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Improving Customer Case Resolution Time in Telecom Vendor Technical Support Centers

Customer Service Prespective

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Preface

This thesis has been a rewarding and learning experience for me. Attending to the intensive Master's Degree program in Industrial Management required dedication and prioritization in work and life. I am happy to see all my efforts paid off finally, when this thesis is completed. I learnt a lot about process improvement studying best practice frameworks from the BPM, LEAN and ITIL prospective. I am proud to present the results of my learning in this thesis.

I want to thank my instructors Dr. Juha Haimala and Dr. Marjatta Huhta for their constructive feedback and guidance. Special thanks go to Zinaida for her persistent efforts and supports that made me improve time after time. Furthermore, I want to express my appreciation to all the lecturers for interesting topics during the autumn session.

Last but not least, I would like to thank my wife, two children and two lovely dogs for their patience during my studies, which have taken many late night hours and weekends of my time, which we could have spent together.

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This Thesis investigates how to improve the customer case resolution time in technical support centres (TACs) of a telecom vendor. The case company is a major telecom vendor which manufactures data, optical, access and metro Ethernet products. The case company has TACs across the globe and one of its global TACs is based in Finland. Presently, the case company has placed a special focus on customer support and resolving customer cases faster and with higher quality in TACs.

This study concentrates on the customer support function of the case company. From this point of view, it examines the case company's current state and service practices, reflecting on the elements of process improvement such as business process management (BPM), ITIL and Lean six-sigma. These three perspectives create the basis for the conceptual framework of this study.

This study is an in-depth single case study which utilizes action research to identify the business problem, provide solution, test it and measure the success of the suggested solution in the companywide pilot. The primary data for this study comprises the case company performance reports, key employee's interviews and value stream mapping done according with the Lean Six-Sigma principles applied in the case company. A detail literature reviews of relevant best practice in the area of process management and service improvement was done before the conceptual framework and then the solution were developed.

To produce the solution, the study identifies key bottlenecks for a faster case resolution time, and points especially to one critical point which is the rate of rejection. Rate of rejection can be described as the number of customer cases rejected internally due to the information received in in-accurate or in-complete manner, or in a form that cannot be used.

The solution that the study proposes is a technical escalation template to be used for case escalation in across all the case company TACs. The technical communication with the new case escalation template was tested with a pilot for four weeks in several TACs, and positive qualitative feedback was gathered to further improve the template. Finally, the study proposed a set of recommendation on how to implement it in the case organisation.

Keywords	Customer support, case escalation, Lean, BPM, communication, global teams, case escalation template, TAC, Telecom

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TERMS

Case resolution time	Total time taken to resolve a case from logging a case and case closure
Customer case	A customer problem incident
Tier 1	Front line staff facing customers directly
Tier 2	Second line staff assisting Tier1 staff
Tier 3	Third line of staff with advance knowledge assisting Tier1 and Tier2
R&D	Research and Development
SLA	Service level agreement
NA	North America
LA	Latin America
EMEA	Europe, Middle-east and East Africa

1 Introduction

This Master Thesis focuses on improving the case resolution time for customers in technical support centres of Telecom equipment vendors. Telecom operators, who are the main customers for telecom equipment vendors, need critical support service from telecom vendors to smoothly run their operations in case of vendor equipment failures. Improving the case resolution time plays an important role in meeting the SLA's agreements and, thus, providing better service to Telecom customers.

1.1 Background of the Thesis

Telecom operator's core service relies on infrastructure such as networks and equipment use in mobile phone services and broadband services. This dependency on support service makes it also the core function for telecom operators (Vargo et al. 2004: 324-335). Thus, telecom operators give business to those telecom vendors who have good support organisation providing quality service with timely resolution of operator problems.

Telecom vendors are in a fierce fight for survival. Since the differentiation through product features and designs is difficult due to regulated standardization of technology and high speed of innovation from rivals, they can only compete through services. Thus, from a Telecom vendor point of view, it is critical to have a good service support organisation for faster resolution of customer cases coming from telecom operators. In order to distinguish from rivals, vendors have to invent new, innovative ways of providing high quality service support with timely resolution of cases to create value for customers.

Currently, customer support service and support makes an essential part of the business for telecom equipment vendors. Among other problems in providing this type of services, resolving customer cases that come from telecom operators in a timely manner makes a critical service feature. Any delays in resolving these cases can cause significant losses of revenue for telecom operators. To better control service quality, telecom operators and telecom vendors make service level agreement to handle the cases coming from telecom vendors. For example, a case of a network outage could fall into the critical category, and the time to resolve such a case is set to be two hours.

A failure to resolve such a case in a given two hour time by a telecom vendor support organisation would incur a financial penalty to the telecom vendor. Service level agreements define different categories of cases, mainly falling under the category of Critical, Major and Minor problems, with the agreed time frame to resolve each of them stipulated in the contract. Thus, timely resolution of customer cases in each service level contract is essential to maintain and win new business for telecom vendors.

Presently, the case company is facing a problem in maintaining service level agreements for case resolution and paying substantial financial penalties each year. This situation is also affecting customer confidence, and the case company may be losing business due to not being able to resolve cases in a timely manner. This problem needs to be investigated, and improvements need to be done in the current organization for its customer support to shorten the case resolution time for customers.

1.2 Case Company and Continuous Service Improvement

The case company is a Telecom equipment manufacturer vendor providing product and services to more than 500 customers worldwide, on six continents and in more than 100 countries. The case company has more than 3500 employees worldwide with R&D centres in Europe, Asia and in United States. The case company has global support and services team with more than 500 employees working from support centres located globally. The main customers of the case company are Telecom operators.

Within the case company, its services teams are designed with layered organizational structure organized into Tier1, Tier2 and Tier3 teams. Tier1 teams work directly with the customer in customer premises or local case company offices across regions. Tier2 and Tier3 teams are based in Europe, USA and India. This thesis mainly focuses on Tier2 team based in of Espoo, Finland, called Finland TAC. Finland TAC provides support services to all Tier1 teams for its Data, Access and Network Management products. Finland TAC has more than 40 engineers providing technical support services.

Presently, the case company places a significant focus on customer support optimization and improvement using Lean six sigma approach. The case company is utilizing the Lean methods in all customer service departments to identify and eliminate waste from the customer support processes. This Master thesis utilizes best practice of process analysis and optimization frameworks such as BPM, ITIL and Lean Six Sigma for

thesis study. Business process management or BPM is a management approach to align an organisation process with the needs and wants of a customer. BPM uses a systematic approach to identifying all tasks involved in the process and brainstorm to improve efficiency of each task in order to reach the overall process improvement.

Lean Six Sigma can be defined as an approach containing a set of tools and techniques for process improvement. Lean Six Sigma improves quality of the process output by identifying and removing the cause of defects in a service or a product (Miguel et al. 2012: 63-64). According to Motwani (2004: 63), "Lean Six Sigma is the combination of the customer focused efforts of Lean and waste elimination with the quantitative D-M-A-I-C methodology of Six Sigma". D-M-A-I-C is a problem solving methodology described as Define-Measure-Analyse-Improve-Control. Figure 1 illustrates the key Lean Six Sigma DMAIC phases of a process improvement.

Figure 1. Lean six sigma DMAIC phases (Ramly et al. 2012:359)

Figure 1 shows the DMAIC approach to improving service processes which start first with defining a process and end with verifying a solution and maintaining the solution. As shown in DMAIC diagram, it is a continuous process improvement model in which one process feeds input to the next stage in the process. Lean six sigma DMAIC process, being the case company approach to service improvement, is referred to at the end of each section in this thesis.

1.3 Research Question, Scope and Structure of the Study

The research objective of this Thesis is to improve the case resolution time in a technical support organisation of a telecom vendor. The study focuses on examining the full life cycle of customer cases, identifying the current bottlenecks from the moment when the case is reported until it is finally resolved. Once the bottlenecks are identified with the help of the data collected from the survey, as well as interviews with key employees and performance reports from performance management tools, the propose is to de-

velop a solution that would improve the customer case resolution time. A more specific research question is formulated as follows:

"How to improve the customer case resolution time in technical support centres?"

The scope of this study is to analyse the current case resolutions in technical support teams in the case company customer support services, to find out the current bottlenecks which add delay for customers. The case company is a global telecom vendor with customer support organisations spread across the globe. Support organisations are divided into Tier 1, Tier 2 and Tier 3 teams. The Scope of this study is limited to analysing the case resolutions handled between these support teams and identifying the bottlenecks that add delay to the case resolution time. This study does not cover the customer processes and product knowledge related to the product support. This study does not cover the R&D processes and how R&D provides support through their support teams for bug fixes.

Overall, the study suggests how to remove the current bottlenecks and improve the case resolution time for customers. The outcome of the study is a case escalation template which helps to streamline case escalation technical information in a brief and precise case summary. To visualize the service improvement process, the study uses a reference to Lean six sigma approach. This stage, for example, corresponds to the *Define* phase in Lean six sigma approach, as shown in Figure 2 below.

Define	Measure	Analyze	Improve	Control
-Define problem statement -Define desired outcome -Very high level view of existing process -Identify customer and their requirement				

Figure 2. Lean six sigma D-M-A-I-C processes (Ramly et al. 2012: 359).

As shown in Figure 2, this section defines the problem and envisages the desired outcome. This phase takes a very high level view of the improved processes and identifies the problem as improvement of the case resolution time. The second section of this study will be directed to data collection and analysis, which corresponds to the next Measure phase.

This Thesis is written in six sections. Section 1 presents the introduction, Section 2 explains the research approach, methods for data collection and analysis applied in this study. Section 3 presents the conceptual framework for analysis of customer support, support methods, and best practice using ITIL and Lean Six Sigma process improvement for services. Section 4 analyses the case company data including performance reports coming from tools, surveys and interviews in the case company. Section 5 presents the proposed solution template and discusses what problems this template solves. Section 6 discusses pilot test of template and analyse feedback of pilot test finally Section 7 summarizes the findings from this thesis and research results.

2 Research Method and Material

This section provides the overview of the data collection and research methods used in this study. This section also describes the data sources collection and their analysis in this thesis. Finally, this section discusses reliability and validity in research.

2.1 Research Approach

The action research is selected as its research approach to achieve the purposes of the study. Action research can be defined as participatory research approach where the researcher is a participant in the implementation of a change in the system (Westbrook et al. 1994: 7). Action research theory suggests that an action research starts with an idea in the practitioners' mind that a change is needed (French et al. 2009). Action research can also be defined as a method used for improving the existing practice. It involves action, evaluation and critical reflection based on the gathered evidence. Action research can include problem solving if the solution leads to improvement in the existing practice (Koshy et al. 2010).

The action research can be described as having seven distinctive features. First, action research is described as a method used for improving practice. It involves action, evaluation and critical reflection. The action research is based on gathered evidence that changes practice and implements it. Second, action research is collaborative and participative research which is undertaken by individuals with a common goal. Third, it is situation based and context specific. Fourth, it is research that develops reflection based on interpretation made by individuals participating in action research. Fifth, it is research that creates knowledge through action and at the point of application. Sixth, it is research leading to the problem solving if the solution to the problem leads to improvement in practice. Finally, action research makes the type of research where research findings emerge as the action develops, but these are not absolute or conclusive.

Figure 3 illustrates the action research cycle shown as a spiral of repeated action research cycles.

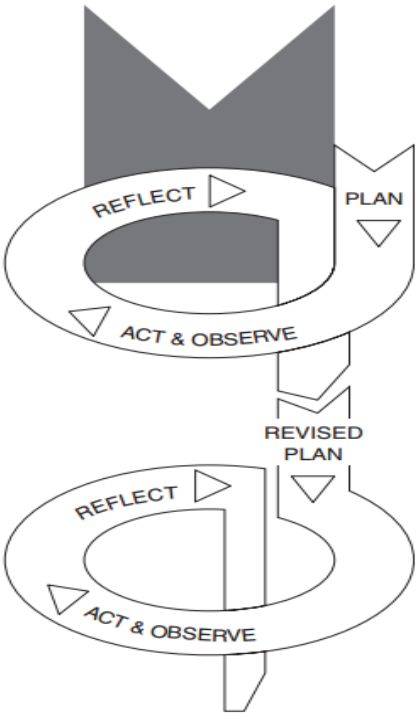


Figure 3. Action research spiral (Kemmis and McTaggart's 2000: 595).

Figure 3 shows the action research spiral. It begins with planning a change, which involves observing and identifying what could make the impact of the change. This stage is followed by acting to bring change to the current process. After the action stage, it is followed by reflecting on the results and gaining knowledge of how the changed process works and re-planning for the new cycle of change. In the new cycle, a new plan is finalized and enacted by implementing a new series of planning, observe, acting and reflection. After gathering feedback and analysing as shown in the reflection part, the cycle continues until the desired state of the process is achieved.

Action research has two main objectives such as improving existing practice and generating knowledge. A critical feature of action research is the learning that the researcher learns about themselves while doing action research projects. Figure 4 illustrates the basic action research cycle showing each phase of the process is represented with a new cycle in which learning from the earlier phase is fed to next phases.

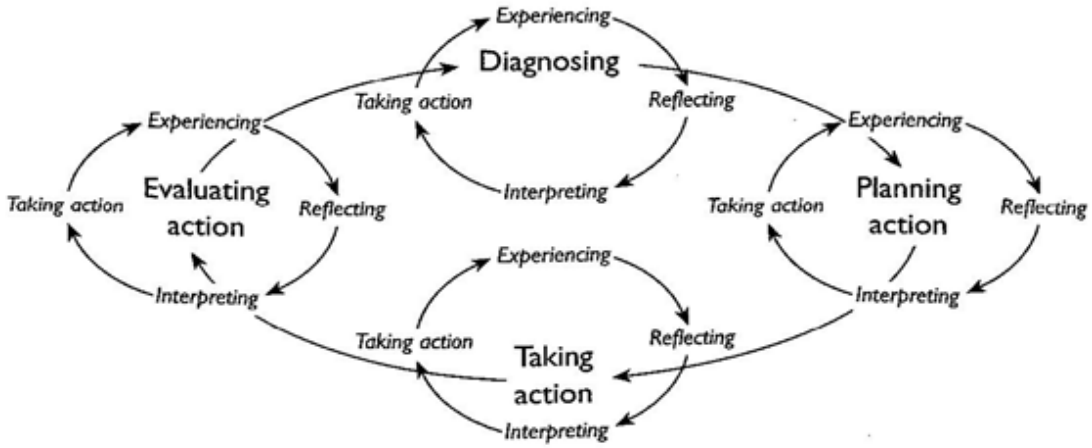


Figure 4. The experimental learning cycle in action research projects (Coghlan et al. 2001)

Figure 4 shows four major cycles in the experimental action research cycle. These four major cycles can be described as *diagnosing, planning action, taking action* and *evaluating action*. Each of these four cycles has its four inner-cycles involved in *experiencing, reflecting, interpreting* and *taking action*. For each of these inner-cycles within the major action research, the researcher of this study undergoes a learning cycle by experiencing, reflecting, interpreting and taking action at each stage of his study.

In this study, the logic of developments was the same. For example, during this study the researcher continually stepped back and reflected on learning experience towards planning further action for this study. The action research is not a tidy methodology and sustaining action research in four cycles could lead to extended project over months or years depending on the research scope and scale. The researcher needs to maintain credibility of research by becoming a change agent or a driver of change. At the same time, the researcher needs to manage his colleagues, peers and superiors through building personal relationship with significant people in the department where researcher is working for.

2.2 Research Design

This study applies action research principles to search for solutions based on the current state analysis and the search for best practice, which are subsequently merged into the conceptual framework for building a proposal. Figure 5 illustrates the research design applied in this study.

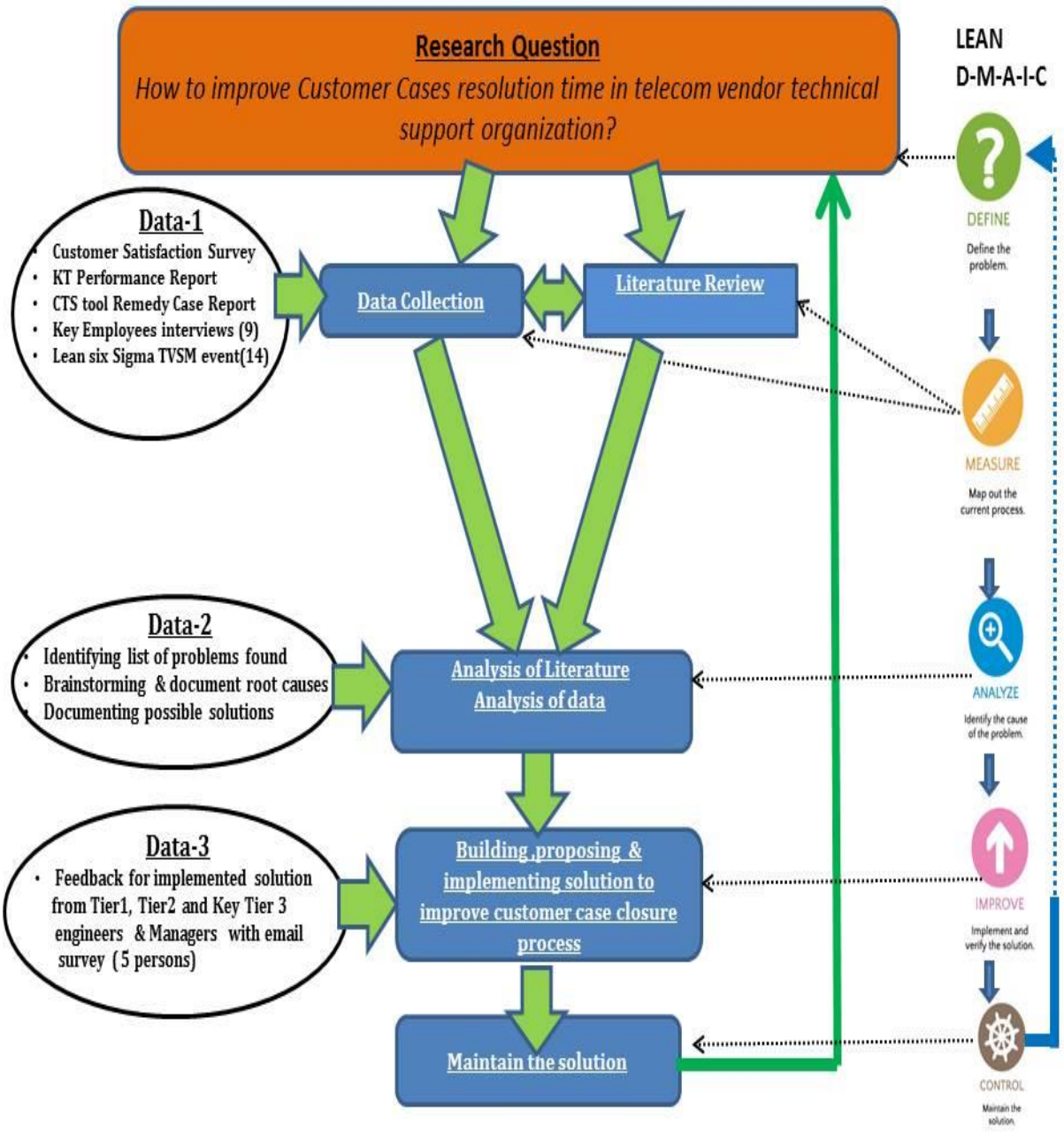


Figure 5. Research design of the thesis.

As seen in Figure 5, the logic of action research is visible in the research cycle in this study. The study starts with defining the problem and formulating the research question to be solved. Second, it performs data collection (data-1) and literature review on best practice to improve customer support processes. Data collection utilizes customer satisfaction survey report and performance reports from the existing Kepner Tregeo tool. The data collection also utilizes qualitative data from the key employees' interviews and inputs from Kaizen LEAN event organized by the case company to study and map the current case handling process and find improvements (held in Chicago USA, from 4 February to 7 February, 2014). Third, analysis of literature review and analysis of data

was done and as a result of this analysis data-2 was collected. The data-2 listed all identified problems with currently used customer services processes, possible causes of identified problems and possible solutions for each identified problem are documented. Fourth, with analysis of literature and data collection a solution was built and proposed for a pilot test. The pilot test was done for a four weeks and feedback was gathered as data-3 for this study. The input from data-3 is utilized to improve the solution and a new round of implementation and feedback is planned as a next step for continuous improvement of proposed solution. The final step in research design is control such as maintaining the implemented solution.

This research design also incorporates the Lean six sigma process improvement frameworks called D-M-A-I-C described as define, measure, analyse, implement and control. As shown in Figure 5, *Define* helps to clearly define the problem statement; Measure helps to guide and analyse the data collection, map the current state of processes and identify best practice in literature review. *Analyse* helps with identifying waste in service processes and possible causes. *Improve* deals with the implementation of the proposed solution. Finally, *Control* deals with maintaining a solution and providing feedback to implemented solution for continuous improvement of service processes.

As evident from the Figure 5, the study follows the logic of action research cycle, simultaneously reflected in Lean six sigma logic. It starts with posing a research question, then it moves to the investigation and analysis of the case company situation, then moves to building the proposal and testing it in the case company. According to the logic of action research, the action research cycle will then lead to a new round of investigation and improvement, which lies outside the scope of this Thesis.

2.3 Data Collection and Analysis Methods

The study utilizes the methods most typical of qualitative research (Biber et al. 2004: 3-5), namely: in-depth interviews, document analysis, surveys and discussions. These qualitative research methods best suited to gain insights into people experiences, attitudes and situations. The overviews of the data sources and analysis methods are given blow.

2.3.1 Data from Customer Satisfaction Survey

As its primary source of data, this study utilizes the case company qualitative survey on various aspects of customer support. Each quarter of a year, the case company conducts customer satisfaction survey utilizing the services of a third party company to conduct it. This survey collects customer feedback on the customer support provided by the case company technical support centres across the globe. A third party company, WALKER, conducted this survey for which the case company provided customer names. A total of 8129 web survey requests were sent during 2013, and the participants who provided feedback to the survey amounted to 1944 customers. Thus, the response ratio was 24%.

This survey looks into the customer feedback on various aspects of customer support. Firstly, one part of the survey asks for qualitative feedback on how the customer would rate its overall experience with the case company support centres (on the scale from *Excellent* to *Don't know).* Second, the survey focuses more in-depth on the quality, knowledge and response from the support person, and separately on the customer evaluation of the case response time. The final section of this survey focuses on getting information if the customer is not happy and would like someone from the case company management team to contact the customer. The survey questions can be found in Appendix 1.

2.3.2 Data from Kepner Tregeo Tool

This study also uses the data from a process tool called Kepner Tregeo, known as KT, used by the case company. This too is used to support the information flow for support centres between Tier1, Tier2 and Tier3 teams. KT tool analyses how the information flow on customer cases is flowing between the teams. KT tool also generates the case summary reports which provide information on the overall customer case handling and their current status. The KT tool generates information, first, on how many cases have met or failed to meet the SLAs resolution time. Secondly, it further investigates if the case owners have followed the KT process in their problem analysis for the cases which have not met the SLAs.

2.3.3 Data from Key Employees' Interviews

As another source of data, the key employee's interviews were conducted to get understanding of how employees perceive the current situation in customer support services, and collect their ideas how to improve the overall case resolution time. The key employees from the investigated customer support organisation, such as senior engineers, staff members and managers, were invited to the case company head office in USA, Chicago, for a four day session. They represented the global support teams from Asia, Europe, North America and South Africa. A total of 9 persons participated in a series of one-to-one interviews. The overview of the interview details and the background of the employees participated in the interview are presented in Table 1 below.

Table 1. Details of the interviews and background on the employees.

Interviewee	Date and duration	Position in the case company and area of responsibility	Background of the interviewee	Topic of the interview and how documented
1	04.02.2014 60 Min	Technical Support Manager. Areas of responsibility: Tier2 Support manager APAC region, Managing Tier2 APAC support team, Customer support Management, Customer case handling management	11 years of experience in customer support Management in Telecom vendors and 5 years in the current role in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
2	04.02.2014 60 Min	Technical Support Manager. Areas of responsibility: Tier2 Support manager NA region, Managing Tier2 NA team, Customer support Management, Customer case handling management	18 years of experience in customer support Management in Telecom vendors and 11 years in the current role in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
3	04.02.2014 45 min	Staff Engineer. Residential Engineer at the case company customer in South Africa. Customer is one of the largest operators in South Africa	12 years of experience in the case company and 6 years working with this customer in South Africa	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
4	05.02.2014 45 min	Tier2 engineer for EMEA region. Area of responsibility: Member of Tier2 EMEA TAC support team	4 years of experience in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
5	05.02.201 90 min	Tier1 engineer APAC: Member of Tier1 APAC TAC support team	8 years of experience in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio

				recorded and interview notes were taken
6	05.02.2014 45 min	Tier1 engineer LA: Member of Tier1 LA TAC team	2 years of experience in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
7	06.02.2014	Tier1 engineer NA: Member of Tier1 NA TAC team	15 years of experience with the case company in different support roles.	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
8	06.02.2014 45 min	Technical Support Manager. Areas of responsibility: Tier2 Support manager LA region, Managing Tier2 NA team, Customer support Management, Customer case handling and case resolution within SLA	More than 25 year of experience in telecom industry. 13 years of experience with the case company and 3 years in the current role	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken
9	06.02.2014 30 min	Tier3 Support engineer: Data and NMS products	7 years of experience in the case company	Detailed interview questions are listed in Appendix 3. Interview was audio recorded and interview notes were taken

As shown in Table 1, the interviewees have represented all customer support regions in the case company such as APAC, EMEA, NA and LA. The interviewees also represented different levels of the support organisation such as Tier1, Tier2 and Tier3 teams. The persons interviewed have been working with the case company from 2 years to 15 years, thus representing both the newly hired as well as the experienced expects from the case company.

The interviewees also represented diverse positions and responsibilities in the case company. Three of interviewees were technical support manager responsible for running the support organisation in their regions. Three of the interviewees were working with Tier1 teams from APAC, LA and NA. The job titles of these Tier1 interviewees are Technical support engineer, Senior engineer and Staff engineer. Since Tier1 team works directly with customer and with Tier2 and Tier3 teams for case escalation, this selection of the interviewees also guaranteed the representation across the tiers. Two

of the interviewees were from Tier2 teams working as Staff engineers, and one of the interviewee was a Staff engineer from Tier3 team.

The interview questions were distributed to the interviewees in advance on 30 January 2014 using email, giving brief background information about the purpose of these interviews. The interview questions formulated to obtain qualitative feedback on the current state of customer case handling, from the interviewees' point of view. The questions covered the complete case handling life cycle beginning, from the moment when the customer creates a case, until the end when finally case gets resolved and closed. The questions were created mainly to guide the interviewees, but many valuable inputs were collected during the course of interviews.

To conduct the interviews, the interviewees were invited to the case company head office in Chicago, US, for a four days session, from 4 February 2014 to 7 February, 2014. The interviews were conducted in the office meeting rooms within one to two hour session each. The interviews were recorded with a Samsung phone voice recorder application. The researcher simultaneously took field notes during the interviews and used the voice recordings later to analyse the findings. English was used as a language for the interviews. The questions for the interviews are listed in Appendix 2.

2.3.4 Data from LEAN Kaizen Event

Another source of data was the LEAN Kaizen event conducted by the case company. Kaizen LEAN is a process tool which can be used to find waste in a process. This LEAN process tool could be utilized in any industry ranging from manufacturing to telecom support services. LEAN process methods and LEAN terminology is described in detail in Theoretical background section of this thesis.

The case company has organised LEAN Kaizen process conference meeting in USA at its head office in Chicago by inviting representatives from all support teams such as Tier1, Tier2 and Tier3. Technical support Managers and Vice president on Service delivery also joined along with an external consultant from Next partner, USA. The Conference meeting agenda was set to find out all possible bottlenecks in the current case handling process for achieving a faster case resolution time.

For conducting the LEAN Kaizen event, the case company had hired an external consultant who worked with the researcher of this thesis to map the current state of the process lifecycle of case handling in the customer support organisation. The LEAN event was organised in Chicago, USA from 3 February 2014 to 7 February 2014. The event involved the nine participating employees who were involved in the interviews representing the support teams in EMEA, APAC, NA and LA regions. In addition, five other persons were involved, their background and other details are presented in Table 2 below.

Table 2. Details of the backgrounds on the employees in LEAN Kaizen event.

Participant	Position in the case company and area of responsibility	Background of the interviewee
1	Tier2 engineer for EMEA region. Area of responsibility: Member of Tier2 EMEA TAC support team	4 years of experience in the case company
2	Tier3 Support engineer: Optical and Access products	9 years of experience in customer support
3	Tier2 engineer for USA. Area of responsibility: Member of Tier2 USA TAC support team	11 years of experience in the case company
4	Tier2 engineer for Brazil. Area of responsibility: Member of Tier2 brazil TAC support team	3 years of experience in the case company
5	Technical Support Manager. Areas of responsibility: Tier2 Support manager EMEA region, Managing Tier2 EMEA support team, Customer support Management, Customer case handling management	More than 13 year of experience in telecom industry. 5 years of experience with the case company

Thus, a total of 14 persons were invited to the LEAN Kaizen event, representing diverse backgrounds such as engineers, staff engineers and technical support managers. The goal of the LEAN Kaizen event was to investigate the current life cycle of the case handling process and identify the bottlenecks to improve the case resolution time. Findings from the LEAN process tool are documented and analysed in the current state analysis section of this thesis.

2.3.5 Data from Pilot 1

A pilot test was carried to get qualitative feedback for the pilot implementation of the case escalation template in the case company support organisation. During the pilot, it was made mandatory to use the case escalation template and after four weeks of the template use, an email survey was conducted to take feedback on how the implemented template succeeded and how it can be further improved. The feedback also asked

about the effect that the case escalation template had on improving the customer case resolution time.

Table 3. Details of the backgrounds on the employees for pilot test feedback survey

Partici-pant	Position in the case company and area of responsibility	Background of the interviewee
1	Tier3 engineer, EMEA TAC, Tier3 support for NMS products	6 years of experience in the case company Tier3 TAC
2	Tier3 engineer, EMEA TAC, Tier3 support for Data products	11 years of experience in the case company Tier3 TAC
3	Tier2 engineer, USA TAC, Tier2 support for	9 years of experience in the case company Tier2 TAC
4	Tier2 engineer, ASIA TAC, Tier2 support for	4 years of experience in the case company Tier2 TAC
5	Tier1 engineer, Mexico TAC, Tier1 support for	7 years of experience in the case company Tier1 TAC

As seen from Table 3, five support engineers provided feedback on the implementation of the case escalation template representing Tier3, Tier2 and Tier1 engineers from EMEA, ASIA, USA and Mexico TAC support organisation. The findings from email feedback survey are documented and discussed in Section 6 of this study.

2.4 Reliability and Validity

According to Quinton and Smallbone (2006), validity of a research design in business studies management originates from the validity phenomenon in experimental research, for example, in biology and chemistry. Four types of validity are commonly identified (Yin 2003). These four types of validity are described as internal validity, constructive validity, external validity and reliability. Internal validity relates to the tool that the measurement is done with, and ensures that the study actually measures what it was intended to measure with this research. The key test of validity is therefore presented as the question “was what was found a response to the question originally asked?” (Quinton and Smallbone, 2006: 127-128). Internal validity is important especially for doing an experiment which is designed to test or prove a hypothesis.

Constructive validity refers to the “degree to which a test measures what it claims” (Cooper and Schindler 2003). External validity relates to the results of the experiment, “if the results of an experiment could be applied to other context or situation and up to what extent is that possible”. One example of external validity could be taken for election survey where 2000 people are interviewed to predict an outcome of an actual elec-

tion in which 20 million people would vote. This aspect of external validity is entwined with the concept of generalization.

Reliability can be presented with an assessment of the findings of an experiment, and checks if they would be same if the experiment is repeated or conducted by someone else. According to Cooper and Schindler (2003), reliability of research can be improved by using different data sources or using different data collection tools. Reliability can also be improved also by applying an established theory from one area to another, as well as by collecting data at different time using different research methods.

3 Best practice on Improving Customer Support Service

This section discusses the existing knowledge and best practice on customer service, especially focusing on process improvement for case closure in technical support organizations. This section begins with a brief overview of customer service and discusses difference between product and service business. The second this section discusses business process management (BPM) focusing how processes can be improved using BPM framework. The third this section discusses ITIL framework on best practice used for incident handling in customer support service. The fourth this section discusses lean six-sigma DMAIC process framework to analyze, identify and removing waste from any service processes in customer service. Finally this section discusses need of continuous service improvement for improving customer service.

3.1 Customer Service Overview

For telecom vendors customer service is an important part of business. Its customers such as telecom operators critically analyze quality and performance of customer support and services while making buying decisions because it is critical for them to get fast and quality support from vendor in case of failures with vendor equipment and services. The telecom vendors can win customers by building strong customer service organizations providing value to its customer by facilitating outcome desired by its customers. The service facilitate outcome by enhancing performance of associated tasks with customer services. The good customer service results in gaining trust of customers and win business. It is critical for customer service to continually analyze customer service processes and improve them. Any process can be improved by analyzing, identifying and removing waste from the process by using process improvement frameworks, for example, BPM, Lean and ITIL.

3.1.1 Definition of Customer Service

Customer service can be described as “a series of activities designed to enhance level of customer satisfaction- that is, the feeling that a product or service has met customer expectation” (Turban et al. 2004: 89). Some definitions of service from well-known writers provide a broad idea about the service. According to Kotler et al. (2008: 218), “a service is an activity or benefit which one party can offer to another which is essentially intangible and does not result in ownership of anything”. Thus, the definition of service

come into contract with the goods which can be defines as *"objects, devices or things, whereas service can be defined as deeds, efforts or performances"* (Berry et al. 1980: 22).

3.1.2 Features of Services Business

Aurich et al. (2010) define four features which describe services. Services are intangible, heterogeneous, and perishable as well as demonstrate simultaneity of production and consumption which in the service occurs at the same time. Intangibility means that services are hard to define or measure in physical sense. Heterogeneity means that service quality delivered is heterogeneous in nature as it depends on different persons providing services. Simultaneity means that service is produced and used at the same time as opposite to products which created first and then consumed. Perishability mean that service cannot be stored or returned or saved for a later use, rather service is consumed at the same time when created.

Differences between services and products can be summarized (Aurich et al. 2010) and point to their contrast, as shown in Table 4 below.

Table 4. Differences between product and services (Aurich et al. 2010: 136–143).

Service	Product
non-physical	physical
non stockable	stockable
no change of ownership after purchase	change of ownership after purchase
production and consumption are not separate	production and consumption are separate
interaction between service technician and customer represents realization of service	production without integration of customers

As shown in Table 4, services are non-physical hence services cannot be stored for future use whereas products are physical, stockable and can be stored for future use. Table 2 also confirms that service experience depends on the quality of interaction between the customer and service provider but production can be done without such integration.

3.2 Business Process Management (BPM) for Customer Services

Business process management (BPM) is a management approach to align organisational business processes with the needs of a customer. BPM framework is utilized in this study to learn how to analyse customer support processes by listing all associated tasks involved in a process and find ways to improve cycle time of each task to optimize overall process.

3.2.1 Definition of BPM

Business process management (BPM) analyses, identifies, changes and monitors business processes of an organisation. BPM techniques and methods help to identify and modify existing processes to align them with a desired future state. Business process management or BPM can be defined as "A *structured approach to analyse and continually improve fundamental activities such as services, manufacturing, communication, marketing or other major element of a company's operation" (*Zairi et al. 1997). Business process management or BPM can also be defined as "*a discipline of promoting business efficiency and effectiveness through the use of a globally recognized methodology"* (Panagacos et al. 2012: 101-103).

BPM identifies all the processes associated with an organisation and analyse them for efficiency and effectiveness by measuring the results over a period of time and optimize these processes. A process can be defined as an approach used to convert inputs in to outputs by utilizing resources of an organisation used in a reliable, consistent and repeatable way to achieve its goals (Panagacos et al. 2012: 110-113). A process has mainly four features associated with it. The first feature is a process should be predictable with definable inputs. The second feature of a process is it should have a linear and logical sequence of flow. The third feature of a process is it should have a set of clearly defined tasks and activities. The fourth feature of a process is it should have a predictable and desired outcome.

3.2.2 BPM Framework Overview for Improving Customer Processes

Business process management or (BPM) can be implemented for improving customer service process by following basic principles of process management. Figure 6, illustrates principles of process management.

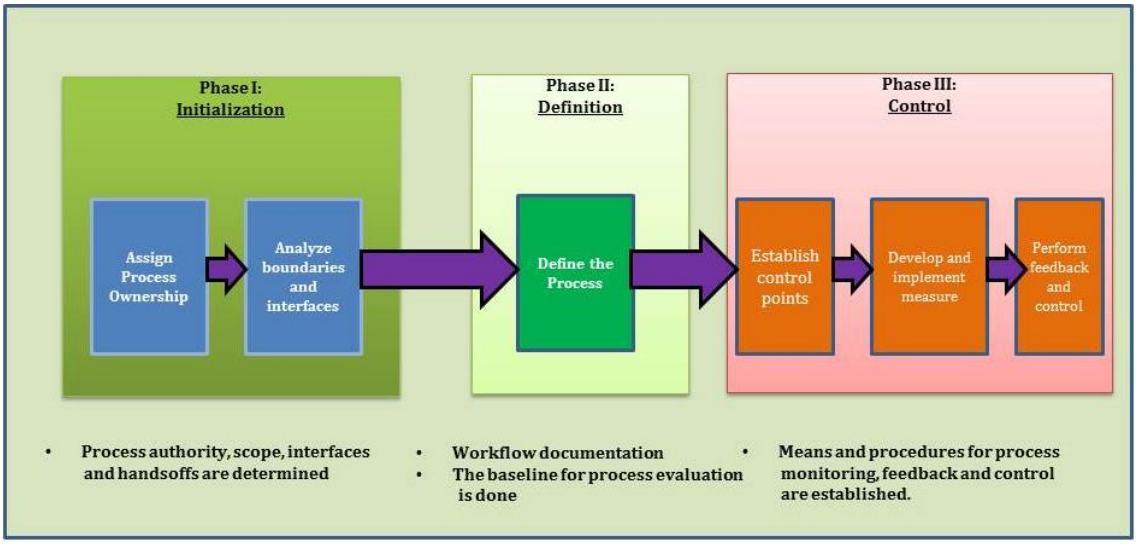


Figure 6. The basic principles of process management (Laguna and Marklund 2004).

As shown in Figure 6, basic process management can be divided in to three main phases. The *first* phase begins with appointing an owner and defining interfaces and boundaries for the process. Appointment of a process owner is critical part of process management as someone should in-charge and able to lead changes in process improvement process. Defining interfaces and boundaries for process improvement helps to determine scope of the project. The *second* phase requires a thorough understanding of process workflow and detail tasks involved in process end to end. Defining and documenting process guide to identify waste in a process which could be eliminated. The *third* phase is about establishing a method to control process and provide feedback to those involved in a process. The control phase deals with activities such as inspection, auditing, measuring, verification and checking. These activities helps managers to reflect on their decisions and reveal if process is heading to a right direction as expected.

3.2.3 The Benefits of Using BPM for Services

The business process management or BPM helps organisations to process more services and products with less effort, reduced cost and a higher quality. As more and more organisations are focusing on services and process centric organisations, the adoption of BPM is gaining more popularity (Panagacos et al. 2012:16). A study conducted with organisations who has implemented BPM by *Gartner* in 2008 found that implementing BPM, 78 percent of organisation received a 15 percent or higher rate of investment (Panagacos et al. 2012:16). The benefits of implementing BPM for services organisation can be described in seven points. The first benefit can be described as

BPM saves time and money for an organisation by identifying redundant processes and eliminate duplication of tasks. BPM standardize business processes across organisations reducing their operating cost by executing repeatable process that achieve same result every time. The standardize process is than automated to reduce process cycle by reducing waste and enhancing efficiency.

The second benefit can be described as *BPM improves business agility*. BPM helps to differentiate between desired and essential services providing agility to organisation to add or remove service. BPM also helps organisation to introduce new products to market quickly. The improved business agility provides control, flexibility and visibility to respond to customer needs.

The third benefit can be described as *BPM creates continuous improvement.* The BPM creates an environment for continuous process improvement for an organisation and implement those improvements. BPM first standardize process and then automate it which results in reducing manual work and decrease lead times.

The fourth benefit can be described as *BPM creates effective measurement of processes.* BPM utilizes tools such as LEAN and Six Sigma to quantify outcome of operational activities such as cost, quality, cycle time and throughput. The effective measurement closed feedback loop in process management cycle and provides management with critical information for further improvements.

The fifth benefit can be described as *BPM creates performance visibility.* BPM enhances end to end visibility of a process by making it transparent to staff members responsible for a process. The staff members can monitor performance of a process by identifying and eliminating waste quickly. BPM tools such as Lean Six Sigma can create performance report across an organisation and can display result in management dashboard for process analyst to further investigate and isolate root causes of all bottlenecks such as time delay and high processing costs.

The sixth benefit can be described as *BPM creates effective risk management.* In BPM, documented processes are analysed and reviewed from a risk prospective by inserting effective controls to all processes and for all level of staff members. The BPM process analysts are able to reduce overall risk to an organisation by enforcing rigorous process management in all business departments.

The seventh benefit can be described as *BPM creates good compliance and regulatory governance.* The successful BPM implementation ensures effective and coherent controls in place and at every process level.

3.3 Incident Management in ITIL Services Operation

Incident management is a critical part of customer service business which involves documenting, classifying, prioritizing and resolving incidents to restore normal operations for customers. A good incident management requires strong processes to be implemented which covers complete life cycle of an incident which begins with incident reporting and end with incident closure. The information technology infrastructure library called as (ITIL) provides a strong framework on creating and implementing incident management system for customer services operation.

3.3.1 Definition and Features of Incident Management

Incident can be defined as an unplanned interruption to an IT service or degradation of quality of a service (OGC 2007: 72-73). Incident management is defined as a process responsible for managing lifecycle of all incidents. The purpose of Incident management purpose is to restore normal service operation as quickly as possible. Normal service can be defined as an operational state where services are performing within their agreed service and operation level.

Objective of Incident management can be described as mainly five key points. The first objective of incident management is to ensure standardized process and methods are used for prompt and efficient response to an incident analysis, documentation and reporting of incident. The second objective of incident management is to increase communication and visibility of incident to business and support staff. The third objective of incident management is to enhance business perception of services using a professional approach to resolve an incident as quickly as possible. The fourth objective of incident management is to align incident management activities and priorities with business. The fifth objective of incident management is to maintain user satisfaction by

3.3.2 Incident Management, Case Handling and Life Cycle

ITIL framework suggests the idea of life cycle for incident management. Each step in the incident life cycle such as incident identification, incident logging, categorization, prioritization, diagnosis, and incident resolution with incident closure are reflected in the indecent life cycle.

The first step of Incident management begins with identification of an *incident*. Work on an incident cannot start until it is known that an incident has occurred. From a business point of view it is not acceptable to wait until a service is affected and service desk is contacted. From ITIL framework point of view a process of monitoring of all key components of a service should be followed so that potential failures or failures could be detected and resolved earlier (OGC 2007:75-76).Incident management process ideally should resolve an incident before it has impact on service users. Figure 7 illustrates a typical incident management process flow in a service organisation.

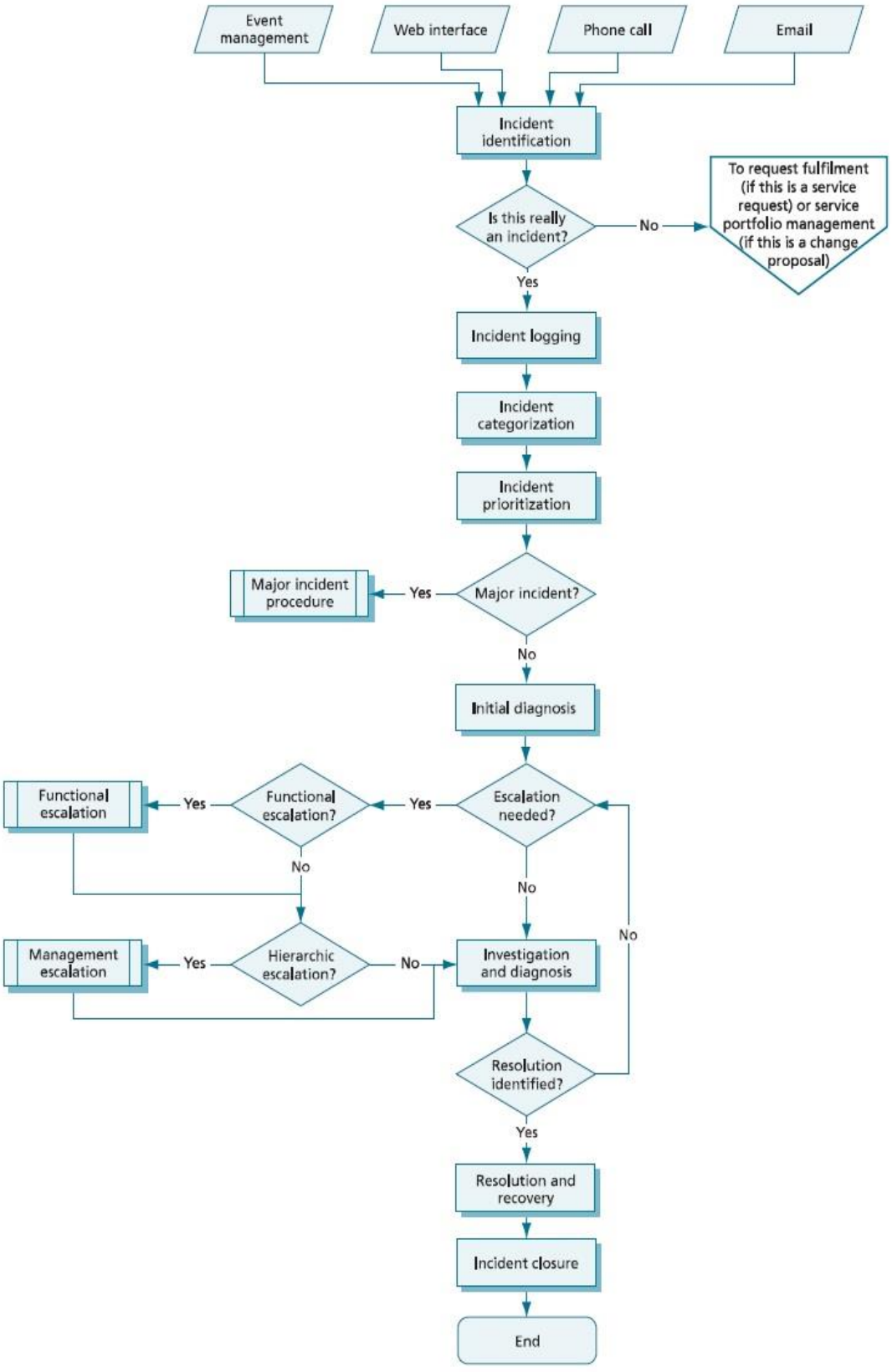


Figure 7. . Incident management process map (OGC 2007:77).

As described in Figure 7, Incident management process flow begins with knowledge that can incident has occurred. Incident can be found with proactive monitoring or reported by affected service users using phone, email or web. Incident is logged with information such as date and time of incident reported, categorized and prioritized based on business requirement. Incident is investigated and a resolution is found and incident is fixed and closed.

The second process step of incident management is incident *logging*. All incidents should be logged with complete information such as date and time stamp of incident occurrence. Information relevant for incident should be logged so that a historical record is created and can be used by others in support group if similar incidents occur in other part of support organisation. A Typical incident should have following information logged shown in Table 5 below.

Table 5. A sample Incident report fields.

- Unique reference number
- Incident categorization
- Incident urgency
- Incident impact and prioritization
- Data/time of incident
- Name of person recording incident
- Method of notification
- Name/department/location of user
- Call back method
- Incident status
- Support group to which incident is assigned
- Description of symptoms
- Related problem/known error
- Activities undertaken to resolve an incident
- Resolution date and time
- Closure category
- Closure date and time.

As seen from Table 5, A typical incident reporting form should have information such as unique reference number, incident category and prioritization, name of the person

who reported problem and information on how to contact the person who has reported the incident.

It is important to provide quality training to first line support staff dealing with incident handling to be aware of all information gathering needed for incident logging. Incident information should be updated with incident investigation progress. For example, incident description, priority and category might change with the knowledge gain during incident investigation process. This information should be updated to create correct historical data for incident.

The third process step of incident management is *categorization*. Categorization of an incident deals with logging category of an incident. This information is important to establish trends for use in supplier management or problem management. Incident categorization can change throughout the life cycle of an incident. For example, initial incident reporting indicate only symptoms of an incident such as service unavailable or performance slow but later investigation might reveal more accurate category such as server failure or disk failure. Figure 8 illustrates an example of a multi-level incident categorization.

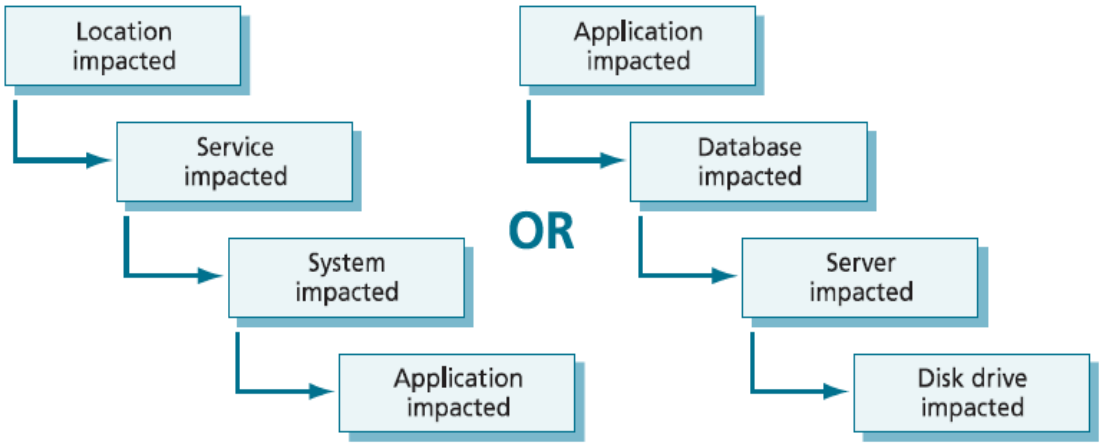


Figure 8. Multi-level incident categorization (OGC 2007: 78).

As described in Figure 8 example, incident category could be location, service, system or application category or incident can be tools specific such as application, database, server or disk-drive category.

The fourth process step of incident management is *prioritization*. Prioritization deals with how an incident will be handled by support tool and support staff based on priority set on an incident. Prioritization can be determined by urgency and impact of an incident to a business need. Table 6 below Illustrates an example of a simple priority coding system.

Table 6. Simple priority coding system, (OGC 2007: 79).

	Impact			
Urgency		High	Medium	Low
	High	1	2	3
	Medium	2	3	4
	Low	3	4	5

Priority code	Description	Target resolution time
1	Critical	1 hour
2	High	8 hours
3	Medium	24 hours
4	Low	48 hours
5	Planning	Planned

As displayed in Table 6, priority of an incident can be set as based in urgency and impact on business needs. Priority of an incident can also set target for time resolution for incident such as critical incident should be resolved within one hour and high priority incident should be resolved within eight hours etc.

The fifth process step of incident management is *Initial diagnosis and escalation*. Front line staff dealing with incident identification should perform initial incident investigation and try to resolve an incident. If front line staff cannot resolve an incident and need an expert to resolve incident they should inform customer and incident should be escalated to an expert for further investigation. Incident escalation mainly falls in two categories such as functional escalation and hierarchic escalation. Functional escalation is used when organisation has multiple levels of support groups with product expertise and an incident needs to be escalated to these support groups for incident resolution. Hierarchical escalation deals with escalation to support managers and is used for incident of serious nature such as high impact incident. Hierarchical escalation should continue to higher management so that management is aware of high impact incident. During escalation process incident ownership should stay with front line staff even if he is

not directly investigating incident. He should update incident investigation progress to incident and customers at all time.

The sixth process step of incident management is *Investigation and diagnosis*. Investigation and diagnosis of an incident includes mainly five steps. The first step is to establish what is gone wrong with a service or a product such that it is not working as expected to work. The second step is to understand chronological order of events how incident has started. The third step is to confirm full impact of the incident such as number of users affected or services went down. The fourth step is to identify and evaluate each event which could have triggered the incident such as recent changes and user actions. The fifth step is to do detailed knowledge search looking for known problems, evaluating product or service logs to find error codes etc. to know root cause of incident.

The seventh process step of incident management is *resolution and recovery*. Resolution and recovery process is initiated once potential resolution is identified. Resolution needs to be tested and verified. Resolution could be tested by affected users For example, on his desktop or server. It could be tested by service desk team responsible for implementing solution for an incident or by a specialist group such as network support for reconfiguring a router etc. Regardless of who takes action for testing and implementing resolution of an incident all resolution activities should be logged to incident management system to create a historic record of incident.

The eighth process step of incident management is *incident closure*. Incident closure is done when service desk confirm incident is fully resolved and customer is satisfied with incident solution and willing to close this incident. Service desk should check the five items before incident closure. The first point is to confirm closure categorization of incident. This is to verify initial logged category of incident is still valid after case investigation and resolution. If category needs to be updated based on knowledge gained during incident investigation, category should be updated before incident closure. The second point is carrying out a user satisfaction survey through using call back or by email. The third point is to confirm incident documentation is complete such as tasks or actions done for incident investigation are logged correctly. The fourth point is to confirm if it is ongoing or recurring problem by discussing with support group if incident was resolved without root cause was identified. If incident was resolved without finding root cause it is most likely that incident will reoccur and needs an action plan to capture root cause

next time. The fifth point is complete formal incident closure. Some organisation chooses for automatic case closure but it should be agreed with users how incident should be formally closed. For example, for critical or major incidents it is more appropriate to have formal case closure form user either with phone or email.

3.3.3 Communication requirement in Incident Handling

Many Telecom organisations provide customer services to its customers across the globe with global customer support teams operating from many countries. For these organisations, a comprehensive global communication process is required to provide clear, precise and quality information related to support operations within global support teams and towards its customers. A good communication process ensures that all communication has an intended purpose and a resultant action. Information should not be communicated if information is not clear or it does not have a clear audience. It is also important that audience is actively involved in determining the need of communication and what they need to do with information.

Incident management in global support team environment requires effective communication to avoid communication gaps and re-work due to ineffective communication. Figure 9 illustrates the seven Cs of effective communication.

Figure 9. The seven C,s of effective communication (Murphy et al. 1997).

As shown in Figure 9, the first *C* of effective communication is *completeness*. Communication is considered effective or complete when it contains all the necessary information that audience is required. The sender of information should provide all information, answers all questions to the receiver. The sender should anticipate receiver needs while providing information. The second *C* of effective communication is *correctness.* Correctness in communication ensures information sent is correct such that it use right level of writing and accuracy of facts. The third *C* of effective communication is *conciseness.* Conciseness means wordiness such avoid unnecessary repetition and stick to purpose. The fourth *C* of effective communication is *courtesy.* Courtesy in communication means it should show sender, s expression as well as respect to the receiver. The fifth *C* of effective communication is *clarity.* Clarity in effective communication implies emphasizing on one goal at a time. Clarity can be achieved in communication with the use of facts and figures, use of active voice. The sixth *C* of effective communication is *consideration.* The effective communication should have consideration for receiver viewpoint, background, mind-set, needs and emotions. The seventh C of effective communication is *concreteness.* The effective communication should have concreteness such as being particular and clear on information shared than be fizzy or general. It helps the receiver confidence of receiving value added information from sender.

3.3.4 Service Quality and Value Creation Using Incident Management

Incident management is highly visible to a business as unplanned downtime of a service or degradation of quality of service means cost to business or loss of revenue. It is therefore easier to create value with efficient use of Incident management by resolving each incident in a timely manner. The abilities of incident management creating value for services can be described in five points. The first ability of value creation with Incident management is to reduce labour and cost for both the business and support staff caused by incidents. For example, longer time to resolve an incident can result in loss of revenue to business.

The second ability is to detect and resolve incidents which result in lower downtime for business. Which means higher availability of service which enables business to exploits full functionality of the service as designed. The third ability of incident management can create value for services by aligning Incident management activities to real

time business priorities. This is achieved because incident management includes capability to clearly identify business priorities and allocate resource dynamically as required. The fourth ability to create value with incident management is to identify potential improvement for services. This is achieved by understand what constitutes an incident and being in contact with Incident handling operational staff. The fifth ability for value creation with incident management is to create new business by identifying additional services and training requirement for customers based on knowledge gained by handling incidents for a customer.

To summarize this section defines incident management as resolving all unplanned incident reported by users. Good incident management handling creates value for services business by resolving incidents in a timely and professional way. Finally this section discusses in detail ITIL framework on incident management discussing eight process steps in incident handling from beginning of an incident to incident closure.

3.4 LEAN Six Sigma Method of Process Improvement for Services

Lean six-sigma is a process improvement method which can be utilized to improve any process involved in product or services. Lean method helps to analyze a process, identify waste in a process and suggest methods to remove waste from a process to make process improvement. This study utilizes lean six sigma method called as D-M-A-I-C for process improvement by defining, measuring, analyzing, improving and controlling a process.

3.4.1 Definition of LEAN and LEAN Six Sigma

LEAN can be defined as a systematic approach in identifying and eliminating “waste” through continuous improvement in a process of creating product or a service (Alukal and Manos 2006). Waste is defined as all non-value-added activities in a process of delivering goods or service to customers such as Re-work, in-efficient movement or unplanned downtime. Lean is a management or manufacturing philosophy that shortens the lead time between a customer order and the shipment of goods or service delivered to customer through elimination of all forms of waste (Alukal and Manos 2006). Lean focuses on value-added activities which include all the tasks in process that changes the form or function of a product or service. Lean help firms to reduce cost, cycle time and non-value-added activities resulting in a competitive and agile firm. Lean

concepts are applicable to manufacturing firms as well as purely service firms such as banks, hospitals and Telecom service companies. *"Lean is a set of principles that accelerates the speed of all processes across the enterprise"* weather the process is for manufacturing or services (Alukal et al. 2003).

To define "Lean Six Sigma" first one should define Six Sigma. Six Sigma can be defined as a set of tools and techniques used for process improvement. Six Sigma improves quality of a process output by identifying and removing cause of defects in a product or a service (Miguel et al. 2012: 63-64). Lean Six Sigma is a fusion of two process improvement methods such as LEAN and Six Sigma combined together to create a process improvement tool which can be implemented to services organisations to achieve quality and speed of delivering services in a cost efficient way to customers (Alukal et al. 2003: 6-7).

> "*Lean Six Sigma for services can be defined as a business improvement method that maximize shareholder value by achieving fastest rate of improvement in cost, quality, process speed and customer satisfaction (Alukal 2003: 21)."*

According to Motwani (2004: 18): *"Lean Six Sigma is the combination of the customer focused efforts of Lean and waste elimination with the quantitative D-M-A-I-C methodology of Six Sigma".* D-M-A-I-C is a problem solving methodology described as Define-Measure-Analyse-Improve-control. DMAIC is described in detail later in this section.

Fusion of Lean and Six Sigma is a must for improving processes in a service organisation because Lean cannot bring process under statistical control and Six Sigma alone cannot improve process or reduce invested capital. Lean and Six Sigma together can reduce the cost and complexity of a service business.

3.4.2 Eight Waste of Lean Six Sigma

Waste is defined as all non-value-added activities in a process of delivering product or service (Alukal and Manos 2006). Non-value-added activities are defined as nonessential steps or activities that increase process time and add costs rather than value to a product or a service. Excess inventory, Unplanned downtime are few example of waste or non-value-added activities. Waste of resources has direct impact on costs, quality and delivery of a product or a service. Elimination of waste in a process results in high-

er customer satisfaction, profitability and efficiency. There are mainly eight type of non-value-added waste identified with Lean (Alukal and Manos 2006).

First, waste of lean process is identified as Defects. Defect is described as any characteristic of a product or service that hinders its usability for the purpose for which it was designed. Defects in a product or service process can usually occur due to design changes, poor quality control or misunderstood customer needs.

Second, waste in lean process is identified as overproduction. Overproduction is described as making a product or service in-excess or earlier than it required by customer. This waste can consume capital resources that could be used in other business operations. Overproduction is usually occurs due to unclear customer needs, wrong production forecast or misuse of automation.

Third, waste in lean process is identified as Inventory excess. Inventory excess can be described when there is supply in excess of actual customers demand. Inventory excess usually occurs due to production buffers, unbalanced workload or unreliable suppliers.

Fourth, waste in lean process is identified as Waiting. Waiting is described as idle time that is created when waiting for material, equipment or a process to complete. Waiting waste usually occurs due to unplanned downtime, poor process quality or unbalanced workload

Fifth, waste in lean process is identified as transportation. Transportation waste is described as waste incurred due to transporting parts and material. That creates an idle time for other depending processes. Transportation waste is usually occurs due to poor plant layout, misaligned process flow or large batch sizes.

Sixth, waste in lean process is identified as Motion. Motion waste is described as any movement of people or equipment that does not add value to the product or service. Motion waste usually occurs due to unorganised workplace, poor methods or unplanned downtime

Seventh, waste in lean process is identified as Employees/People. People waste is described as not using people's creative physical and mental abilities. People waste

usually occurs due to lack of teamwork, lack of adequate training or poor communication between teams.

Eighth, waste in lean process is identified as over-processing. Over-processing waste is described as non-value-added activities which add no value to product or service form customer point of view. Over-processing waste usually occurs due to poor process communication, misunderstood customer needs or poor document control system. (Alukal and Manos 2006)

Identifying and elimination of these eight wastes is the major objective of lean process implementation. The continuous identification and elimination of these eight waste results in reduction in cost and cycle time for product and service.

3.4.3 LEAN for Service Improvement

Lean Six Sigma is an effective and simple methodology which helps to find problem with any service processes and implement a fix based on facts rather than assumptions. Lean Six Sigma is based on clear principals and can be implemented on any process within any industry such as manufacturing or service and companies of any size from large to small. Lean Six Sigma method for service improvement consists of five basic phases such as Define, Measure, Analyse, Improve and Control known as D-M-A-I-C process (Alukal et al. 2003: 288-298). Figure 10 illustrates Lean Six Sigma DMAIC phases of a process improvement

Figure 10. Lean six sigma DMAIC phases. (Alukal et al. 2012: P-223)

Figure 10 describes DMAIC process, systematic approach for improving service processes which start first with defining a process and end with verifying a solution and maintaining the solution.

For executing a successful Lean Six Sigma process improvement method it is important to identify a department or a unit in an organisation which is a good candidate for improvement. For example, which has an obvious problem with processes or which has potential for reducing cost or increased revenue and efficiency? Next part of this section described five phases of DMAIC process improvement method.

The first phase of Lean Six Sigma process improvement method DMAIC is described as *Define*. Define phase starts with identifying a problem which needs to be solved along with creating a Lean Six Sigma team responsible to resolve the identified problem. A Project charter is created which describes a high level view of a “problem” to be solved focusing on underline problematic process. The needs of a customer from that process are identified.

Project charter is created with mainly two sections. The first section of a project charter defines a problem by developing a “Problem Statement”. Second section defines outcome by developing a “Goal Statement”. To develop problem statement in a project charter existing data of a process should be analysed to confirm process has an ongoing problem to be solved. Once problem with a process is confirmed, team should create a problem statement. Problem statement should include severity of a problem such as how big is the problem, business impact of the problem is and which units or departments are involved. After defining problem statement goal statement needs to be created. Goal statement in a project charter should be a direct reflection of a problem statement identifying clear target of resolving problem mentioned in problem statement. For example, if a certain service process takes 10 days to resolve a customer case, goal might be to cut resolve time for customer case to 5 days. Goal statement should be measurable and time-bound to measure project success.

Next step in *Define* phase is to create a very high level view of existing process also called as high-level process map. High-level process map is to describe a process from beginning to end for creating a service or a product but from a high level view point because detailed current state map is created using top down chart under measure phase of DMAIC process. Last step in Define phase is to define customer and their requirements. Customers are defined as individuals or groups who receive goods or service of the process.

Figure 11 illustrates a sample project charter template of Define phase of Lean Six Sigma DMAIC process.

Project Charter	
Business Case	**Problem Statement**
Goal Statement	**Project Scope**
Project Plan	**Team Selection**

Figure 11. Project Charter (adopted from Ramly and Yaw et al. 2012: 359).

Figure 11 illustrates a sample project charter as output of define phase. Project charter begins with identifying a problematic unit under section business case which is mentioned as support organisation. Once problem unit is identified problem statement is written with clear evidence of problem with supporting data.

The second phase of Lean Six Sigma process improvement method DMAIC is described as *Measure*. Measure phase focuses on how a process is currently performed. First step in Measure phase is to create a current state map of existing processes also called as “baseline” of the process before making any changes. Baseline becomes the standard for measuring improvement against changes made to process. Current state map of a process should describe all steps involved in a process including tools such as IT software’s and humans. Current state map of a process can be created with a tool called top down chart. Figure 12 illustrates an example of the current state map of the case handling process using the top down chart

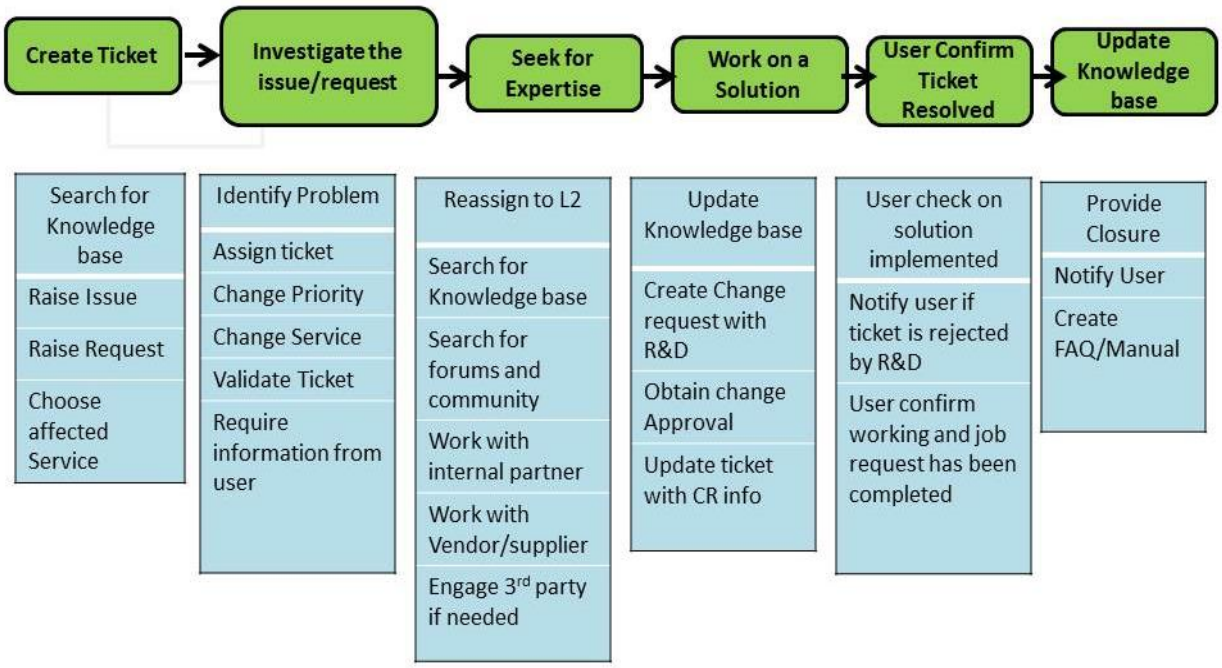


Figure 12. Top down chart (Ramly and Yaw et al. 2012: 363).

Figure 12 illustrates a tool called “Top down chart” used for creating current state map of a case handling process. Top down chart first lists all different stages of a process from start to end. As described in Figure 12, a case handling process begins with creating a ticket for a problem customer has reported. Once ticket is created it is investigated and expertise help is requested if required. Ticket investigation leads to problem cause and solution is built for ticket resolution. Solution is delivered to customer and customer confirmation is required to confirm customer is happy to close this ticket. Process ends with updating knowledge base so that knowledge learned from this ticket could be used by other members of organisation. Top down chart second lists all individual tasks or action performed during each stage of a process. For example, at the time of ticket creation it lists all the tasks or action taken such as checking knowledge base for known problems and identifying which module or software has a problem by choosing appropriate service. Similar way top down chart list detailed tasks performed during each stage of a process, for example, during investigate ticket phase, ticket is assigned to appropriate team. Ticket priority is set and all required information is gathered from customer to start work on ticket.

The second step in “Measure” phase begins after current state map of a process is created with top down chart. In this step team collect data and analyse all individual tasks mentioned in top down chart to identify possible improvements with individual

tasks. Output of this task is to identify all kind of waste exist in individual tasks or action for different stage of a process listed under top down chart

The third phase of Lean Six Sigma process improvement method DMAIC is described as *Analyze*. Analyze phase of DMAIC process uses top down chart or current state map of a process created under Measure phase as an input. After creating, verifying and examining detailed process map under measure phase, pain points within the process are identified. Next step in analyse phase is to closely examine whole process and find possible causes of pain points identified in Measure phase. It begins with determining value of each task or action done during a process. First process analysis is called “Time analysis”. Time analysis focuses on “actual time” work is being done in a process versus time spent waiting. Second process analysis is called “Value added analysis”. Value added analysis is way to look at the process from customer eyes. What customer would think of each task or action done in a process as a required task or a non-essential task? Based on time analysis and value added analysis output a value stream map is created. Value stream map evaluate each task either as value added task or non-value added task called as waste. Value added task is described as a task which create a value for a product or service such it change form of product or service. Non-value added task is described as a task which do not change outcome of a product or a service and called as waste. Based on Value stream mapping such as identifying all non-value added task or waste teams are able to develop theories around possible causes of identified waste. The team must confirm possible causes creating problem with a process through data analysis, process observation, team interviews and comparative analysis.

The *Analyze* phase can utilize fishbone or cause and effect diagram to systematically identify and present all possible causes of a particular problem.

Figure 13 illustrates an example of Ishikawa diagram showing all possible causes of a problem.

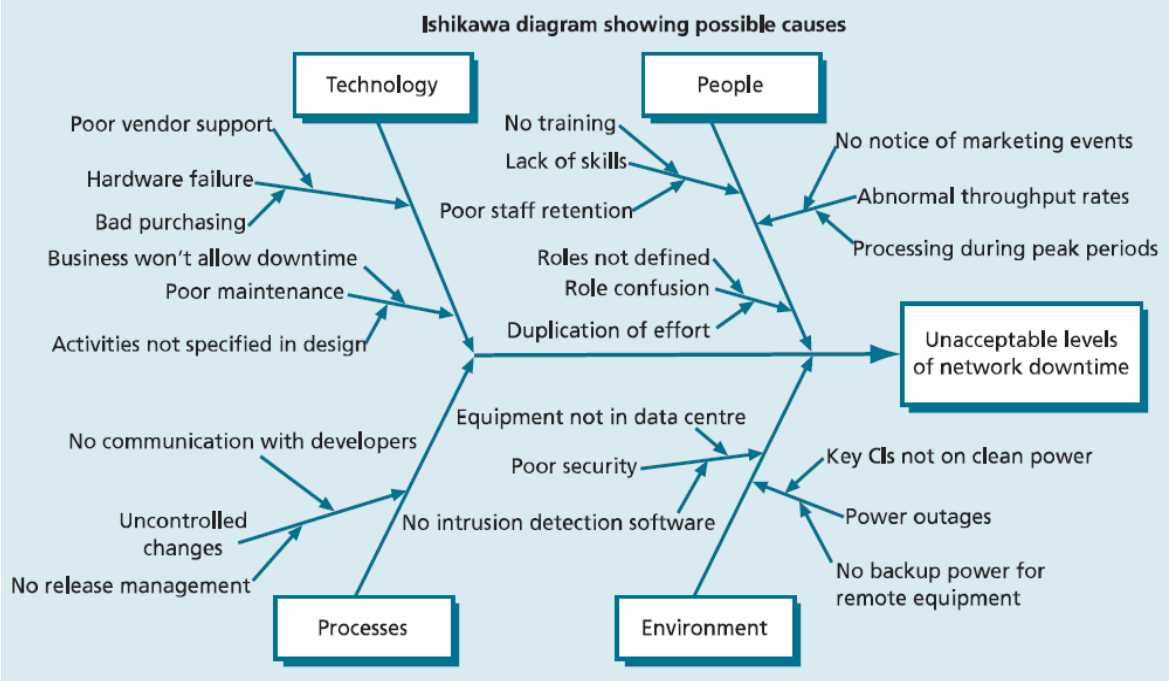


Figure 13. . Ishikawa Diagram (OGC 2007: 272).

Figure 13 display an example of cause and effect or Ishikawa diagram to find out all possible causes of a problem to be solved. The Main goal is represented by the spine of the diagram such as “Unacceptable levels of network downtime”. Primary factors affecting possible cause of a problem is displayed by branches such as technology, people, processes and environment. Secondary factors affecting possible causes are displayed as a stem such as poor vendor support, hardware failure etc. under technology. Creating Ishikawa diagrams stimulates discussions and leads to better understanding of a complex problem.

The fourth phase of Lean Six Sigma process improvement method DMAIC is described as *Improve*. Improve phase of DMAIC process has one sole purpose and that is to make changes to a process to eliminate defects, waste, cost etc. identified under “Analyze” phase. Improve phase has mainly six steps. First step is to brainstorm solution that might fix the identified problem. During brainstorming session team should come out with as many ideas as possible for a possible solution to a problem. Quantity of many ideas should be focused rather than quality of those ideas. We should not kill any idea and should give each idea a space to be discussed and evaluated. Once quantity of ideas are around to solve a problem a better quality idea could be chose to solve a problem.

The second step of *Improve* phase is to draw future map of a process. Based on possible solutions for possible causes of identified waste new process map can be designed which describes how a process could work in future. From all possible solution available best solution should be selected. The team should consider logistic, training, documentation and communication plans while choosing best solution to be implemented. Identified solution should be used and improvements should be documented to compare new process with old process. For example, a case closure for a product X was taking 10 days to close but with new process it takes only 5 days for case closure.

The fifth phase of Lean Six Sigma process improvement method DMAIC is described as *Control*. Control is about sustaining newly achieved process improvement and continuous improvement. It focuses on continuously improve process using four Lean principles such as Value, Flow, pull and perfection. Value is determined by the process or task which creates value for customer. *Flow* removes waste in the process and optimizes the process, while *Pull* ensures that the process responds to the customer demand, and finally, Perfection can be described as continuous process improvement.

Summing up, for the lean implementation of process improvement all phases of DMAIC process need to be executed in a systematic manner starting from defining of a problematic process to finding a solution, and maintaining and controlling the improved process. Each phase of lean implementation of process improvement identifies input and output. The *Define* phase output comes as a project charter defining the problem and the goal for improvement. The *Measure* phase output comes as a detailed current state process map or a top-down chart. The Analyse phase provides the output in a form of an Ishikawa or fish bone diagram listing all possible causes of a problem. The Improve phase finds the solutions for each identified possible causes, and finally the Control phase documents the improved process and maintains the process and the process improvements. As can be seen from this description, Lean makes a continuous improvement approach which needs to be run again and again for improving the process and eliminating waste.

3.5 Continuous Service Improvement

Service improvement focuses on improving the efficiency and maximizing the effectiveness of a service by optimizing underline processes of a service. The service im-

provement opportunities should be identified throughout service lifecycle. Figure 14 illustrates continuous service improvement approach.

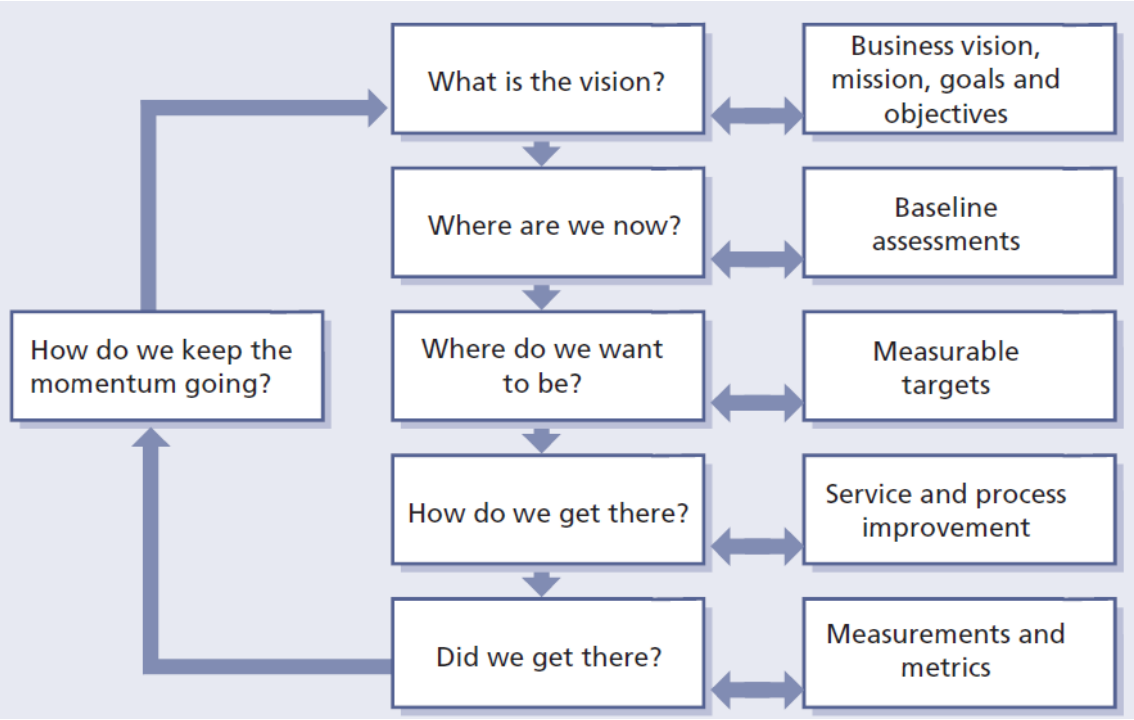


Figure 14. Continuous service improvement approach (OGC 2007: 49).

As displayed in Figure 14, continuous service improvement approach can be summarized in six steps. The *first* step begins with embracing a vision by understanding the high level business objective. This step helps to set clear goals and objective of continuous service improvement. The *second* step deals with accessing current situation and creating a baseline analysis of current state in terms of business, process, people and technology. The *third* step deals with understanding priorities of improvement based on principles define in the vision. This step helps to provide specific improvement goals and timeframe to achieve those improvements. The *fourth* steps deals with implementing solution or process to achieve service improvement. The *fifth* step verifies that measurement and metrics are in place and milestones are achieved. This step validates if objective and priorities were met by level of service. The final step sixth ensure that momentum of quality is maintained by assuring changes are embedded in to organisation.

3.6 Conceptual Framework in This Study

The conceptual framework used in this thesis study collects most relevant and industry proven best practice from literature and articles. The conceptual framework utilizes the findings from Sections 3.1-3.4 of this study which includes Business process management (BPM), Lean Six Sigma and ITIL best practice processes and tools throughout this study starting from current state analysis, building proposal and implementing solution to case company. Figure 15 illustrates the resulting conceptual framework used as a basis for solution development in this study.

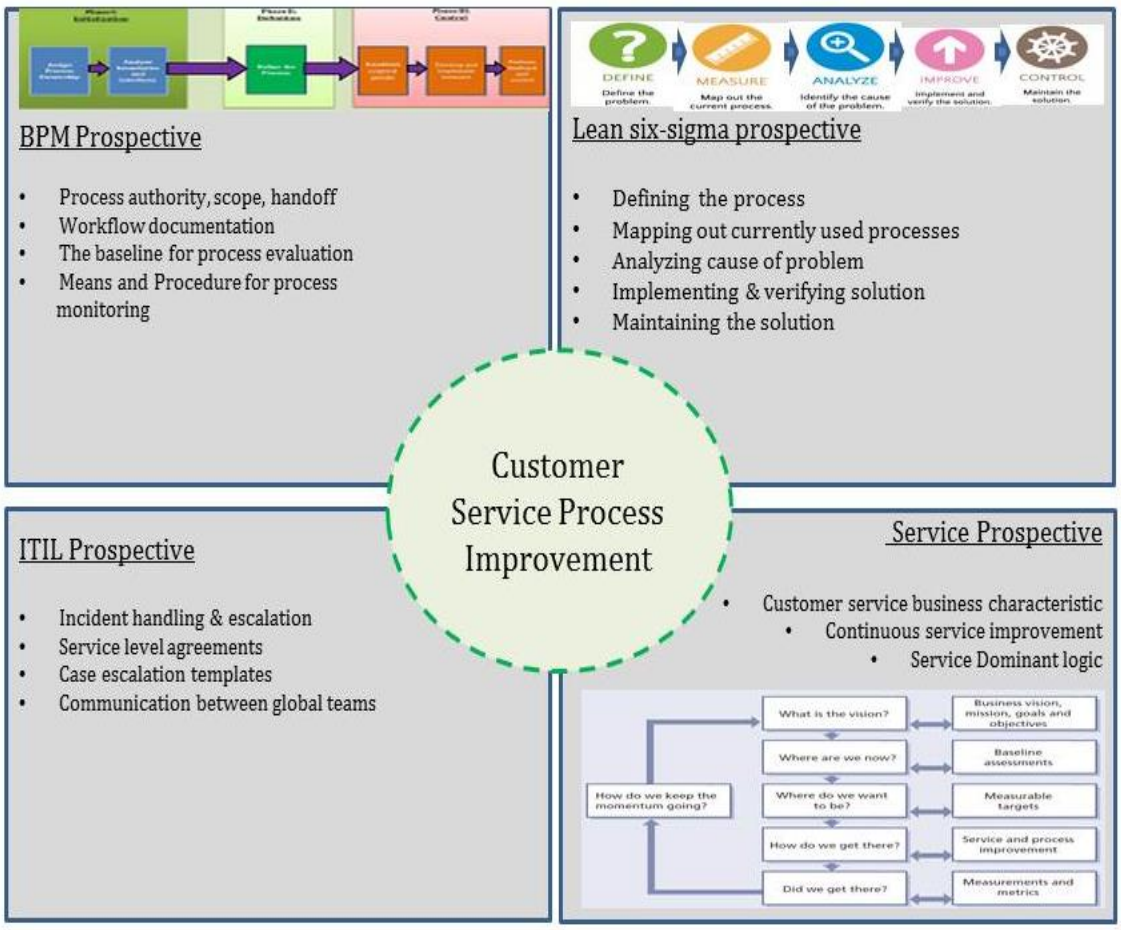


Figure 15. The conceptual framework for this thesis.

Figure 15 displays the best practice utilized for this study for customer service improvement which includes, first, the lean six sigma approach to service improvement focusing on how to find waste in the service improvement process can be eliminated. Second, it utilizes the ITIL service framework for incident handling, communication between the global support teams and continuous service improvement. Third, the study utilizes business process management approach to implementation and activity cycle to find out how to calculate total time cycle of a process and reduce execution time of a process. Finally, the study utilizes the service perspective which is evident in the emphasis on the customer perspective and rooted in service dominant logic. This concep-

tual framework in applied in the subsequent section to develop solution which would address the challenges identified in this study.

4 Current State Analysis

This section presents the results of the current state analysis of the case handling process and identifying the current bottlenecks for faster case resolution. Section 2 and 3 of this study has completed data collection and review of best practice in literature, as described in conceptual framework next step is to analyze current state of exiting processes and identify all kinds of waste in processes.

This section begins with the case company background and overviews the current customer support organization structure. Second, it examines the current case handling process in the case company. Third, it analyzes the case company data from the customer satisfaction survey, KT tool performance reports, findings from the key employees' interviews, as well as the mapping of the current case handling process using Kaizen LEAN method. Finally, this section summarizes the findings from the current process and areas of improvement to achieve a faster case resolution time in the case company technical support organization.

4.1 Case Company Background & Organisational Structure

The case company is a Telecom equipment manufacturer vendor providing product and services to more than 500 customers worldwide. Telecom operators are the main customers for the case company. The case company has global support and services team with more than 500 employees working from support centers located globally.

Services teams are designed with layered organizational structure organized in to Tier1, Tier2 and Tier3 teams. Tier1 teams works directly with customer in customer premises or local case company offices across regions. Tier2 and Tier3 teams are based in Europe, USA and India. This thesis mainly focuses on Tier2 team based in of Espoo, Finland, called Finland TAC center. Finland TAC center provides support services to all Tier1 teams for its Data, Access and Network Management products. Finland TAC center has more than 40 engineers providing technical support services.

Structure of the customer support organization is built to provide better focus on serving its customers by utilizing three levels of support teams such as Tier1, Tier2 and Tier3. Figure 16 illustrates the current structure of the customer support organization.

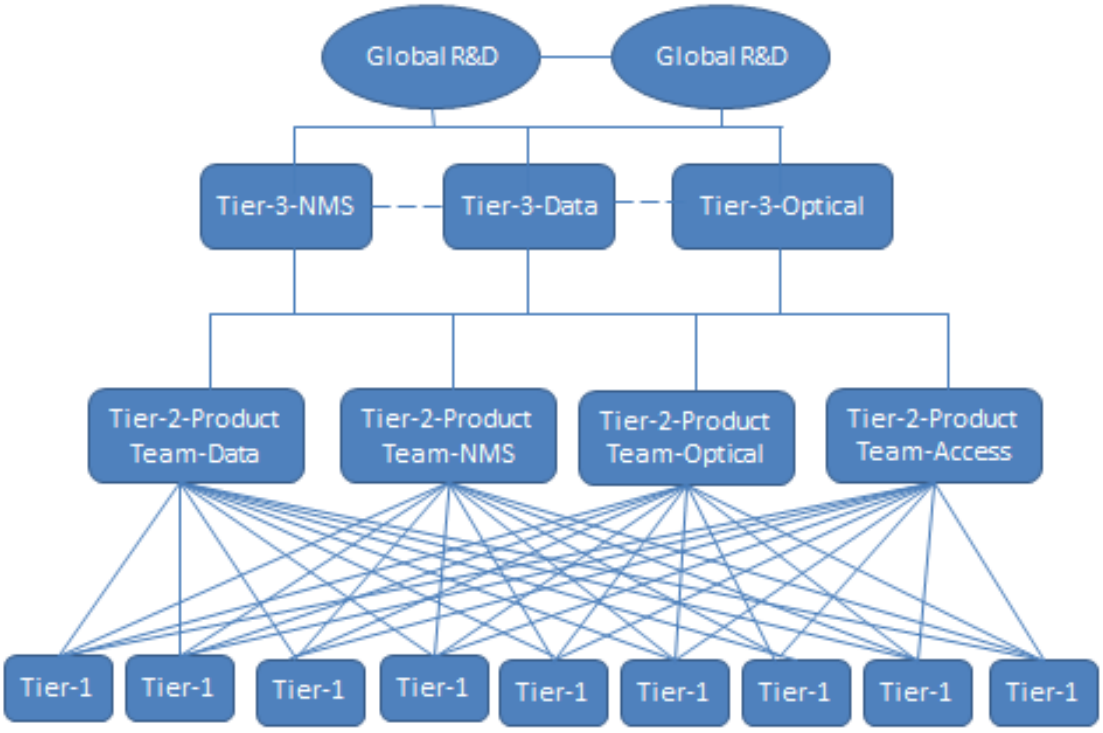


Figure 16. Structure of the customer support organization.

As seen from Figure 16, the current support organization of the case company is built from different support teams across the globe, having different functions and communication within the organization. The first layer of this organization is built with Tier1 technical support teams. Tier 1 team works very closely with customers either on the customer premises or in the case company support office in the local country. Tier1 team's engineers are trained in various products and provide support to all the products sold to customers. Working directly with the customers helps Tier1 to build relationship and provide faster solution to customer cases. Tier1 teams mainly work with customers in their local country or region, and do not work with customers from other regions or countries.

The second layer of organization is built with Tier 2 technical support Teams. Tier2 teams are built around product specific groups based on the product line such as Data, NMS, and Optical products. For example, the case company data product line 9600, 9000, 9300 and 9100 Tier2 is based in Europe. Tier2 teams work with the cases escalated from Tier1 teams across the globe. Any Tier1 teams working for any customer in any region can escalate a customer to Tier2. Tier 2 teams also work directly with the customers if this is the customer who does not have a Tier1 team in their local country

or region. The case company has Tier2 teams in Europe, India, China and United states.

The third layer of the organization is built with Tier3 teams. Tier3 teams work closely with the product houses. Tier3 engineers are the people who work on the development and design of products, and they have detailed information on all modules or software, and their designers. Tier3 works directly with Tier2 teams. Tier3 team does not communicate to the customer directly. Communication to customer from Tier3 is done through Tier2 or Tier1 teams.

The fourth layer is R&D development team. In case Tier3 cannot resolve the case, they can turn to using information from R&D personal. In this situation, the case is internally assigned to an R&D engineer. The R&D engineer works on the case and builds a solution and then forwards this solution to Tier3, passing the fix and information on to the end customer.

4.2 Current Case Handling Process

The current case handling process is a process that described the life cycle of a customer case starting with the case creation, when the customer reports a problem, and lasting to the final moment, when the customer accepts the case resolution and the case is closed.

Figure 17 illustrates the current case handling process.

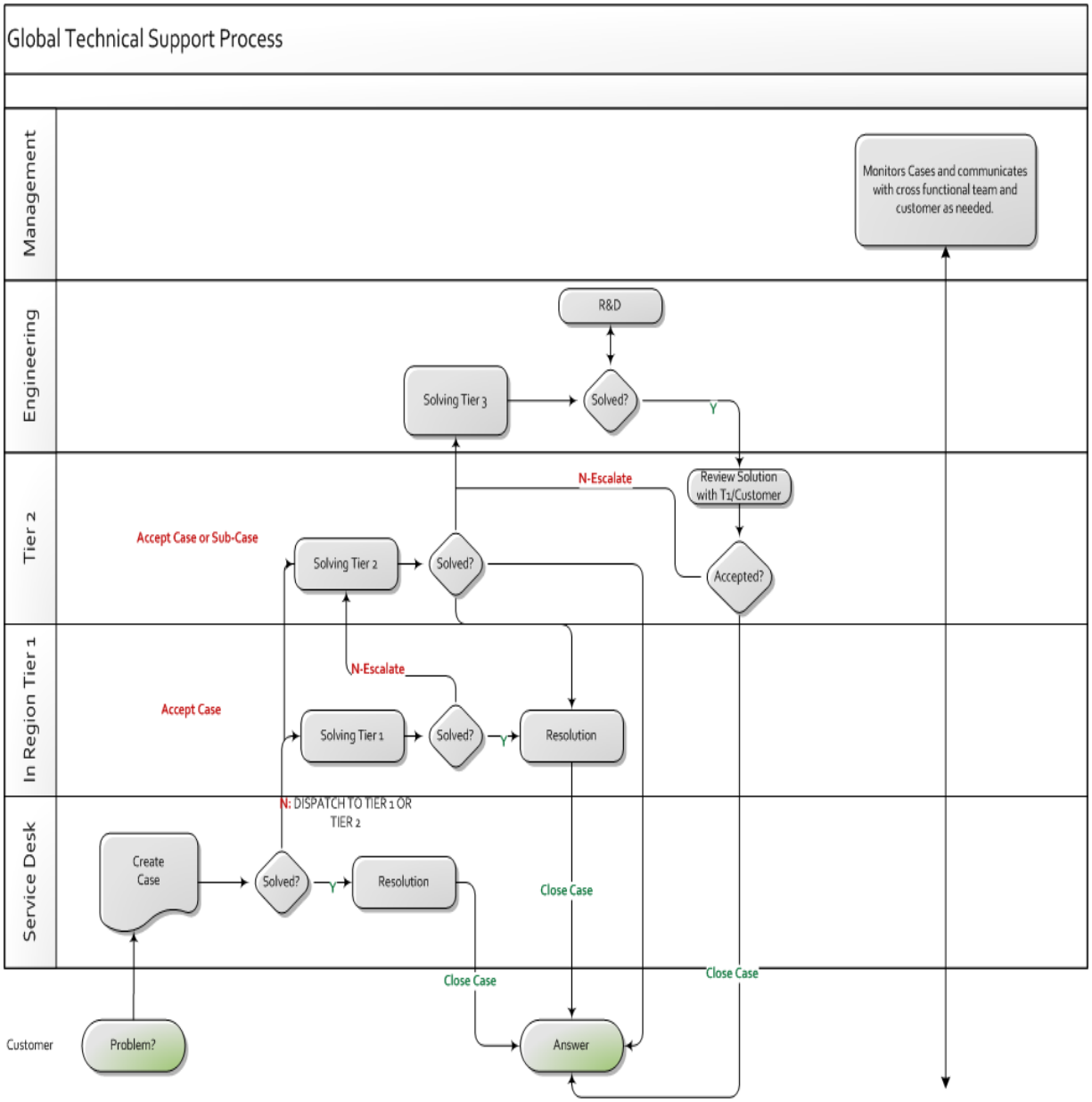


Figure 17. The current case handling process in the support organization (Company internal documentation 2013).

Figure 17 shows the case life cycle of the customer case. It also shows how the case is processed through various support teams such as Tier1, Tier2, Tier3, ending with the customer accepting the final resolution and the case being closed.

Typically, the customer creates a case with support contract using a web-based tool or by calling the case company 24x7 Service Desks. The case is created with a unique case number identifying the customer and the product line on which the problem is reported. Service Desk collects all the details regarding the reported problem case and checks the knowledge base if a solution can be provided. If the solution is found, the customer is informed about the solution and the case gets closed. In case a Service

Desk person cannot find a solution for the reported case, Service Desk assign the case to the regional Tier1 team. Tier 1 team accepts the case and starts investigation. If Tier1 team can find a solution for the case, the customer is informed about the solution and the case gets closed. If Tier1 team does not find solution, they can create an internal case to escalate the case to global Tier2 teams which are created based on various product lines and staffed with engineers who are subject matter experts. Tier2 teams handle direct cases as well as the cases from customers in the regions where Tier1 teams are not available.

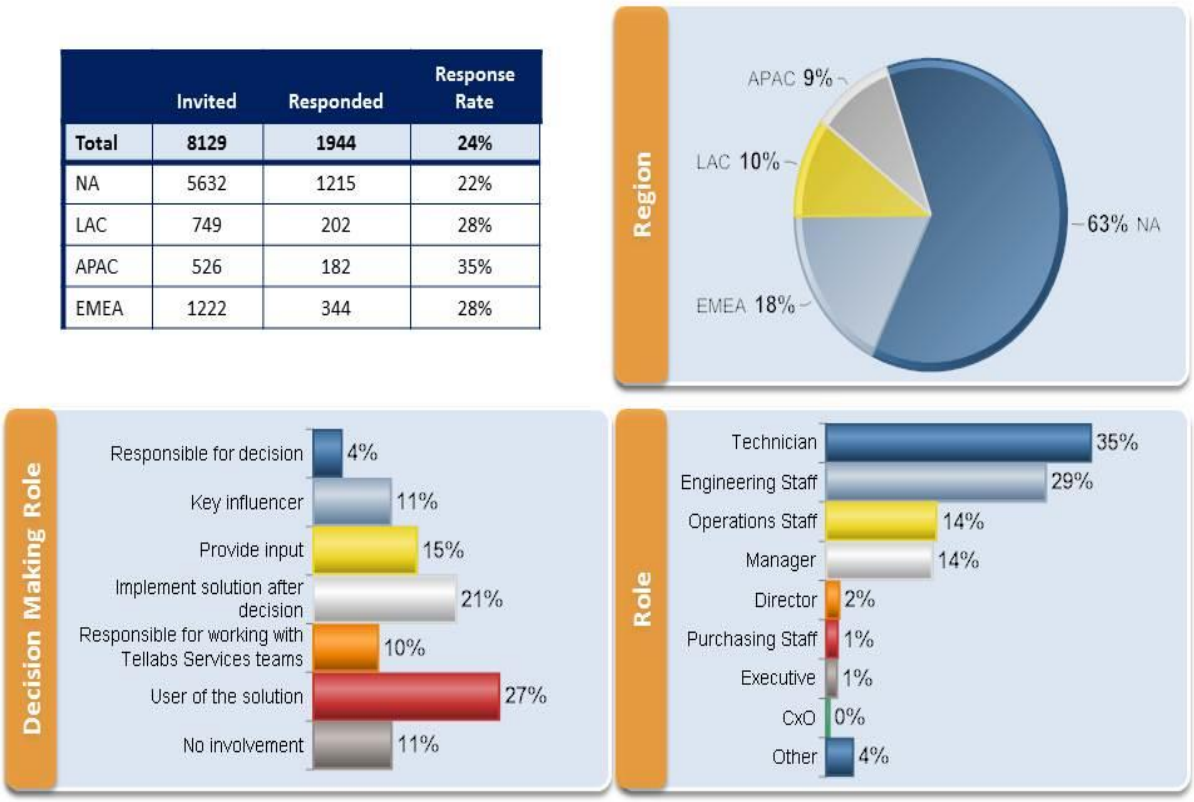
Tier2 team starts the case investigation with the problem reproduction in the lab and checking the database on the already existing bugs. When Tier2 finds a solution, they inform Tier1 team about the solution. Tier1 team which is related to the customer communicates the case resolution and the case gets closed. In case Tier2 team cannot find a solution for the case and needs help, an internal case is created with Tier3 team which is part of R&D and consists of engineers who are developers and write codes for products.

Tier3 can find a solution which already exists or create a software fix, if needed, and communicate to Tier2 teams. Tier2 teams send the solution to Tier1 if the case escalation has come through Tier1, or directly to the customers if the case has come directly from the customer to Tier2. Once the solution is delivered to the customer, the customer is requested for the solution acceptance and the case is closed. If the customers do not agree with the solution provided, the case is again investigated until the customer is happy with the solution and agrees for the case closure.

4.3 Analysis of Customer Satisfaction Survey Result 2013

Another source of the information on the case handling is the customer satisfaction survey. In 2013, the customer satisfaction survey was conducted three times over three quarters of the year. For the purposes of this study, the results are combined from all three surveys, though this section highlights mainly two parts from customer satisfaction survey report. The first part describes participant profile such as how many customers participated in survey and from which regions. The second part describes participants profile and their position in their organisation.

Figure 18 below shows the participant profiles in the customer satisfaction survey 2013.



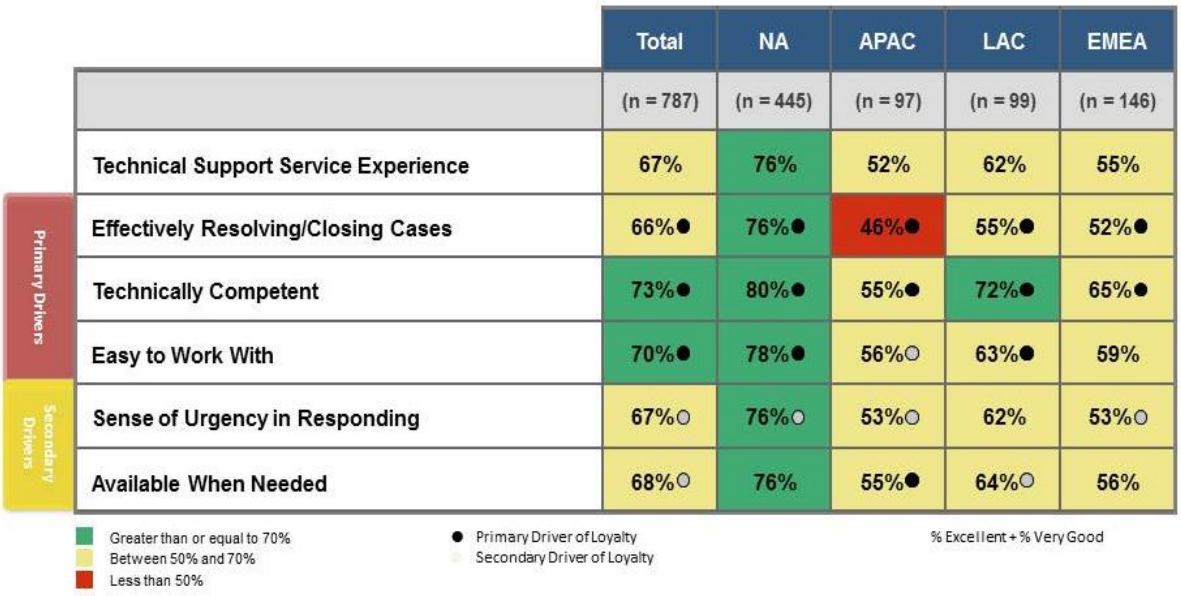
	Invited	Responded	Response Rate
Total	**8129**	**1944**	**24%**
NA	5632	1215	22%
LAC	749	202	28%
APAC	526	182	35%
EMEA	1222	344	28%

Figure 18. Participant profiles in the customer satisfaction survey (Customer satisfaction survey report 2013).

Figure 18 displays the profile of the participants in the customer satisfaction survey in 2013. The survey was conducted in all regions the case company operates in, such as North America, Latin America, Asia and EMEA region. Most of this survey requests were sent to the North America region as the region represents a total of 63% of the overall case volume. People at different levels of decision making participated in the survey. Survey results show that the people who work directly with the case company products (such as operation staff, engineering staff and managers) responded most actively to the survey. In 2013, survey participation was highest in the APAC region, followed by 20% from the LAC region.

The second part of customer satisfaction survey reports the result for technical support evaluation. The results are divided by regions focusing on what customer say about technical support quality of support services in each region.

Figure 19 displays the results of the technical support evaluation by region.



		Total	NA	APAC	LAC	EMEA
		(n = 787)	(n = 445)	(n = 97)	(n = 99)	(n = 146)
	Technical Support Service Experience	67%	76%	52%	62%	55%
Primary Drivers	Effectively Resolving/Closing Cases	66%●	76%●	46%●	55%●	52%●
Primary Drivers	Technically Competent	73%●	80%●	55%●	72%●	65%●
Primary Drivers	Easy to Work With	70%●	78%●	56%○	63%●	59%
Secondary Drivers	Sense of Urgency in Responding	67%○	76%○	53%○	62%	53%○
Secondary Drivers	Available When Needed	68%○	76%	55%●	64%○	56%

Figure 19. Technical support evaluation by region (Customer satisfaction survey report 2013).

Figure 19 shows the findings of the technical support evaluation by regions. The survey was divided into six main sections. The first four sections are described as the primary drivers of loyalty, and the last two sections are described as the secondary drivers of loyalty. The primary drivers represent the core skills needed for the customer support service. The secondary drivers are considered as essential soft skills for the customer support service.

The first section enquired about the overall technical support service experience. If the customer has reported feedback as excellent or very good, it is shown as the green color. If the rating is given as good or fair, it is shown as the yellow color. Poor rating is shown as the red color. It is evident from Figure 19 that the support service experience of the customer can be improved as most of the customers across regions has rated services as good or fair, except for the North America region.

The second section of this survey enquired about the effectiveness of the support team in the case resolution and case closure. Customers in the APAC region rated effectiveness as poor and the improvement actions clearly need to focus on that region. Other regions such EMEA and LAC also need improvement, except for the customers from NA has given good rating for the case resolution and case closure.

The third section of this survey enquired about the customer perception of the support person and their technical competency. Based on the results, the case company customers perceived the support staff as technically competent. The APAC region needs to improve the results in this aspect as only 55% of the customers in APAC think that the case company staff is good or fair in their technical competency.

The fourth section of this survey enquired about the customer impressions of working with the support staff. A total of 70% of the customers stated that support the staff are easy to work with. APAC showed the lowest rating here, with only 56% customers rating them as good or fair.

The fifth section of this survey enquired about the sense of urgency in responding to customer needs. Only 67% of total customers rated case company services as good or fair at it. This numbers goes lower to 53% in APAC and EMEA. This aspect could also be improved.

The sixth section of this Survey enquired about the availability of the service support when needed. Based on the results, the case company seems to be quite effective in this respect, since about 68% of the customers think that the support staff is available when needed.

Summarizing the results from the customer satisfaction survey in 2013, it can be concluded that, overall, customer perception about the support services falls into good or fair category. The case company support services can be further improved, by identifying bottlenecks in these areas, especially focusing on the APAC countries where customers have major concerns.

4.4 Analysis of Performance Reporting Tool KT & Remedy

Another important source of data in the data from the performance measuring tools used in the case company such KT and Remedy. KT is a Kepner Tregeo tool which is used to streamline the information flow between the teams, while Remedy is used for case tracking and SLA monitoring. The sub-section will first overview the total numbers of cases received in 2013 and then analyze how many cases are failing to meet SLAs, especially in the fault resolution time (FRT).

Figure 20 illustrates the total number of cases divided by the type of products in 2013.

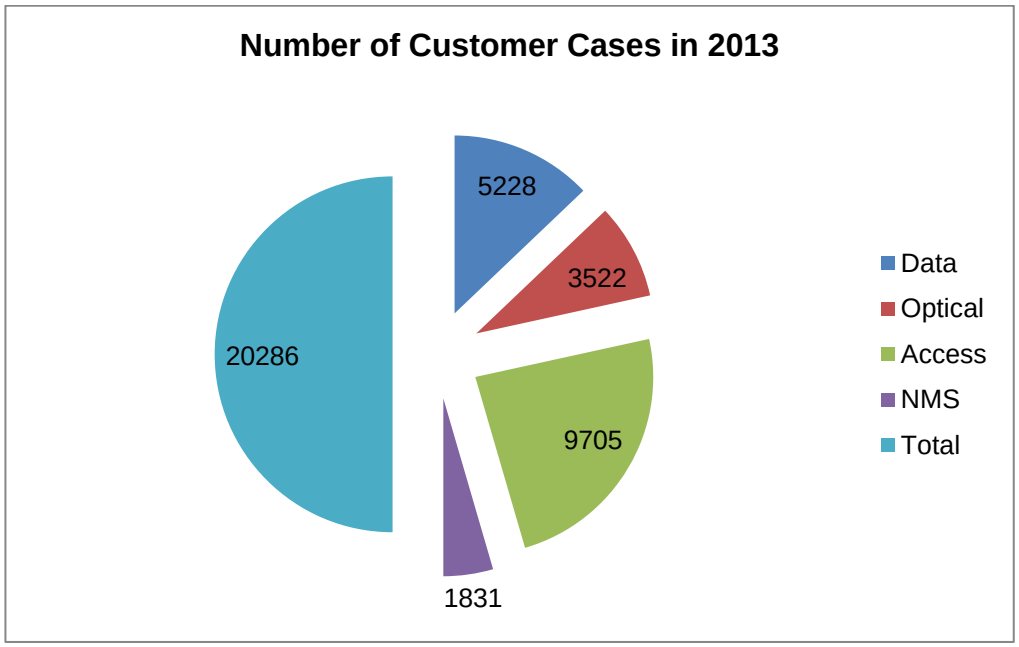


Figure 20. Total case numbers by products in 2013 (Customer satisfaction survey report 2013).

Figure 20 provides an overview of the number of cases reported by customers for year 2013. As seen in Figure 20, there was a total of 20 286 cases created in 2013. The data from the performance measuring tools confirm that the case company has a considerable flow of cases coming from customers for resolution. Among them, the access products received the biggest number of cases with 9,705 total cases created. This figure confirms that the area where the most improvement should be focused in is made of the services for the access products. Access products can be described as products which deliver phone, internet, video and data services to consumers home. Data and optical products built the next major portion of the overall cases for year 2013.

Another important result is gained from the data on the cases breaching SLAs. Figure 21 illustrates the fault resolution time and the cases breaching SLAs for 2013.

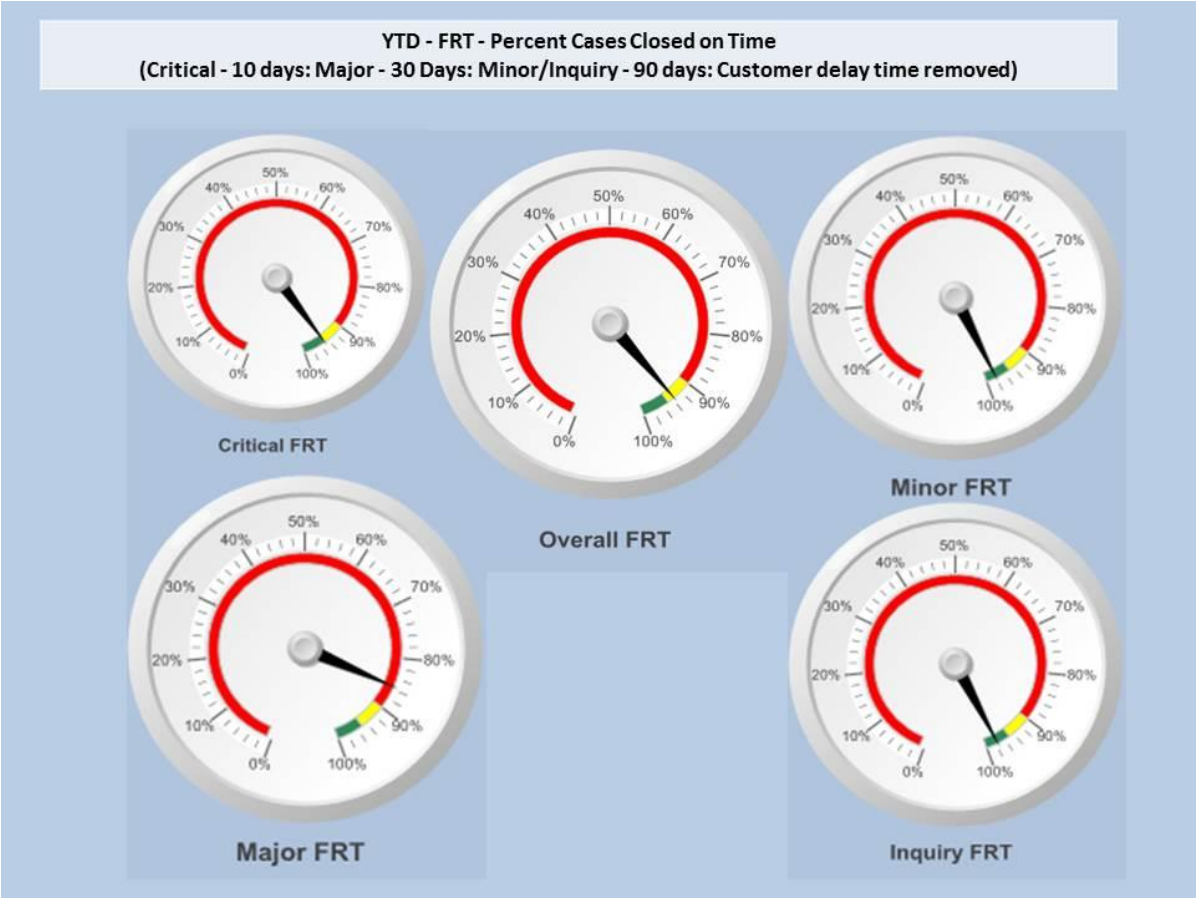


Figure 21. Field resolution time (FRT) for the cases in 2013 (KT performance report 2013).

Figure 21 illustrates the periods for FRT per service level agreement with customers. For Critical cases, FRT makes 10 days and for Major cases 30 days. For Minor and Inquiry cases, FRT is stipulated as 90 days. For the purposes of this calculation, FRT of all the delays, due to the customer own reasons, are deducted from the overall FRT calculation.

Figure 21 also shows the percentage of cases which were closed on time in 2013, per each case category. Data from Figure 21 confirm that the case company is not able to meet service level agreements in 100% cases. Critical cases are meeting SLAs in only 95% of cases; Major cases meet SLAs in 85% of cases; and Minor and Enquiry cases meets SLAs in around 98% of cases. Overall, SLAs for all cases with the case company are met in about 92% of the total number of cases, which makes a major cause of concern. Exceeding the time limitation in SLAs is causing considerable losses of revenue and affects the company reputation with the customers.

4.5 The Current State Map of Case Handling Process

This section provides the overview of the current case handling process based on the current state analysis conducted with the Kaizen Lean process method. Lean process terminology and methods are explained in more detail in the theoretical section of this thesis.

Figure 22 illustrates the current state of the case handling process.

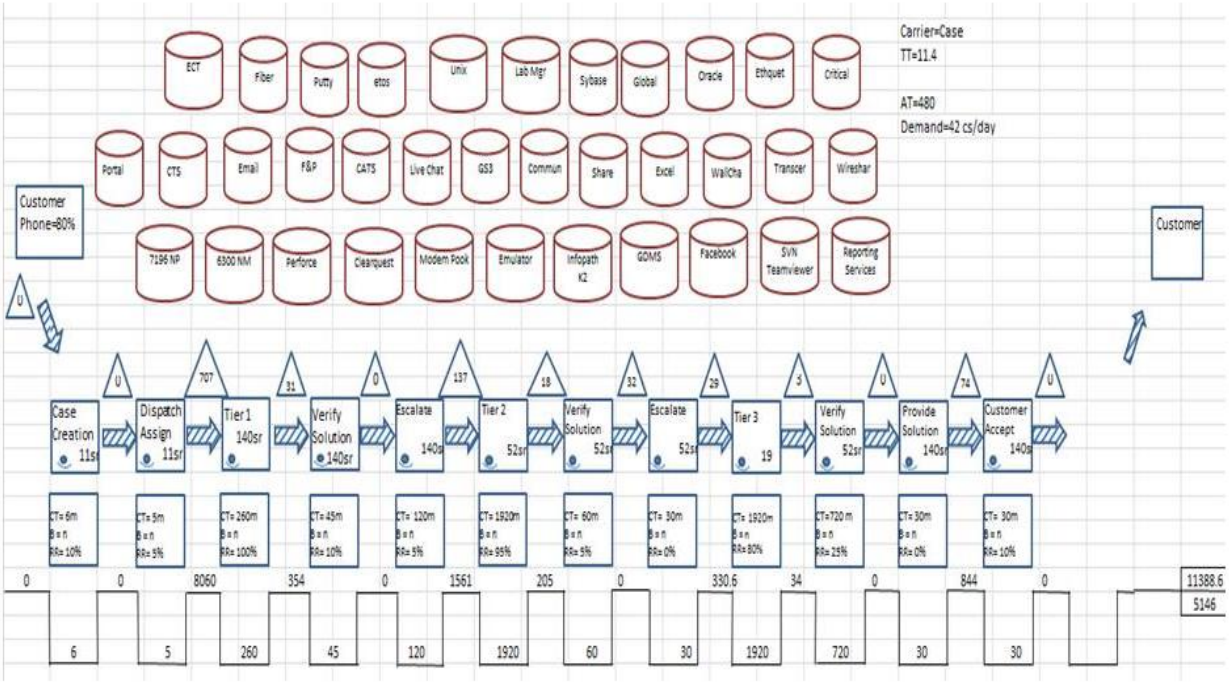


Figure 22. The current state of the case handling process. (Case company Lean Kaizen Event 2014).

Figure 22 illustrates the current state of the case handling process in the case company. The current state analysis begins with the case entering the support organization and ends with the cases getting closed. Detailed explanation of the current state analysis is provided below.

The data from 2013 was studied for the current state analysis and mapping the life cycle of the case handling process. These data represented such information as the total number of customer cases came to the case company and the time that each of those cases took for their resolution. There were three major parameters selected for the analysis of the case handling process. The first parameter is called the cycle time. The cycle time represent the total time used by a person for actual work on the case. The

second parameter was batching. Batching was used to check if any person waited for a batch of cases before the work actually started on the case. The third parameter was the rejection rate. The rejection rate displayed the percentage of rejection at each step when the person receiving the case needed to send the case back because the provided information was incomplete, inaccurate or was in a form which cannot be used.

The current state analysis established, first, that various tools are used in the case handling process by all the departments in the customer support organisation. The tools involved are the software tools used in customer support organisations such as the case reporting tool software “CTS”, databases such as “Oracle and Sybase” and operating systems used such as Unix or Windows etc. Second, all the teams involved in the customer case resolution process were identified such as Tier1, Tier2 and Tier3 teams.

Further on, for the current state analysis, quantitative data were collected from the customer case tracking tool database of the case company from the year 2013. The customer case tracking tool called CTS provided the data on the total number of cases which came to the case company in the year 2013. The case resolution time was studied for each case. CTS data also provided information about the delay at each layer of the support organisation such as Tier1, Tier2 and Tier3. Delay is described as a dead time when there is no actual work on the case is performed, and the case is waiting for some information either from the customer or between the teams working on that case. Qualitative data was also collected from the discussions asking for valuable inputs on the cycle time and the rejection rate from the representatives of support teams. Based on the inputs from the discussions and the data gathered from the tool, possible bottlenecks were identified and improvement suggestions collected. The findings from the current state analysis are discussed below.

4.6 Findings from the Current State Analysis and Areas for Improvements

Based on the results from current state analysis key bottlenecks were identified which can be described in to mainly six points. The *first* key bottleneck identified was rate of rejection. Rate of rejection can be described as information received is incomplete, inaccurate and cannot be used. This was creating a lot of waste and ideal time in support organisation resulting in to delay for customer case resolution time. The second key bottleneck identified was cycle time which can be described as actual time spent

on a case work was quite big between support teams. The third key bottleneck identified was Tier1 teams working in isolation such as not sharing work load or lab resources with other support teams such as Tier1, Tier2 teams in organisation. The *fourth* key bottleneck identified was customer not creating cases using web based tools for case management. The sixth key bottleneck identified was there are too many software tools used in company such as each department using its own set of tools related to case management.

The improvements on the current state map were also identified in the LEAN Kaizen process.

Figure 23 illustrates the bottlenecks and improvement areas found from the analysis and mapping on the current state of the case handling process.

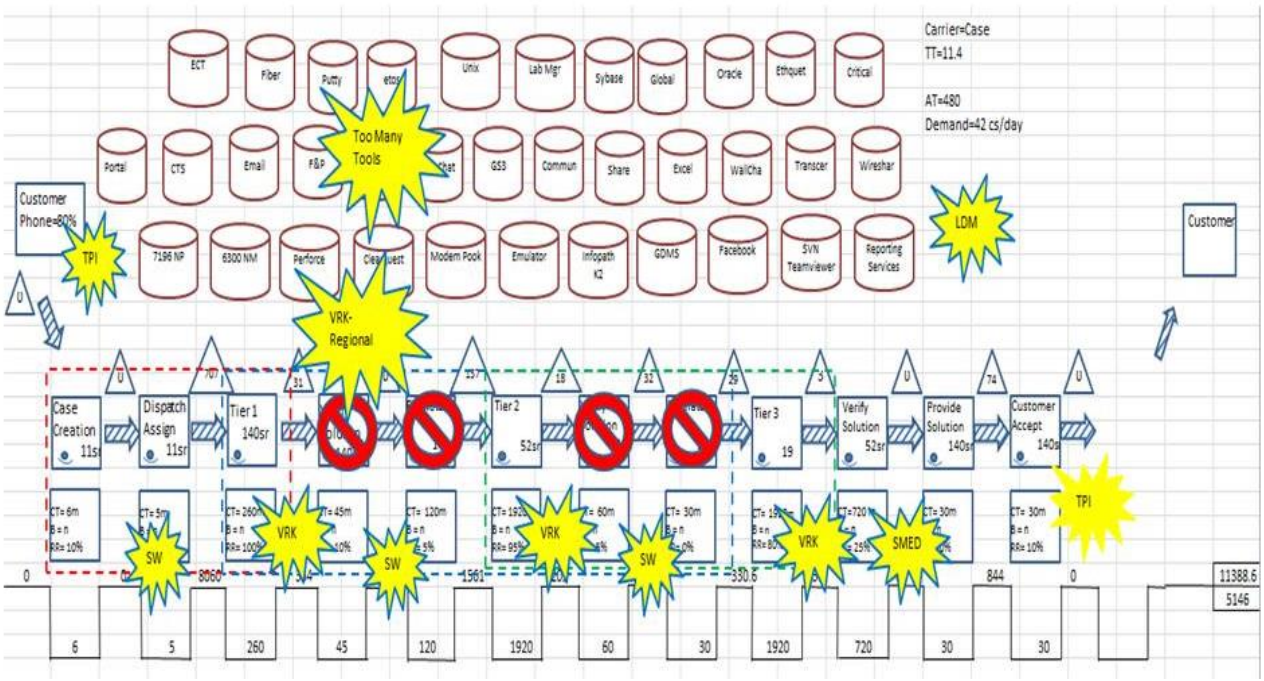


Figure 23. Improvement areas found from mapping the current state of the case handling process (Case company Lean kaizen event 2014).

Figure 23 presents the bottlenecks in the current case handling process identified based on the data from various sources utilized in the current state analysis. Figure 10 also identifies the areas for improvements, including the re-work on the high reject rates, over-processing, transportation (hand-offs), as well as improvements needed in the set-up and solution testing stages. The main six improvement areas shown in the map in Figure 23 are specified below.

The first improvement area identified was the rate of rejection for cases. The rate of rejection was described as sending a case back to the customer or support team because the information provided in the case was inaccurate, incomplete or in a form which could not be used to start the actual work on the case. The rate of rejection between the customer and Tier1 team was found to be 100%. This means that each time that the customer reports a case to the case company, a Tier1 engineer needs to request for more information for the case problem details or logs. This was identified as a key bottleneck adding considerable delays to the case resolution time.
For example, Tier2 engineer from EMEA in interview expressed this as follows:

> *"Almost on 90% of cases, we need to request basic information such as which product HW and SW version have reported problem. Case investigation cannot be started without such basic information. This kind of basic information should be provided as a minimum info while case escalation".*

For example, Tier3 engineer from Data and NMS unit expressed this as follows:

> "*Quite often problem description in case is not accurate or not in detail to understand how investigation should be started. We need to always request Tier1 and Tier2 to be very specific which unit has a problem, what is the problem, what is the impact of the problem etc. This creates delay and waste to start actual work on the case".*

The rejection rate was found to be 100% for case escalation between Tier1 and Tier2 teams and 80% between Tier2 and Tier3 teams. The high rate of rejection for the case information flow between the support teams and customers was identified as a key element adding delay to the case resolution time.

The second Improvement area identified was as a big cycle time used for case resolution between Tier2 and Tier3 teams. The cycle time is described as a total amount of time used for actual work done on a case.

For example, Technical support manager from ASIA expressed as follows:

> *"It takes long time to get answers from Tier2 once we have provided all required inputs. It is not acceptable to wait for days to get a response from Tier2, while customer is chasing us on hourly bases for update".*

It was found that Tier 2 team's average cycle time to work on a case was 1 920 minutes or 4 days. Tier2 teams explained the long cycle time by the complexity of the problems escalated through Tier1 teams which need problem reproduction and verification in Tier2 labs. The cycle time for a case with Tier3 teams was identified as 720 minutes or 2 days per case. The long cycle time for case handling with Tier3 was explained by the time needed to build a fix and test the software. The long cycle time for case handling by Tier2 and Tier3 teams was adding considerable delays for faster case resolution for customers, and this area requires improvement.

The third improvement area identified was as Tier1 teams working in isolation. Currently, Tier1 teams only handle the cases with direct customers as they are working on the cases coming only from their local region. There are more than 30 Tier1 teams across the globe. There are many expert level engineers with many years of experience with the case company products are working in Tier1 team. Their skills, however, are not being utilized in other parts of the support organisation due to the current organisation structure. This concern was raised by almost all technical support managers.
For example, Technical support manager from NA region expresses as follows:

> *"We have a serious issue of resource sharing with Tier1 teams. We have seen while Tier1 team struggles with lot of cases in our region and lack of lab resources, Tier1 teams in UK and USA do not help with case work of our region and it is difficult to get their lab resources".*

The Tier1 teams have very good labs in their regions, with many expensive tools and products. These labs are the currently reserved only for the use by local Tier1 teams. The other regions could be struggling for good labs and tools but currently Tier1 teams do not share their labs across the organisation.

The fourth improvement area identified was the case creation process currently used in the case company. The data from Remedy tools suggested that 80% of the cases were created by a phone call and only 20% of the overall cases created using a web tool.

The 80% cases coming through phone is forcing the case company to maintain call centres in USA, Europe and Asia. Thus, if customers created more cases using a web tool, call centres cost could be reduced.

The fifth improvement area identified was the knowledge sharing practices between the support teams. It was found that Tier1 teams works in isolation and do not share their knowledge from cases with other Tier1 teams. This lack of knowledge sharing is also evident between Tier2 and Tier3 teams. This was raised as a common concern by Tier1 and Tier2 engineers in Lean event.
For example, Tier1 engineer from Mexico expressed this as follows:

> *"It seems we are working in still on old ways, we do not have a common SharePoint for example to share our experience and knowledge with other support teams"*.

The case company does not have a common forum tool where support engineers could ask a question or ask for help and extend their knowledge on product and design from the global team. This is causing more cases to be created between Tier1 and Tier2 teams, which cost money.

The sixth improvement area identified was the excessive number of tools used in the case company. During interviews it was pointed by many support engineers and managers that organisation is using too many software tools creating rework.
For example, Technical support manager EMEA expressed as follows:

> *"Organisation is using different tools for support and R&D units for case handlings; it creates lot of re-work and communication gaps for interaction between support and R&D team. The software tool used needs to be streamlined"*.

It was found that currently different support teams use different tools in the case handling process. Using different tools create problem with the information flow between the support teams. For example, the information shared with an email was lost in the customer case database. The case company pays a huge fee for licenses and maintaining all the different tools, which adds as cost to the support organisation.

To summarize the results from the current state analysis, it was identified that the rate of rejection is adding especially considerable re-work and time in the case resolution process, and this area needs immediate improvement. The rate of rejection was identified as a major problem causing delays, so that this particular waste will be targeted in this thesis. The results of the current state analysis led to the development of a proposal to reduce rate of rejection between the support teams which will be discussed in subsequent sections. Figure 25 illustrates analyse the process according to the logic of Lean six sigma method.

The second and third section of this study such as data collection and review of best practice is mapped to *measure* phase of Lean six sigma method of process improvement. Figure 24 illustrates Lean six sigma DMAIC *Measure* phase.

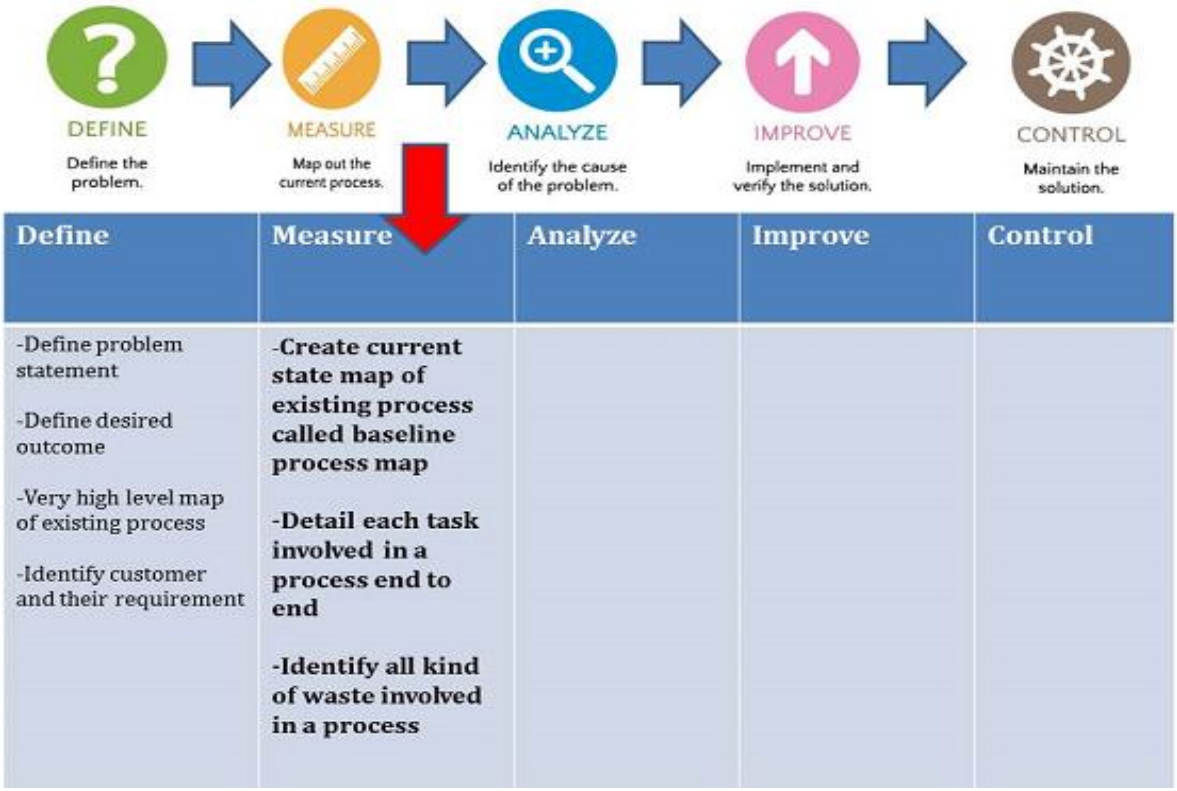


Figure 24. Lean six sigma D-M-A-I-C processes (Ramly et al. 2012) applied is this study.

As displayed in Figure 24, Sections 2 and 3 of this study analyzed data collection results from the interviews, performance reports, Lean six sigma event and merged them with the findings from literature review and best practice for mapping the current state of the existing processes and identifying waste.

5 Building and Proposing Solution

This section builds the proposal to reduce the rate of rejection identified as a key bottleneck in the current customer case resolution time. First, this section examines the current rate of rejection based on the current state analysis and literature review. Second, it identifies possible causes of rejection. Third, this section examines ideas on how to reduce the current rate of rejection. Fourth, it proposes a template that could help in reducing the current rate of rejection. Finally, this section ends with a discussion on what problems are expected to be resolved with the proposed template, and validate the template with the company experts.

5.1 Current Rate of Rejection

The rate of rejection represents the number of cases rejected due to the information in the technical communication flow being inaccurate, incomplete or in a form that cannot be used. The current state analysis has identified rate of rejection as a key bottleneck in the case life cycle. The case life cycle can be described as life of the case which begins when customer creates a case and ends with the customer accepting the case closure with the proposed resolution. As described in Section 4.9.2, the rate of rejection is considered as an over-processing waste (Alukal and Manos 2006), or in other words, as non-value-added activities which add no value to the product or service, from the customer point of view. The current state analysis stressed that the case company support organization is built as a layered structure with the technical communication flow between the layers such as Tier1, Tier2 and Tier3. A high rate of rejection was identified mainly at three levels in the case company support organization such as Tier1, Tier2 andTier3 levels.

The first rate of rejection was found to be at 100% for the cases coming from the customers to the case tracking system. Every time the customer created a case with the case company, it was rejected on the ground that the initial information provided in the case, to start working was inaccurate or incomplete. As a result, the case work could not be started, and more information was requested to understand the problem statement. This adds the first round of delay for the actual case resolution.

The second rate of rejection was identified to be at 100% between Tier1 and Tier2 teams. Each time a Tier1 engineer escalated the case to a Tier2 engineer, the case

was rejected on the ground that the information received with the escalated case was inaccurate or incomplete. Moreover, Tier2 interviewees mentioned that a Tier1 engineer does not typically provide them with the complete information on the problem analysis already done at Tier1 level, and the logs needed for an investigation for Tier2. This request for product specific logs and information on specific problem details creates lot of delays to start the actual work on the case, thus severely affecting the overall case resolution time.

The third rate of rejection was identified to be at 80% between Tier2 and Tier3 teams. The interviewees from Tier3 team mentioned Tier2 team does not always provide the problem reproduction step list for the cases where the problem was reproduced in Tier2 labs. It means that the logs and information needed to work on the case are not provided correctly at the time of the case escalation to Tier3 team.

5.2 Causes for Rate of Rejection

In the current state analysis, the study investigated possible causes for the high rate of rejection for technical information shared on a case. These causes for the high rate of rejection were divided into four main areas.

The first identified area causing the high rate of rejection is the customers not being aware what information and logs are required at the time of the case creation. The case company uses Remedy tool for case creation which requires customers to fill in some basic information about the problem statement, the product and the location of the site where the problem is observed. There is no help, however, which could guide the customers what information and logs are needed for describing a product problem at the time of case creation with the case company. The customer first creates a case with the most basic information about the problem. The case is assigned to an engineer who then asks for the needed information and logs specific to the problem area before he can start working on that case. This causes 100% of the first rate of rejection. Subsequently, Tier1 engineers may need to ask many other rounds of information to understand the problem statement before they can start working on the case.

The second identified area causing the high rate of rejection is the fact that Tier1 engineers do not have in-depth product knowledge for all the supported products to know what information must be provided for successful case escalation to Tier2 Teams.

There is currently no single template or a process guide which can provide information on what specific details should be added to each case before starting the case escalation from Tier1 to Tier2 teams. Each Tier1 engineers provide information for the case based on his knowledge of the product. As a result, Tier2 teams need to ask for specific information on the problem and the product logs to start the actual work on the case.

The third identified area causing the high rate of rejection is the fact that Tier2 engineers are not aware what information Tier3 teams needs for successful case escalation from Tier2 to Tier3 teams. The interviewees from Tier3 pointed out that many cases escalated from Tier2 teams relate to the already known problems and can be found from R&D database. There is no process, however, which ensures that Tier2 team has checked the R&D database for the already known problems before the case escalation to Tier3 team. Tier3 team also pointed out to the lack of process that would ensure that Tier2 team has tried to reproduce the problem in the lab before the case escalation. As Tier2 team can reproduce the problem already in the lab, this information would help Tier3 team to faster provide a fix for the escalated case. Thus, it was identified with the interviewees from Tier1, Tier2 and Tier3 teams that the major share of time in case resolution is spent on identifying the problem. Once the problem is identified, building a solution is fast.

The fourth identified area causing the high rate of rejection is the lack of the case summary at the time of case escalation between the support teams. The Remedy case creation and escalation tool does not currently provide a brief summary on the case work done since the case creation or at the time of case escalation. Cases are first created by the customer and worked on by Tier1 engineers. The case could then be escalated after a few days of investigation from Tier1 engineers. Once the case is escalated to Tier2 or Tier3 engineers, they have to read all the case notes to understand what has been investigated so far. These case notes contain all communication information shared so far, and could make many pages of raw data. Moreover, it was observed in the analyzed case reviews that the same information was asked repeatedly from the customer and between the teams.

5.3 Ways to Reduce High Rate of Rejection

Based on the causes for the high rate of rejection identified in the current state analysis, and the knowledge gained from the literature review, Lean Six Sigma implementa-

tion, and suggestions from the stakeholders, the following ways to reduce the high rate of rejection could be suggested.

First, the customers need to be educated on all the information required for successful case creation. The customer should be aware that all the required information at the time of case creation helps in a faster case resolution time for customer cases. Customers should have templates which would guide them on all the required information for case creation. These templates should be made to address all the case company products, for example, Template A for product X, Template B for product Y. This will help to reduce the current rate of rejection from the cases coming from the customers.

Second, the case escalation process should be streamlined between the support teams. Information shared with case escalation should be organized in a brief, readable format with all the needed information to start working on the escalated case immediately. The escalated case should have a clear product and problem description, and provided with all the investigation information done so far on the case.

Third, it should be ensured that all engineers facing customers try to resolve cases at their level. Cases should be allowed to be escalated only after completion of certain checks, such as local Tier1 or Tier2 engineers have to check the R&D database for a solution to the problem that can be already known. Tier2 engineers should try to reproduce the problem in their lab and then provide a complete list of steps on reproducing the problem, with the necessary lab set up details, information and screenshot clearly demonstrating how the problem was reproduced.

Fourth, the case escalation process should use only one escalation tool across the organization, so that all the support engineers working on the case during the case life cycle provide accurate and complete information about the case using the same tool. This should help in streamlining technical information for case handling and case escalation.

5.4 Case Escalation Template

To reduce the high rate of rejection in the case company and improve the case resolution time for customer cases, this study suggests a template for technical communication between the support teams based on the conceptual framework of this study.

Based on the current state analysis and literature review, technical communication template is designed and presented below.

Figure 25 illustrates the sample Case Escalation Template.

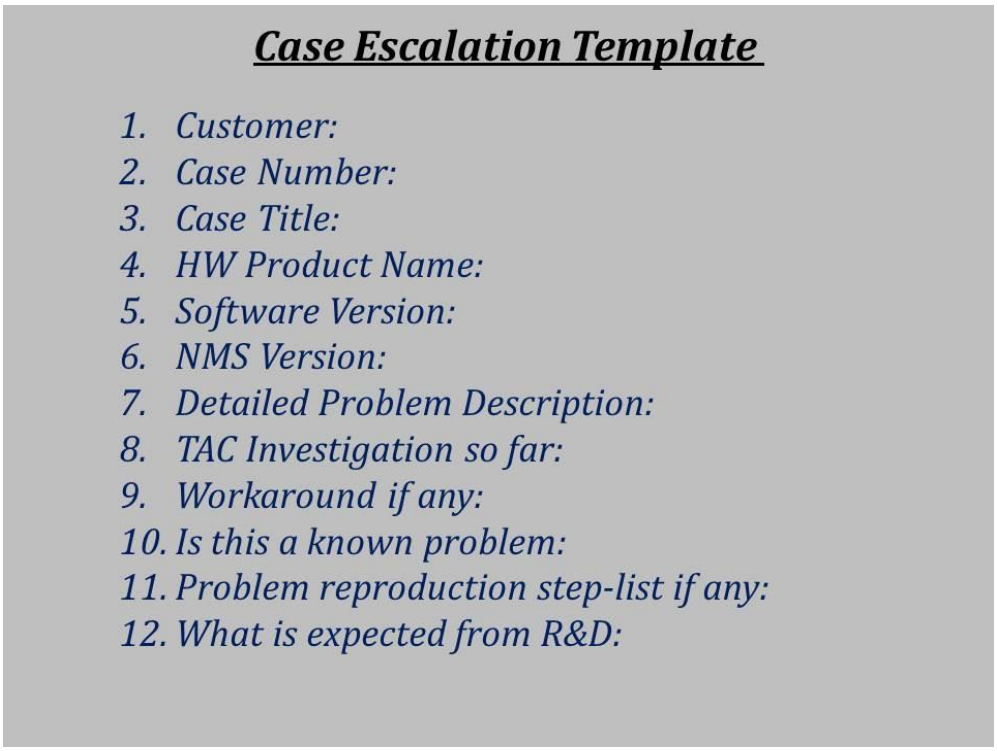


Figure 25. Content of the case escalation template.

As seen from Figure 25, the proposed case escalation template provides a brief summary of the case at any stage of case life cycle in case escalation process. The information provided by the template starts from the customer and problem description up to the possible highest level of case escalation to the R&D team.

Thus, the proposed case escalation template aims to provide information about the problem which would be accurate, complete and in a form that could be used to start work on the case immediately.

The case escalation template is divided into twelve main sections. These 12 sections are further explained and provided with examples below.

Section 1: Customer: ABC Telecom Inc.

Section 1 of this template provides the key information about the Customer (name). This information helps the case handling person to know which customer case is being

escalated. It is significant because Tier2 and Tier3 teams can prioritize work on the escalated cases with the customer who has strict SLAs, such as 10 days SLA to resolve Major cases and 3 days SLA to resolve Critical cases. In the given example, Section 1 provides information that the reported case is from customer ABC Telecom Inc.

Section 2: Case Number: CS00456789

Section 2 of this template describes the Case Number. The case company receives thousands of cases each year for different product lines. Each case is given a unique number by the case tracking tool such as CTS or Remedy. In the given example, Section 2 provides information that the reported case number is CS00456789.

Section 3: Case Title: Network Management does not detect serial number of new added 9800 cards

Section 3 of this template describes the Case Title. Case title provides information about the problem statement. Case Title is initially written by the customer while creating the case. Case Title is changed by Tier1 team along their investigation, if they find the actual problem not matching with the initial case title. This helps Tier2 and Tier3 teams to establish the correct problem area. In the given example, Section 3 provides information that the problem reported relates to the network management system, and this problem is specific to adding new cards to 9800 box.

Section 4: HW Product Name: 9880 series router

Section 4 of this template describes Hardware Product type. This section provides information on what hardware product series demonstrates this problem. This section should provide detail information about the correct Hardware model where problem is observed. In the given example, Section 4 provides information that the problem relates to hardware router series 9880.

Section 5: Software Version: SW-9.1.0.1_GA20_131114.1213

Section 5 of this template provides information about the software version running on a hardware box. This information is critical to know for verifying existing bugs or problem reproduction in lab. Case company customers could be running different version of software in their network so this information becomes very critical for case investigation. In the given example, Section 5 provides information that the hardware box 9880 series router is running software version “SW-9.1.0.1_GA20_131114.1213”.

Section 6: NMS Version: TNM 4.0 SP2.18 & TNM 5.0SP2

Section 6 of this template provides information about the Network Management system software version used in the customer network where the problem is reported. The customer reports a problem for the product if the feature of the product is not working as designed. Only when the problem is investigated it could be found if the problem relates to the product hardware or the problem is with network management system. Since the case company customers are running different version of network management system, it is very important to know the combination of the Hardware box and the version of the software running on that hardware box, as well as which network management system software version is used in the case where problem is reported. In the given example, Section 6 provides information that the network management system used for the reported case is “TNM 4.0 SP2.18 & TNM 5.0SP2”.

Section 7: Detailed Problem description: Adding new units to 9800 nodes does not show up unit serial number in the database. As a result of this web reporter tool cannot show these serial numbers

Section 7 of this template provides information about detailed problem description. The initial case title in Section 3 only provides the most basic information about the problem statement provided by the customer. This section explains the problem in greater detail and moves from the initial case investigation to narrow down the problem area to point to what product specific function or module is not working. In the given example, Section 7 provides information that the web reporter is not showing serial numbers because of adding new units to 9800 box which results in not showing the serial number in the database. This information guides the support engineers to investigate the cause such as why 9800 new added cards do not show the unit serial number in the database, instead of investigating why the web reporter tool is not showing the unit serial numbers.

Section 8: TAC Investigation so far:

- *Tested problem exist also in TNM 5.0 SP2 and SW-9.2.0.3*
- *Problem is consistent with all 9800 nodes*
- *Problem is only with new added units serial number after first discovery of node with NMS*

Section 8 of the template provides information on the investigation done by a Tier1 engineer before the case escalation to Tier2 team. If the template is used for case es-

calation to Tier3 team, this section provides information on what has been done from Tier2 before the case escalation. This section gives a quick summary on the case investigation and findings. Next team working on the escalated case can read this information and plan next actions for the case investigation. In the given example, Section 8 provides information that the problem is consistent in nature and relates to all 9800 series hardware boxes. The problem is also specific to the newly added cards. The problem is reproducible in TAC lab, and they have created a detailed step-list on the problem reproduction. This section of the template also ensures that the initial case investigation is done by Tier1 or Tier2 teams, so that the case cannot be escalated before the initial case investigation is completed.

Section 9: Workaround if any: Workaround is available. Workaround is nasty, we need to reboot whole node causing traffic outage

Section 9 of this template provides information on the workarounds available. Workaround is described as a method to achieve the desired functionality or feature without fixing the actual problem. In the given example, Section 9 provides information that the workaround is available but the Hardware box is need to be power reboot which could cause traffic outage for the customer, so the customer might not agree to the workaround. If the customer agrees for a reboot of the hardware box, this workaround can be applied to provide a temporary solution until the actual problem is investigated and fixed.

Section 10: Is this a known Problem: R&D database checked no known problem found

Section 10 of this template provides information if Tier1 or Tier2 engineer has checked the R&D database for the existing known problems. It is necessary to do since the problem identified with a hardware product or network management system with one customer may sometimes be observed with other customers using a similar hardware product or network management system. In the given example, Section 10 confirms that the R&D database was checked, and the reported problem was not found to be a known problem. This information confirms that the reported problem is a new problem or bug which might need a fix.

Section 11: Problem reproduction step-list if any: Problem is reproduced in TAC lab and following steps are created how to reproduce this problem

Section 11 of this template provides information if problem can be reproduced in technical center labs. If the problem is reproducible, a detailed step-list is required to be sent with the case escalation. This section of the template ensures engineers' engagement in finding the root cause of the problem and the reproduction steps. It is significant since it was found with Tier2 and Tier3 engineers that most of the case resolution time is spend on the problem reproduction in TAC labs. Once the problem is reproduced, it helps Tier3 or R&D engineer to understand the problem and find a fix and resolve the case.

Section 12: What is expected from R&D: Please confirm if this a bug and provide fix

Section 12 of this template provides information on what is desired from R&D on the escalated case. For example, Escalating Team such as Tier1 or Tier2 could inform R&D if the customer would need a temporary workaround or patch quickly, and if a permanent fix would be coming in the later versions of software or hardware releases.

A sample of the filled in case escalation template is provided in Appendix 3.

5.5 Benefits of Using the Case Escalation Template

The proposed template aims to resolve several main problems in the case handling process which cause the biggest delays in the case resolution time. The four problems which are expected to be resolved with proposed template and identified as waste in literature review are described below.

The first problem this template helps to resolves is to streamline and gather all the required information for a customer case so that work can be started on the case immediately after case escalation from Tier1 to Tier2 team. The current state analysis identified that the rate of rejection for case was at 100% when the case was escalated from Tier1 to Tier2. The case escalated with all the required information filled in the template will also reduce the rate of rejection at the time of case acceptance at Tier2 teams from Tier1 teams.

The second problem this template helps to resolve is getting more accurate information about the product hardware and software versions. Since the customers use a range of

product lines, and within these product line a range of different software and hardware versions, this information often adds to the high rate of rejection. This template makes it mandatory for all Tier1 engineers to verify and update all the hardware and software versions before escalating the case further. This accurate information is critical for successful case resolution prospective. If this critical information is not provided or accurate, this could result in a waste of time as rejection. Moreover, it may cause re-work as problems could be very specific to a certain software or hardware version, or a combination of both, such as the product hardware version X has a problem with software version Y.

The third problem this template helps to resolve is the information shared in a summary format to the next level of escalation. Presently, the Remedy tool as the case company customer case tracking software does not provide a brief accurate summary of the case. For example, a Tier1 engineer could work with a case for days before escalating it to higher levels such as Tier2. During Tier1 engineers work there can be tons of case notes and logs attached to the case. It is challenging for Tier2 engineers to read all the case notes and analyze the logs to know the current status of the case. This template helps to provide a summary of the case for faster case escalation. The template section “TAC investigation so far” briefs the engineers on all the actions done so far to resolve the case. This information gives a head start to understand what should be the next action needed to resolve this case.

The fourth problem this template helps to resolve is ensuring that Tier1 and Tier2 teams have verified the R&D database for the problem being not known. If Tier1 and Tier2 teams can identity that the problem is already known, it can save a lot of time for case investigation.

5.6 Validation with the Case Company Experts

Technical case escalation draft template was sent to senior experienced engineers in Tier2 and Tier3 teams for review and comments via email. Email was sent to a total of five engineers such as three Tier2 engineers in two Tier3 engineers working with data, optical and NMS products. They were informed that a new case escalation template could be used for case escalation in the case company support organization. They were asked to review the draft template and provide further inputs what information would they need from Tier1 teams for case escalation to reduce the rate of rejection for

the escalated cases. Feedback from five engineers was received, and their inputs were used to further modify the case escalation template, some of the received key inputs are described below.

Tier 3 engineers provided the following input to add a detail problem statement filed in template.

> *"Tier1 and Tier2 engineers escalate case with the same case title which customer has written. It is found that customer writes very generic case title. It will be good if Tier1 and Tier2 engineers after initial investigation write a detail problem statement to clarify what is the real problem with case".*

Tier2 engineer provided the following related to adding a filed if Tier1 has checked R&D database before case escalation

> *"Many cases we received we find that the problem was already known. Tier1 engineers would have known it if they check R&D database for known problems. Problem escalated to Tier2 which is already known is a waste of time and resources for organization and customers".*

These comments and feedback from Tier2 and Tier3 engineers were collected via email, and the template was improved based on them. The first draft was corrected, and Action plan was added which is described in Section 6 below.

Summing up the results of Section 5 from the Lean six sigma point of view, this stage corresponded to the Analyze phase. It included the brainstorming done to find the solution for identified bottleneck in the current state analysis. The high rate of rejection was identified as a key bottleneck and the solution to reduce it was identified as introducing the case escalation template in Section 5.

Figure 26 shows the stage of the service improvement process, according to the logic of Lean six sigma.

Define	Measure	Analyze	Improve	Control
-Define problem statement -Define desired outcome -Very high level map of existing process -Identify customer and their requirement	-Create current state map of existing process called baseline process map -Detail each task involved in a process end to end -Identify all kind of waste involved in a process	**-Identify pain points in a process** **-Examine whole process and find possible causes for pain points** **-Time analysis of tasks involved in a process** **-Value added analysis of processes** **-Analyze cause and effect of each task involved in a process**		

Figure 26. Lean six sigma D-M-A-I-C processes (Ramly et al. 2012) applied is this study.

As shown in Figure 26, this section belonged to the Analyze stage and it identified all key bottlenecks in the current process. It examined the whole support process and explored possible causes of bottlenecks. Time analysis was done and it revealed that, for example, Tier2 teams were taking 1920 minutes as a cycle time to resolve a case. The value added analysis confirmed the reason for rate of rejection was due to the lack of quality information shared between the teams. The cause and effect of each identified is also briefly described in this section.

The next steps in the service improvement process are discussed in Section 6 below.

6 Pilot Testing of Proposed Solution

This section discusses the pilot testing of the proposed Template for the case company for improving the customer case resolution time. This study utilizes action research method for continuous improvement. First, it presents the action research plan and then discusses how to plan, act and evaluate the template implementation in the case company.

6.1 Template Implementation in a Pilot

For implementing the case escalation template in the case company support organisation, this study suggested an action Plan which is based on the ideas derived in the current state analysis and the suggestions from the validation with the case company experts. The researcher of this study invited a meeting with TAC management in Espoo office and discussed template content and benefits of implementing template to reduce the rate of rejection in case escalation process. TAC management was happy with proposed template and decided in that meeting to perform pilot testing of template for four weeks including Tier1, Tier2 and Tier3 teams from EMEA, USA and ASIA region. This meant support organisations in these regions such as Tier1, Tier2 would use this template for all case escalations initially for four weeks and a feedback would be collected and analysed after four weeks of template use to measure benefits of using case escalation template.

To implement case escalation template the researcher of this study invited a meeting with the key stakeholders from Tier1, Tier2, Tier3 including the engineers and managers in the case company Global-TAC centre in Espoo, Finland, on February 13th 2014.The participants in this meeting pointed out a continuous improvement cycle to strength case escalation process to reduce rate of rejection. The best model for continuous improvement is action research cycle. Figure 27 illustrates the proposed action plan.

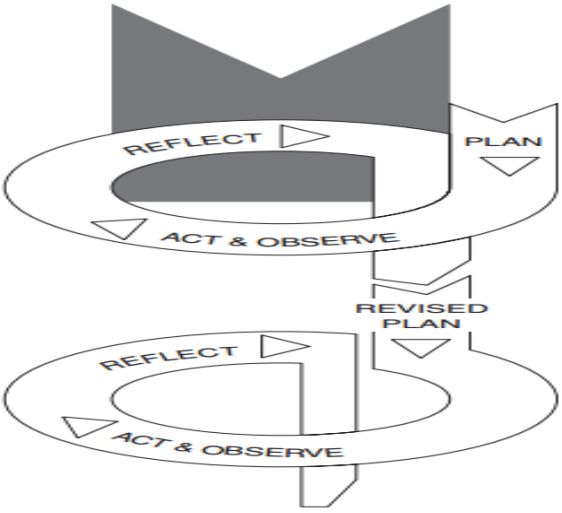


Figure 27. Action research spiral (Kemmis and McTaggart's 2000: 595).

As described in Figure 27, the action research cycle begins with a detail planning. The same logic is used for the Action plan for implementation of the case escalation template in the case company support organisation. The Action plan for the template implementation included four main parts. The first part is the *planning* stage. In this stage, it is planned which teams will be involved for pilot testing of template. Who will be project owner and how information will be communicated for template use. The second part is the *act & observes* stage. This stage is used for implementing and feedback for template. This stage identifies who will conduct feedback, feedback method and persons involved. The third part is *reflecting* stage. This stage deals with adding inputs to template to improve it. The final fourth part is *revising* stage which deals with continuous improvement and restart the cycle of implementing improve template, feedback, and continuous improvement of template.

As described by Kemmis and McTaggart (2000), the action research cycle will continue until all stakeholders improve the case escalation template to the point when it fits their needs and put it to regular use, or made it part of the tools used for case escalation in the case company.

6.1.1 Stage 1: Planning the Template Implementation

The planning for implementation of the case escalation template started in the meeting with the key stakeholders from Tier1, Tier2, Tier3 including the engineers and managers in the case company Global-TAC centre in Espoo, Finland, on February 13th 2014. A total of fifteen people attend this planning meeting. Outcome of this meeting can be

summarized in five major points discussed about template implementation such as time, location, responsibilities, stimulation and evaluation.

The first point discussed was *time* such as when to start pilot testing. It was decided to implement case escalation template between Tier2 and Tier3 teams starting on February 17th 2014. This meant that starting from February 17th 2014 all the case escalated to Tier3 from Tier2 can only be escalated using the case escalation template.

The second point discussed was *location* such as teams participating for pilot testing. It was decided that pilot test of case escalation template will be carried out with between Tier1 teams based in Europe, ASIA and USA and Tier2 teams. This meant that all case escalation from Tier1 teams based in Europe, ASIA and USA to Tier2 can be only done with the case escalation template. Tier1 teams in a few countries such as Brazil, Mexico, Nigeria and some others were not included in the first round due to the regional language other than English. It was decided that these teams may take the case escalation template in use at a later stage.

The third point discussed was *roles & responsibilities* to drive pilot testing of template. It was decided that local TAC managers will be responsible for driving case escalation using template in their teams. Tier2 and Tier3 engineers can escalate to TAC managers if they receive case escalation without the use of template. The researcher took responsibility of collecting feedback from Tier2 and Tier3 after template use of four weeks. Feedback was collected with en email survey and that data is discussed in data collection section 2 of this study.

The fourth point discussed was *stimulation* to ensure use of template for case escalation. It was decided to include the template into the performance target for using the case escalation template for employee's yearly performance appraisal. Performance target was set more than 95% of cases should be escalated using case escalation template to meet the target and 98% of cases should be escalated using case escalation template to exceed the performance target.

The fifth point discussed was *evaluation* taking qualitative feedback from Tier2 and Tier3 teams about case template after template in use for four weeks. The first round of feedback was planned to be taken on 17th March 2014 using email or phone to call identified key persons in Tier1, Tier2 and Tier3 teams. During the planning meeting, the

participants also discussed the questions for feedback collection. It was decided researcher of this study will collect feedback and summarize for TAC management by 20th March 2014. TAC management decided to review feedback to take future course of action with case escalation template.

6.1.2 Stage 2: Act and Observe

During this stage, the case escalation template was implemented on 17th February 2014 with Tier1 teams in EMEA, ASIA and USA region as planned for pilot test. Case escalation template was used for case escalation between Tier1, Tier2 and Tier3 teams for four weeks. The researcher of this study monitored case using case escalation template by verifying template is filled and attached to escalated cases coming to EMEA TAC centre. A feedback session was planned in the first meeting held on 13th February 2014. The feedback was collected by researcher by email on 17th March 2014, detail from interview is described in next section stage 3 under reflection.

6.1.3 Stage 3: Reflect and Implement Improvements

The case company has implemented the case escalation template in its support organisation in Tier1, Tier2 and Tier3 teams. After four weeks of implementation, the feedback was collected. On March 17th an email was sent to the key persons identified in the planning stage asking for a qualitative feedback on the case escalation template. A total of seven identified key persons were contacted in Tier1, Tier2 and Tier3 support teams, and the responses from five persons were received. The feedback asked for their responses to five main questions on the use of the case escalation template.

1. *Are you using the case escalation template for case escalations as discussed on February 13th in the support organisation meeting?*
2. *What is your feedback on the quality of information you have received with the case escalation template?*
3. *Does the case escalation template help you to provide information you need to start the case work comparing it with not using the case escalation template"?*
4. *What areas of improvement you would like to suggest for further improving the case escalation template?*

5. *Do you have feedback if the case escalation template affects your work in a negative way?*

The qualitative feedback received from five respondents can be summarized into mainly five conclusions based on the answers received.

The first conclusion is that all five respondents gave a positive response as for using the case escalation template for case escalation. The second conclusion was positive feedback on the quality of information received by using the case escalation template.

For example, Tier3 engineer expressed his views as follows:

> *"it is excellent to get case summary in a two pages sheet now rather than try to read fifty pages from case notes"*

For example, Tier2 engineer expressed his views as follows:

> "*Case escalation template is helping to do our job better as Tier1 engineers are now verifying known problems from R&D database and trying reproduction of cases in labs before case escalation".*

For example, Tier1 engineer expressed his views as follows:

> *"This template is guiding on what information to be attached for case escalation. Tier2 teams cannot complain about information not received from tier1 engineers" I would appreciate if a supplement document is created on how to fill all field of this template.*

The third conclusion from the feedback was that all ten respondents claimed that the case escalation template was more effective in communicating the case summary for case escalation than using the other tools, such as Remedy or IBM BMC software. The respondents further commented that the case escalation template gives them a quick summary and head on to start their case work and saves their time. It was also pointed out by some of the respondents that Tier1 and Tier2 teams are checking for known problems and reproduce problems in their lab before case escalation.

The fourth conclusion was that the respondents suggested a few Tier1 and Tier2 teams need more education on the importance of sending the case with the case escalation template and the opportunities for gaining quality information with the case escalation template.

For example, Technical support manager expressed his views as follows:

> *"It seems that Tier1 engineers in my team do not understand overall benefit of using case template to the organisation and how use of it can benefit Tier2 and Tier3 team, we should create more awareness about use and benefit of using case escalation template".*

To summarize the results of the first round of feedback on the implementation of the case escalation template, the findings were generally positive and the respondents confirmed that the template is helping them in their case work.

6.1.4 Stage 4: Revise for the New Cycle

The first round of feedback about case escalation template was very positive. Few improvement areas were suggested. The first improvement area suggested was to educate Tier1 and Tier2 teams on importance for case escalation template and what problems it solves. The second improvement area suggested was educating Tier1 teams and Tier2 teams for providing quality of information with case escalation template. The third area of improvement suggested was to create some sample help guide or template which provides information on all field on case escalation template explain what each field means and how to collect that information correctly.

To summarize the results of the pilot test for template implementation, the case escalation template was implemented in EMEA, ASIA and USA with Tier1, Tier2 and Tier3 teams, over four weeks. This pilot was planned in a meeting on February 13, 2014. The case escalation template came into use from February 17th to March 17th 2014 and the first round of feedback was taken on March 17, 2014 on the use of the template. The feedback was generally positive and also pointed to a few improvement areas, the main area being training in some teams and more communication on the importance of benefits from template use. The feedback was briefed to management and the management decided to start the implementation of the case escalation template companywide.

As for the stage in the continuous service improvement according to Lean six sigma approach, Section 6 of this study corresponds to the Improve phase lean six sigma shown in Figure 28 below.

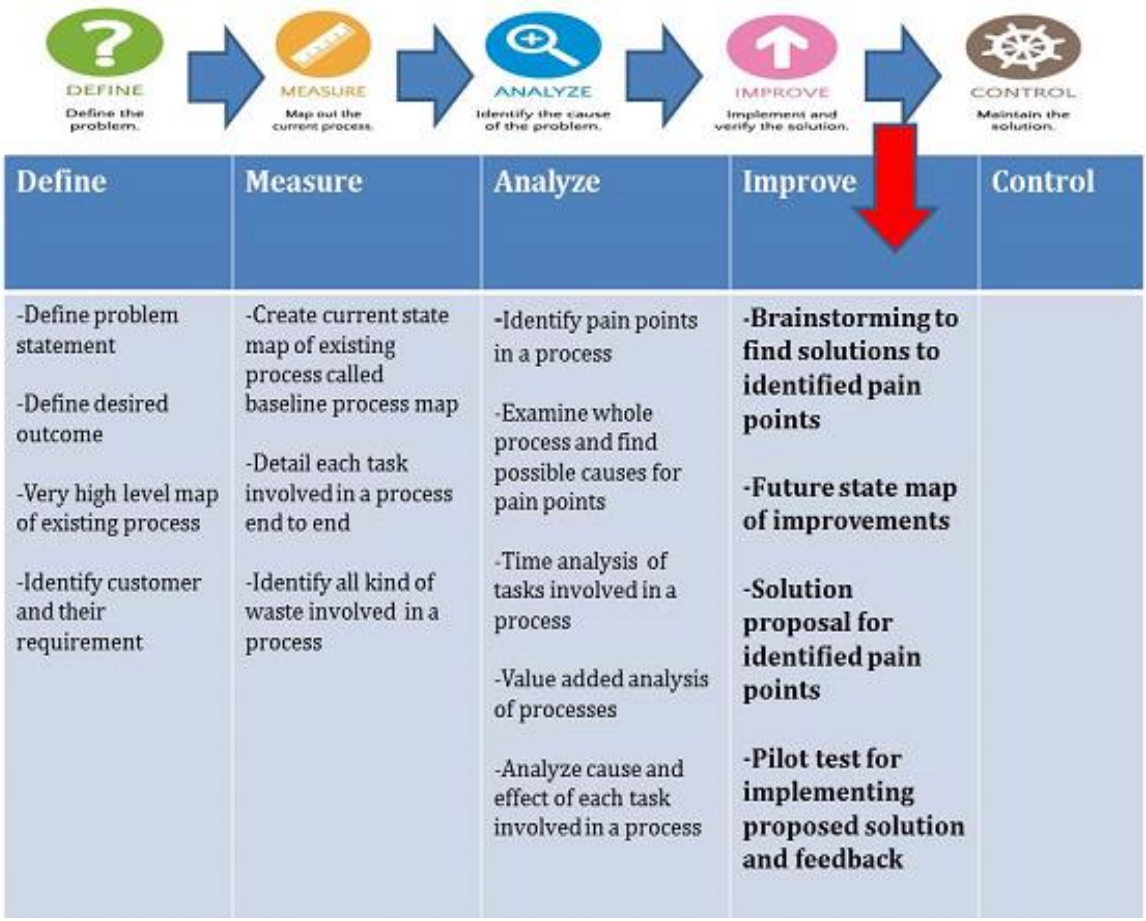


Figure 28. Lean six sigma D-M-A-I-C processes (Ramly et al. 2012) applied is this study.

As seen from Figure 28, the Improve phase of Lean six sigma corresponds to the pilot stage of the case escalation template. Section 6 dealt with a pilot test and collecting feedback after four week of template use in support organisations. Feedback confirmed that the information flow became better with use of the case escalation template.

6.2 Preparation for Template Implementation Companywide

Based on the results of the Pilot described in Section 5 and 6, the implementation of the improved template was decided to be started. The implementation of the template as it is, however, lies outside of the scope of this study. It will be accompanied by introduction of the template to the customers and training the customer and the staff for template use. This study ends with a general discussion on what makes the next stage in the template implementation and should be taken into account for it to be successful.

To prepare for the companywide implementation, the researcher of this study collected feedback to the case escalation template and briefed to EMEA TAC management on the results of the template pilot. Apart from the researcher, the local TAC managers from ASIA and USA communicated very positive feedback about template to EMEA TAC management and supported the suggestion to implement it companywide.

Based on this feedback, EMEA TAC management decided to continue use of the template as a normal practice with the teams in the pilot test and also start planning for the companywide implementation and taking steps to improve the template based on the received feedback. One key customer in Europe also shown interest in training his own staff for the use of template in order to improve quality of information sent from the customer for case creation. This customer has planned to send four of this staff member in June 2014 for training on the template use and also planned for other organizational steps in the template use. Thus, the companywide implementation will start with the regular use of the template it in local Tier1 teams.

Figure 29 below illustrates this final phase in the service improvement process which corresponds to the *Control* phase in lean six sigma process improvement.

Define	Measure	Analyze	Improve	Control
-Define problem statement -Define desired outcome -Very high level map of existing process -Identify customer and their requirement	-Create current state map of existing process called baseline process map -Detail each task involved in a process end to end -Identify all kind of waste involved in a process	-Identify pain points in a process -Examine whole process and find possible causes for pain points -Time analysis of tasks involved in a process -Value added analysis of processes -Analyze cause and effect of each task involved in a process	-Brainstorming to find solutions to identified pain points -Future state map of improvements -Solution proposal for identified pain points -Pilot test for implementing proposed solution and feedback	**-Measure success of pilot test** **-Create control to maintain the solution** **-Implement solution to whole organization**

Figure 29. Lean six sigma D-M-A-I-C processes (Ramly et al. 2012) applied is this study.

As seen in Figure 29, the final phase of lean six sigma process improvement phase is control. The *Control* phase will deal with maintaining the solution by measuring success of pilot test and create control in organisation to maintain the solution and implement solution to whole organisation. Although planning for this stage lies outside of the scope of this study, the improvement of the case escalation case will continue according to the steps described below in Section 7.

7 Discussion and Conclusions

This section summarizes the results of the thesis. This section begins with a brief summary of the thesis, then it discusses the managerial and practical implications and evaluates the proposed solution. Finally, this section discusses the reliability and validity of the thesis.

7.1 Summary

This thesis focuses on improving the case resolution time for technical support centers in a telecom vendor support organization. The case resolution time was needed improvement as the case company was not able to meet the case resolution time agreed in service level agreements with its customers.

The case company of this thesis is a telecom product vendor which provides product and support services to more than 500 customers spread across more than 100 countries in six continents. The need for improvement became obvious when the customer satisfaction survey for support services revealed that the case company was able to meet SLAs for only 95% of the overall customer cases it had received in the year 2013. This situation called for improvement since it is critical for the case company to meet SLAs for customer cases closure time.

The research approach applied in this thesis was action research. A proposal was made to resolve the key bottleneck identified as “rate of rejection for technical information flow between support teams” that critically affected the faster case resolution time. To address this challenge, the existing case resolution process in the technical support organization was studied based on the interviews, feedback and case company metrics. Additionally, a five day Lean six sigma event was arranged in the company headquarter in USA in which representatives from different support teams and regions participated to examine the current work process and discuss possible improvements for faster case resolution time. When the key bottleneck was identified, a meeting was called for planning on how to implement the case escalation Template and another round of feedback were taken from the key stakeholders in different support teams such as Tier1, Tier2 and Tier3 as for the suggested Template. The received data were analyzed and steps were taken to implement the identified improvements.

The findings from this analysis were used for a focused search for best practice in the existing literature. The review included investigation on what are best practice for the case handling process in a technical support organization. A review of the literature also included best practice for communication in support services and how Lean Six Sigma can be implemented in support service to achieve excellence in services.

The outcome of the thesis is a case escalation template to be used for case escalation between the support teams in the case company. The current state analysis and literature review confirmed that the rate of rejection in support teams for technical communication was about 100%. Rejection occurs when the information received is in-accurate, incomplete or in a form that cannot be used. High rate of rejection creates waste and re-work in the support teams. The idea behind the case escalation template was to reduce the rate of rejection in order to eliminate re-work and waste for improving case resolution time for customer cases.

The proposed case escalation template helps to organize and collect all relevant case information about an escalated case in a brief and precise summary. The template documents a detail problem statement describing the problem along with the correct version of hardware and software where problem is reported. The template also helps to document Tier 1 team investigation steps done so far before the case is escalated to Tier2. This helps Tier2 to understand what is being investigated already. This Template also ensures that the R&D database is verified for known problems to avoid wasting time and resources for investigating the already known problems when handing a case.

This study also implemented the proposed template in some support organizations. First, a planning meeting was held for implementing the case escalation template. Second, the pilot testing was done for four weeks including teams from EMEA, ASIA and USA. Third, feedback was collected from the users of the template after four weeks of the template use. Fourth, positive management feedback was received and it was decided to start companywide implementation of the new improved template based on the feedback received from the pilot.

7.2 Managerial Implications

The following managerial implications were identified during the course of this study as necessary to be taken into account when putting the Template into practice:

Management:

1. Make sure that the proposed case escalation template is strictly followed in the support organization.

   Local TAC managers need to be involved from all support teams such as Tier1, Tier2 and Tier3 and should drive the implementation of the case escalation template. A higher manager should assign a senior manager as a project lead on a management level who can help driving the implementation of the case escalation template in the organization.

2. Evaluate the quality of information in the case escalation template on a regular basis, and give and take further feedback on the case escalation template from Tier1, Tier2 and Tier3 teams.

   The company should assign a project lead for the case escalation template feedback and continuous improvement. Feedback should be planned on a monthly basis for the first year to take inputs from the support teams and improve the template.

3. Ensure using the case escalation template as a key performance goal in the employee's yearly performance targets.

   Use of the case escalation template should be made a must. This can be achieved by making a performance goal of using the case escalation template for all support engineers. For example, 97% of cases escalated with the template could be made a target achieved as above plan.

Employees:

1. Utilize the case escalation template for case escalation between the support teams.

   The case escalation template helps to streamline information for faster case escalation. It saves time of all support engineers involved in the case escalation process. All the support persons should use the case escalation template for faster case resolution time.

2. Ensure quality of information as part of the template.

   All the support persons should carefully fill all the fields of the case template to provide quality information for faster case resolution. The template guides how to fill in information with a sample attached as Appendix 3 in this study.

3. Give feedback on how to improve the case escalation template.

   Providing a good feedback will ensure improving the template. A good template helps every support person in handling cases better and resolving them faster. All the support persons giving feedback should use their experience to give inputs for developing the case escalation template further.

7.3 Evaluation

This thesis proposed a case escalation template which was developed and implemented during the action research study in the technical support organization. The evaluation of the outcome of this thesis was given in the final round of feedback taken on the proposed case escalation template by different support teams Tier1, Tier2 and Tier3. The received evaluation and feedback was very positive, and they claimed that this template has improved technical communication flow between the support teams. Literature review on ITIL framework in the case handling process and communication between support organizations for case escalation guided this study to generate ideas for template creation and how to improve technical information flow between support service organizations.

7.3.1 Outcome vs. Objective

The objective of this thesis was to improve the customer case resolution time of the case handling process in the case company. The current state analysis and literature review of best practice helped to reach the objective of this thesis. The research question for this thesis set was: How to improve the case resolution time for support cases for technical support centres?

The key bottleneck identified was the current rate of case rejection within the support teams. Rate of rejection was quite high due to the information received on the case being incomplete, inaccurate or in a form that could not be used. This problem was

identified in the technical case information flow between the support teams. As a result of research in this thesis, a case escalation template was proposed which was subsequently implemented in the technical support organizations Tier1, Tier2 and Tier3 in EMEA, ASIA and USA region. Very positive feedback was received from the support teams of the case company. The feedback confirmed that the case escalation template has helped to provide better technical information flow for case escalation through the case company support organisation, which helped to improve the case resolution time for customer cases.

7.3.2 Reliability and Validity

In the course of this study, reliability and validity were considered as described in Section 2.4 of this thesis. Section 2.4 discussed the key points of reliability and validity in research. These four points are discussed again in the context of this thesis.

Construct validity was ensured by drawing from multiple source of data such as key stakeholder interview, customer satisfaction survey reports, Kepner Tregeo performance reports, and Lean six sigma event held in the case company. Internal validity was ensured by keeping focused and pointedly finding answer to the research question identified at the beginning of the study. The researcher kept focused on the key question of the study throughout all the stages of research - the analysis of current state output, proposal building of the case escalation template and collecting feedback taken after the implementation of the case escalation template. External validity can be evaluated in terms of the proposed solution to be implemented and fitting other parts of organisation. The proposed and implemented case escalation template was already implemented in different support teams such as Tier1, Tier2 and Tier3, also based in different countries. By positive feedback from implementing the template in different support teams we can conclude that external validity was ensured. Reliability was ensured by following best practice identified in the literature review such as ITIL framework on the case handling process and communication between the support teams along with the review of LEAN six sigma DMAIC process for service improvement.

Strengthening validity for this study was especially targeted over the data collection stage - during the interviews, surveys and workshops, - by involving people from different support teams such as Tier1, Tier2 and Tier3 teams. Customer Account managers, project manager and key R&D persons involved in handling the customer cases were

involved and interviewed. Thus, the study represented the people from a wide range of departments from the customer service organisation, and also a wide representation was ensured to validate the findings and the proposed improvements with the key experts in the area.

To strengthen reliability, this study collected data from different sources by using various methods of data collection. For example, the interviews were conducted with Engineers and Support managers while other data are collected from the customer satisfaction survey. The data were also collected with the tools such as Customer Case Tracking tool and the KT tool. To further strength validity and reliability of this study, a brainstorming meeting was arranged involving representatives from all of the support teams to finalize the current mapping of the company's case handling process and identify the improvement areas. Involving people from diverse backgrounds such as engineers, developers and managers, as well as the representatives of the diverse teams such as Tier1, Tier2 and Tier3, and finally the team members for producing the improvement suggestions, was done to ensure a wide participation and avoid possible bias.

References

Aurich and Schweitzer, E. (2010). How to Design and Offer Services Successfully. CIRP Journal of Manufacturing Science and Technology. Vol. 2 (3), 136-143.

Alukal, G. and Manos, A, P. (2006). Lean Kaizen: A Simplified Approach to Process Improvements. ASQ Quality Press.

Berry, L.L. (1980). Service marketing is different. Business, Vol. 30(3), 24-9.

Carr, W. and Kemmis, S. (1986) Becoming Critical: Education, Knowledge and Action Research. London: Falmer.

Coghlan, D. and Brannick, T. (2001). Doing action research in your own organization. London: Sage Publications.

Cooper, R. and Schindler, P. (2003). Business Research Methods. 8th edition. New York: McGraw-Hill.

French, S. (2009). Action Research for Practising Managers. Journal of Management Development. Vol. 28 (3), 187-204.

Hesse-Biber, S. N. and Leavy, P. (2010). The Practice of Qualitative Research. 2nd ed. London: Sage Publications.

Koshy V. and Waterman H, P.(2010). Action Research in Health Service Business. London: Sage Publication

Kotler. P. and Armstrong, P. (2008). Principles of Marketing. 12th ed. New Jersey: Pearson Prentice Hall.

Miguel, P. A. and Monteiro, M. (2012). Benchmarking Six Sigma Implementation in Services Companies Operating in an Emerging Economy. An International Journal. Vol. 21(1), 62-76.

Motwani, J., Kumar, A. and Antony, J. (2004). A business process framework for examining the implementation of Six Sigma: a case study of dow chemicals. The TQM Magazine, Vol. 16(4) P. 273-283.

Murphy, A. P. (1997). Effective business communications. 7th edition. Mcgraw-Hill.

OGC (Office of Government Commerce). (2007). ITIL: Service Operation. London: TSO.

Panagacos Theodore, P. (2012). The ultimate guide to business process management. CreateSpace independent publishing platform.

Quinton, S. and Smallbone, T. (2006). Postgraduate Research in Business: A Critical Guide. London: Sage Publications.

Ramly and Yaw (2012). SIX Sigma DMAIC process improvements towards better IT customer support. *International journal of e-management*, Vol. 2, (5), 359-364.

Turban, E. and Lee P. (2004). *Electronic Commerce: A Managerial Perspective*. New Jersey: Prentice Hall.

Vargo, S.L. and Lusch, R.F. (2004). The Four Service Marketing Myths – Remnants of a Goods-based, Manufacturing Model. *Journal of Service Research*. Vol. 6 (4), 324-353.

Westbrook, R. (1994). Action Research: A New Paradigm for Research in Production and Operations Management. International Journal of Operations & Production Management. Vol. 15 (12), 6-20.

Yin, R.K, P. (2003). *Case Study Research Design and Methods*. 3rd ed. Thousand Oaks: Sage Publications.

Zeithaml, V., Berry, A., Leonard, L., and Parasuraman, A. (1988). Communication and Control Processes in the delivery of Service Quality. Journal of Marketing. Vol. 52 (4), 35-48.

Zairi, Mohamed (1997). Business process management: a boundaryless approach to modern competitiveness. Business process Management journal Vol. 3(1), 1-64.

APPENDIX 1.

Customer Satisfaction Survey, 2013

The case company TRANSACTION SURVEYS, 2013

Thank you for sharing your experiences and opinions about the products and services provided by the case company. In our quest to better serve the case company community, we have implemented an ongoing program to measure and act upon your feedback. We greatly value your comments about your experiences with us. This survey should only take 5 minutes of your time.

Please be assured that your responses will be used only by the case company and will not be shared with others.

Please base your answers on the most recent interaction you had with the case company. Please feel free to respond "Don't Know" and then move on to the next question.

Click the Start button to begin.

PLEASE NOTE:

To move forward or backward in the survey, use the "Next" and "Back" buttons at the bottom of each screen. Using your Internet browser buttons may cause survey information to be lost.

Select your preferred language: English, Japanese, Italian, Spanish, and Portuguese

INTRODUCTION

1. Recently The case company completed a Technical Support Request for you. Do you recall this specific activity with them?

❍	Yes	1
❍	No	2

PROGRAMMING NOTE: IF Q1=punch 1, continue. If Q1=punch 2, display thank you message and terminate. QUESTION IS REQUIRED; USE STANDARD MESSAGES.

OVERALL EXPERIENCE

PROGRAMMING NOTE: ASK Q2 IF SL_TRANSTYPE=REPAIR & RETURN (2), CREDIT COLLECTIONS (3), DEPLOYMENT (4), SUPPORT SERVICES (5) OR PROFESSIONAL SERVICES (7).

2. Was this The first time you have had this activity with The case company or have you had others?

❍	Yes, this was The first time for this activity	1
❍	No, I have had other experiences with this activity	2

3. Overall, how would you rate this experience with The case company Support Services?

Excellent **5**	Very Good **4**	Good **3**	Fair **2**	Poor **1**	Don't Know **9**
❍	❍	❍	❍	❍	❍

4. Based on this experience, what is your opinion about The case company support staff competency for case resolution…?

Improve Substantially **5**	Improve Somewhat **4**	Stay the Same **3**	Decrease Somewhat **2**	Decrease Substantially **1**	Don't Know **9**
❍	❍	❍	❍	❍	❍

CONTACTING THE CASE COMPANY

5. Now please think about the case company contact(s) you worked with primarily for this activity. How would you rate your experience in working with the case company Support Team?

Excellent **5**	Very Good **4**	Good **3**	Fair **2**	Poor **1**	Don't Know **9**
❍	❍	❍	❍	❍	❍

THE CASE COMPANY PERSONNEL

6. Overall, how would you rate being able to reach The case company to get assistance?

Excellent **5**	Very Good **4**	Good **3**	Fair **2**	Poor **1**	Don't Know **9**
❍	❍	❍	❍	❍	❍

7. Has your Technical Support Request now been completed properly and to your satisfaction?

❍	Yes	1
❍	No	2

8. Would you like someone from The case company to contact you about this?

❍	Yes	1
❍	No	2

CLOSING COMMENTS

PROGRAMMING NOTE: ASK Q26 IF PT_TRANSTYPE=REPAIR & RETURN (2), DEPLOYMENT (4), SUPPORT SERVICES (5), TAC (6), PROFESSIONAL SERVICES (7))

9. Based on your experience, would you use The case company again for Technical Support Services?

❍	Yes	1
❍	No	2

10. What could The case company have done to make your experience more positive?

Thank you for your participation! Your feedback is appreciated.

Please Note: All your survey responses have been saved. When you move to the next screen, your survey will be marked complete and you will not be able to re-enter.

If you have just been looking at the survey questions and have not entered your responses, please press the Back button at the bottom of each screen until you are returned to the initial screen with the Start button. Then click the Start button and move through the survey entering your responses.

Please press **OK** to close the survey.

APPENDIX 2.

Key Employee's Interview Questions.

The key employee's interviews for data collection were done with nine persons representing Tier1, Tier2, Tier3 teams and TAC managers. The questions in the interviews were designed to get qualitative feedback on the current support organisation operations. The interviews were conducted in English.
The interview questions are listed below.

1. What is your opinion/feedback about possible causes of not meeting SLAs in case resolution of customer cases in our support organisation?
2. What do you think is the most critical cause which is affecting our case resolution time, from your list of possible causes?
3. In your current team, how do you see the support you receive to complete your case work from the other support teams such as Tier1, Tier2 and Tier3 for case resolution on time?
4. What ideas you have on how we possible can improve the case resolution time as your organisation?
5. What is your experience/feedback on the current case escalation process in direct relation to your work?
6. What inputs or ideas you could suggest to improve the case resolution and case escalation process?
7. How do you see our current support organisation structure for our goal of achieving 100% SLA for customer cases?

APPENDIX 3.

Case Template: A Sample

A Sample of the Case Template to improve technical communication improvement between support teams proposed in the thesis.

Customer: Customer ABC

Case Number: CS00456789

Case Title: Network Management does not detect serial number of new added 9800 cards.

9800 FP version: SW-9.2.0.3 & SW-9.1.0.1_GA20_131114.1213

NMS Version: TNM 4.0 SP2.18 & TNM 5.0SP2

Detailed Problem description: Adding new units to 9800 nodes, does not show up unit serial number in database. As a result of this web reporter tool cannot show these serial numbers.

Workaround: Workaround is Nasty, We have to remove whole node from NMS inventory, create sub rack and rediscover node.

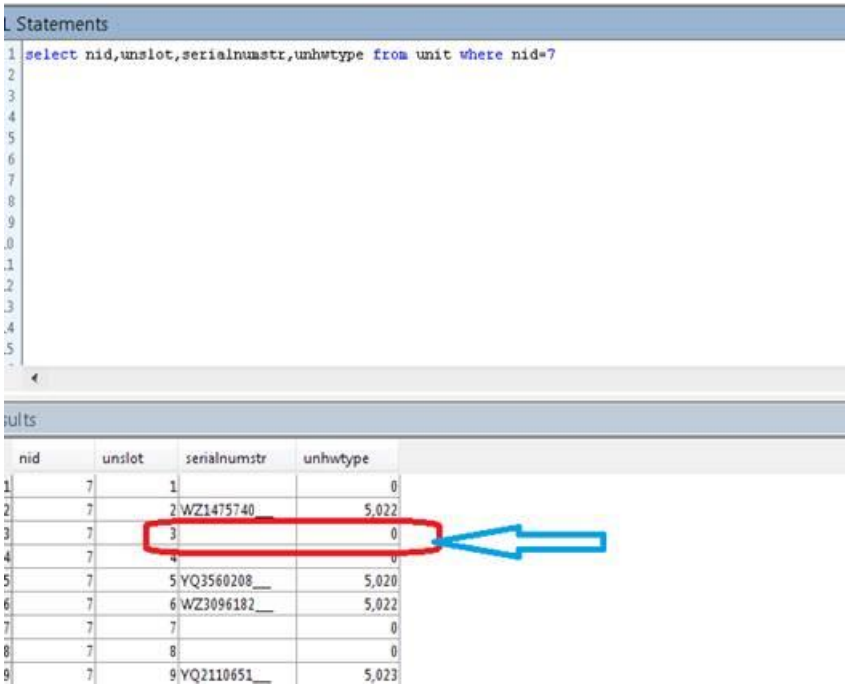
Similar Defect found: None found

TAC investigation:

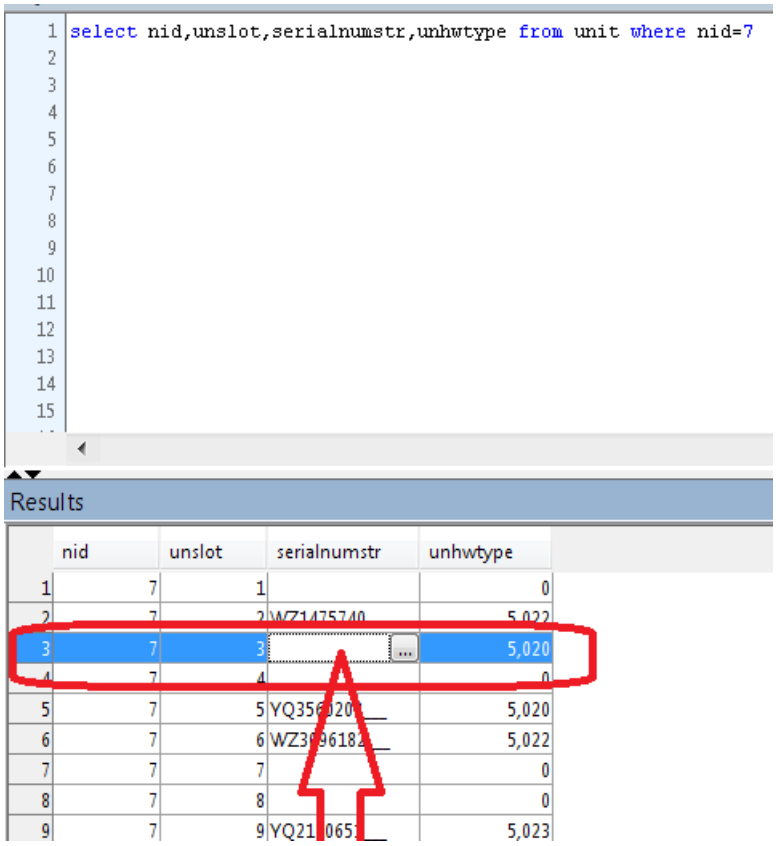
- Tested problem exist also in TNM 5.0 SP2 and SW-9.2.0.3
- Problem is consistent with all 9800 nodes
- Problem is only with new added units serial number after first discovery of node with NMS
- Problem is reproduced in TAC lab and following steps are created how to reproduce this problem
- Created step list for a workaround

Below, there is a guideline to show the case in a picture format.

Step 1: Take ISQL to check 9800 node slot 3 is empty

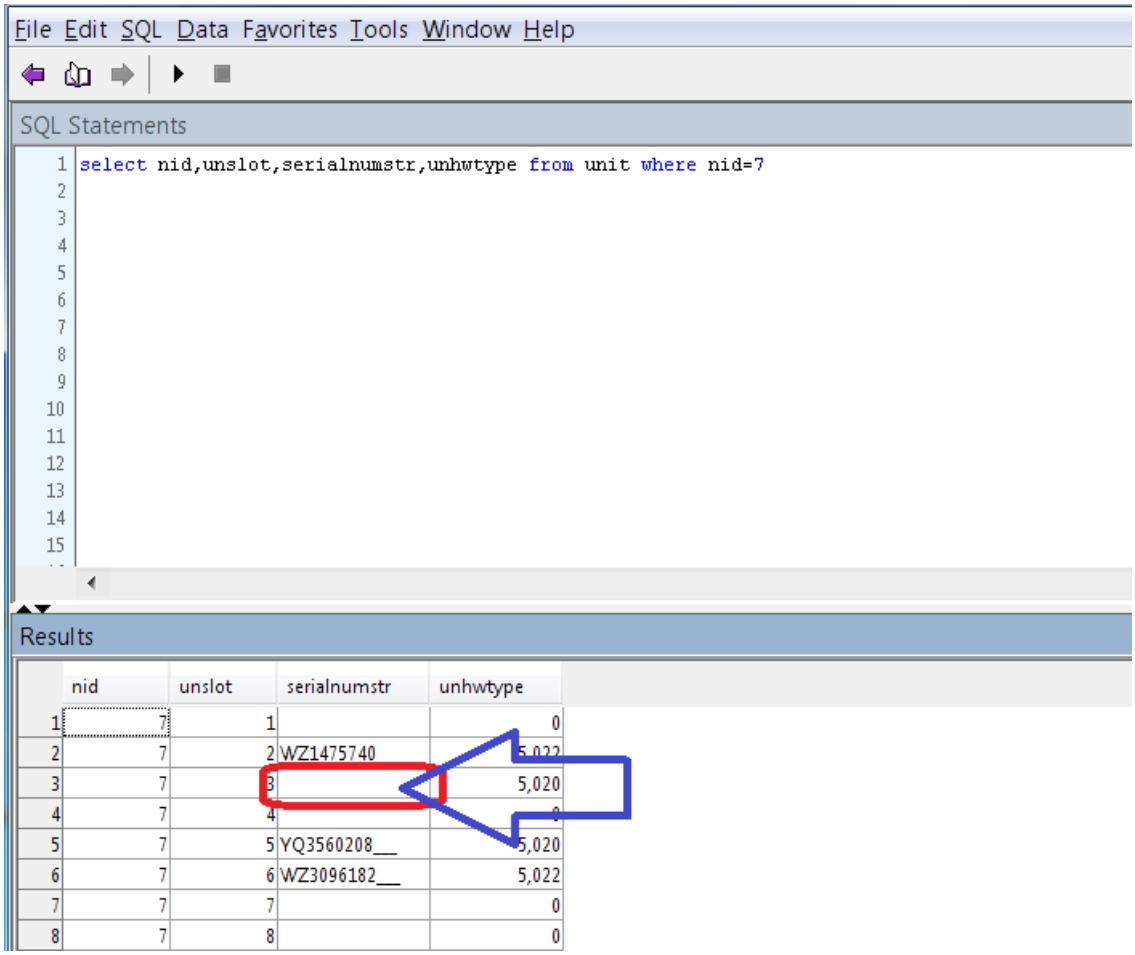


Step 2: Add a new unit to slot3 of 9840 node, check now with ISQL, unhwtype is detected but no serial number in DB.



```
Card Idx   Admin      OpSts   Conf Typ   Act Typ    Equip. State   Reset Mode
--------   -----      -----   --------   --------   ------------   ------------
1/1        disabled   down    none       none       empty          none
1/2        enabled    down    ULC-2      none       empty          none
1/3        enabled    up      ELC-1      ELC-1      plugged        none
1/4        disabled   down    none       none       empty          none
1/5        enabled    up      ELC-1      ELC-1      plugged        none
1/6        enabled    up      ULC-2      ULC-2      plugged        none
1/7        enabled    down    none       none       plugged        none
```

Step 3: Check if Resync ems inventory fix this issue, but this does not help



Step 4: Remove the node from NMS, re-add the sub-rack and rediscover now and check now if the serial number of the unit is updated in DB.