impact, a few key improvement actions were chosen to be implemented to achieve best results within a relatively short timeframe.

5.6 Executing Improvements

Weekly monitoring was established for a period of two months during the project. Key improvement areas were identified and changes enforced. Some constructive feedback was received during implementing changes that was incorporated into the improvement plan.

Going over the existing process steps the team identified actions that could be taken to support the call agents better during the call handling process. At this stage it was decided that the procedures would be limited to certain customer and specific product categories due to fear over customer satisfaction and not wanting customers to feel forced to adopt any new process changes without first introducing them in controlled stages.

Improvement Actions:

- Preparing and distributing simple documentation and guidelines for making sure sales and service managers were better informed about customer self-service. Helping them promote the importance of this to customers as a viable service option.
- Enforcing process on certain products as per existing process where previously no guidelines had been followed or measures implemented. Preparing plans to extend this process later to other product categories or customers if needed.
- Weekly monitoring and introducing new metrics for customer self-service to be added as control procedures.
- Training sessions and additional material about self-service was provided for the call agents to increase their “soft-selling skills” and to help them follow the process more correctly in the future. Agents should be now better equipped and trained to promote and advocate customer self-service to the end users.
- Guidelines and metrics were put in place that were previously not available to help with later root cause analysis and any future process improvement actions.

5.7 Control

At the final stage in the project, a control plan was established as the project was closed and handover performed with the different business functions. The decision was made that the improvement actions would continue as per original improvement plan in controlled stages within the call centres and in the business organization after project closure to ensure continuous improvement.

For the actual control phase activities, project approval was received and hand over to production. The team distributed all documentation in regards to project as well as established and continued communication activities about customer self-service internally and externally. A training plan and additional monitoring actions were requested to be performed by the call centre teams to be able to sustain the gains.

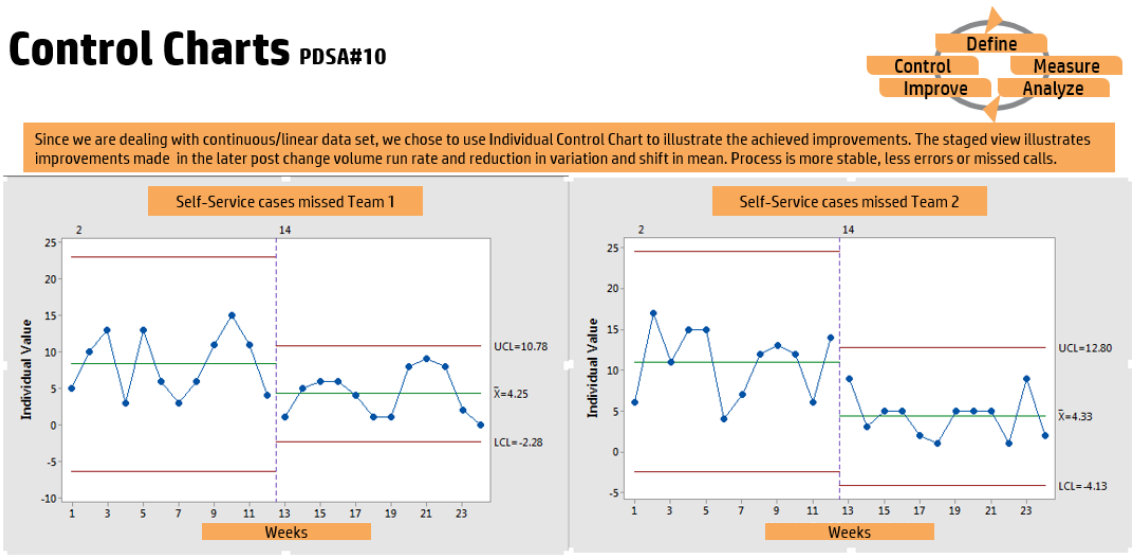


Figure 18. Control charts

A control chart (Figure 18.) with stages was utilized to measure the improvements made after initial measurement period of January until March for the missed opportunities in self-service. After March a slight drop in the number of missed cases was observed after the improvement and tracking measures were put in place. The Upper Case and Lower Case levels narrowed which meant that the process had less variation and was more stable. There was a small detectable shift in the mean for the missed opportunities in both team categories meaning that there were less missed opportunities than before so the process was improved.

6 Results and Further Development

This chapter presents the project results, research findings and ideas for further development.

6.1 Results

The purpose of this project was to improve the customer self-service rate in Finland by 20% and lower the overall number of onsite service requests by 10% within the calendar year. Although the project goal was optimistic and it was known that changes might take a long time to take effect due to effectively trying to change operating culture, the customer self-service rate improved by 19% within a 6 month period in comparison to the

earlier baseline utilization rate. The number of onsite service requests in comparison fell 9% during the same period. Below is a four month trend chart from showing the small increase in the number of self-service cases and the larger decrease of onsite cases during this period (Figure 19.).

Overall, the customer self-service rate in certain product categories increased by over 30% during a period of 12 months. Customer satisfaction was not negatively impacted due to any process changes. Major cost savings were achieved in the organization in comparison to the old utilization rate if no changes would have been implemented.

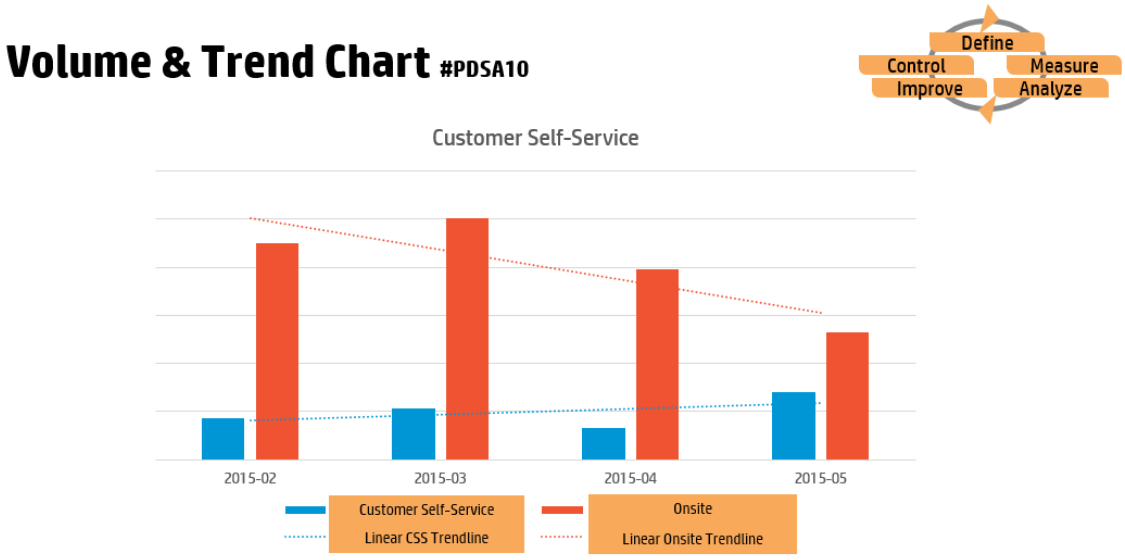


Figure 19. Volume and Trend Chart

As a summary, the process changes made were:

- Reinforced customer self-service process, guidelines and metrics within the call centres and internally in the organization – Improved customer self-service rate while maintaining customer satisfaction.
- Streamlined and clarified communication about customer self-service – Provided clear and consistent information, documentation and communication about customer self-service, process changes and control plans internally within the organization and externally to customers.
- Established process improvements, monitoring and measurements not previously available for customer self-service – Process measurements established for increasing quality and reducing variation in the process.

6.2 Discussion and further development opportunities

Lean Six Sigma approach and methodology provided a very good framework and set of tools for process improvement projects and could also be applied to other projects or business areas. Lean is about facilitating continuous improvement and driving customer satisfaction. It is about making the process flow as waste- and defect-free as possible. Six Sigma provided the tools for measurement- and data-based decision making. This helped to bring the process under control and reduce variation, which in turn helped with improving quality.

The DMAIC and PDSA models provided a good project framework that was scalable, easy to follow and structured in a way that guided the work naturally from one stage to the next, with multiple iteration and improvement cycles in between. There is much potential in applying these tools to improve productivity and efficiency more widely in the organization, be it in service delivery, manufacturing, logistics or process improvement. The Lean Six Sigma approach is universal in the sense that it can be utilized in many different areas and business aspects. If more widely adopted in the organization and day-to-day work, its applications are numerous.

To be able to improve anything, you first need to be able to measure it as without the data you cannot really start improving. You need to be able to get a process under control to be able to standardize and eventually improve. You need to bring people together and align the team under one common goal. Lean Six Sigma concepts and tools for process improvement are very useful for establishing a clear baseline, collecting and analyzing data for identifying the underlying root causes, prioritizing improvements and implementing changes in a controllable and sustainable manner. It also provided the control mechanisms to ensure that the improvements are sustainable and that these are not lost once the project ends. This was a danger that was identified during the project after handover was done to the business and call centres. Also, some of the tools utilized might not have been needed to achieve the results. Lean Six Sigma should be approached as a methodology or strategic goal guiding the process, not necessarily just as a toolkit to be applied without assessing the actual need or requirements for the use of these tools.

The proposal to the company was summarized in an improvement and action plan prepared based on the results of this research. In order to sustain and improve the self-

service rate in Finland, the identified improvement actions should continue in the organization and be extended more widely in the teams. Further development opportunities lie with more research into the different aspects of Lean Six Sigma to find the most relevant applications for everyday business use. In order to sustain the good self-service rate in Finland, the author recommends that the IT Company should continue with the improvement actions, especially focusing on communication, training, monitoring and control activities within the service delivery organization and call centres. In summary, this project attained its business and research goals but will only serve as a first step on the road for future improvements within the organization and company.

6.3 Reliability and validity

The Lean Six Sigma approach and methodology during this project proved very useful during the research process. In general, the research findings can also be applied in other departments and business areas, be it in manufacturing or services. The presented approach, tools and concepts should be valuable in any business environment and especially useful in projects that deal with process or quality improvement due to its nature.

More time will need to pass before it can be fully assessed whether the improvements made resulted in sustainable and controlled results. Although much emphasis was put into enabling continuous improvement within the organization it is too early to tell whether the changes implemented can actually facilitate a permanent procedural or cultural change within the teams. A gap identified was with the control mechanisms put in place and whether these were enough to facilitate a long standing change within the organization or customers. Also during the research the team found out that it needed to also include additional metrics for tracking customer satisfaction, although this was not originally a metric the project success was measured on.

Overall, the results should be reliable enough to be reproducible, although a lot of metrics are dependable on single variables and some data findings might have reproducibility issues due to the human factor present during the gathering of the results. None of this was deemed substantial to warrant questioning the reliability of the results for the project or the actions taken. The project and research design, statistical and data-driven approach facilitated that the results should be as valid and reliable as possible.

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