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Developing an integrated framework for analyzing customer complaint flow with Six Sigma

An approach to identify, and analyze bottlenecks in the customer complaint collection system of Mölnlycke Health Care AB

Master's thesis in Master Programme Quality and Operations Management

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An approach to develop and maintain quality KPI's and performance measures to reduce customer complaints

A framework development for understanding and analyzing the customer feedback collection process in Mölnlycke Health Care AB to improve customer retention and defect resolution

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Abstract

The abstract of the thesis involves a structured development following the Six Sigma Methodologies incorporated into the analyzing and development of customer complaint process collection in Mölnlycke Health Care. Eventhough, previous research have been done regarding similar acumen, in this particular thesis, a special focus has been given to link the KPI of the organisation to that of the detailed collection of the complaint system identifying the pitfalls in the process, thereby helping to produce substantial results in the organisation level dynamics and decision making
.

Keywords: Six Sigma, Manufacturing, Customer Complaint resolution.

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Aravind Vasudevaru Ajaya Kumar, Gothenburg, March 2023

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

CC	Complaint Collection
DMAIC	Define - Measure - Analyse - Improve - Control
NVA	Non Value Adding
LSS	Lean Six Sigma
VoC	Voice of Customer
ORS	Operating Room Solutions
PP	Procedure Pack
DCU	Designated control unit
KPI	Key Performance Indicator
TPS	Toyota Production System
SME	Subject Matter Experts
CPM	Complaints per Million
PSS	Problem solving sheet
FAA	Field Action Assessment
MC	Master Control Database

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Introduction

1.1 Background

1.1.1 Background of Mölnlycke Healthcare AB

Mölnlycke Health Care AB is a world-leading medical solutions company focused on producing value for its clients by bringing innovative solutions to its customers. Starting off as a textile manufacturer supplying gauze for Swedish Hospitals in 1849, Mölnlycke invested in pioneering better ways to develop and deliver care and support to the public through the healthcare fraternity.

Starting off, with pioneering in the mass production of wound dressings, single-use drapes, etc, ensured the improvement of Operation theatres. These operational improvements along with other major innovations like tubular bandages and powder-free surgical gloves were other feathers in the cap leading to the innovative mindset and innovative strategies involved in healthcare.

Another major breakthrough was the introduction of Safetac, an innovation that changed wound care forever. Safetac is an original less-pain contact layer with silicone adhesion that means less pain for the patient and support faster natural healing. The Safetac technology is used in a range of Mölnlycke wound care products, such as Mepitel, Mepilex etc.

Today, Mölnlycke is organized around its four business areas Wound Care, Operating Room Solutions, Gloves, and Antiseptics, where customer centricity, sustainability, and digitalization are their strategic priorities. Within Wound Care, Mölnlycke's largest business area, the company provides wound care products and therapy-based solutions for chronic and acute wounds used in hospitals, post-acute settings, and home care. The company's wound care solutions help prevent wounds from developing, reduce patient pain and discomfort, stop wounds from becoming infected, and promote faster, more effective, healing. Furthermore, Mölnlycke provides a range of drapes, staff clothing, and surgical instruments for the operating room to support efficiency, safety, and prevention. The offering includes ProcedurePak® customized trays and Biogel® gloves.

Innovation is a part of the organization's motto, they are leading the way in preventing pressure ulcers with the help of prophylactic dressings and devices for turning and repositioning the patients.

Also, for the purpose of the thesis, Mölnlycke Health Care AB would be further referred to as Mölnlycke during the entirety of the thesis

1.1.2 Problem description

Mölnlycke is facing various complaints regarding its products globally. Even though the nature of the defect is identified, and product type noted, the process from lodging a complaint to its resolution is taking a long time. Currently, the measured performance metrics are not clearly linked with the organizational strategy as well.

Even though the customer complaint collection process is standardized within the organization with its DCU connected to its regional sales network creating a feedback loop of information, the key points in data collection vary. Lack of standardization across its European system (with the language being a key issue) to that of its US counterpart brings in the main/key difference. These factors lead to discrepancies in the measured objectives and question the value of the existing KPI's. Furthermore, the data thus obtained is not used for data-driven decision-making processes at an organizational level making the measurement processes and objectives obsolete.

1.2 Aim

1.2.1 Purpose

Without measuring a process, it is often hard to understand and measure progress. Having a deeper process understanding creates better visibility on what to measure and how to do it. In the case of Mölnlycke, the complaint processes are input through a system of filters before being lodged into the DCU (Designated Control Unit) systems. These filters are often verbal in nature, making the process of standardization difficult. Also, the mode of documentation may vary regionally depending on the customer representatives of the firm located globally. These factors make the standardization of requirements and proper data collection even harder, making it imminent for the firm to standardize the process of feedback collection from the customers.
From initial understanding, from the early reports, the end-to-end process from filing a complaint to resolution of the same, takes on an average from 62 to 92 days, sometimes even more, which proves to be a lengthy and tiresome process. These recurrences create customer dissatisfaction and loss of brand value among its customers ultimately leading to revenue losses

1.2.2 Scope

In this thesis, it would be imperative to critically understand the customer complaint collection process, the time taken for the same, the bottlenecks caused due to these processes, and finally the alignment of the organizational KPIs with the data acquired from the thesis to ensure that the firm can make data-based decision making for its vision alignment for the Quality department. The initial application

of the framework developed can be used from both an end-customer perspective and also in an organizational perspective to ensure a smooth and clear process flow hence ensuring a verified metric for process improvement.

RQ 1: What are the bottlenecks in the customer complaint process system leading to a high lead time in complaint resolution?
RQ 2: Are the existing measured objectives useful for a data–based decision-making at the organizational level? Is it an appropriate KPI (Key Performance Indicator) measure?

1.2.3 De-limitations of the project

Currently, the measured performance metrics are not clearly linked with the organizational strategy. These factors lead to discrepancies in the measured objectives and question the value of the existing KPIs. Furthermore, the data thus obtained is not used for any data-driven decision-making processes in the firm making the measurement processes and objectives obsolete. For example, the verbal filters used as part of the customer complaints processing system may affect the quality of the metrics in which the process has to be measured for standardization. Also, it plays a significant role in increasing the lead time in the complaint resolution process. Another major limitation would be the lack of a common language used for customer complaint data collection.

1.2.4 Future work from the thesis

The future work and limitations of the project include:
- Further implementations to different departments across the organization
- Further implementation to different KPI/Processes
The project handles to reduce the lead time for customer complaints by reducing/removing the bottlenecks in the customer complaints handling processes.

2

Theory

The current chapter portrays the concepts and fields relevant to the thesis project presented. Concepts of Lean Six Sigma (LSS), Six Sigma (SS), Healthcare manufacturing, etc are mentioned in this section. As a matter of fact, since the mentioned topics align more with conventional manufacturing and its wide applications there, this thesis project intends to shed light on the service applications of the methodologies and process improvements in the service operations as well.

In any industry, customers bring in value and revenue to boost the economic value and conditioning of the organization. The case of the healthcare industry is a very unique and complex one. The DMAIC procedures combined with Lean thinking, help to reduce wastage and mitigate the influence of variation. Even though Lean and Six Sigma, started out as a tool aiding to reduce waste and mitigate the influence of variation, improve quality performance and diminish Non-Value adding (NVA) activities [3] it started to find its niche in the services sector and other branches of the organizational hierarchy as well. The incorporation of Lean Six Sigma (LSS) in healthcare has been done in the service aspect of healthcare firms to improve service efficiency, reduce waiting times and improve patient satisfaction[3].

2.1 Six Sigma

The healthcare industry is a rapidly evolving field wherein cutting-edge technologies are put into test and practice for attaining "fit for human use" status. In such conditions, continuous improvement along with consistent customer feedback is necessary to improve product and process quality. Six Sigma proves to be an excellent combination of collecting the VoC (Voice of the Customer) and combining it with the process/ product deviations to develop a scientific analysis.
According to [4] Six Sigma is an organized and systematic methodology used to improve processes or products' performance with impact on customers, and is based on scientific and statistical methods. Six Sigma methodology is used to improve the performance of the processes/products and the quality of service through the reduction of variation, based on statistical and scientific methods [4]. The major area of application of Six Sigma would be in problems or processes with no definite and clear goal or idea of the solution. In similar cases bringing in structural as well as process clarity to the issue developed is of paramount importance. As mentioned in [6], if no data can be provided to substantiate the best solution made

for improvement, if the solution actually solves the problem, and its drawbacks, Six Sigma can provide to be an effective solution. In the case of the Healthcare industry, especially in the customer CC process, achieving and identifying both the perceived value and tangible value of a product or the process is of utmost importance as it remains to be a major point of concern for the patient and hospital staff and even the regulatory bodies concerned.
The foundation of Six Sigma relies on "taking an organization to an improved level of sigma capability through the rigorous application of statistical tools and techniques"[9]. The key beneficial factor separating the Six Sigma approach from that of other conventional approaches is its strong customer focus combined with the analysis of data to develop a quantified approach to problem-solving. A majority of the cases mentioned as part of the Six Sigma implementations in the Health care industry would focus mainly on the process aspects like claim reimbursement, Healthcare delivery, and administration, and inventory reduction of surgical equipment[9]. On the contrary, in the thesis project, specific focus has been given to the optimization of the processes in relation to the customer complaint process, analyzing the bottlenecks of the process, and increasing the possibility for faster delivery of problem resolution.

2.2 Lean Methodology

Lean Production or Lean Methodology is a direct adaptation of the famous Toyota Production System (TPS) which evolved its way under the famous Taiichi Ohno's experimentations in the Toyota Motor Company [13]. The comprehensive and multipronged nature of lean production with its specialized focus, primarily on the reduction of the NVA process was entirely new to the US managers who till then used a one-eyed approach to isolate the evident cause of the process without taking into account non-evident ones. The primary goal of the TPS system is to reduce Cost by the elimination of waste in the process steps. These can be achieved by Quality control and assurance in the processes, thereby only manufacturing just the required quantity of units later paving the foundation for JIT (Just in time)[13]

2.3 Lean Six Sigma

Lean and Six Sigma are both process improvement methodologies that are extensively used in organizations to achieve operational excellence. Even though having common roots in methodologies and ideologies, the combination, of bringing in identification of wastage in resources, processes, or even revenue (Lean methodology) and backing it up with a strong data-oriented approach (Six Sigma) provides the best of both worlds, hence leading to the symbiosis[11]. In LSS the strong combination of a data-oriented approach to identification, analysis, and restructuring of the process flows provides a stronghold in initiation, maintaining, and optimizing the value streams in an organization leading to uniformity in productions and turnovers[11]. Moreover, Lean having an ideological approach to the identification of waste in organizations, lacks the structure and only provides quick fixes to the symptoms thereby

essentially not treating the root cause of the wastage caused. On the contrary, Six Sigma follows the structural approach with a focus on the identification of root causes of the problem definition hence leading to a clear resolution. In simple terms, the symbiosis could be coined as Lean being a contributor of strategy and structure while Six Sigma employed the tools and techniques to reap the maximum possible improvements thereby bringing the process to its full potential[11]. The effective combination thereby brings stability to the statistical approach to the Six Sigma system and also provides a benefit to the SS approach by reducing the lead time to focus on the main areas of wastage creation.

Adding on, if one has the patience to scrutinize the concept in detail a Lean Six Sigma implementation in an organization is rather scattered. Upon effective implementation, One common parameter that can be observed would be the application of tools and methods that are measly in comparison to the organization's resistance to change which outweighs the structure in fathoms. [11].
LSS started out as a methodology developed in the automotive world for process optimization. As the healthcare system became more professional, optimization of processes and services became a necessity, eventually leading to its adoption in the healthcare industry as well. The tandem approach in the combination of LSS helped in providing practical solutions through Lean and breakthrough Quality improvements through Six Sigma[12]

2.4 Feedback systems in the service sector

Currently, in the Industrial world, the feedback systems incorporated for customer feedback collection are varied in nature. The classic definition of customer feedback is defined as the communication made by the customer regarding a product or service.[18]. The feedback collection can be through solicited or unsolicited customer feedback. The solicited mode of feedback collection is through a structured medium like surveys, questionnaires, etc. While the latter is more direct – customer desire to communicate regarding the experience of the service or product.[18] As the progress in the mode of communication increases, the unsolicited form of feedback collection can be classified as a private and public mode of communication, using social media as well.
Another research conducted on similar aspects of customer feedback collection and measurement of customer satisfaction includes the measures taken by Milner, R.,& Furnham, A. (2017)[19]. The approach points towards two methods denoting different modes/approaches to measurement namely, conformation–dis confirmation and Performance-based [19]. The author lets in a detailed comparison of the mode at which, a service should be offered taking into account various parameters like reliability, responsiveness, accuracy, assurance, quality of the service, etc, that has helped in gaining valuable perspectives for the thesis developed. On deeper scrutiny, the quality paradigm was taken into account, with maintaining focus on doing it right the first time, providing the merchandise during the time of customer requirement, and error–free sales.[19].

2.5 Six Sigma in Service Operations (Customer Quality)

Six Sigma has made a significant contribution to the service industry by developing a structure to the system and improving the process layout in general. According to [16] the concept of service quality is elusive in nature. Often in service industries, there is an involvement of multiple segments of customers involved whose needs and desires have to be satisfied through the customer service processes. Six Sigma provides deeper knowledge into the variation observed in customer segments to develop modularity in the service processes eventually helping to produce scalable outcomes [16]. The major benefit of the same is a standard and consistent approach to aspects of services like responsiveness, complaint resolution, feedback collection, and so on. Another factor that six sigma brings into play would be, helping the organization by offering the process to imbibe the range of preferences and personality attributes [16] of the customers thereby helping in better customer understanding. Also, it helps in understanding the customer needs on a holistic level thereby helping to structure and develop cross-functional teams to address the needs of the target customer segment. As a cherry on top, they also offer flexibility to the services offered making it more approachable to the crowd in general. As a trailing factor to the existing conditions, through Six Sigma, service performance gaps can be addressed too. Since it offers a generalized and constant level of service to the targeted customer segment, variation can be evidently reduced. Speaking of variation, currently, in the service industry, there are services based on processes and based on knowledge, [16] where different levels of customer satisfaction and standardization of complaint collection are observed. Through the implementation of Six Sigma, in sectors like healthcare, where a tad bit of prominence is given more to the work experience and familiarity of the CC rather than the standardized approach, Six Sigma can provide to be a structured tool/method to capture the customer mindset.

3
Methods

In this research submission, as part of complaint collection, a detailed study has been initiated in examining the process mapping and identifying the process bottlenecks of the CC collection process in the medical products manufacturing company - Mölnlycke Health Care AB. Furthermore, the analysis of the KPI which can be put in control on an organizational level for planning is also mapped for better process optimization.

The project consists of both quantitative and qualitative analysis of data for the representation of customer satisfaction. Since the project was part of a process of customer feedback collection in Mölnlycke, there are a lot of estimations used, as cycle times for certain process steps were vague. In order to obtain the best possible/optimum cycle times for process steps, project management tools like 3-point estimation and PERT has also been introduced in the thesis.

3.1 Approach

3.1.1 Empirical research

The report presented here has been referred to with the Six Sigma Philosophy (DMAIC). The methodology is divided into 5 parts with their representations done in detail in the following sections of the thesis report. The sections are also introduced with the tools and techniques which were involved along the way to represent the process flow, identify and contain the bottlenecks of the process.

Based on the Six Sigma philosophy as a baseline, the data representation for the project is both qualitative and quantitative in nature. There were 3 interviews collected and remaining as data interpretations and estimations in order to analyze the total flow of the process. Various thoughts and opinions were also counted in the report for the analysis from the Subject Matter Experts (SME) in the organization and field. These opinions later became based on the process understanding of the thesis.

3.1.2 Define

The initial stage of the project consisted of understanding the problem description properly and using various tools and techniques to give an outline to it. This process

was done in order to understand the project scope and help the author, the company supervisor to get an idea of the outcome/suspected outcome of the thesis. The tools used were Effective scoping and flow charts to create an understanding of both the information and material flow (complaint ticket).

3.1.3 Measure

In the measure phase, VSM was done on a detailed level along with the Swim lane chart to understand the detailed flow in the customer complaint process. The VSM helped in identifying the time taken for the entire CC collection process along with the Value adding and the non-value-adding parts in the system. The swim lane chart gave in a detailed understanding of how the inter dependencies between various departments and functions inside the organization made the process of CC collection hard and least optimized. Finally, a flow chart containing the entire process flow was described.

3.1.4 Analyze

The analyze phase involved various contingencies related to the process activities. These noise factors and inputs were measured with the help of a P-Map (process map) which quantified the process and gave it an analytical overview to choose which factors lead to the maximum effort/time during the customer CC process. Adding on, 3 - point estimate was done in order to assimilate these factors to provide the Critical path (Optimum time) for the process completion. Finally, a C&E matrix to identify and contain the wastage against lean.

3.1.5 Improve

In the Improve phase, brainstorming sessions were held with employees in the organization. These led to fruitful opinions, which later led to the base for improving the recommendations for the process in the future. Costs were also asked to be calculated for the change, which has to be implemented, to cross-verify with the estimations given by the author. This brings about a solid understanding and areas of improvement for future development. These elements are associated with the KPI framework of the existing company to help improve and control the results/outcome

3.1.6 Control

In the Control phase, there are only recommendations that are to be given to the organization as this process upgradation will take an immense amount of time (probably 1-2 years). Moreover, in a complex system as present here, it is quite important to develop and evolve at the earliest stage possible. Oftentimes, the initially small bottlenecks compounds to create larger bottlenecks thereby making the process even harder to solve. During the update, these recommendations can be used as a baseline for further developments and iterations thereby addressing the situation in a step-by-step procedure.

3.2 Data Collection

In the thesis, the data collection done is qualitative in nature as the entire complaint collection process is generally not bound by an exact metric or enumerative figure. Since it is difficult to get the statistical measure and data for the CC system, the qualitative mode of data collection was a preferred choice. All the primary mode of the investigation was done through the interviews conducted in the organization and also through the observations made in the firm. The data thus collected was transcribed in detail to ensure that no form of data loss or misinterpretation is made in the process of data collection. The data collected through the interviews were also later used in the analysis phase of the thesis to gain deeper insights and conclusions on the recommendations to be made for improvement.
The mode of sampling chosen for the project is representative sampling According to [17] *Representative sample: is a sample that reflects the population accurately so that it is a microcosm of the population.*
The sampling mode as explained is used to represent the teams responsible for the data collection in the organization over different geographical locations like Norway, Sweden, etc. The prime motive for a similar mode of data collection was to assimilate the findings thus observed through the interviews and make a generalized comparison of the mode of CC. As the mode of CC was developed, they will eventually provide a consensus over the reliability of the data thus observed as well. Additionally, to strengthen the representative sampling, the stratified sampling method (a mode of representative sampling) [17] was the chosen alternative that suits the requirements of the data collection. The major advantage that led to the choice was that the resulting sample generated will be distributed similarly to that of the entire population subjected/selected for the study [17]

3.3 Define

The main aim of the Define Phase in the Six Sigma Project was to understand the key problem description and use various tools and techniques to give an outline to it. The better understanding one could get and produce in the thesis helped in the better analysis of where the actual problem lies. i.e. the root cause of the problem. Each process identification was done with the help of interviews, surveys, and observations made in order to understand the broader perspective of the process layout. The customer representative from Mölnlycke helped understand the pulse of the general market, which in turn helped to understand and analyze the patterns associated with the complaint collection done in Mölnlycke and how it differs according to the various locations.

3.3.1 Company Structure

Mölnlycke Health Care has an overarching 4 Business Areas encompassing aspects of medical background. In the thesis, the due focus is given to the overall layout of these 4 business areas, the common systems, and establishments that are existing in the organization to provide value to the customers. The organizational hierarchy

it follows is linear in nature with a standard structure in reporting and chain of command (Fig 3.1)

Figure 3.1: Mölnlycke organization Hierarchy

Figure 3.1 gives a peek into the Quality Department of Mölnlycke helping each and every individual understand their role and level in the developmental chain. The organizational vertical with corporate ideas and alignment are often hard or sometimes even impenetrable when it comes to cascading to the lower level of the organization structure. These can be due to the lesser understanding of the corporate vision down to the QA roles in the hierarchy of reporting that creates a bottleneck in the lack of KPI alignment and measurement strategies.

3.3.2 Effective Scoping

Effective Scoping is a tool used to understand the key customer requirements (Y) and convert them to the product or process parameters (y) thereby bringing in customer satisfaction to the product/process. The methodology and tool employed helped in bringing a shift from "Push Thinking" to "Pull Thinking" wherein unwanted or irrelevant features and facilities are introduced in the product/process while failing to focus on the key factors or features that are extremely important in a product or process.

In the thesis, after the initial understanding of the products Mölnlycke manufactures, the process in which it goes through, the various checkpoints currently in place, etc for the customer complaint process, it was not evident what the actual outcome of the project is. On understanding that it is the development of a framework used to measure and analyze the customer complaint collection process, thereby leading to a metric system for measurement.

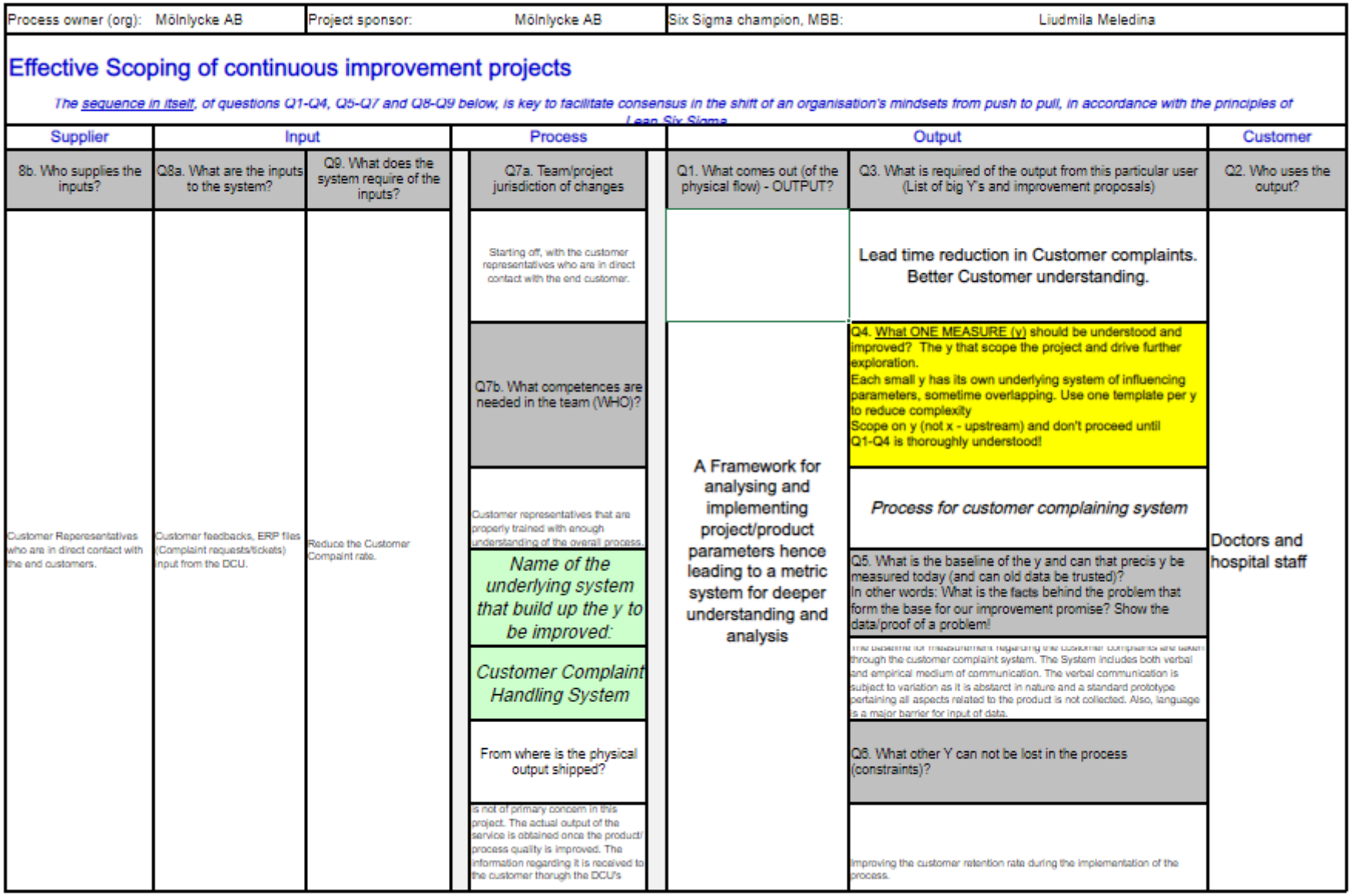
Having an idea of the process outcome, next came the humongous task of identifying the existing target group that is affected by the process improvement. On using the tools, and addressing the 7 questions template, the evident customer base was concluded to be doctors and hospital staff. Further moving up through the questions, it became more evident that the customer had longer waiting times during a feedback loop, and the product had repeated failures thereby creating the notion that the root cause of the problem is not addressed effectively. Hence, an initial analysis was made on reducing the lead times in the CC process and also understanding the bottlenecks in the process.

In order to decrease the lead times in the process, it had to be measured and quantified in any manner possible to help visualize the total flow and identify where and how many hindrances are present in the system. Adding on, the various Mölnlycke representatives which are situated all across the world and housing different languages and cultures made the process of CC a bit more complex in nature.

Furthermore, aiding the Pull thinking methodology, and drilling backward to the key stakeholders that are associated with the change needed helped in pinpointing the type of team necessary, the process, and the output that is to be expected out of the shift. Additionally, as the discussions with the key stakeholders and the customer representatives in the firm were finalized, the final inputs necessary for the process were emphasized to be the Customer complaint rate that is collected in the form of CPM (Complaints per million) in Molnlycke Health Care.

Finally, on pin-pointing, the inputs about the customer feedback, the collection process, etc. were supplied to the author through the help of interviews and surveys done with the customer representatives from Molnlycke aided in bringing a holistic picture of the process present in front of us.

Figure 3.2 represents the effective scoping of the project.



Process owner (org): Mölnlycke AB	Project sponsor: Mölnlycke AB	Six Sigma champion, MBB: Liudmila Meledina

Effective Scoping of continuous improvement projects

The sequence in itself, of questions Q1-Q4, Q5-Q7 and Q8-Q9 below, is key to facilitate consensus in the shift of an organisation's mindsets from push to pull, in accordance with the principles of Lean Six Sigma

Supplier	Input		Process	Output		Customer
8b. Who supplies the inputs?	Q8a. What are the inputs to the system?	Q9. What does the system require of the inputs?	Q7a. Team/project jurisdiction of changes	Q1. What comes out (of the physical flow) - OUTPUT?	Q3. What is required of the output from this particular user (List of big Y's and improvement proposals)	Q2. Who uses the output?
Customer Reperesentatives who are in direct contact with the end customers.	Customer feedbacks, ERP files (Complaint requests/tickets) input from the DCU.	Reduce the Customer Compaint rate.	Starting off, with the customer representatives who are in direct contact with the end customer.	A Framework for analysing and implementing project/product parameters hence leading to a metric system for deeper understanding and analysis	Lead time reduction in Customer complaints. Better Customer understanding.	Doctors and hospital staff
			Q7b. What competences are needed in the team (WHO)?		Q4. What ONE MEASURE (y) should be understood and improved? The y that scope the project and drive further exploration. Each small y has its own underlying system of influencing parameters, sometime overlapping. Use one template per y to reduce complexity Scope on y (not x - upstream) and don't proceed until Q1-Q4 is thoroughly understood!	
			Customer representatives that are properly trained with enough understanding of the overall process.		*Process for customer complaining system*	
			Name of the underlying system that build up the y to be improved:		Q5. What is the baseline of the y and can that precis y be measured today (and can old data be trusted)? In other words: What is the facts behind the problem that form the base for our improvement promise? Show the data/proof of a problem!	
			Customer Complaint Handling System		The baseline for measurment reparing the customer complaints are taken through the customer complaint system. The System includes both verbal and empirical medium of communication. The verbal communication is subject to variation as it is abstarct in nature and a standard prototype pertaining all aspects related to the product is not collected. Also, language is a major barrier for input of data.	
			From where is the physical output shipped?		Q6. What other Y can not be lost in the process (constraints)?	
			is not of primary concern in this project. The actual output of the service is obtained once the product/ process quality is improved. The information regarding it is received to the customer thorugh the DCU's		Improving the customer retention rate during the implementation of the process.	

Figure 3.2: Effective Scoping

3.3.3 VSM

The VSM was made to develop a deeper understanding of the material and informational flow of the processes in the Customer CC system in Mölnlycke.(Fig 3.3) The first point of contact made in the VSM from the Customer to the Supplier (In this case Mölnlycke). The customer registers the complaint with the customer-facing representatives of the firm leading to the initiation of the following steps. The complaint collected is being registered on a document of their choice (Word documentation) which is used for reporting to the Decision Control Unit (DCU) unit verbally or in writing. The model creates instability in the process of warranty case complaint collection. This lack of standardization in the processes can also create missing information in the total CC chain.

The method of documentation varies between verbal understanding to written documentation depending upon the convenience of the Molnlycke Customer representative and their expertise in complaint collection thereby making the process have variation and noise factors in the complaint collection. These noise factors lead to difficult data collection hence making the data biased in nature.

Furthermore, moving to the next main parameter of the CC would be the decision on the criticality of the complaint raised. The checklist involved with the EU regulations decides the complexity of the process and makes it decisive on whether the regulatory authorities are to be notified or not. These decisions have approximately a time frame of around 2 to 5 days depending upon the complexity of the case. Moving on, one of the most crucial steps in the value chain would be the product investigation and the root cause analysis of the failure type. The process takes the most in the total value chain proving to be one of the major bottlenecks in the process. The product investigation ranges from anywhere between 50 to 60 days creating or clearly identifying the factor, thereby making it a concerning factor of further discussion.

3.3.4 Existing KPI measures

In the current scenario, the organization measures a variety of Quality KPIs for their annual assessments. The Global Quality Objectives include an array of them, but here the focus is laid upon the ***KPI - Complaint Processing Time***. The complaint processing time is calculated on a yearly basis, but aligned on a Quarterly basis helping in understanding 3 parameters:

- The total no: of complaints generated in a year
- The total no: of complaints closed in a year
- And also the no: of complaints that are still under investigation.

The data collected through the CPM is being used to assess the Quality KPI mentioned. On average, they take around 77 days the completion the complaint, which is quite high for industrial standards. The factor can create displeasure in customers as the customer response received is delayed and in some cases, is not satisfactory.

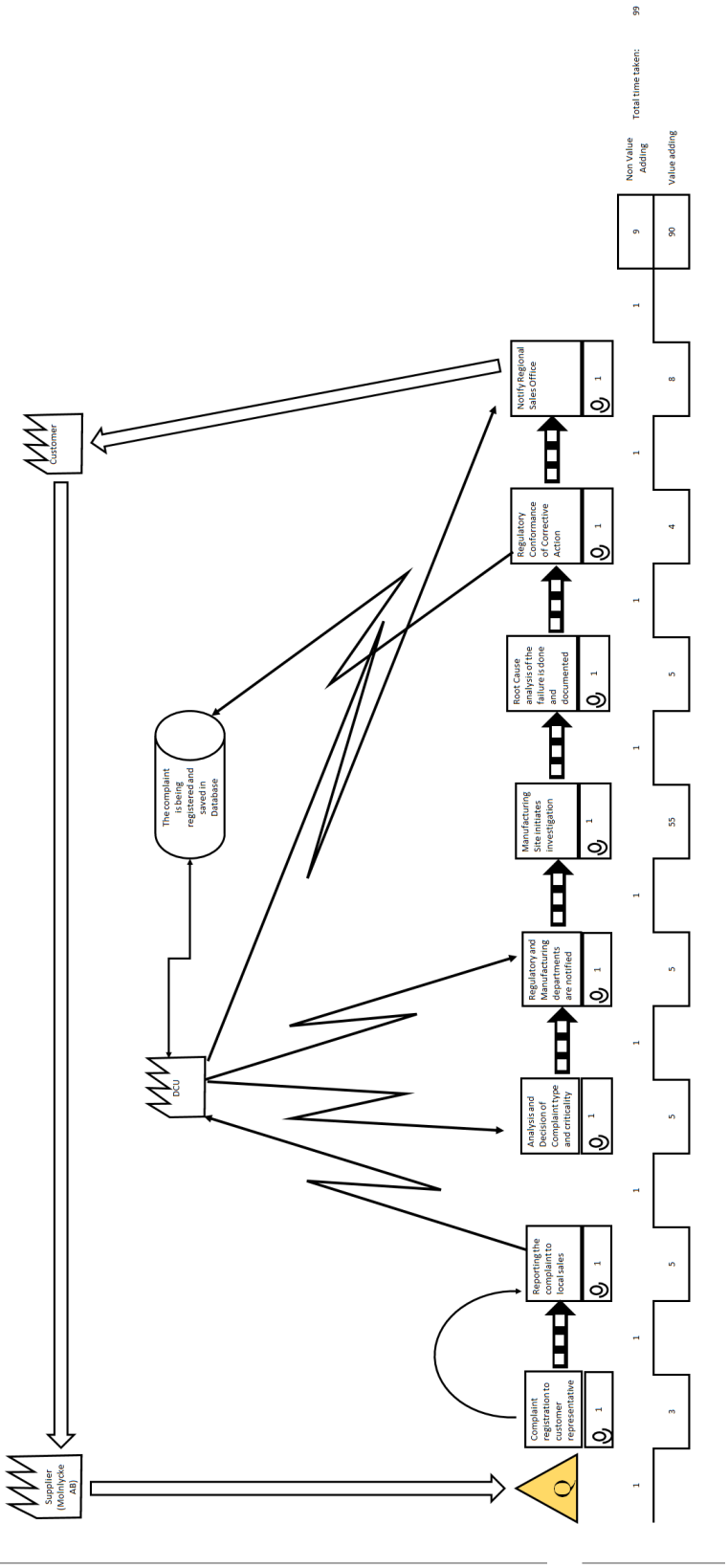


Figure 3.3: Value Stream Mapping

3.3.5 Swim Lane

In Swim Lane, the major takeaways were to understand the process flow of the complaint process through the different departments in Mölnlycke. Seemingly a small factor like a concern raised by the customer is processed through 4 departments (Sales, Legal, Manufacturing, and DCU). The interconnection of actions and the measured processes were the key parameters that were the outputs generated from the chart. The rate of decision response varied substantially on the basis of factors like, if it is a product failure or is it related to usage of the product and so on. Another seemingly interesting fact would be the criticality of the failure in regard to the patient. If the criticality of the patient is high, the regulatory authorities are immediately notified that problem-solving is initiated in a span of 2 to 3 days. Followed by, an EU regulations checklist to initiate the corrective actions in a shorter span of time.

3.3.6 Process cycle time - Customer CC process

In the current scenario, the cycle time required for each step is approximately equal to the observations made in the VSM. The major outliers in the program would be Step 2 and Step 3 namely, event investigation and reporting, and product investigation. An interesting observation to be made here would be that the cycle time required for the product investigation actually is low in comparison to the documentation and the initial documentation of the event. This points fingers to the first bottleneck in the system, "*Standardisation of Documentation*" in the CC process. As mentioned in the previous sections, the initial data collection made on the product, from the customer is purely based on the comfort of the Mölnlycke representative, creating confusion, back and forth travel in the complaint collection system thereby making the process vague and hard to follow.

A representation of the cycle times taken for each process in the system is depicted below in Fig 3.4. Through the figure, it is evident that the cycle time for the entire process takes around 85 days (2,5 months approx.). The time frame mentioned is on the higher side in comparison with any problem-solving time frame employed by tools like PSS, 8D, or Six Sigma. In order to improve the standardization of the process, recommendations have been made towards the end of the thesis.

Step Name	Target Step Duration (Due Date)*
Complaint Review & Evaluation	2*
Event Investigation & Reporting	54*
Product Investigation	45*†
Investigation Acceptance	2*
Complaint Resolution	15*
Final Approval	15*
Average Complaint Duration Target (excludes Product Issue steps)	**85** (75** stretch)**

Figure 3.4: Quality KPI -Molnlycke

3.4 Measure

3.4.1 P - map

In the measure phase, the key process indicators that were taken into account were the process identified through the Swim lane and VSM. Even though there was sufficient clarity in the process steps, they were not defined enough to bring in and understand the noise factors in the process. This led to the deeper definition of the process steps into the current condition with the help of P- mapping. They were also built on the quality system and parameters used in Mölnlycke (Fig.3.4). Keeping the QMS system in Mölnlycke as a benchmark, the author tried to dig deeper and break down the processes of the steps in the system to understand and analyze bottlenecks. As previously mentioned, the cycle times of the process varied a lot as they could not be properly estimated and a lot of back-and-forth movement in data collection took place. Due to the long lead times, which is essentially a case emerging from larger variations in the process, it helps in connecting to one of the core messages of LSS as well - working on reducing the variation.
This led to the usage of a process/project management tool called a 3-point estimate to estimate and analyze the cycle times for each of the processes. The data were estimated of the most likely value, optimistic and pessimistic values associated

with a process step with the help of Mölnlycke associates and their understanding, experience, and strategic understanding of the processes.

The process starts when the customer interaction is made with the Mölnlycke customer representative to give in a detailed description of the complaint. Generally, the representative takes in the details of the complaint by adding mandatory requirements like a picture (visual medium of the failure), any type of documentation related to the product, its usage specialties, etc. The process is then verified with the experience of the Mölnlycke representative and decides whether it is a product failure or a usage failure. Depending on the decision, the case is transferred to the regional sales team which then cross-verifies the information and inputs in the DCU. The variations related to the information (missing links) are being redirected back to the customer-facing representatives which then further loops its back to the end customer. Once all the mandatory fields are checked and listed in the DCU, the data is stored for further reference in the future. The centralized directory, in turn, helps in the easy analysis and identification of serial failures in the products, thereby giving way to better product quality in the organization. Following the data check and verification, the case is notified by the regulatory authorities to classify the criticality of the defect. Simultaneously, information regarding the same is being sent to the Manufacturing units where the product investigation begins. The above statement or process is only valid if the quality non-conformance is due to a clear product failure. Adding on, if the product price is dire cheap when in comparison with the no: of units sold, the company generally employs to replace the whole product than a detailed follow-up.(Fig 3.5)

Following the fifth step in the process would be to initiate the product investigation. The product investigation starts off with the development of a team to initially understand the problem definition followed by a deeper analysis and root cause identification. The time taken for the product investigation and analysis would approximately take around 45 to 55 days depending on the product group and type. The time required for the product analysis is one of the key outliers in the process which takes up a majority of the process time. As mentioned in the previous section, the average cycle time for the entire process takes around 85 days, and the major outlier being the product investigation stage. The interesting observation that could be made here would be the time taken for the documentation and event investigation time required for the same. The time for the latter often exceeds the product investigation stage which became the key focus of improvement in the thesis. As there is a compounding effect of the processes in the system, if the first outlier of the process is not improved, the remaining process could not be optimized to the maximum efficiency possible.

Upon full investigation, the process is meticulously reported and documented to form the final investigation report that will be notified back to the DCU and thereby to the respective regional sales office for the completion of the process cycle. The report received is being further simplified into statements that make sense to the end customer. Finally, the end customer is reported back with the feedback received in the regional sales office, thereby bringing closure to the case.

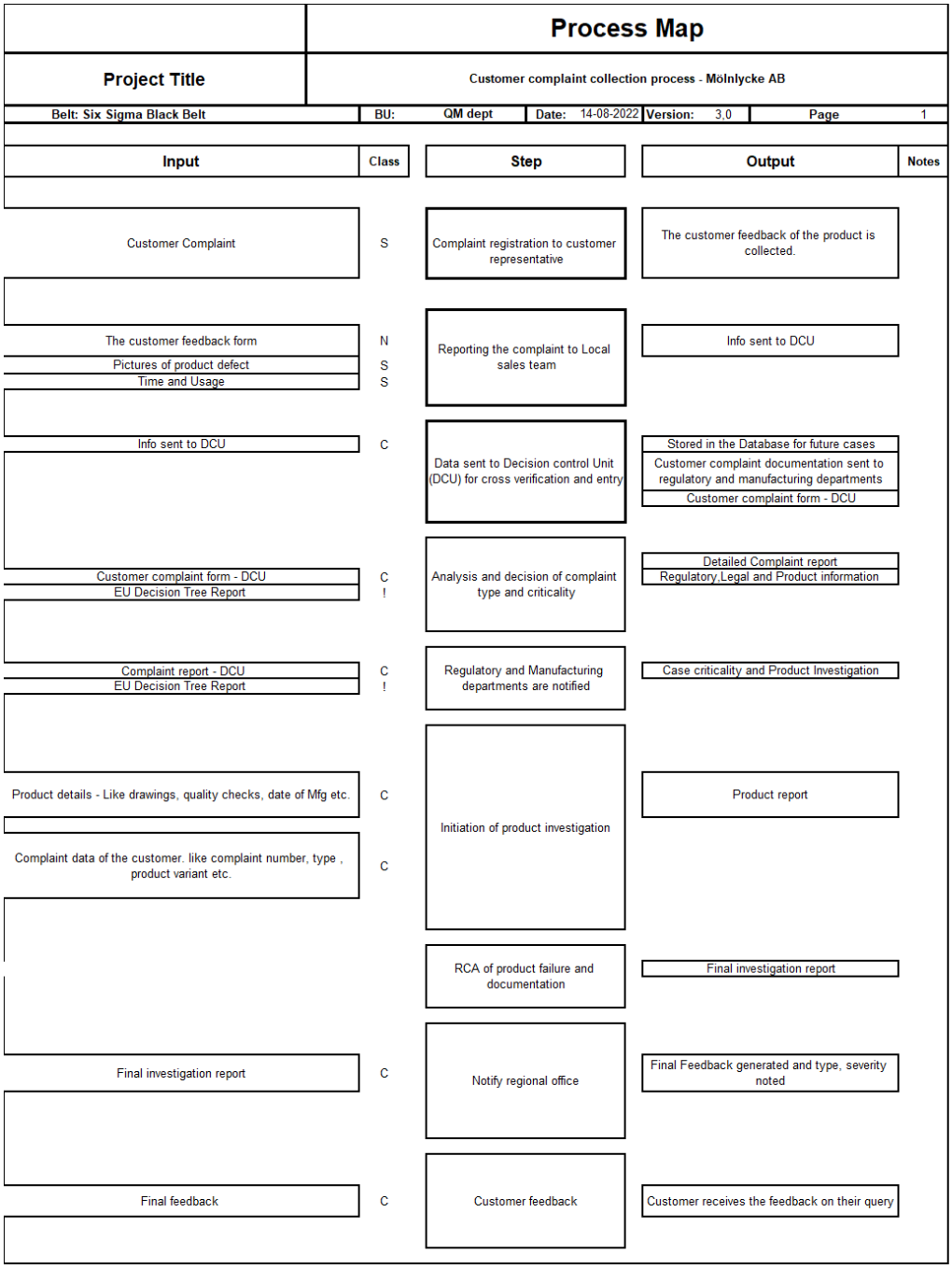


Figure 3.5: Process Map - Molnlycke

3.4.2 Interview - SME

Respondents	Designations
Interviewee 1	Norway
Interviewee 2	Denmark
Interviewee 3	Portugal and Spain

3.4.2.1 Interview - 1

Respondent in Norway - 4 years of experience.
Interviewee 1 is from Norway and is the customer representative of Mölnlycke Health Care with several years of experience in the medical domain. On asking about the mode of data collection regarding complaint collection, the response was " *I collect the customer feedback in the form of a file (excel file) with the help of communication mediums like email or other sources.*" The statement clearly points to the lack of standardization in the data collection process and hence the noise elements associated with it. The interviewee also points out the importance of pictures and samples that are collected as part of the complaint collection. Even though the mode or method of complaint collection is acceptable and would be of real use, the lack of structure is still a matter of question. Adding on, further references were made regarding "*Contacting the customer directly, in the case of missing information.*" The trend observed is highly operator dependent (on various factors like years of experience, depth of knowledge in the domain, etc.) and hence needs to be standardized. As the interview progressed, factors like customer dissatisfaction were also expressed by the interviewee, Quoting the words,*" A customer comes again and again - on the same product, but then we don't understand the problem or an issue.*" The major reason which might be contributing to the differences when it comes to data collection modes would be the different languages in different parts of Europe. The data collection even though is collected in the respective local data collection, is subject to the linguistic expertise of the representatives when it comes to translation (into the regional sales office and DCU). At times, it is difficult to understand the problem description of the product or service mentioned by the customer. The products offered by Mölnlycke are mostly used in sterile conditions, and people are unable to take pictures or create samples during the event of a failure. Similar conditions make it even harder to record and understand the failure description. These factors also lead to a lot of back-and-forth communication between The customer representatives in Mölnlycke and the end customers. As quoted from the interview "So much back and forth information is being passed to and from the customer again and again - Questions developed or to be asked are not relevant to the problem description". Upon curiosity developed regarding the top offenders when it came to the specified country, gloves and trays were mentioned as the top among many.
Finally, due to the complexity of the nature of complaint reporting, the responses given to the end customer are not always satisfactory, especially when it comes to serial failures.
All the contributing views obtained in the interview led the author to understand the initial issues faced during the data collection process, and the ambiguity generated around the problem description, thereby clearly pointing out the initial bottleneck in the process.

3.4.2.2 Interview - 2

Interviewee 2 mentioned here, unlike the previous interviewee, is a bit higher up in the organization hierarchy, leading and specializing in wound care applications of Mölnlycke for a substantial amount of time (circa 20 yrs). This interview has

common factors similar to that of the previous one but gave the author a different perspective when it came to complaint collection. The conversations and data collection of the CC process moved from a personalized form of data collection to a very structured form wherein all data was routed through the MC (Master Control) database. Even though structural clarity is achieved here, the initial mode of data collection is done through forms in the local language of communication existing in those regions. In the CC process, all personnel is made to collect precise data on the batch no, pictures, and samples making the traceability of the complaint collection more linear. *"I don't say that they always collect the details, but I always push them to collect the maximum data possible and most important, collect samples and pictures of the product to understand the failure mode."*.When asked about the mode of entry into the MC database, and if all complaints are registered in the MC unit *"I try to immediately enter the complaint into the Master Control System when it is reaching to me"*.
All of the interviewees have been unanimously claiming on the existing mode of complaint collection is efficient when at the level of entry into the Master control unit. Meanwhile, it is severely divided in the case of data collection down the customer collection center making the process repeatable and time-consuming.

3.4.2.3 Interview - 3

Interestingly the third interviewee had deeper knowledge when it came to claims related to Portugal and Spain. Unlike the other candidates that were interviewed previously, here the interviewee was more proficient with the wholesale aspect of the company sales. The respondent had direct contact with the sales force team who collects the data for the respondent and get in touch via email. Unlike other products like trays and medicines, here it is difficult to track the complaints as they consist mostly of the scrub suits used in surgeries. This also directly links to the traceability of the product as it is extremely difficult to do so. *"Earlier the scrubs were marked with size and date of production, now only the size is mentioned"*. In the interview, the respondent mentions the difficulty in attaining the information/ failure description regarding the product, as once they are removed in a sterile environment, it is extremely difficult to describe the product failure and its samples. This is another factor that also is a major concern when it comes to the lead time for the investigation of the product. Even though having similar views as that of other respondents regarding the structural clarity of MCU, there was a slight difference in opinion found here. The respondent found that MCU cannot address the vastness of quality defects that can occur in a product and cannot cater to all the cases to provide a clear-cut failure description. Adding on, even though clear Quality control is implemented on the master control entry-level (by implementing Vigilance teams to monitor improper cases) it is not clearly evident down the CC chain. One another factor that was evident through the interview was that the CC team (Mölnlycke representatives) try to collect the reference no: and pictures of the failure description into an Excel file of their choice which is later used as a reference to fill in the master control file and furthermore stored in the database. The standardization in the latter half of the process and the non-standardized approach in the initial half of the CC process, are leading to the reverting back of the process

to the sales force team to attain more data regarding the failure.

3.5 Analyze

The Analyze phase constitutes the compilation of the identifications made in the critical factors made on the observations made on the detailed process steps of the entire customer complaint collection process in Mölnlycke. In the Analyze phase, the sequential analysis was initially made through the P - mapping process, of which the output from the same was fed into the 3-point estimate analysis to define the most appropriate time frame for each process, and how to execute it efficiently. Finally, the Cause and effect analysis (C&E) of the process and cost estimations for the process were analyzed to finalize the understanding of the process.

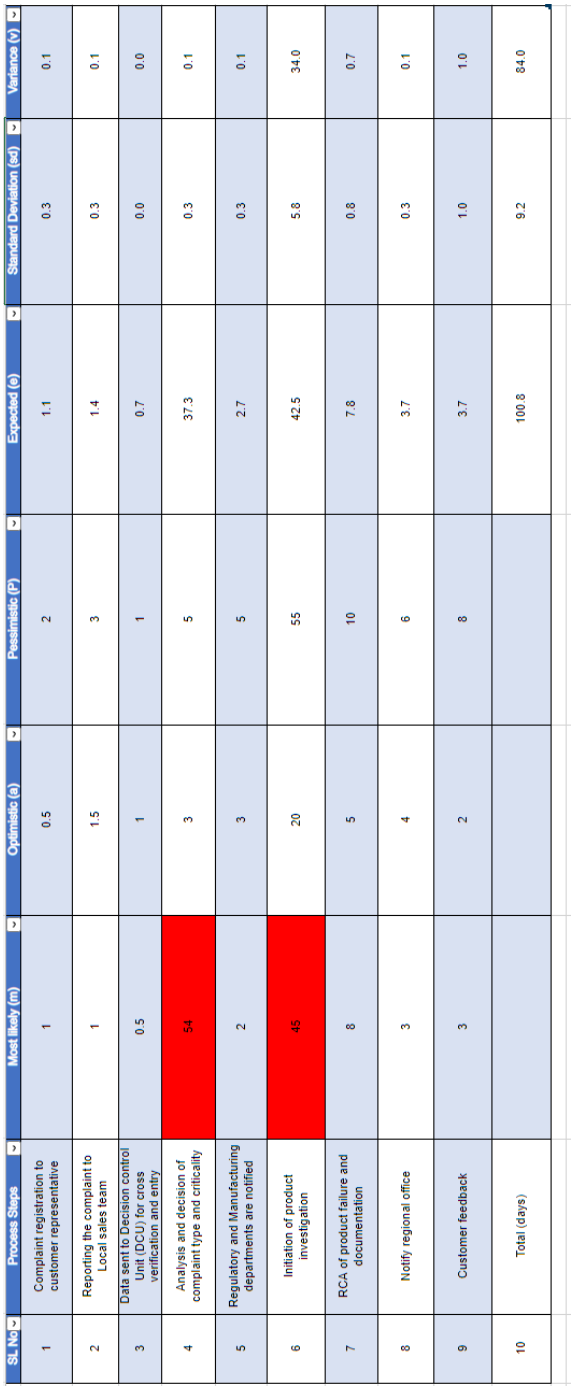
3.5.1 P - map

The P - mapping done is similar to that of the one mentioned in the previous section. The inputs from the same were extremely critical to understand the process parameters for both the 3-point estimate and cause & effect matrix. In order for the successful completion of the P - mapping, the understandings and viewpoints of the Mölnlycke representatives, thesis supervisor (Quality manager), and various other representatives within the organization were taken into consideration for final analysis.

3.5.2 3 - point estimation

The 3-point estimation is specifically a tool used to analyze the most efficient estimate for the cycle time of a process. Generally used as a project management tool, the application involved calculating the most optimistic (a), pessimistic (p), and most likely value (m) for a process. On calculating the same, the expected time frame for the process step can be analyzed based on the triangular distribution formula[10]. The value thus generated can be used to calculate the standard deviation and variances in the process, thereby leading to a clear picture of the extent to which each process step has deviated from the expected timeline. Applying the 3-point estimate, the beta distribution has been calculated due to the importance given to the most likely value. The most likely value is been given importance to calculate the weighted average as it gives the most efficient estimate of the process outputs since all processes are expected to deviate from the optimum time frame and noise factors are always influencing the process steps at various junctures. [10].

3.5.3 3 - point estimation - Current



Sl. No	Process Steps	Most likely (m)	Optimistic (o)	Pessimistic (p)	Expected (e)	Standard Deviation (sd)	Variance (v)
1	Complaint registration to customer representative	1	0.5	2	1.1	0.3	0.1
2	Reporting the complaint to Local sales team	1	1.5	3	1.4	0.3	0.1
3	Data sent to Decision control Unit (DCU) for cross verification and entry	0.5	1	1	0.7	0.0	0.0
4	Analysis and decision of complaint type and criticality	54	3	5	37.3	0.3	0.1
5	Regulatory and Manufacturing departments are notified	2	3	5	2.7	0.3	0.1
6	Initiation of product investigation	45	20	55	42.5	5.8	34.0
7	RCA of product failure and documentation	8	5	10	7.8	0.8	0.7
8	Notify regional office	3	4	6	3.7	0.3	0.1
9	Customer feedback	3	2	8	3.7	1.0	1.0
10	Total (days)				100.8	9.2	84.0

Figure 3.6: 3-point estimate - Current

In the current 3-point estimation, the average time for both complaint registration and reporting to the local sales team include being within the time frame mentioned in the Quality KPI (Fig.3.4). The real bottlenecks in the process arise from the understanding wherein the analysis and decision type of the complaint is made. The observed value is way higher than the industrial standards. One of the contributing

factors to the long time frame between the analysis and decision-type finalization would be the improper documentation of fact collection. Also, the back-and-forth communication employed between the Mölnlycke representatives and the suppliers can also lead to the longer processing times of the case. From the 3-point estimate it was evident that the longer time for the analysis, further drives longer lead time into product investigation, thereby leading to the 2nd major bottleneck in the Process. According to the Pareto Principle [15], 80 % of the deviations in a process are contributed by 20% factors in the process.

"*Once one has identified the few problems that account for 80 percent of discrepant quality, one can concentrate efforts on seeking solutions for those few problems rather than attempting to tackle the whole gamut of problems at once*" - *RobertSanders* [15]

Applying the early statement to our understanding, reducing the key outliers there would be a major improvement in the total time range of the project. This would also mean that, if the expected time range (Fig 3.7) is being able to be achieved there would be significant improvements in the cost efficiencies related to the organization.

Being the key outliers in the process, the factors boil down to how they could be reduced and contained in a realistic manner. Since the Identification and measurement of the problem have been made, taking the first issue into account and reducing the variation in it was of prime importance in the thesis.

Range	Probability	Lower Boundary	Upper Boundary
SD - 1	68%	37	55.3
SD - 2	98%	27.8	64.5
SD -3	99%	18.7	73.7

Figure 3.7: 3-point estimate - Current

Some of the suggested recommendations are discussed in the following section, but giving into insight being,

3.5.4 3 - point estimation - Revised

SL No	Process Steps	Most likely (m)	Optimistic (a)	Pessimistic (P)	Expected (e)	Standard Deviation (sd)	Variance (v)
1	Complaint registration to customer representative	1	0.5	2	1.1	0.3	0.1
2	Reporting the complaint to Local sales team	1	1.5	3	1.4	0.3	0.1
3	Data sent to Decision control Unit (DCU) for cross verification and entry	0.5	1	1	0.7	0.0	0.0
4	Analysis and decision of complaint type and criticality	2	3	5	2.7	0.3	0.1
5	Regulatory and Manufacturing departments are notified	2	3	5	2.7	0.3	0.1
6	Initiation of product investigation	15	20	55	22.5	5.8	34.0
7	RCA of product failure and documentation	8	5	10	7.8	0.8	0.7
8	Notify regional office	3	4	6	3.7	0.3	0.1
9	Customer feedback	3	2	8	3.7	1.0	1.0
10	Total (days)				46.2	9.2	84.0

Figure 3.8: 3 - point estimate - Revised

3.5.5 Cost analysis

The main motivation to develop an idea for analyzing the costs associated with complaints was to dive deep into the eminent costs associated with each complaint. Even though, the organization does follow a detailed version of tracking the no: of complaints in the system, through their CPM and PPM, the mentioned tools along with their comparison can only give an overview of the trends regarding the complaints received and closed. This in turn only approaches the given problem on an overarching level. On the contrary, the cost calculations associated with each complaint once made, can give a traceability regarding the amount of money spent on each complaint. The calculation is of utmost importance as they are associated with the miscellaneous costs of the infrastructure which often goes unnoticed. Applying the Pareto principle again, [15] focus should be given on the 20% of factors that when controlled and optimized, create 80% of the returns in revenue.
As previously said, the devil lies in the details and one has to have control over the smaller factors in order to optimize and refine the bigger outcomes. Implementing the philosophy here, through the thesis the author has tried to bring in a framework to calculate the costs associated with each complaint. In here, the focus is given a bit more on the manpower associated with the claims. Even though many other factors can be in play, the framework helps the decision-makers understand the importance of the costs associated with the claims on an end-to-end basis before making a strategic decision. The framework also gives a peeping eye into various unnoticed factors that can also decrease the efficiency of the value chain. The cost estimation started off with the initial research from the union website, Sverige's Injenor, as they had the publicized version of salary scales in the current market times. In the estimation, only Sweden is taken into consideration as the salary slabs are fairly stabilized and the statistics of the salary are easily available to make a confident estimation regarding the costs spent.

SL No	Process Steps	Expected No: of personnel	Experience of the Personnel:	Avearge Salary for Engineers (SEK) : (Sveriges Ingenjor 2022 statistics)	Mean Range of salary	Expected costs per process: (SEK) (Mean Range)	Expected Time
1	Complaint registration to customer representative	1	1 to 2 yrs	37000 - 39000	38000	38000	1.1
2	Reporting the complaint to Local sales team	1	1 to 2yrs	37000 - 39000	38000	38000	1.4
3	Data sent to Decision control Unit (DCU) for cross verification and entry	2	3 yrs	41000	41000	82000	0.7
4	Analysis and decision of complaint type and criticality	3	3 to 5 yrs	41000 - 45000	43000	129000	2.7
5	Regulatory and Manufacturing departments are notified	1	3 to 5 yrs	41000 - 45000	43000	43000	2.7
6	Initiation of product investigation	3	3 to 5 yrs	41000 - 45000	43000	129000	22.5
7	RCA of product failure and documentation	3	5 - 7 yrs	45000 - 50000	47500	142500	7.8
8	Notify regional office	1	1-2 yrs	37000 - 39000	38000	38000	3.7
9	Customer feedback	1	1-2 yrs	37000 - 39000	38000	38000	3.7
	Total					**677500**	**46.2**

Total No: of complaints (May 2022)	Global (Open)	Global (Closed)	US/Latin (Open)	US/Latin (Closed)
953	607	162	130	54

Total Expense: 677500	**Per complaint:**
	881.0143043

Figure 3.9: Cost Estimations

Even though the estimation is limited to Sweden, the format can be used elsewhere as well depending on the knowledge in the salary scales.
According to the statistics presented, on average, a customer-facing representative with 0 -2 yrs. experience receives about 37000 to 39000 SEK/month as the gross salary. Given that for a particular complaint, 1 person is delegated for the same for collecting info regarding the complaint and sending it over to the local sales team. The local sales team may further employ 1 to 3 personnel when it comes to handling multiple claims. They are also most likely in charge of the initial processing of the info and reporting it in the master control database for further analysis.
Cumulating all the costs associated with the no: of personnel involved with the complaint collection system costs around 677500 SEK/year. A detailed view of the estimation made can be seen below. (Refer Fig 3.9).
The total costs average to only the EU region as they are only taken into consideration during this analysis. Also, all the complaint registered in the EU is being processed in Sweden DCU tagged "Global" in the figure. The complaint reported in the US and Latin America is being processed in the DCU located in the US termed “US/Latin” in the figure. Therefore, the data thus obtained can be extrapolated to both US/Latin and EU regions to find out that per complaint it costs around 881 SEK, which is a substantial cost associated with the return on investment made in the same. Furthermore, experiments regarding the changes associated with personnel have also been made in the experimentation. Excitingly enough, there was not much impact made on the outcome thereby ensuring that hiring more people without implementing a lean mode of complaint collection would be useless

3.5.6 Cause and Effect Matrix

The Cause and Effect matrix was introduced to understand the potential modes of wastage or re-run in the system. The primary reason for the Cause and effect to be done was to understand the major bottlenecks in the process. The process was fed with the results from the P - map which turned out to be the inputs for the C&E matrix. Each factor was tabulated according to the process steps that were aligned from the process map. After each process step was identified and aligned, they were cautiously arranged according to the major wastage areas identified and scores marked. Finally, the scores are sorted in order to find the factors contributing to the major bottlenecks in the system leading to a lesser response in the system.

The key contributor driving the bottleneck in the process is the *"Documentation and RCA of the Product failure"*. The contrary factor to be noted here is that, process steps namely,

- Analysis and decision type of complaint criticality
- Initiation of Product Investigation

compounding together contributes more to the criticality of the process than the major bottleneck. As mentioned by Pareto [15], if the contributing factors can be reduced, the variation in the process can also be reduced. Understanding the same, steps made were to analyze and standardize the process of reducing the variations and noise factors when it came to the above-mentioned process steps. Upon reducing

the variations occurring in the sub-processes, there will be a significant reduction in the overall process flow. The improvements are to be made in improvement cycles/ iterations where feedback loops have to be maintained to monitor the changes in the process. These changes have to be meticulously recorded as well to view the improvements attained in the cycle times (End to end). When the improvement is done, the processing time for the above-mentioned sub-bottlenecks (process steps) is substantially reduced from 100 days to 47 days (almost 50% reduction and time savings.)
In the process of analyzing the complaint criticality, the communication mode being used is informal in nature thereby leading to back-and-forth communication between Mölnlycke and the end customer. The initial focus has to be given to the unification of the process and reducing the variation in the initial few steps of the data collection process. The back-and-forth communication was due to regional preferences like language, mode of communication, etc against the benchmark system used in the DCU system wherein English is the preferred language for the data collection and archiving. Language being a key separator, suggestions were made to standardize the language used as the same showed significant differences in the DCU for the US. There can also be possible influences of cultural diversity when it comes to complaint registration as it is also very people-dependent in nature. Such factors have not been taken into consideration as they will be out of scope for this thesis.

3.6 Improve and Control

The Section deals with the various practices the author had in mind, which were put into discussion with the organizational representatives for future improvements from the deviations observed.

3.6.1 Brainstorming

Through the discussion, the classic tool of brainstorming was implemented to generate ideas and viewpoints on the solutions to the Q-deviations. As per the suggestions a feedback loop had to be made to collect the customer responses from the end customer. In order to achieve the same, a sample survey form was developed with the details including the responses for the customer service offered. The survey covers the various aspects of complaint collection through a series of descriptive questions and Likert scale models for a better understanding of customer perception.

3.6.2 Recommendations for future improvements

Digitalization in Lean SS: As technology evolved, so did quality management practices and systems too. Initially, quality management practices involving random inspection often visual in nature (Industry 1.0) to SPC (Statistical process control) to find patterns in the variations of defect ratios (Industry 2.0).[20]. As the digitization practices in conventional technological/manufacturing platforms evolved and improved, the incorporation of Big Data, Data Analysis, and Machine learning also took place to create early warning systems and predict the failure rates and

modes.[20]. The rapid progression of the industrial standards to incorporate data analytics and predictive maintenance (Industry 4.0) developed in the manufacturing sector, paved the way for recommendations and suggestions for improvement in the current thesis proposition.

3.6.3 Evaluation of Existing KPI

In the current setup, the organization focuses its developmental routine on the statistics received from the CPM and PPM collected per product and its calculating between the costs associated with the ratio of the same. The approach even though is predominant when it comes to creating the overall view, lacks data quality that can be supplied to the quality objectives measured in the quarterly meetings. The KPIs measured as part of the complaint collection are complaint collection times and FAA (Field Action Assessment). In the thesis, the predominance was given to the complaint collection times as the KPI will be directly affected due to the change. On identifying the process cycles, the time required for each cycle was calculated and matched with the expected time to find the optimized cycle times. The comparison made with the optimized cycle to the cost estimations made with the help of Sverige's Injenor salary statistics created a concrete idea of the total cost saving that can be involved during the improvement cycle. Currently, each complaint costs around 881 SEK, which can be brought down significantly after the change. The development in turn affects the overall cycle times for the closure of the product investigation hence bringing down the Complaint Collection times. Currently, the time required for complaint collection till closure is around 77 days according to the Q1 of 2022, which is significantly higher in comparison to the industrial standards. The focus made with the 3 - point estimate tried o bring down the value to an estimated time of 46 days bringing down the costs also associated with each complaint. The reduction in complaint collection time also affects the FAA directly, as the overall average of the same increases. Currently, the quarterly average of FAA is around 15 days which also improves as part of the improvement made in the thesis.

4

Results and Discussions

The DMAIC cycle helped in analyzing the process deeply and understanding the major pain points in the value stream. The major travel between the back-and-forth communication in the data collection system also contributed to the long lead times in the process. It was found that the lack of standardization in the initial complaint collection process, specifically for the initiation of the product investigation was the initial bottleneck that had to be tackled in the value stream.

The above-mentioned findings paved ideas for the recommendations for the project towards the organization. The first recommendation was to improve and standardize the initial phase of the complaint collection system. Currently, they were collected from multiple sources (mostly according to the choices of the Molnlycke representatives facing the end customer), leading to the loss and gaps in the information when it is finalized in the MC unit. The process also is mundane and time-consuming as it creates extension in the communication channels established. These might also be due to the difficulty in obtaining first-hand evidence, samples, and problem description from the end customer. Even though the difficulties exist, It does not accentuate the fact that the internal processes involved during the complaint collection can be optimized to bring transparency and standardization, thereby bringing optimization to the complaint collection process. In the contemplation of the bottleneck observed, the author suggests the organization extend or introduce ERP (Enterprise Resource Planning) systems like SAP for bringing structural clarity to the CC process. Using digital tools like SAP early on helps the organization to track the complaint from its source. These can also contribute to the fact that the information can be linked together with other digital tools like Power BI or Access databases for centralized data collection and information storage. Another added benefit to the new system would be the traceability of the information in the central database system (DCU) even though the initial complaint collection is done in a language of their choice breaking the stigma of the language barrier when it comes to the CC.
Understanding the second bottleneck, to improve the total value stream, product investigation and the root cause analysis of the cases/products have to be improved. The detailed recommendations for the same can be assessed through another 8D/PSS/Six Sigma procedures through which, the problem can be assessed with specific needs and data correctness. Since the topic does not come under the scope of the thesis, they are not dived into deeply.
Cost efficiency is another parameter that should also be taken into consideration when it comes to the optimization of processes. The cost estimations given (Refer

to Section 3.5.5) are shown in a template that can be used as a reference for building detailed costs associated with the time frame and personnel allocation to the CC system. The primary reason to imbibe cost analysis for the CC system would be to understand the costs associated with each step in the CC process. Currently, the costs are cumulated, which on the contrary only gives a distant overview of the actual scenario. Moreover, the data thus collected can be used to analyze the Quality KPIs of the organization and bring in better data efficiency in their reviews. Finally, the improvements made to the processes lead to a direct impact on the Quality KPIs the firm currently employs – FAA (Field Action Assessment) and complaint processing times. The data thus received can be made into useful information that can reflect in the reduction of the processing times in the overall process of the CC system.

In conclusion, through the DMAIC approach, the author was able to make suggestions for improving the process flow by systematically breaking down the complex processes and making them into manageable amounts. The process thereby helps in addressing the need of the organization at the same time, but not having to pay a hefty amount (both in terms of manpower allocation and cost expenditure). Identifying the key problem areas as mentioned above, helps Mölnlycke to understand where more efforts are to be invested in to bring in maximum results, thereby gaining strategic alignment on their key KPIs and efforts to improve on it. Moreover, the cross-functional nature of the methodology aids in the application or adaptation of the findings to different departments within the organization with ease.

The data-based approach made in the thesis along the value stream, where it is difficult to gain information, was also due to the accuracy in the probabilities made in the time cycles of the entire problem-solving. The 3-point estimate tool also played a huge role in providing valid and accurate estimation statistics for the aspects of planning the cycles, manpower allocation, per capita costs associated with the manpower required, etc. making it even more relevant in today's times. The estimate also provides a realistic time frame, idea, risks, and uncertainties that may affect the cycle times of the process. Moreover, the estimate allows the key stakeholders in the organization to attain realistic improvement plans, foresee risk, develop contingency plans, and efficient budgeting. The constant mode at which the monitoring of the process is employed through Six Sigma, combining it with efficient planning and execution makes process improvement effective in Mölnlycke.

5
Conclusion

In the thesis project, the prime focus was given to the mapping of customer complaint collection flow in Molnlycke, identification of bottlenecks in the process, and also linking it to the core values of the organization. The core philosophy to which the project is related is Six Sigma Thinking (DMAIC). In each of the sections, a deeper focus has been given to the implementation of various tools and processes of Six Sigma. Meanwhile, recommendations that were generated were based on optimizing the outcomes and estimations derived from the research study. One such estimation is the cost analysis made for each complaint and for the entire collection process. The research study helps in shedding light on the different process efficiencies involved in the CC process. In Addition, the focus on the impact it makes on the organization's KPI during the implementation is also assessed. The study is focused on generously answering the bottleneck identification and its impact on the organizational KPI which in turn brings the project to a full circle.

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