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Reduction of Recurring Billing Errors of a Service Company Using Lean Six Sigma: A Participative Action Research

Rex Jayson Tuozo
De La Salle University, Manila
rex@6sigmaph.com

Abstract

This paper aims to utilize Lean Six Sigma to describe and solve the recurring billing defects of a Philippine-based service industry corporation. Participatory Action Research (PAR) facilitated process improvement tools following Six Sigma's Define, Measure, Analyze, Improve, and Control (DMAIC) methodology. The average monthly new return-to-sender (inaccurate and known) billing defects decreased from 2,348 to 1,114 from January 2018 to October 2019, representing a 52.56% reduction. The project has reduced RTS-related complaints by 46%, which canceled the plan to hire additional six customer service personnel. Also, the project reduced churn accounts due to RTS by 52.40%, which is equivalent to an annualized revenue of P37.58 million pesos. The research was performed in a Philippine-based service industry company. The results and findings cannot be generalized outside similar circumstances and situations.

Keywords: *Lean Six Sigma, business process improvement, DMAIC, participative action research*

Introduction

This paper aims to utilize Six Sigma through participatory action research (PAR) to describe and solve the recurring billing defects of a Philippine-based service industry company. The project was conceptualized when the management was alerted of the increasing yearly number of pre-terminated accounts. It was found out that the Billing team made several attempts to solve the problem, including the replacement of accredited couriers, implementing text messaging campaigns and email blasts for new customers, and directly calling thousands of new accounts, but the problem still relapsed. It seeks to describe how PAR can be used to solve the recurring delivery defects of the company.

Literature Review

With improving access to data and information, consumers have become more demanding. With the entrants of direct and indirect competitors, many businesses are fighting tooth and nail to acquire new clients. Retaining a customer is five to twenty-five times more affordable and is equal to minimizing expenses by five percent (Gallo, 2014; Reichheld & Sassar Jr., 1990). In addition, a repeat client has a high probability of paying more to avoid gambling with an unacquainted supplier (Reichheld, 2001).

Countless organizations from different industries have integrated Lean Six Sigma as an essential element of their strategic plans and management approach (Adebanjo et al., 2016; Bilgen & Sen, 2012). Lean Six Sigma aims to attain predictable and stable process outputs with

minimal defects and variations (Sony & Naik, 2019). It promotes cross-functional changes, organizational learning within the company (Miguel & de Carvalho, 2014) and aims to embed the value of doing things correctly the first time in the organization's culture (Laureani & Antony, 2017).

As a project-driven quality initiative (Goh, 2002; Bilgen & Sen, 2012), the short-term projects require complete dedication from the business leaders (Antony et al., 2012), preparedness of organizational culture for change (Knapp, 2015), and a sufficient number of Lean Six Sigma experts (Graves, 2014) who leads and facilitated the methodology and tools with executive sponsors and process owners.

There is numerous literature about the success of Lean Six Sigma (Kollberg et al., 2006; Jorma et al., 2007), all pointing to critical success factors discussed by several studies (Sony et al., 2020; Achanga et al., 2006; Jeyaraman & Kee Teo, 2010; Antony et al., 2012; Manville et al., 2012), which are oppositely-aligned with findings of failures of Lean Six Sigma projects (Antony et al., 2019).

Framework

To check the proposed conceptual framework in **Error! Reference source not found.**, the four hypotheses (Figure 1) specifying the excellent relationship between the RTS defects and the four suspected root causes are presented below:

Figure 1
Proposed Conceptual Framework and Hypotheses

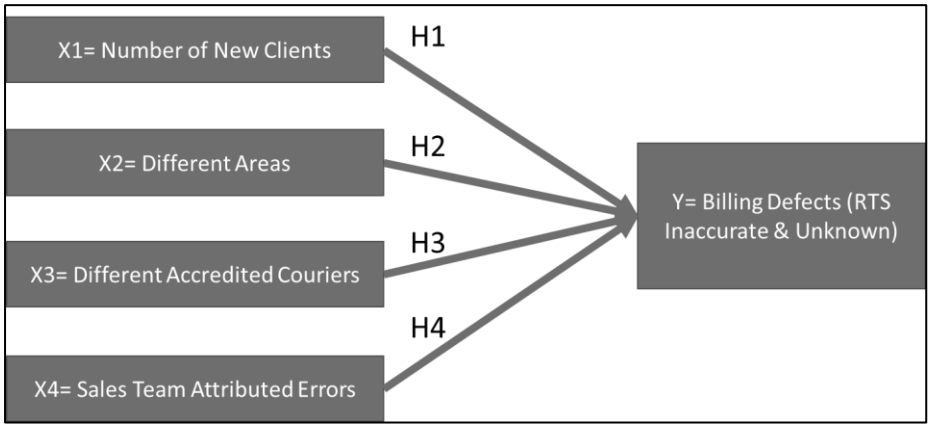


Table 1
Four hypotheses of the study

H1: Is there an association between the number of new clients and number of new defects?	
Ho	Ha
There is no association between the number of customers and the number of RTS billing defects.	There is an association between the number of customers and the number of RTS billing defects.
H2: Is there a difference between the average RTS defects of areas covered by the company?	
Ho	Ha
No RTS difference among the group averages.	At least one area RTS average is significantly different from the others.
H3: Is there a difference between the average RTS defects of the accredited couriers by the company?	
Ho	Ha
No RTS difference among the group averages.	At least one accredited courier's RTS average is significantly different from the others.
H4: Is the rate of sales attributed RTS errors in the random sample different from target value of 60%?	
Ho	Ha
Proportion of sales attributed RTS reason equal to or less than sixty percent.	The proportion of sales attributed RTS reason is greater than sixty percent.

Methodology

In Lean Six Sigma, process improvement facilitators involve and lead stakeholders to solve business process problems. Similarly, participatory action research (PAR) focuses on addressing specific problems (Waterman et al., 2001), engages process owners by eliminating the boundary between the researched and the academic (Coughlan & Coghlan, 2002; Baum et al., 2006), implements solutions (Baum et al., 2006), and assess the effects of action items by comparing the before and after data over time (Goddard & Melville, 2004).

PAR in this project is alternatively called "Six Sigma Circuit." The term 'circuit' is adopted from exercise training. Circuit training is a workout of a series of activities that work for different muscle groups. A time is allotted for each station of activities before proceeding to the next stage until the overall objective for the day has been met.

The author acting as the facilitator guided the team members (representatives from cross-functional departments) in accomplishing the different process improvement exercises: SIPOC Diagram and details process map, brainstorming of potential root causes, Impact vs. Control Matrix, and brainstorming of solutions. Discussions are visualized using sticky notes, markers, and flip charts. Six Sigma Circuit is two consecutive half-day sessions (4 hours each day), wherein three roles must be present: the facilitator, project team member, and the decider (Executive Sponsor). Project team members include employees from the Billing Department, Customer Service Group, Technical team, Collections Department, IT, and Vendor Management Office. Graphical and statistical tests were made using Minitab v19 software.

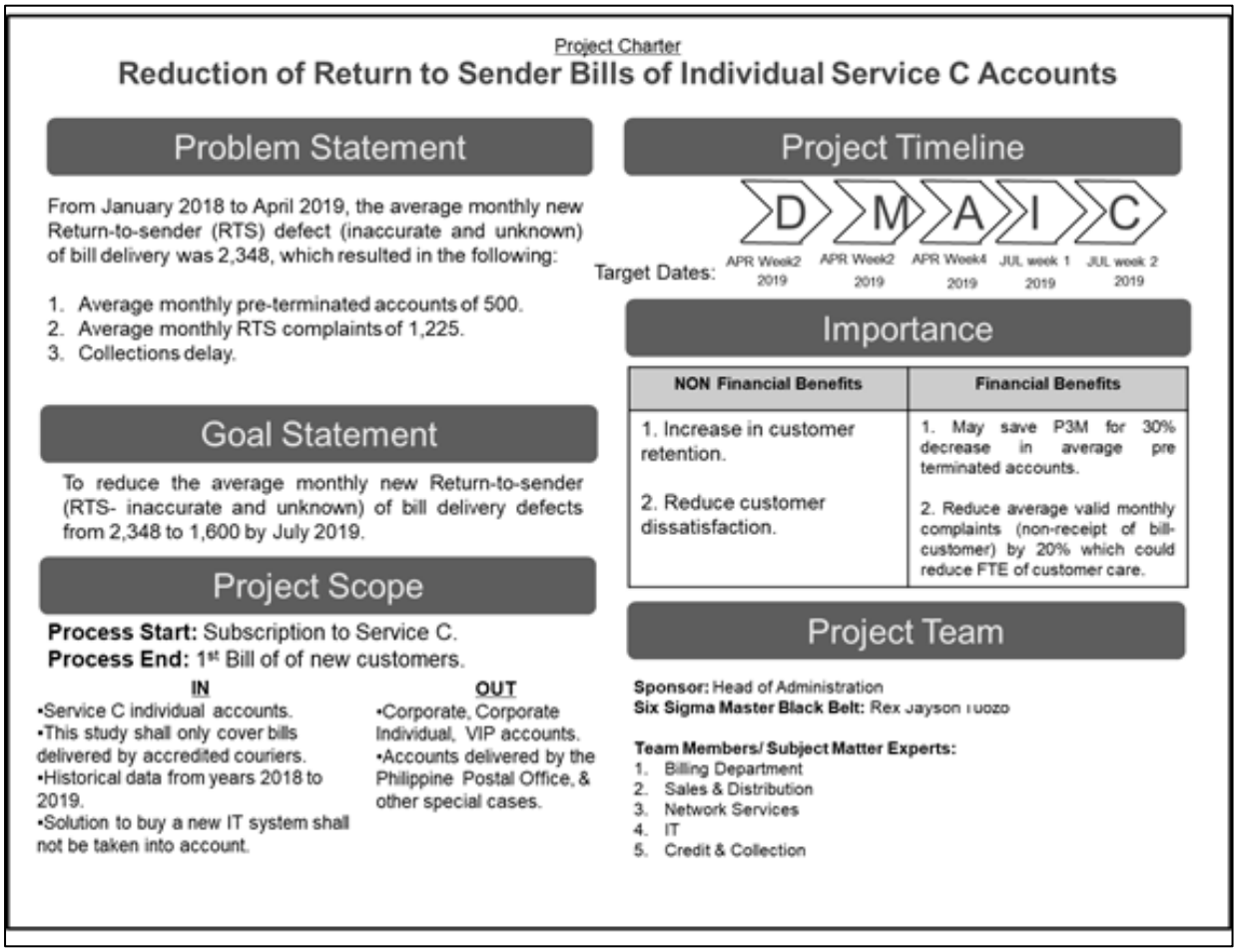
Discussion of Results

The specific steps and results of the study of the Philippine-based service company are discussed following Six Sigma's Define, Measure, Analyze, Improve and Control (DMAIC) methodology:

Define Phase

The Define phase of DMAIC seeks to write down the details of the project. It starts when the process improvement project manager drafts the project charter (Figure 2), which contains the statement of the problem and its objectives, the team members involved, the scope and limitations, and the importance of the project. Next, a discussion between the project manager and executive sponsor will be scheduled, and the project will commence when the executive sponsor gives the signal to start the project.

Figure 2
Project Charter



The project scope was derived from Pareto Charter (Figure 3) with inaccurate and unknown as the top 2 highest contributed RTS equivalent to 74.10%. The Executive Sponsor decided to make other RTS types out of scope since the rest are uncontrollable, as defined by the operational definition (Figure 4).

Figure 3
Pareto Chart of RTS by Types

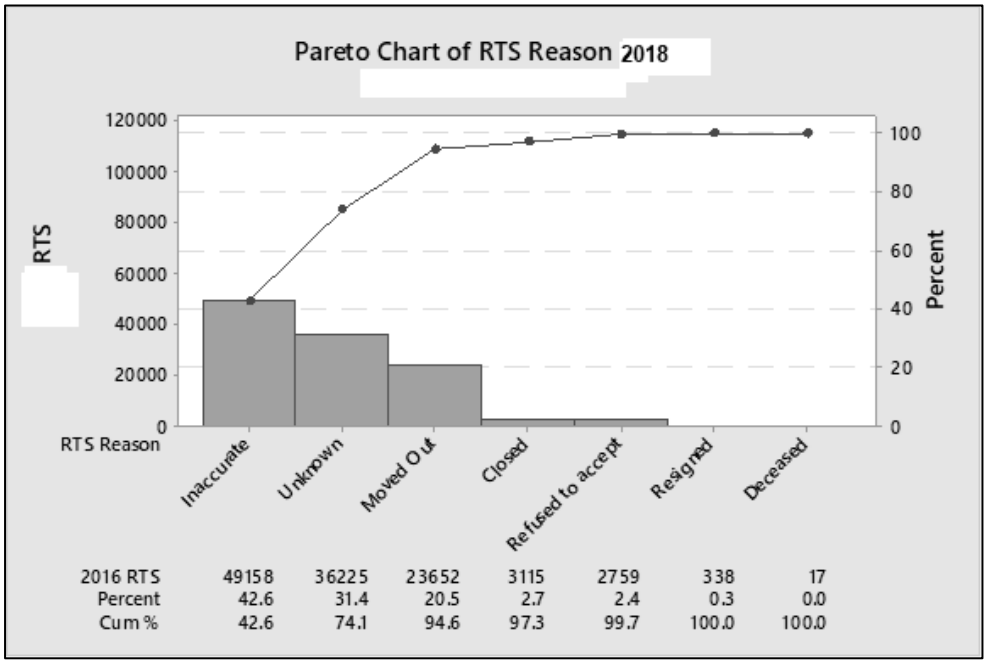


Figure 4
Operational Definition of RTS Types

1. Closed – No one to receive the bill in the billing address, or the address is closed.
2. Deceased
3. Inaccurate- Incomplete, insufficient, erroneous billing address.
4. Moved Out- Subscriber has moved out from the address.
5. Refused to Accept- Person/s present in the address refused to accept the bill.
6. Resigned- The subscriber has resigned form the company where bill is addressed.
7. Unknown- Person/s present in the billing address do not know the subscriber.

As shown in Figure 6, the team mapped out the big picture of the process, which includes: the creation of a marketing plan, the subscription process of Service C; Registration of client to service C; and the first billing of the customer. To complete the SIPOC Diagram, the team identified the inputs required of each of the high-level process steps and then enumerated the suppliers of each of the inputs. The last steps are to identify the output/s of the process steps and then write down the recipients or customers of all of the identified outputs.

An analysis of the SIPOC diagram revealed that the Billing team has not explored identifying potential root causes on process steps A1 to A3. All process changes were implemented in the Bill Customer step.

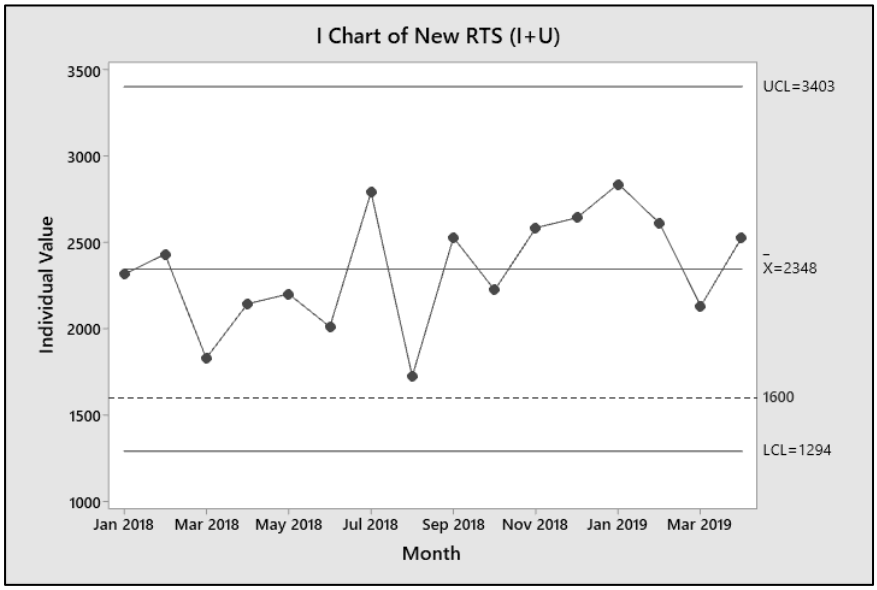
Figure 5
SIPOC Diagram

SUPPLIERS	INPUTS	PROCESS	OUTPUTS	CUSTOMERS
Sales	Marketing Plan Proposals Historical performance Customer data	Create Marketing Plan A1 ↓ Sales, CC	Service C Marketing Plan	Sales Personnel
Sales, Sales Personnel & Subscriber	Subscriber Application Form (SAF)	Subscribe to Service C A2 ↓ Client	IT System & account details	Scheduler, Installer, IT, Billing
NSD	List of paid accounts from Channel Portal	Register Service C A3 ↓ Service C Department	Newly activated accounts	Subscriber, IT, Billing
1. IT, Billing 2. Courier 3. Customer Service	1. Data from IT 2. RTS 3. Complaints (SR via CSP)	Bill Customer A4 Billing	1. Billing statements 2. RTS Report, Call out Report 3. Closed SRs, Deviated SRs.	1. Courier, Customer 2. Billing 3. Customer Service

Measure Phase

The second phase of DMAIC seeks to quantify the problem, collect the current-state data, and determine the process capability. After several discussions and revisions of the charter, the Executive Sponsor decided only to include new inaccurate and unknown RTS subtypes. As shown in Figure 6, the average monthly mean of defects is 2,348, with no outliers. Also, all data points have failed to reach the target goal of 1,600.

Figure 6
Individual Control Chart (Inaccurate & Uknown)



The computation of the current-state process capability displayed a process yield of 85.46%, equivalent to 2.5 sigmas. After implementing the solutions, the project team will re-compute the process capability to measure improvement.

Table 2
Current State Yield of the Process

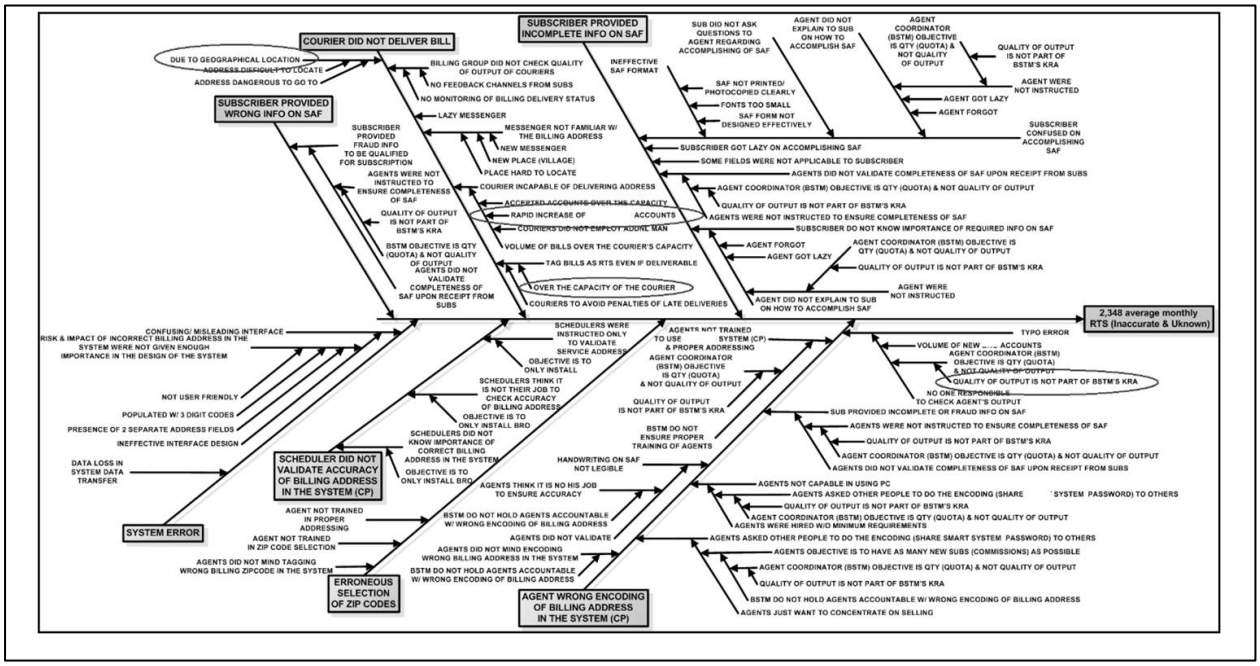
Calculating Process Sigma Score: New RTS (Inaccurate & Uknown)	
Determine the number of defect opportunities	O=1
Determine the number of units processed-New Accounts	N= 188,837
Determine the total number of defects made- New RTS (I&U)	D= 27,453
Calculate Defects Per Opportunity	DPO= 0.14538
Calculate Yield	Yield= 85.46%
Look Up Sigma in the Process Sigma Table	2.56

Analyze Phase

The third phase of DMAIC targets to analyze the current state process, brainstorm potential root causes, recognize key variables (De Koning & De Mast, 2006), and generate graphs and statistics to validate the cause-and-effect relationships of potential root causes to the problem.

In this phase, after the facilitator (author) discussed the project charter and SIPOC diagram, everyone received a marker and a pad of sticky notes. For six minutes, everyone thought of probable reasons for a high number of monthly delivery errors. Ideas were recorded on the paper. This activity happened without discussions to reduce bias and groupthink. This also allowed even the most introverted group members to present ideas they might usually not get a chance to articulate. When the time was up, all members randomly posted what they had written on the wall. The facilitator then instructed the group to combine ideas with standard themes and remove exact duplicates. The team began drilling down several ideas by asking 'why does this happen?' and added new ideas. The team then arranged the potential root causes into a fishbone diagram, as seen in Figure 7, and voted on the top drivers of RTS.

Figure 7
Fishbone Diagram of RTS Potential Root Causes



After constructing the fishbone diagram, the team identified the top drivers and mapped them on the impact vs. control matrix. The drivers were categorized by being in or out of control of the company and having a low or high impact on RTS.

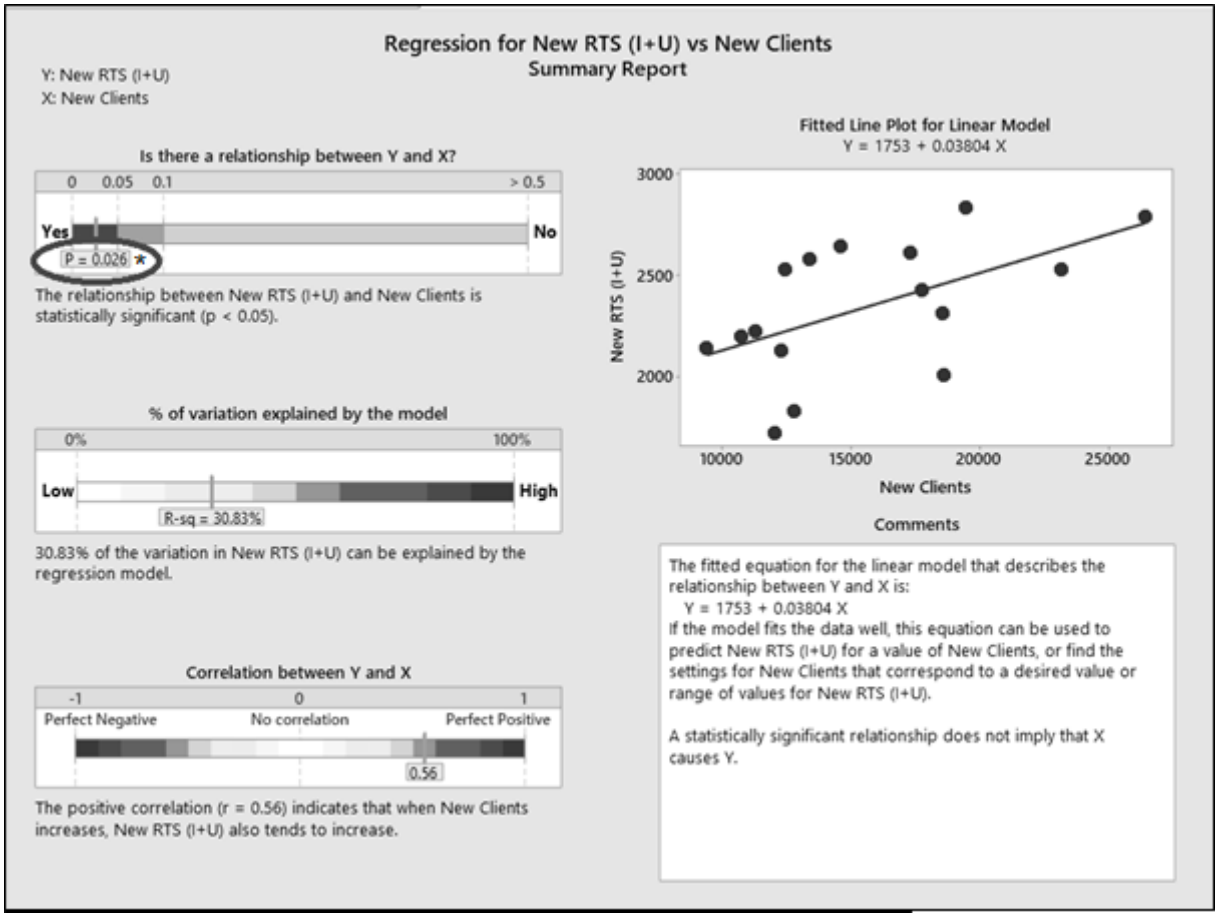
X1: Number of New Clients

The first test is to identify an association between the number of acquired clients and the quantity of RTS defects. With the customers of the service company becoming more demanding, and pressure from the competition, the company has been fighting tooth and nail to retain existing clients. The team identified regression analysis as the appropriate statistical tool after identifying regression analysis variables in Table 3. The test in Figure 8 revealed a p-value of 0.0260, which indicates an association between the number of customers and RTS billing defects. It is also discovered from the fitted line equation that as the business obtains 27 new customers, one RTS defect is produced. The analysis also displayed that the number of new clients explains 30.83% of the variation of the RTS billing defects.

Table 3
Regression Analysis Variables

Variable	Data Type	Input or Output?	X or Y?	Is X controllable or used to predict?
Number of new clients	Continuous	Input	X	Used to predict
Number of New RTS (I&U)	Continuous	Output	Y	N/A

Figure 8
Minitab Screenshot- Regression Analysis



Note. *p < 0.05.

X2: Different Service Areas

The next test is to check if there is a difference among mean billing defects of locations serviced by the company. If areas with significantly higher defects than the rest, the team may revisit its scope and focus on those locations. In Figure 9, the team summarized the six areas and the cities/ municipalities. Data were then collected by area, and analysis of variance (ANOVA) was used. Figure 10 shows a p-value of 0.1170 which means that there is No RTS difference among the group averages. No area is contributing significantly higher average billing defects than the rest.

Figure 9
Category of Different Areas

LUZON	NORTH NCR	CENTRAL NCR	VISAYAS	MINDANAO
LAGUNA	QUEZON CITY	PAMPANGA	CEBU	MISAMIS ORI- CDO
BATANGAS	CALOOCAN	BATAAN	ILOILO	DAVAO
CAVITE	MALABON	ZAMBALES	GUIMARAS	LANAO DN
MINDORO ORIENTAL	NAVOTAS	TARLAC	NEGRO OCC	S.COTABATO
PALAWAN	SAN JUAN	NUEVA ECIJA	NEGROS ORI	MAGUINDANAO
CAMARINES	MANDALUYONG	BULACAN	BOHOL	ZAMBOANGA DS
ALBAY	PASIG	SOUTH NCR	LEYTE	BUKIDNON
QUEZON PROV	VALENZUELA	MAKATI	SAMAR	AGUSAN DN
BAGUIO	RIZAL	PARANAQUE	KALIBO	ZAMBOANGA DN
CAGAYAN PROV	MARIKINA	LAS PINAS	BORACAY	SURIGAO DN
ISABELA		TAGUIG		
LAUNION		PATEROS		
PANGASINAN		MUNTINLUPA		
ILOCOS		PASAY		
		MANILA		

Figure 10
Minitab Screenshot- Analysis of Variance by Area

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Method

Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05

Equal variances were assumed for the analysis.


Factor Information

Factor  Levels  Values
Factor       6  North NCR., South NCR., Central NCR., Luzon., Visayas.,
                Mindanao.


Analysis of Variance

Source  DF    Adj SS  Adj MS  F-Value  P-Value
Factor   5   1527161  305432     1.84    0.117 *
Error   66  10960515  166068
Total   71  12487675


Model Summary

      S    R-sq  R-sq(adj)  R-sq(pred)
407.515  12.23%      5.58%       0.00%


Means

Factor          N    Mean  StDev       95% CI
North NCR.     12  1194.5  306.9  (959.6, 1429.4)
South NCR.     12    1451    412  ( 1216,   1686)
Central NCR.   12    1113    365  (  878,   1348)
Luzon.         12    1283    525  ( 1048,   1518)
Visayas.       12    1062    482  (  827,   1296)
Mindanao.      12  1022.8  301.8  (787.9, 1257.6)
```

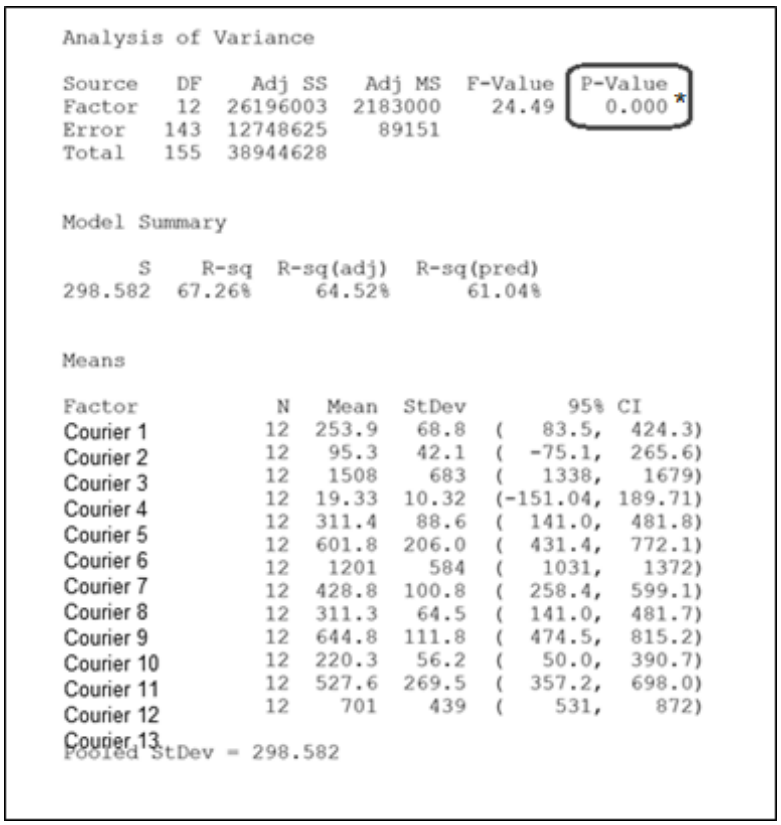
Note. *p < 0.05.

X3: Different Accredited Courier Vendors

The third variable to be tested is the different accredit courier vendors of the company. A number of the PAR participants have speculated that defect outputs of some of the vendors are greater than the rest. The group identified the accredited vendors and the cities they serve to test this assumption, as seen in Figure 11. The team counted the number of RTS defects by courier and ran ANOVA. The test resulted in a p-value of 0.0001, as seen in Figure 12, which means that at least one accredited courier has an average RTS significantly different from the rest. The author also generated an interval plot in Figure 13, identifying couriers 3 and 7 as significantly contributing to more billing defects than other couriers. The project team met separately with the representatives of the two couriers to bring out the analysis and develop corrective actions to address the problem.

Figure 11
Accredited Couriers and Service Areas

Figure 12
Minitab Screenshot- Analysis of Variance by Courier



Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	12	26196003	2183000	24.49	0.000 *
Error	143	12748625	89151		
Total	155	38944628			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
298.582	67.26%	64.52%	61.04%

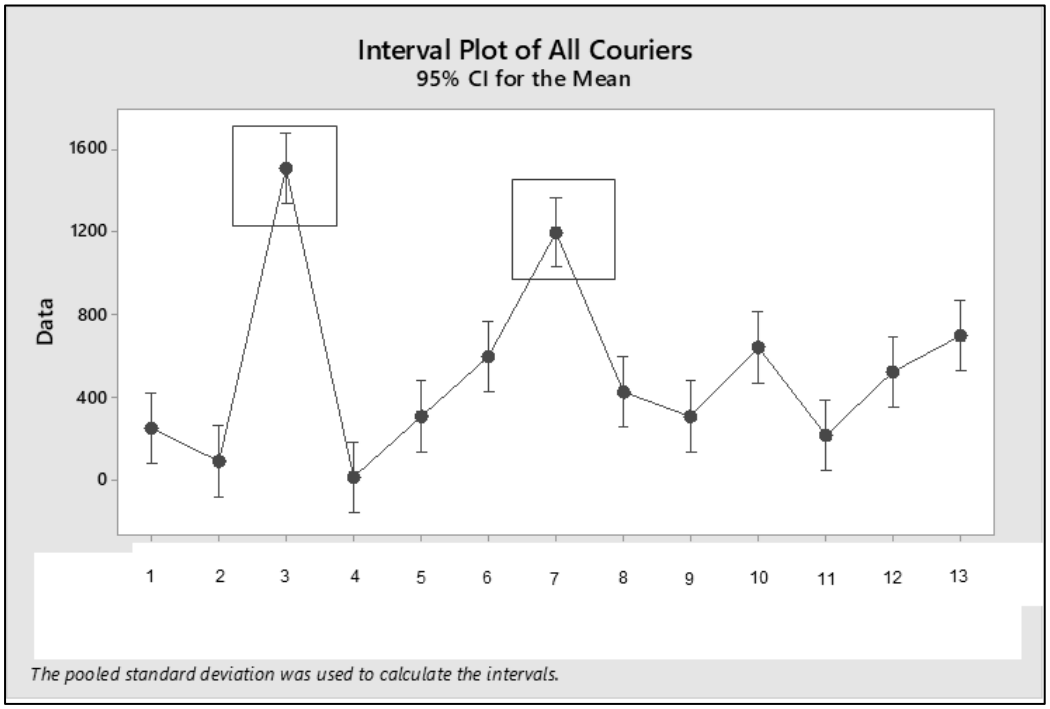
Means

Factor	N	Mean	StDev	95% CI
Courier 1	12	253.9	68.8	(83.5, 424.3)
Courier 2	12	95.3	42.1	(-75.1, 265.6)
Courier 3	12	1508	683	(1338, 1679)
Courier 4	12	19.33	10.32	(-151.04, 189.71)
Courier 5	12	311.4	88.6	(141.0, 481.8)
Courier 6	12	601.8	206.0	(431.4, 772.1)
Courier 7	12	1201	584	(1031, 1372)
Courier 8	12	428.8	100.8	(258.4, 599.1)
Courier 9	12	311.3	64.5	(141.0, 481.7)
Courier 10	12	644.8	111.8	(474.5, 815.2)
Courier 11	12	220.3	56.2	(50.0, 390.7)
Courier 12	12	527.6	269.5	(357.2, 698.0)
Courier 13	12	701	439	(531, 872)

Pooled StDev = 298.582

Note. *p < 0.05.

Figure 13
Interval Plot by Courier



X4: Sales Team Attributed Errors

It is uncovered in the PAR that the sales team employed sales agencies to market and sold Service C directly to consumers. Third-party sales personnel are stationed in malls, markets, airports, and other areas with high foot traffic. Acquired customers are then asked to fill out a form, where the third-party sales agents encode into the company's customer relationship management (CRM). The team found out in the PAR that several third-party sales agents were employing their children, relatives, or other persons in their homes to perform the encoding, while the sales agents were out in the field to acquire more customers. The team checked if the details provided by the customers on the subscriber application form were similar to what was encoded in the system. By using the company's sample size calculator, and company-standard sample precision of 0.08, the team tested 156

Due to high volume, the team performed random sampling using the company's sample size calculator and company standard precision of 0.08, resulting in a sample size of 156, as seen in Figure 14. Data were randomly selected using Minitab's random data selection. The data gathering process performed by the team is illustrated in Figure 16.

Figure 14
Screenshot of Company's Sample Size Calculator

Estimated Sample Sizes for Discrete Sampling (based on a 95% C.I.)			
Enter Population Size Here	**35,039**	**Precision (d)**	**Estimated Sample Size**
		0.01	7,780
Enter Population defect rate (p) Here	**0.5**	0.02	2,334
(p must be between 0 and 1. If unknown use 0.50)		0.03	1,077
		0.04	615
		0.05	396
This worksheet is used to estimate sample size		0.06	276
or discrete data, e.g., good or bad, defective or		0.07	203
non-defective, etc. Sampling error is the expected		0.08	156
precision associated with the listed sample size.		0.09	124
		0.1	100
** For process sampling use the total number of*		0.15	45
units produced in the time period you wish		0.2	25
to characterize		0.25	16

Figure 15
Minitab Screenshot- Random Data Selection

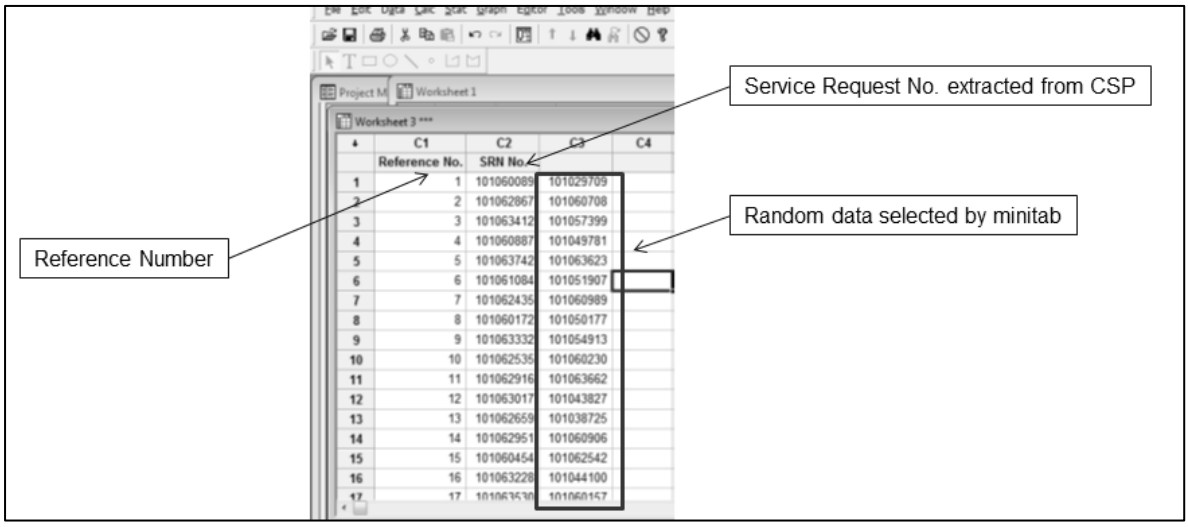
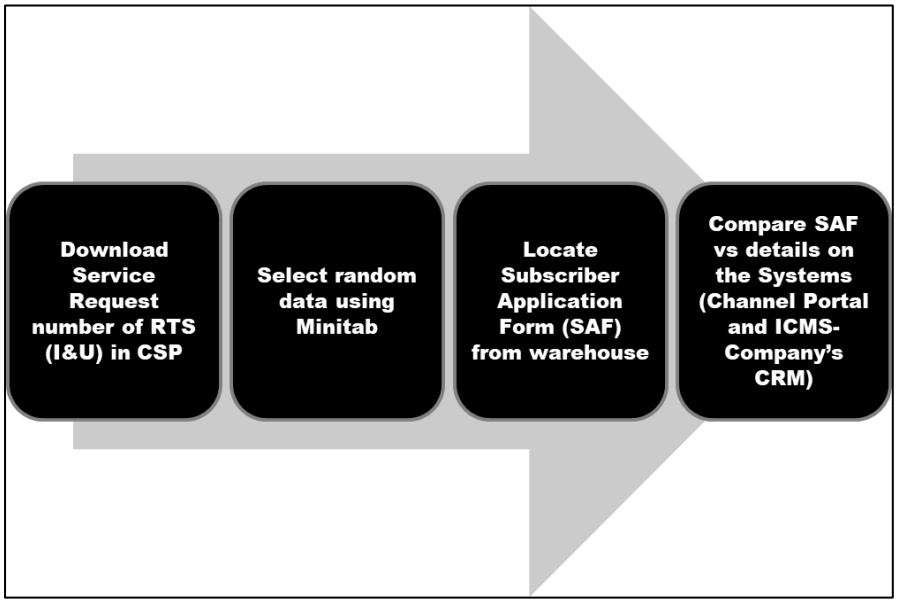


Figure 16
Data Gathering Process

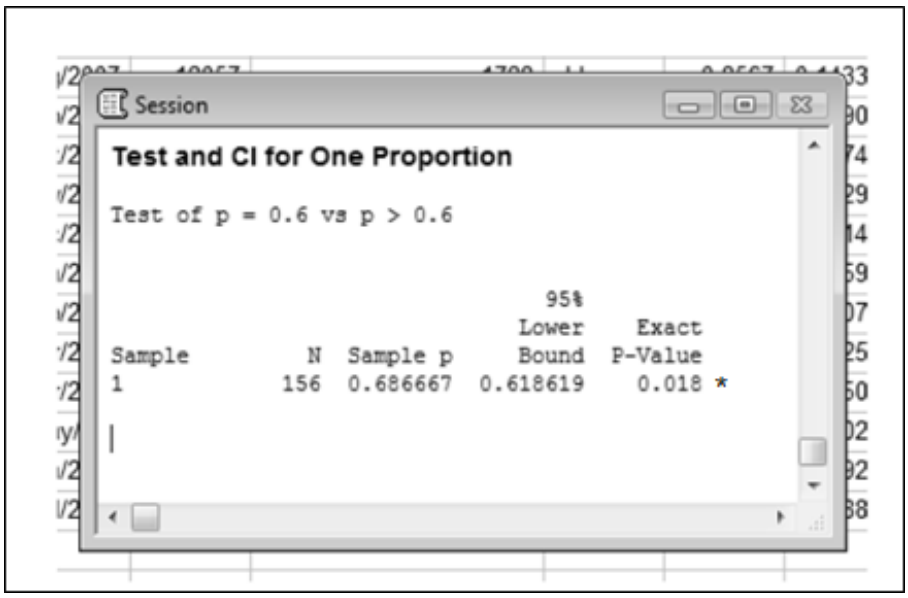


The results are summarized in Table 4, wherein a total of 66.02% of the sample size are identified as defects attributed to sales agent processing. As seen in Figure 17, the one proportion test proportion concluded that the sales attributed to RTS reason is more significant than sixty percent.

Table 4
Sampling Results

N= 35,039 RTS (Uknown & Inaccurate), n= 156, 95% C.I., precision of 0.08			
		Count	Percentage
A	**Added unnecessary number, character, n/a, 0, 00, etc.**	**4**	**2.56%**
B	**Wrong zip code**	**1**	**0.64%**
C	**No lot & block #, street, subdivision, & Barangay name, and addresses with wrong encoding).**	**98**	**62.82%**
D	The terms "building, barangay, village, street, subdivision" were not encoded in the system, confusing couriers.	17	10.90%
E	Same address & deliverable (courier problem)	5	3.21%
F	Customer address has no street number, name (usually provinces)	31	19.87%
	Total	156	100%

Figure 17
Minitab Screenshot- One-Sample % Defective Test



Note. *p < 0.05.

The summary of hypothesis tests is presented in Table 5. Only X2 (Different Areas) is insignificant to the RTS (inaccurate & unknown) billing defect.

Table 5
Hypothesis Test Results

Variable	Test	p-value	Result
X1= number of new clients	Regression	0.0260	Significant
X2= Different areas	ANOVA	0.1170	Not Significant
X3= Different accredited couriers	ANOVA	0.0001	Significant
X4= Sales team attributed errors	1-Sample % Proportion	0.0180	Significant

Improve Phase

The fourth phase of DMAIC focuses on finding creative solutions to solve the verified reasons for the defects (Pyzdek & Keller, 2010). The goal of the improvement phase is to identify action items to reach the desired performance (Ismyrlis & Moschidis, 2013). Like what was done in the analysis phase, team members were given sticky notes and time to think of how the company might address the situation. Participants kept their ideas until the facilitator instructed them to randomly post them on the wall for everyone to see and evaluate. Solutions were grouped by potential cause and then discussed one at a time. The discussions evaluated the solutions and allowed the team to combine and build upon the ideas of others. After all, ideas had been assessed. The team assigned the person responsible and the target date for each solution. The summary of the activity is presented in Figure 18. The team also developed a change matrix, as seen in Table 6, to assess the impact of change on the different groups involved

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Figure 18

Problem, Causes, Sub-Causes, and Countermeasures.

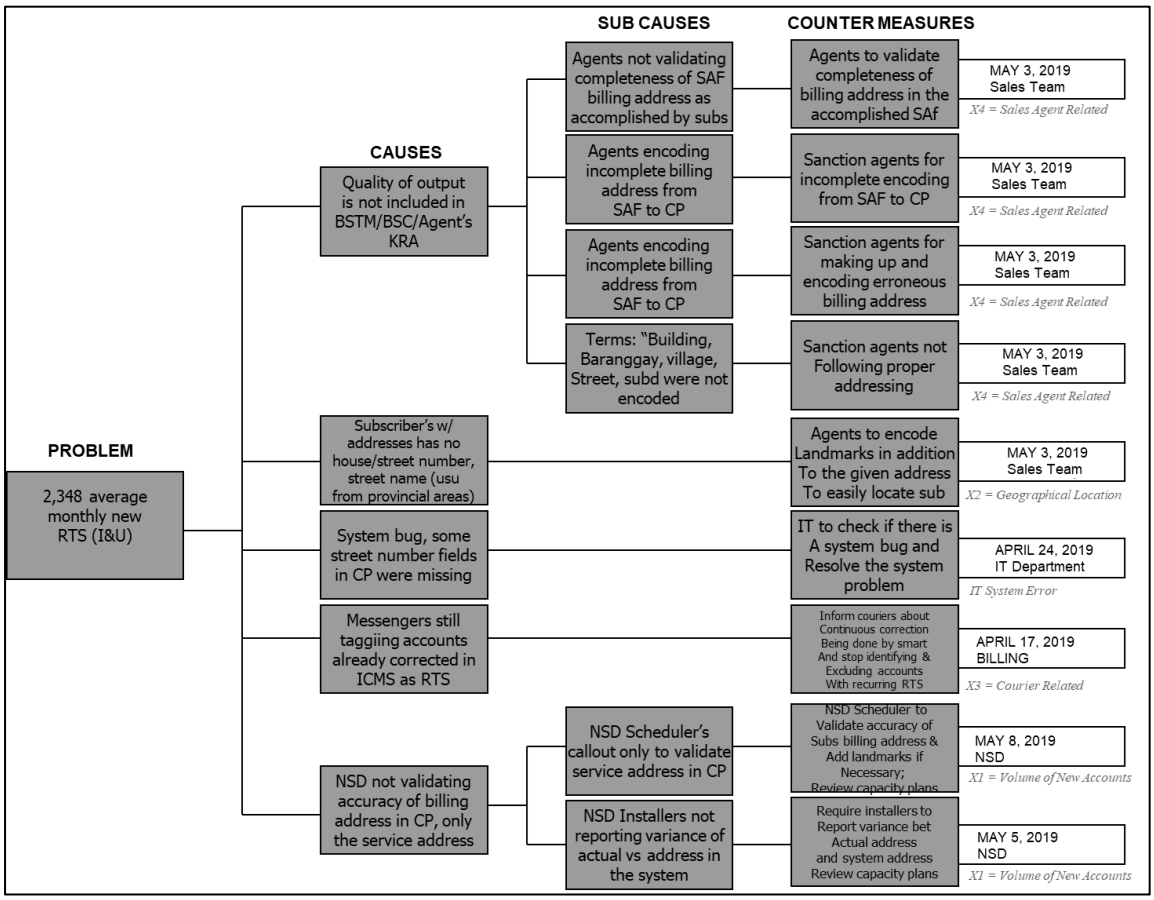


Table 6
Change Matrix of Solutions

Potential change initiated by the project	**From**	**To**	**Impact on the people (High, Medium, Low)**
Improve the new client process by identifying risks and placing appropriate controls so that the quality of the process is enhanced and will lower RTS, increase customer satisfaction, receivables and restrictions.	3RD PARTY AGENTS Deliver required quota (new customers).	3rd PARTY AGENTS Deliver required quota while satisfying standards of quality.	HIGH
	SALES Ensure delivery of target new accounts.	SALES Ensure delivery of new accounts while meeting quality standards of third-party agents.	HIGH
	AUDIT -Individual new connect is still not included in SOA processes.	AUDIT -Ensure that controls set are still adequate by conducting a quarterly audit of the process.	MEDIUM

Five months after implementing the identified action items, the results are presented in Figure 19. The monthly average RTS (inaccurate & unknown) defect significantly went down to 1,114, reducing the number of RTS-related complaints, as shown in Figure 20. With the reduction of calls received by the customer care group, the department canceled its plan to hire six supplementary call agents.

Figure 19
Old-New RTS Control Chart

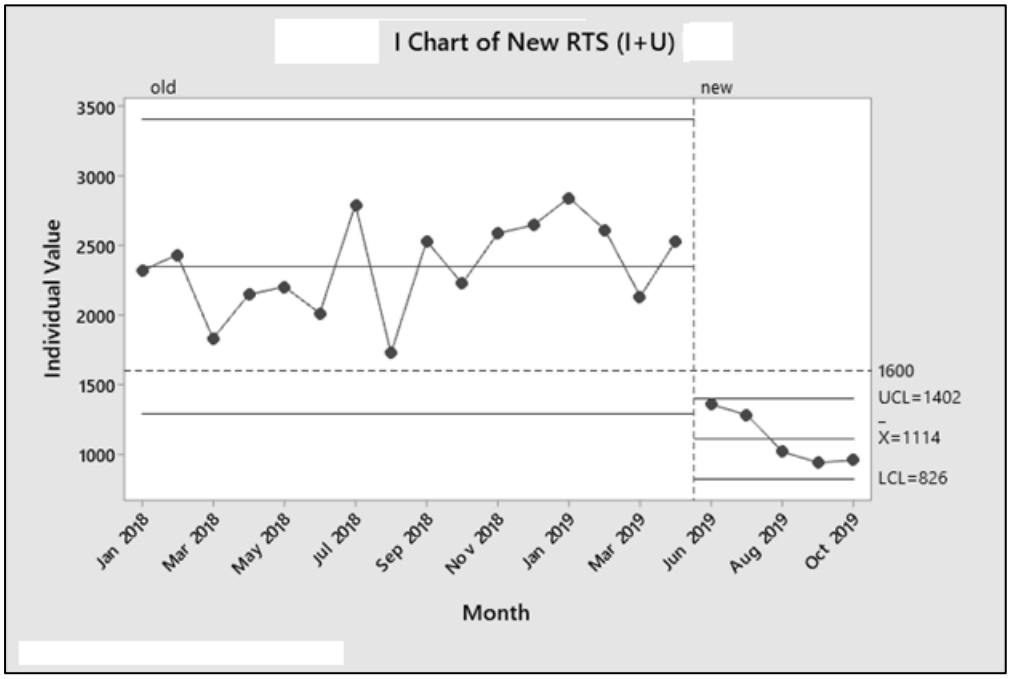
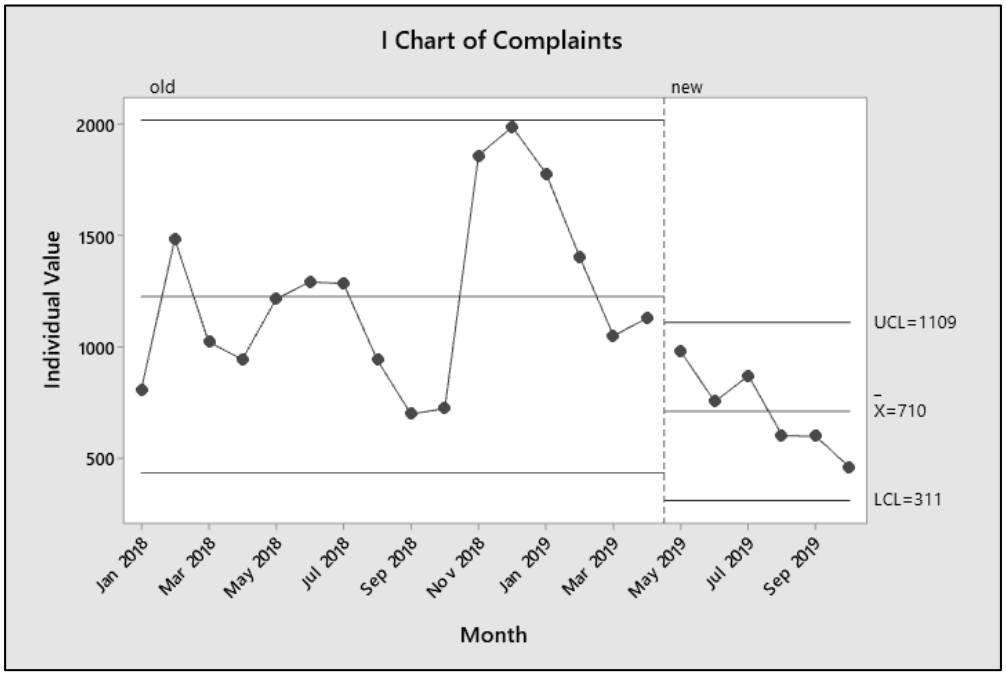


Figure 20
Old-New Complaints Control Chart



The billing department issued a policy to all hired third-party sales personnel to address the recurring sales-attributed RTS errors, strictly enforcing the signed agreement. The six-month summary of violations was recorded, and appropriate sanctions were issued, as seen in Table 7.

The fifty-two-point four percent decrease of average monthly pre-terminated accounts due to the billing defects, as seen in Figure 21, resulted in the potential avoidance of revenue loss of P37, 582,380.00. Finally, the yield of the process increased from 85.46% to 89.57%, as seen in Table 8.

Table 7
Summary of Enforced Agreement with Sales Agents

Number of Agents Sanctioned Due to Incomplete, Wrong Encoding in the System						
	MAY	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*
Written Warning	*24*	*43*	*38*	*36*	*29*	*21*
Holding-off of commissions	*6*	*21*	*16*	*19*	*11*	*12*
Termination	*0*	*1*	*2*	*1*	*0*	*1*

Figure 21
Old-New Pre-terminated Accounts (due to Inaccurate & Uknown RTS) Control Chart

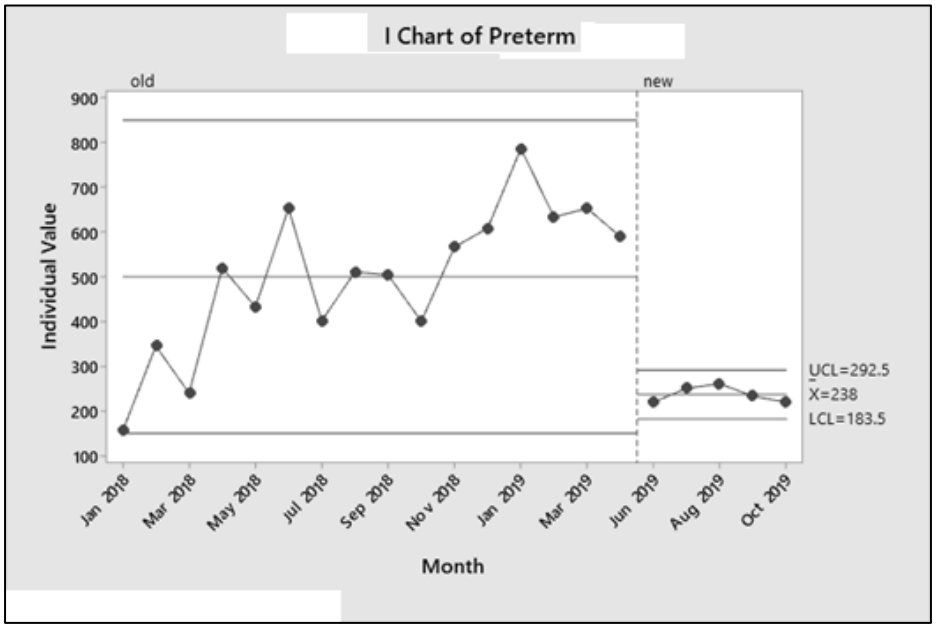


Table 8
Old-New Process Yield Table

Calculating Process Sigma Score: New RTS (Inaccurate & Uknown)		
	Old	**New**
Determine the number of defect opportunities	O=1	O=1
Determine the number of units processed-New Accounts	N= 188,837	N= 75,098
Determine total number of defects made- New RTS (I&U)	D= 27,453	D= 7,620
Calculate Defects Per Opportunity	DPO= 0.14538	DPO= 0.10424
Calculate Yield	Yield= 85.46%	Yield= 89.57%
Look Up Sigma in the Process Sigma Table	2.56	2.76

Control Phase

The last phase of DMAIC aims to ensure that the problems will not recur and maintain the improved situation (Gijo et al., 2019). The team updated the action items' policies, procedures, and work instructions. Quarterly process audits are performed by the systems and methods group to check variations between the actual and standard process, identification of additional operational risks and controls, and validate if current controls are still adequate. The technical team of the Learning and Development group also updated their training plans and learning materials.

Conclusions and Implications

The average monthly new return-to-sender (inaccurate and known) billing defects decreased from 2,348 to 1,114 from January 2018 to October 2019, representing a 52.56% reduction. The project has reduced RTS-related complaints by 46%, which canceled the plan

to hire additional six customer service personnel. Also, the project reduced churn accounts due to RTS by 52.40%, which is equivalent to an annualized revenue of P37.58 million pesos.

This PAR uncovered essential understandings that executives, managers, and staff can apply to improve the company's overall performance.

First, this research agrees with Knapp (2015) that executives should deliberately influence the corporate culture to act a critical part in the practical application of Lean Six Sigma. Second, business leaders should be involved in the different stages of Lean Six Sigma projects from ideation to implementation until closing and celebration (Antony & Gupta, 2019). For a project to be effective, all the parameters must be clear and easy to comprehend by everyone (Sreedharan et al., 2018).

The paper provided several practical implications for the company. First, for recurring problems, managers may start by preparing a SIPOC diagram and looking at the process's high-level map. Most leaders focus only on searching for root causes within their function, which eliminates identifying root causes beyond the process they manage. Second, the executive team may set a high-level strategic alignment session before scheduling each department/group's annual strategic planning to ensure that targets and key performance indicators between groups are aligned. This will avoid competing objectives between departments. Last, the Sales team may adopt quality metrics to balance-out sales targets and efficiency of operations.

Limitations and Recommendations for Future Research

This study is the first paper in the Philippines to use Lean Six Sigma through PAR in solving recurring bill delivery errors. It contributes insights into how PAR can reduce defects, save company time and resources, and avoid revenue loss due to pre-terminated accounts. It was performed in a Philippine-based service industry company. The results and findings cannot be generalized outside similar circumstances and situations. There are many prospects for future papers about applying Lean Six Sigma in the Philippines setting, both for manufacturing and service industries. It includes replicating this participative action research to other service industry companies to validate the findings if they can be generalized to other companies. Another opportunity is to identify a need for a region-specific framework to verify if current models are applicable in the Philippine setting.

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