

# A CUSTOMIZED LEAN SIX SIGMA APPROACH TO REDUCE POSTPAID DATA DISCREPANCY BETWEEN IT SYSTEMS AND TELECOM SWITCH

*Mohd Adeel Shamsi,*

Research Scholar,  
Department of Business Management,  
Integral University, Lucknow, India

*Prof. Aftab Alam,*

Professor,  
Department of Business Management,  
Integral University, Lucknow, India

## ABSTRACT

*This article presents a process improvement study carried out at a major Indian Telecom service provider based on customized Lean Six Sigma methodologies. The DMAIC (Define, Measure, Analyze, Improve, and Control) project management methodology and various lean tools are utilized to streamline processes, reduce errors and enhance revenue. Data discrepancy between IT systems and Telecom Switch was analyzed before and after the DMAIC cycle. Data discrepancy between these systems was causing billing errors and activation delays. The results indicate that the data discrepancy reduced to 0.42% from 5.1%. This resulted in effective operations and revenue enhancement.*

**Keywords:** Lean Six Sigma, Postpaid Number Activation, Billing Errors, Revenue Enhancement

## INTRODUCTION:

Organizations worldwide are looking for ways to improve their management and operational processes in order to survive in the tough competitive market. Gharakhani et al. (2013) states that Quality Management has long been established as an important tool for achieving competitive advantage. The customer has taken the center stage and organization's ability to adapt to ever changing customer requirements has become extremely important for long-term success. To satisfy organizations' need researchers all over the world have been proposing strategies and tools like Total Quality Management, statistical quality control, zero defects, Total Preventive Maintenance, Lean and Six Sigma.

Pillai (2013) quoted Lean and Six Sigma are two systematic business process methods followed by organizations to successfully achieve increased value to customer by eliminating waste, variation and defects in organizational processes, products and services while saving time and cost without capital investment. Lean methodology aims to eliminate waste and maximize the customer value. It focuses on the flow of the entire processes rather than on the optimization of individual operations. Womack and Jones (2003) specified the main components of lean management system as follows:

1. Specify the values desired by the customer.
2. Identify the value stream for each product providing that value and challenge all of the wasted steps currently necessary to provide it.
3. Make the product flow continuously through the remaining value added steps.
4. Introduce "pull" between all steps where continuous flow is possible.
5. Manage toward perfection so that the number of steps and the amount of time and information needed to serve the customer continuously falls.

## LITERATURE REVIEW:

Six Sigma is a data driven methodology used to identify root causes for variations in a processes in order to achieve organizational excellence. Six Sigma management strategies require process improvement through identifying and fixing the root causes of the problem. Six Sigma follows a DMAIC (Define, Measure, Analyze, Improve, and Control) approach. Therefore, as Sampson (2004) states Six Sigma starts by analyzing defects and lean initial focus is on customer, process flow, and waste identifications. Therefore, both, Lean and Six Sigma together are proven methodologies that increase efficiency, effectiveness, quality resulting in continuous improvement to increase the customer value.

DMAIC is a systematic six-sigma project management practice inspired by Deming's PDCA (Plan, Do, Check, and Act) Cycle. The purpose of Define phase is to identify customers and their expectations from the process, map the process, define the project's goals and boundaries, identify the high impact characteristics or the CTQs (Critical to Quality) and, form the team. The Measure phase concentrates on defining and executing a systematic data collection plan for the key measures for the identified process. The Analyze phase tries to unearth the root cause of the problem i.e. the gap between current state and desired state by analyzing data collected during Measure phase. Solutions to fix the root causes identified are brainstormed during Improve Phase. Best fit solution based on available budget are piloted before mass rollout. The activities of Control phase can be summarized into two phrases – "Hold the gains" and "Spread the gains" i.e. preventing organization from going back to old ways and spreading the best practices and solutions implemented to other process areas and other operating units.

Lean Six Sigma have successfully optimized different performance measures both at manufacturing and service industry sectors. Over past few decades both Lean and Six Sigma have demonstrated that enormous improvements in cost, quality, and cycle time can be achieved by focusing on process performance. Linderman et al. (2003) mentioned that Six Sigma could be implemented to the processes of producing manufacturing goods, business trade, executive management, and services. Desai(2006) described how Customer Delivery Commitments were improved at an Indian Small Scale Industry using the Six Sigma way. Roberts(2004) pointed how Bank of America's Customer Loyalty got improved using Six Sigma Signals. Cheng (2005) discussed about enhancing the assembly efficiency of military products by application of Six Sigma. Bisgaard and Does (2009) discussed about reducing the length of Stay at a Hospital. Rucker(2000) explained how Citibank increased Customer Loyalty with Defect-Free Processes. Krishna et al. (2008) showcased the Implementation of Six Sigma in a Multinational Automotive Parts Manufacturer in India for productivity improvement. Mandahawi et al.(2011) described the application of Lean Six Sigma Tools to Minimize Length of Stay for Ophthalmology Day Case Surgery.

Hence it can be summarized that both Lean and Six Sigma methodologies have proven that it is possible to achieve dramatic improvements in cost, quality, and production time by focusing on process performance. In this paper, a customized Lean Six Sigma methodology is deployed at a major Indian Telecom Service provider to reduce data discrepancy between IT systems and Telecom Switch resulting in revenue enhancement. The two methodologies have been used as complementary to each other, wherein DMAIC's roadmap has been used as a general framework for process improvement and Lean tools have been embedded within these phases.

### **PROBLEM STATEMENT:**

The environment for the telecom service providing companies is very challenging these days due to cut throat competition, therefore companies are looking for systematic ways to attract customers to use their services by providing prompt services and attractive billing plans. Telecom Industry has two types of customers – Postpaid and Prepaid. Postpaid users are the ones who receive a monthly bill for the usage made throughout the month. Postpaid customers are high revenue generators for the company and hence are more important for the business. It is therefore of utmost importance to organizations that their postpaid customers get activated in system quickly and without any error.

A Postpaid number (referred as Del in telecom sector) has to be made active at IT systems (Billing and Provisioning) and at Telecom Switch (commonly called as HLR which is abbreviated form of Home Location Register). A Del which is active at HLR and not active at Billing System will make free calls as he/she won't be billed for the usage made. On the other hand a Del made active at IT systems only will not be able to make or receive calls until unless made active at HLR. Sometimes it also happens that Del is made active at both HLR and Billing Systems but certain VAS (Value Added Services) features are found missing either at HLR or at Billing System. Both cases stated above are a loss to business as in first case company loses revenue by not billing customer for the usage and in second case company is losing a prospective customer. Hence a Del is considered as active from business point of view when it is active at both HLR and Billing.

Managers at UP-East circle of a major Indian Telecom player observed that the data discrepancy in postpaid systems is over 5% of the subscriber base which is causing revenue leakage. They submitted a proposal to the board to carry out a Lean Six Sigma initiative with an aim to reduce the discrepancies to less than 2% of the subscriber base. Furthermore, they decided that employees on ground will be involved in this improvement initiative to build up a new culture and guarantee sustainability. The reason behind this approach was that the initiatives that are carried out without creating the underlying culture often end up with poor follow-up, lack of interest, diminished productivity, and no ownership of improvements. So few years down the line, company returns to the previous state and at times to a poorer state. Ayers (2006) mentioned that organizations are like rubber bands - they return to their original, natural state once the pressure for change diminishes.

### **RESEARCH METHODOLOGY:**

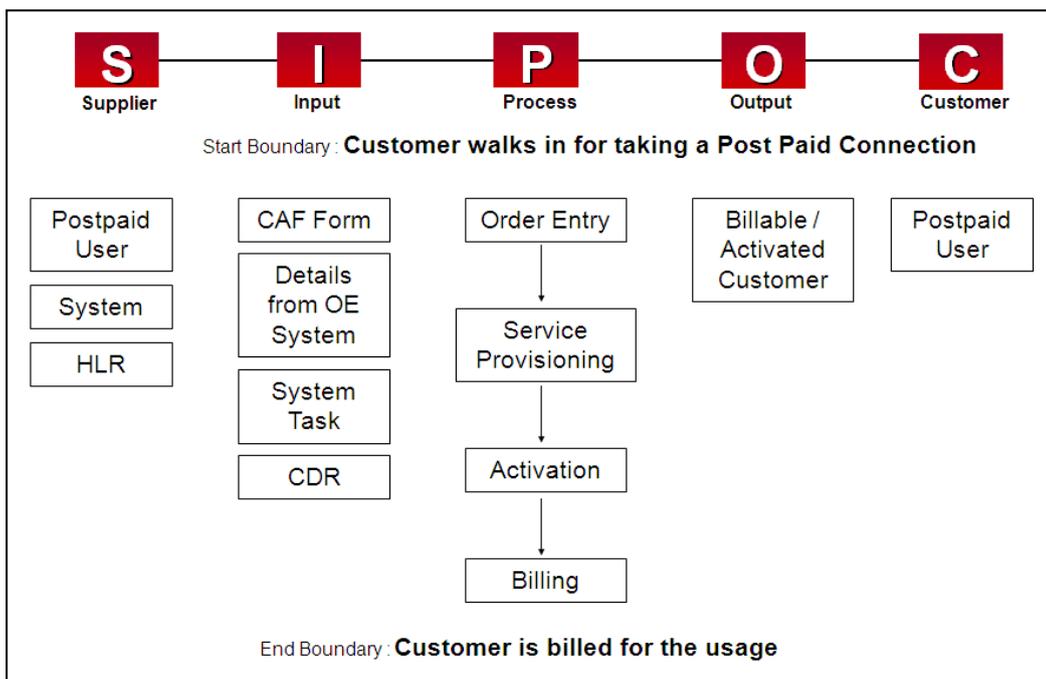
The improvement team assessed various sources to identify the causes of data discrepancy between IT systems and Telecom switch that were attributing to revenue leakage, unsatisfied customers and unhappy business. The team talked to various stakeholders to understand the causes of problem and analyzed data from various system generated reports. During discussion with stakeholders it become obvious that most of them didn't have an overall view of the process. It also came into light that the activations will go through effectively if everyone involved in the process has an understanding of the overall process flow. The data analysis from various system generated reports confirmed that around 5% data discrepancy exists and the process is running at 3 sigma level. Hence a need was identified to find the root causes that is accounting for these errors, develop action plans to fix the identified causes and implement the fix in system. The following subsections illustrate how the DMAIC cycle is used to address the problem of data discrepancy between IT systems and Telecom switch for postpaid customers at an Indian Telecom Service provider.

### **DEFINE:**

The Define Phase clearly identifies project boundaries i.e. in scope and out of scope, Specific Problem that project is trying to address, expected improvements benefits, project goals, project resources and key stakeholders. The Project Charter is wonderful tool to capture Specific Problem Statement, Opportunity Statement, Goal Statement, Business Case, Project Scope, Project Team, and high level Project Schedule. Project charter is one of the most important step in the DMAIC cycle, as expected project delivery is defined that helps to complete the project as per the schedule. To identify the project boundaries, a tool called SIPOC is

used as shown in Figure 1. The SIPOC identifies the Supplier, Inputs, Process Step, Outputs, and Customers for each high level process step of the identified process, ‘Postpaid Customer Acquisition’ in our case. A Value Stream Map (VSM) was also prepared for the overall Customer Acquisition process which provided an overall view of the entire process.

Figure 1: SIPOC Diagram



To identify the project scope, Voice of Customer (VOC) and Voice of Business (VOB) was collected. From VOC and VOB, Critical to Quality (CTQ) or Critical to Process (CTP) measures were identified and classified as per KANO model. The same is depicted in Table 1. The activation status discrepancy between IT and Telecom switch i.e Active at IT systems and not active at HLR or vice versa, targets were set to decrease this value from over 5% to less than 2% (Goal Statement).

Table 1: Converting VOC/VOB into CTQ/CTP

VOC / VOB	Customer Issue / Business Issue	CCR / CBR	CTQ / CTP	KANO Model (Delight, Satisfier, Must Be)
We never get our number activated within the committed time.	I want my number to get activated as soon as I pay for the connection.	Activation must be done within SLA which is: CMO < 24 Hrs Walky < 48 Hrs	Activation must be done within SLA which is: CMO < 24 Hrs Walky < 48 Hrs	Must be
Our number is not yet activated and we have started receiving Bills	Customer want to get billed only when his number gets activated.	Bill start date = Activation date at HLR	Bill start date = Activation date at HLR	Must be
How come our dels get activated at HLR without hitting Billing System?	Business want every activated del to get billed for the calls he/she make.	No. of Dels active in HLR and not present in Billing = zero	No. of Dels active in HLR and not present in Billing < 2% of the Sub base	Must be
How bills get generated for dels which were never active at switch	Business want that bill should not generate for the dels that are inactive at switch.	No. of dels becoming active at BP without getting activated at switch = zero	No. of dels becoming active at BP without getting activated at switch < 2% of the Sub base	Must be
We are not able to bill our customers for each call they make	Business want to get the bill generated for each call made by customers.	MIU count should be zero.	MIU count should be zero.	Delight

Specific Problem Statement provide answer to questions like What is not working well, Since when it is happening or since when the problem exists, Where does the problem exists, and How big is the problem i.e. problem in quantifiable terms. Business case answers the questions like, why it is critical to do this project, how the project is important to customers and business, why it is important to do the project now or what be the consequences of not doing the project now, and how will this improvement suggested will impact the organization. Goal Statement mentions the end results project is aiming to achieve. While preparing the Goal Statement care should be taken to check whether goals set are measureable, realistic i.e. aggressive yet achievable, and time bound. Project Team section details out the different roles and responsibilities of the identified project team. A formal approval on Project Charter was taken from top management. This approval gives a commitment of full support to the team to achieve the required objectives and offered a clear and well-organized vision.

Lean Six Sigma awareness cum hands on training sessions were provided to entire team by Project Champion. TIMWOODS i.e the eight types of wastes were explained to insure correct data collection during the measure phase. Also, posters were put on all floors and mailers were sent in order to deepen the understanding of Lean Six Sigma approach within the entire organization.

**MEASURE:**

Measure Phase focus on Data Collection Strategy, Validating Measurement System, and determining the current Process Capability. In the first step a Data Collection Plan (depicted in Table 2) is prepared that provide details like what data need to be collected, where the data will be collected from, who will collect the data, and the frequency of data collection. Project Champion clearly explained the data collection plan with the team and briefed the data collectors on what to collect, when to collect, and how to collect.

**Table 2: Measurement Plan**

Performance Measure	Operational Definition	Data Source and Location	Sample Size	Who will Collect Data	When will Data be Collected	How will Data be collected
Data Discrepancy Report	Report having all Dels No. whose status is different at HLR and Billing	HLR and Billing Servers, Data for UP-East circle	Variable	Manager-Postpaid Operations	Last Saturday of every month	Reconciliation of HLR and Billing Server Data
No. of system task in error	Total number of system tasks that got fired at the time of activation of various postpaid numbers and which have gone into some error	EPOS and Metasolv Database, UP-East Circle	Variable	IT-Manager	Every Monday	Running SQL scripts in Metasolv and E-POS databases
No. of system tasks in ready/pending status	Total number of system tasks that got fired at the time of activation of various postpaid numbers and which have not completed till the date	EPOS and Metasolv Database, UP-East Circle	Variable	IT-Manager	Every Friday	Running SQL scripts in Metasolv and E-POS databases

Validating the Measurement System means analyzing the variation caused due to measuring system or measurement method being used. In Measurement System Analysis (MSA), statistical methods are used to estimate how much of the total variation is due measurement system. In ideal case scenario measurement system should not have any variation however, in practice a measurement system with variation less than 10% of the process variation is considered good and one with proportion more than 30% is considered unacceptable. For the case in discussion, MSA was conducted by providing a sample of 50 cases to two different operators and they were asked to verify whether correct cause of data discrepancy has been assigned or not. The exercise was repeated with same data sorted differently to check the consistency of their response. The responses of operators were compared with standard response provided by experts. The MSA results are

depicted in Figure 2 and Table 3. The results shows Kappa Value of > 0.7 for all categories implying that the variation in response of operators with that of experts, within operator, and between operators is within control limits, hence Measurement System is deemed fit for measurement of data.

Figure 2: MSA - Assessment Agreement

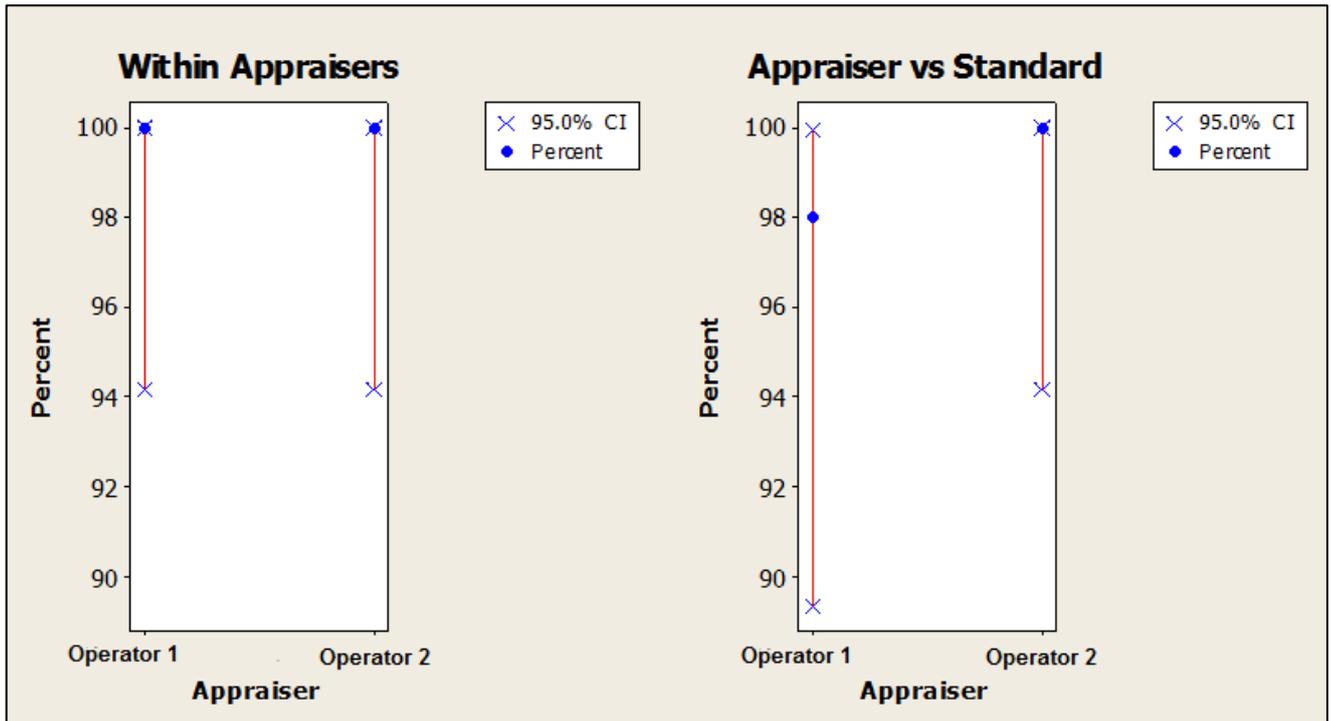


Table 3: MSA Results

Category	KAPPA Value
All Appraisers versus Standard	0.92
Between Appraisers	0.89
Within Appraisers	1
Each Appraiser vs Standard	0.84, 1

The as-is process capability was measured using Defects per Million Opportunity (DPMO) method for sigma calculation in Microsoft Excel. The Table 4 below shows calculation for process sigma value, the process sigma value before improvement was 3.13.

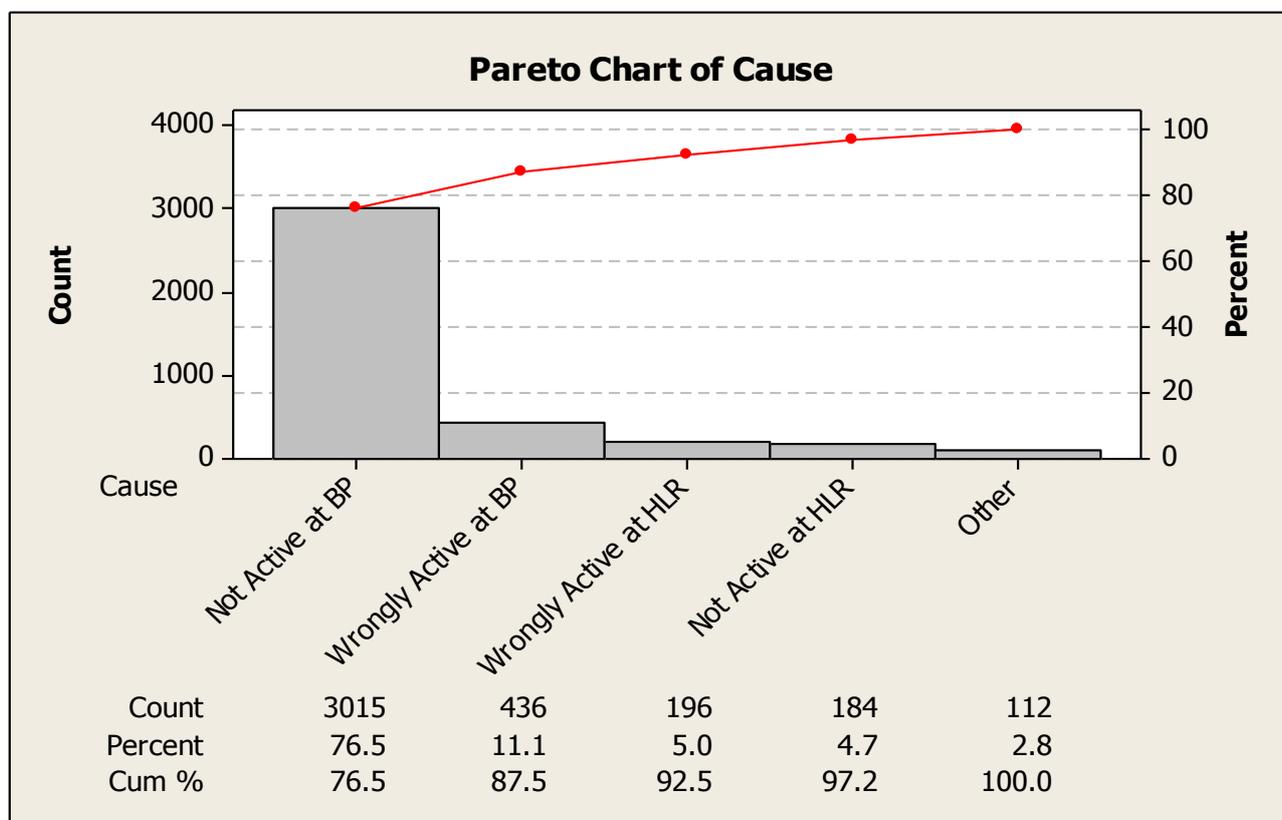
Table 4: Sigma Calculation

Attribute	Value
Total Number Of Units Processed (N)	100906
Total Number of Defects found (D)	5153
Number of Defects Opportunities per unit (O)	1
Defects per Million Opportunities (DPMO) DPMO = (D * 1000000)/(N * O)	51067
Process Sigma In Abridged Sigma Conversion Table Sigma Value = 1.5 + NORM.S.INV(1 - DPMO/1000000)	3.13

**ANALYZE:**

Analyze phase provide the answer to the question “Why is this problem occurring?” or in other words, “What is the cause of the problem?” It is vital to identify the causal factors before making any improvements to the process. Most of the time when organizations deal with a problem they fix the symptoms of the problem which are easily visible on the surface. In doing so they fix the problem momentarily which resurfaces again after some time. Hence it is extremely important not to get deceived by the symptoms on the surface rather pull up your sleeves and dig deeper to reach to the actual or root cause of the problem. This is something Analyze phase help improvement teams do in a systematic way.

**Figure 3: Pareto Chart**



The improvement team (for the case in discussion) started with Pareto Analysis (shown in Figure 3) of collected data in order to find out the vital few causes that are contributing to the maximum number of problems. Pareto Analysis is a decision making technique based on Pareto Principle or the 80/20 rule, which states that 80% of the results could be attributed to 20% of the causes. Pareto Analysis confirmed ‘Not Active at Billing Systems’ to be the vital cause. The vital cause captured from this analysis was further brainstormed using Fishbone Analysis (as shown in Figure 4) to identify the all possible causes of its occurrence. A cause and effect matrix was prepared for all identified causes from fishbone analysis and the prominent causes were identified. ‘Wrong provisioning at Postpaid provisioning system (Metasolv)’ and ‘Tasks not completed in all IT systems’ came out to be the two prominent causes of the problem. A 5-Why analysis as shown in Table 5 was carried out on the prominent causes. It is an iterative probing technique to discover the cause-and-effect relationships at the core of a particular problem. By asking ‘Why’ repeatedly the layers of symptoms is removed and underlying root cause is exposed. 5-Why analysis revealed ‘High Frequency of change of Provisioning Staff’ and ‘Lack of well-defined process in place to monitor and clear out pending tasks’ to be the root causes of the data discrepancy problem.

Figure 4: Fishbone Analysis

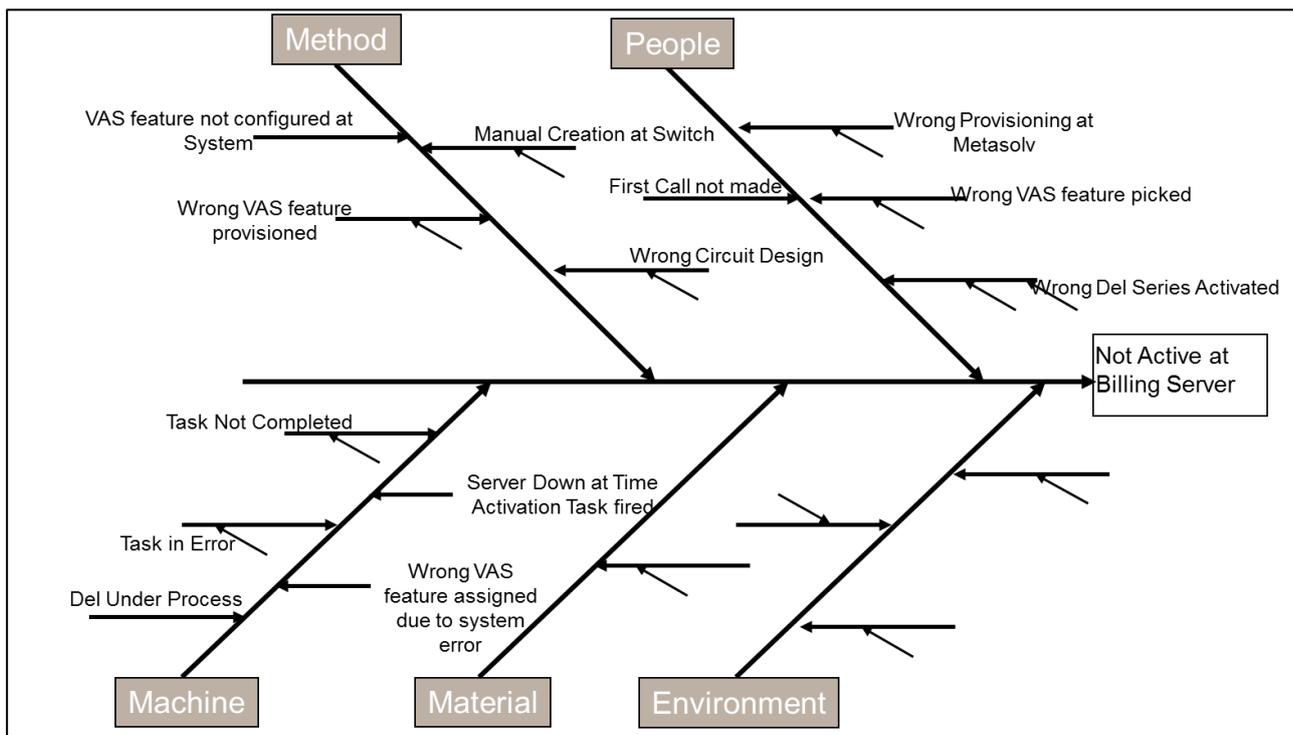


Table 5: 5-Why Analysis

Prominent Cause	Why 1	Why 2	Why 3	Why 4	Why 5
Wrong Provisioning at Metasolv	Lack of knowledge about doing Provisioning at Metasolv	Lack of properly trained staff	High Frequency of change of Provisioning Staff		
Tasks not completed	Proper monitoring of Tasks not done.	Monitoring/ Review frequency not defined	Lack of well-defined process in place to monitor and clear out pending tasks		

**IMPROVE:**

After identification and verification of root causes in last step of DMAIC cycle, the team proposed corrective actions to minimize the probability of reoccurrence for these issues. Brainstorming sessions were held to generate maximum possible solution. Each solution was then evaluated with respect to cost, time of implementation, and Sigma Impact i.e. probability of accomplishment upon implementation. The Rank and Select solution matrix is shown in Table 5.

Table 6: Rank and Select Solution

Root Cause	Solutions	Sigma Impact	Time Impact	Cost Benefit Impact	Evaluation Criteria
		10	8	7	Importance
High Frequency of change of Provisioning	Proper Handover Takeover should be in place	7	4	5	137

Staff	Resource should not be released prior to proper Knowledge Transfer	7	4	4	130
	Metasolv Provisioning Trainings to be conducted more frequently	8	5	5	<b>155</b>
	Whenever there is some change in provisioning plans, All concerned to be communicated properly	7	5	6	<b>152</b>
Lack of well-defined process in place to monitor and clear out pending tasks	Refine the current process with well-defined monitoring frequencies, roles and responsibilities	9	6	6	<b>180</b>
	System Upgradation so that none of the task got stuck	8	3	2	118
	Implementing automated scripts that gives daily reports of all tasks in error	8	7	6	<b>178</b>
	Sending Alerts to all concerned whenever a task goes into error or got stuck at some point.	5	7	5	141

Once team had a clear picture of the problems and best possible solutions to address those corrective actions were started. For example, analysis showed that one of the main causes for the data discrepancy problem was the system tasks that were not completed, the action plan was to implement automated scripts that gives daily reports of tasks in error so that corrective action could be taken immediately. Team prepared an Implementation plan (Table 7) clearly stating all tasks involved in implementation of solution, the task owner, start date and end date, and verification of the task completion.

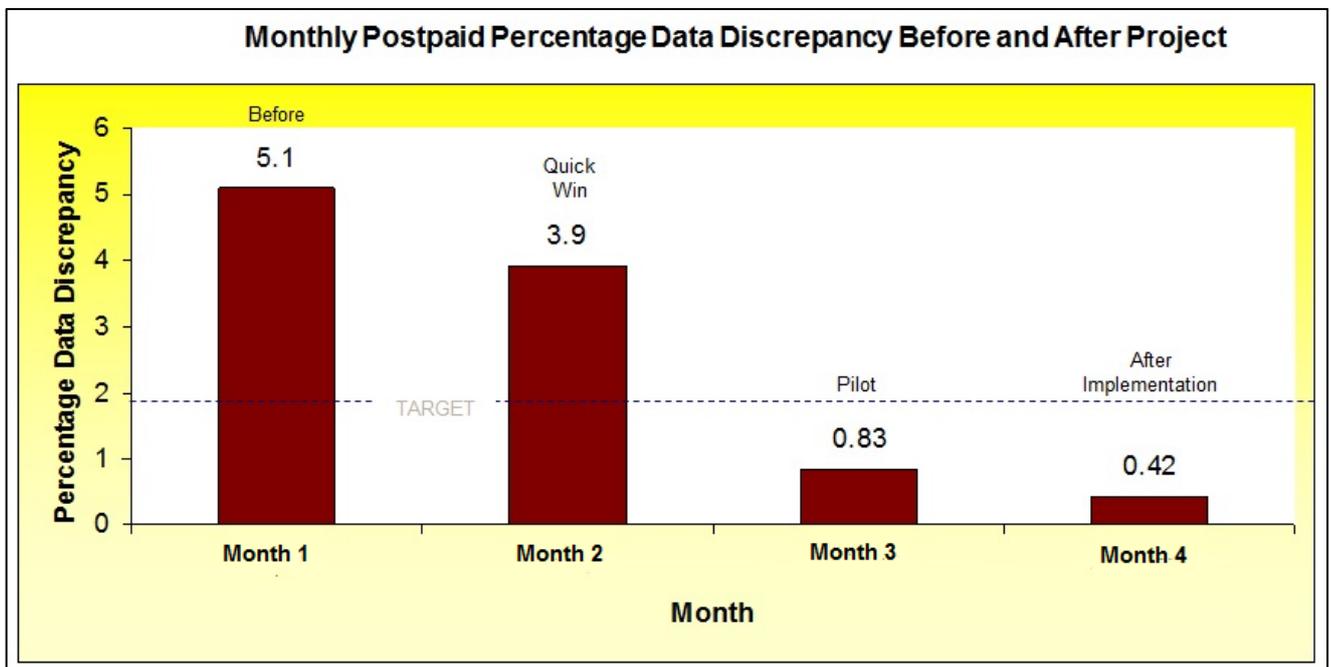
**Table 7: Solutions Implementation Plan**

Process					
Tasks		Activities	Responsibility	Start Date	Completion Date
Select Team Members		Discuss with circle IT Head and Postpaid Business Head			
Risk Analysis		Perform Risk Analysis of all activities			
Training Employees	of	Training to Provisioning staff on working on Metasolv with special focus on selecting correct provisioning Plans			
Implement Solutions		Metasolv Provisioning Trainings to be conducted on monthly basis			
		Communication alert to all stakeholders upon change in provisioning plans			
		Prepare and publish a new Standard Operating Procedure (SOP) for postpaid customer acquisition process			

	Implementation of automated scripts that gives daily reports of all tasks in error			
Verify Results	Result verification date should be finalized.			
	Verification of actual results			
	Results communication to all stakeholders with detailed observations			

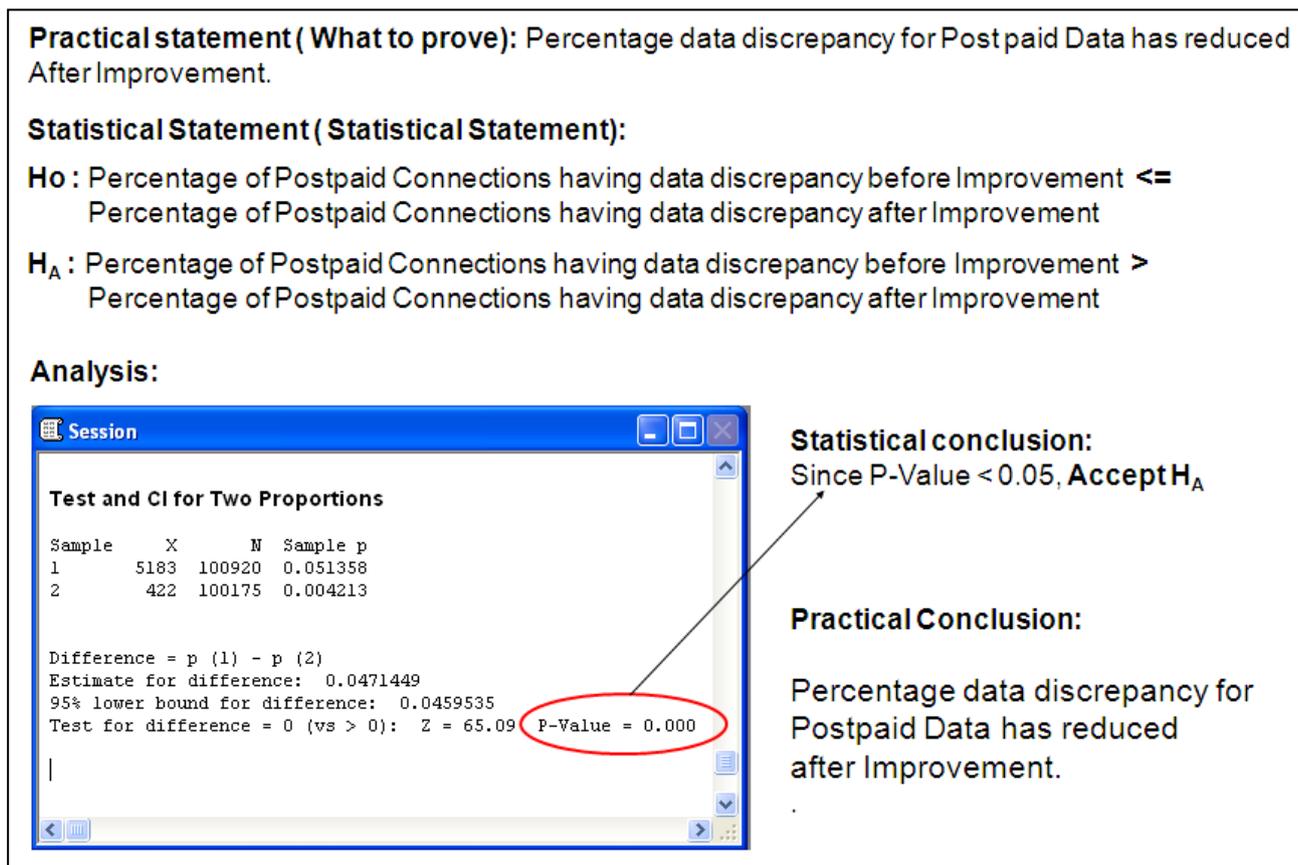
To evaluate gains, data was collected for two months following the implementation of suggested solutions. Results confirm the achievements: discrepant cases reduced to less than 1% during first month and to less than 0.5% by end of second month (Figure 5). Also the Process Sigma value increased to 4.1 from its initial value of 3.13. The financial impact of this improvement in terms of revenue enhancement amounted to INR 4.7 Million p.a. The same was vetted and approved by the circle Finance Head.

**Figure 5: Percentage Data Discrepancy over months**



A Two-Proportions Test or 2-P test was performed as shown in Figure 6 to determine whether the Lean Six Sigma project has actually improved the process. Using 2-P test team wanted to prove statistically that data discrepancy has reduced significantly and the percentage reduction is not just by chance. To perform the test a Null Hypothesis (Ho) and an Alternate Hypothesis (Ha) was prepared. Null Hypothesis stated that the postpaid data discrepancy before improvement was either less than or equal to postpaid data discrepancy after improvement and Alternate Hypothesis stated that the postpaid data discrepancy before improvement was more than postpaid data discrepancy after improvement. Using Minitab test was performed and at 95% confidence interval p-value came out as zero. Since p-value was less than 0.5 i.e. level of significance hence null hypothesis was rejected and it was concluded that postpaid data discrepancy has reduced post implementation of improvement solutions.

Figure 6: Two-Proportion Test



**CONTROL:**

Control Phase focuses on sustaining the results achieved and spreading the learning and best practices to the entire organization. In order to “Hold the gains” i.e. ensuring new ways and processes are followed and preventing organization from going back to old ways of working a Sustenance Plan (Table 8) is prepared. Sustenance plan include a description of critical process steps, and the parameters that need to be kept in check to ensure there are no excessive deviations from the target values. It also includes the checking frequency, responsible role, and contingency plan for each critical step.

Table 8: Sustenance Plan

Critical Process Step	Input / Output Process Indicators	Control Limit	Checking Item	Frequency	Responsibility	Contingency Plan
		Specs/ Targets	What to Check	When to Check	Who will Check	Action Required
Bill Plan and Handset Package Selection	Wrong Bill Plan or Handset Package selected	<1%	No. of cases of wrong provisioning	Weekly	Manager - Postpaid Operations	Regular Trainings to be organized for provisioning staff
Del Activation	No. of system task got stuck or in error	<1%	System Tasks not completed	Daily	Manager-IT	Regular follow ups with Customer Care Team at circle and Product Support Groups at corporate

In order to “Spread the gains” the outcomes of this project are spread out for the whole organization using mailers, posters, and webinars. The refined process for postpaid data reconciliation was documented and published. Automated scripts that give status of all System tasks in error were shared with all Circle IT Teams for implementation in their respective circles. UP-East circle IT team took many knowledge sharing and experience sharing sessions with other circle teams and supported them in implementing the solutions in their circles. The cumulative financial impact reported from all circles was over INR 23 Million. Impressed by the findings and positive outcomes of the project, organization decided to start more Lean Six Sigma projects to address other issues and started a new journey towards building a culture of continuous improvement.

## CONCLUSIONS:

The paper presents a Lean Six Sigma approach to reduce the data discrepancy for postpaid data at UP-East circle of a major Indian Telecom service provider. The scope of the study was to identify, analyze, and remove all causes that are causing data discrepancy. Following a DMAIC cycle, various causes are identified and improvement opportunities are suggested and implemented. As a result, the data discrepancy was reduced to 0.42% from 5.1%. This resulted in effective operations and revenue enhancement of over INR 23 Million p.a. Furthermore, to ensure the sustenance of the achieved results a sustain plan has been prepared along with new working procedure. To achieve long term benefits, awareness and training sessions were carried out to initiate a culture of change focusing on individuals rather than results.

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