# Application of Six Sigma to Reduce Telecommunication Network Failures

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**SIX SIGMA** was first introduced by Motorola in 1986 as a quality improvement programme to reduce defects and improve cycle time, of which were triggered by the threat of global competition. The goal was to achieve the Six Sigma metric, which is equivalent to 3.4 DPMO (Defect Per Million Opportunities). Several years later, the success of the Six Sigma programme at Motorola led to its adoption beyond manufacturing by prominent companies from the financial services sector, the medical healthcare sector and many others. As a result, Six Sigma terminology has evolved from a metric to a methodology for a management system to drive business results.

Six Sigma can be defined as a systematic approach which focuses on improving business processes that can cause breakthrough results in higher customer satisfaction, organisational speed and reduction in the cost of doing business.

This article will show how the Six Sigma methodology was implemented to reduce telecommunication network failures with the main objective of enhancing customers' satisfaction towards their telecommunication services. Therefore, the Six Sigma approach was adopted to increase the network uptime by way of identifying and removing the causes of network failures and reducing the variation in the number of failures over time.

As we are living in an imperfect world, citing Murphy's Law that 'Anything that can go wrong, will go wrong', network failures tend to occur despite implementing highly reliable equipment or designing the network with multiple protections. To be the best in network quality, the culture of continuously improving the network needs to be adopted. This is where the Six Sigma can play a big role in improving the network quality continuously.

## SIX SIGMA METHODOLOGY

The Six Sigma methodology consists of five stages, namely:

Define → Measure → Analyse → Improve → Control

These stages are commonly known as DMAIC. The DMAIC methodology is the high level overview of the project stages, which include the preparation of the project until the result is achieved and continuously maintained. The methodology defines the specific tasks and actions to be executed at each stage. In short, the approach is systematic whereby the project needs to complete the tasks at each stage before moving on to the next stage.

To ensure that a project within a department or division can be completed successfully, the recommended duration for a Six Sigma project is between six months to a year, to avoid external factors from affecting the project completion such as organisational restructuring. To guide the team to achieve certain goals at each stage, there are various tools available which will be covered in the next few paragraphs.

### DEFINE - First Stage

Before any project can commence, it is crucial for the team leader to define the project thoroughly. This is similar to the planning stage. Some of the important information required are:

a) Business Case – to justify the objectives and benefits of the project in order to seek higher management's support and approval.
b) Problem statement – to explain the current problem and how it relates to the objective of the project.
c) Project Metrics – to show the current baseline (problem), the target (goal) and how it is going to be measured.
d) Project Scope – to explain what the project will cover (in scope) and what the project will not cover (out of scope). It is important to define the details at this stage to avoid any dispute once the project completes. This also helps the team to focus on executing the project which falls only within the defined scope and ignore the out of scope areas.
e) Project Plan – to define the duration and deadline of each stage (Define, Measure, Analyse, Improve, Control) and project closure. This helps the team to keep track of each activity and be aware of the period of each stage.

To guide the team leader in selecting the team members, a tool called SIPOC (Supplier, Input, Process, Output, Customer) can be very helpful.

#### • SIPOC (tool for define stage)

The purpose of SIPOC is to identify the end-to-end process in detail. In order to complete the SIPOC process, the team leader must be well versed with the related processes. The process must be described in detail, as much as possible,

*Table 1: SIPOC process to identify the relevant team members for the project*

| Supplier | Input | Process | Output | Customer |
|---|---|---|---|---|
| Customer | Telephone call | Escalation process | Case | Service Operations Centre (SOC) |
| SOC | Case | SOC Troubleshooting process | Case<br>Docket | - Closed (if resolved), or escalate to<br>- Network Mgmt Center (NMC) |
| NMC | Docket | NMC Troubleshooting process | Docket | - Closed (if resolved), or escalate to<br>- Field Operations (FO) |
| FO | Docket | FO Troubleshooting process | Docket | - Closed (if resolved), or escalate to<br>- Technical Support |
| Technical Support | Docket | Tech Support Troubleshooting process | Docket | Network Mgmt Center (NMC); docket to be closed |
| | | END | | |

from the start of the process until the process ends. In the case of network failures, the process of the network failing until the network is restored is referred. The SIPOC process for this project is shown in Table 1.

By identifying the 'customer' involved in the whole process, a representative from each section or department is chosen to be the team member. When applying the SIPOC process correctly, the team leader should be able to select the relevant team members with the right skills and knowledge.

## MEASURE - Second Stage

Once the Define stage has been completed, it is time for the team to collect the historical data to be used as a baseline. For this project, six months of data were collected. Due to the possibly enormous amount of data to be collected, the team must first agree on the standard measurement to be applied to ensure the consistency and accuracy of the data.

At this stage, a tool called 'Process Mapping' is used to describe the telecommunication service used by the customer from start to end. This tool guides the team in brainstorming possible failures at each step of the telecommunication service process. The team is now ready to move on to the next stage, Analyse.

## ANALYSE - Third Stage

This stage requires concentrated effort and participation from all team members to contribute as many ideas and as much energy as possible. Nevertheless, it also offers the most learning opportunities as many tools and methods are applied during this stage. Some of the main tools are:

a) Failure Mode Effect Analysis (FMEA) – a procedure for the analysis of potential failure modes within a system for classification by the severity and likelihood of the failures. This is where the experience and knowledge on network failures can help the team to predict and brainstorm on potential failures. The top of the list (based on Risk Priority Number) is transferred to the Root Cause Analysis (RCA). A sample of the FMEA guidelines is shown in Table 2.

b) Root Cause Analysis or RCA - a class of problem solving methods aimed at identifying the root causes of problems. As a guide in brainstorming the potential root causes, the most common method is utilising the Fishbone Diagram or Ishikawa diagram (shown in Figure 1). From the RCA, similar root causes might be identified from different types of potential failures (effects), which make it easier to solve fewer problems with fewer actions. Once the potential root causes have been identified, the next step is to come up with an action plan.

### • Quick-Win Implementation

While analysing the data for long term improvement, it is also possible to analyse the data to determine if any action can be taken immediately to reduce the network failure. One of the strategies employed for Quick-Win is to identify multiple network failures occurring repetitively at a particular location. A repetitive failure at one location is mostly caused by a single factor and the problem should be straightforward to tackle as the location has been identified.

## IMPROVE - Fourth Stage

Next, an Action Plan is designed to tackle the potential root causes from the RCA method. An important guideline is to define each action item based on the 4W1H (What, Who, When, Why and How).

*Table 2: FMEA guidelines*

| Process step (from 'Process Mapping') | Key Process Input | Potential Failure Mode | Failure Effect | Severity (1-10) | Potential Cause | Occurrence (1-10) | Current Control | Detectable (1-10) | RPN (Risk Priority Number) |
|---|---|---|---|---|---|---|---|---|---|
| What is the step? | What is the input? | What can go wrong with the input? | What is the effect on the output? | How bad? (1-good, 10-critical) | What are the causes? | How often? (1- rare, 10-frequent) | How are these found or prevented? | How quick can be detected? (1-fast, 10-slow) | Severity x Occurrence x Detectable |

It is recommended to brainstorm as many action items as possible, provided it is within control or authority, to ensure a high chance of success. From the list of action items, these are prioritised based on factors such as impact versus cost/time/resource and other criteria that are deemed important. This is to guide the team in executing the action plan effectively and efficiently, *e.g.* based on minimum cost, but which will create the biggest impact to meet the project's objective.

During the execution of Action Plan, an important critical success factor is to monitor the results after each action. Therefore, the team needs to collect data on regular basis and assess the effectiveness of each action.

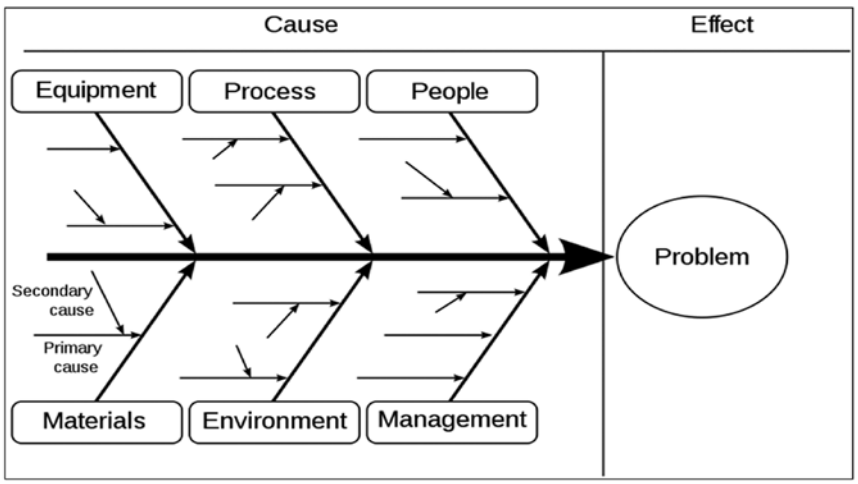



*Figure 1: Ishikawa diagram*

## CONTROL - Final Stage

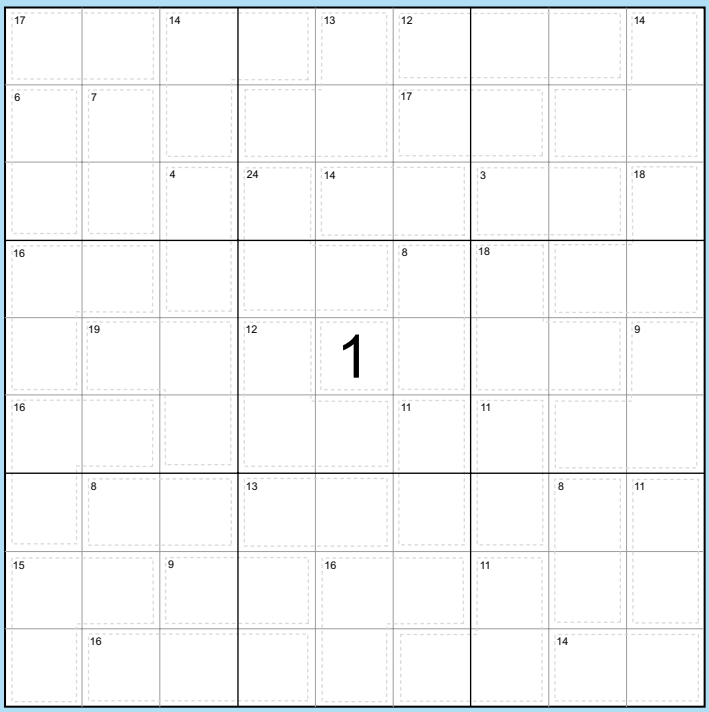
Once the improvement has been achieved from the action plan, the next important step is to maintain the gains. One method to control the result is called Statistical Process Control (SPC). It is a tool to observe variation and uses statistical signals to monitor and improve performance.

For convenience, a software application called Minitab is used during this stage. This software can perform statistical analysis on any type of data. While the Minitab can monitor any variation on the performance (*e.g.* within upper/lower threshold), it also helps to quickly detect and isolate any special cause or condition that affects the performance.

## CONCLUSION

The Six Sigma methodology has been adopted by many organisations to achieve superior improvement in business processes and performance. It has also enabled many organisations to achieve their objectives by providing various tools and methods in a systematic way.

Any organisation which intends to progress to a higher level should seriously consider implementing Six Sigma as it is not only about reaching the destination, but more significantly, it inculcates a culture of continuous improvement. ■




# 1SUDOKU

## Centerpiece "1'

**by Mr. Lim Teck Guan**

About the puzzle:

In this Sudoku variant, only 1 number is given as clue, thus the name 1Sudoku. The rest of the clues are given in the numbered cages (the dotted frame encompassing 2 or more squares). You are to search for the right combinations to fit the total for the cages and end up with a Sudoku Grid, the 9 by 9 composite of squares where there is no repeat of the number 1 to 9 in every Row, Column or Block.

Fill in the remaining 80 squares with single digits 1-9 such that there is no repeat of the digit in every Row, Column and Block. The number at the top left hand corner of the dotted cage indicates the total for the digits that the cage encompasses.

**For tips on solving, visit www.1sudoku.com.my**



*Answer is in the following pages of this edition.*