Concordia Institute for Information System

Engineering (CIISE) Concordia University

INSE 6210: TOTAL QUALITY METHODOLOGIES IN ENGINEERING

PROJECT REPORT

IMPROVING POSTAL SERVICE QUALITY OF PUROLATOR

Submitted To:

Dr. ANJALI AWASTHI

Submitted by:

STUDENT NAME	STUDENT ID
Anjali Verma	40110059
Varinder Singh	40086602
Mohammed Faizan	40131626
Balkaran Singh Dhillon	40111539
Hari Ramasamy	40094073

CONTRIBUTION TABLE

Student Name	Student ID	Contribution Towards Project
Anjali Verma	40110059	Define phase Project charter SIPOC Pareto Chart CTQ's Process Map
Hari Ramasamy	40094073	Measure phase Dpmo calculation R&R analysis Process capability analysis QFD Lessons learnt from measure phase
Mohammed Faizan	40131626	Analyze phase Tree Diagram Cause and effect Diagram 5 whys technique Matrix Data Analysis Lessons learnt from analysis
Balkaran Singh Dhillon	40111539	Improve phase Improved Dpmo Improved process capability 5's Technique Profit Analysis Lessons learnt from improved phase
Varinder Singh	40086602	Control Phase P chart Scatter Diagram Lesson Learnt Website Design Conclusion

Final project report was prepared by everyone's support, with each one typing their part and compiling those at the end at the group meeting coming up with conclusions and lessons learnt.

EXECUTIVE SUMMARY

Purolator is a leading integrated freight, package and logistics solutions provider, they have built one of Canada's most extensive transportation and logistics networks and supporting infrastructure. The advantages of this size and scale benefit for their customers, with more facilities in more regional centers than any other freight and parcel solutions provider in Canada. Nationally, provincially and regionally, their customers can count on best-in-class service and support from Purolator, wherever they are.

They deliver services and solutions critical to Canada's busiest urban centers. Purolator deliver promises. From timely, dependable package delivery to integrated distribution solutions, they are well-equipped with the size, experience and expertise to meet the sophisticated, high-volume demands of our customers and deliver their promises.

So, In the define phase we had consolidated on various feedback surveys from the customer to corner down on the main points of focus from customer view and understood the major CTQs to be on "Timeframe - Late Delivery" and "Customer Satisfaction - Low Index". Later the analyze phase helped us to identify the root cause impacting the major CTQ was due to "Military Management System". The measure phase calculated the current sigma level. Using Poka yoke method in the improve phase a way was identified in eliminating and improving key processes. Further in the control phase using various control charts we ensured whether our process is in place and serves the purpose.

INTRODUCTION

This project concentrates to provide an overview of the current technological developments in the postal market and assess to the recent developments of digitalization etc. In Montreal, Postal services face problems such as poor authorization during delivery, less options with International services, product limitations for the shipping, customer service-based problems etc. We will be using a DMAIC approach to solve these issues and come up with a structured strategy in implementing the analyzed proposition.

Major problems with Purolator post.

- **Labor relation problems**
- **Shipment Delays**
- **Efficiency Problems**
- **Innovational failures**

DEFINE PHASE

Define Phase requires explaining the problem in a very specific manner that facilitate further analysis. The main purpose of this phase includes identifying the customers and the Critical to Quality (CTQ) parameters. We address project management issues such as what is needed to be done, who will do it and by what time and will do it by performing project scoping i.e. drilling down a project statement to a more specific problem etc.

PROJECT CHARTER:

Project Name:	**Improving the postal service quality of Purolator in Montreal**
Executive Summary:	**Postal services are very important these days as many important mails and parcels are being delivered by them. We have come up with certain solutions of the problems faced by them. We have followed DMAIC approach to understand and solve the issues.**
Project Definition:	
The data will be collected from the published reviews and then after their analysis a master plan will be made to improve the Purolator. **The outcome: Customers will experience better services from Purolator and consequently it will have a positive impact on business.**	
Vision:	
To provide customers quality postal services which means the parcels and mails should not be delayed and are never damaged and also we will try to provide some services that will add on to the customer service like customer is provided correct and precise tracking details.	

Objectives:

1. **Measure the influence of the problem faced by Purolator and find the real time solutions.**
2. **Analyze the cause of the problem with the help of the various techniques like root cause and cause and effect analysis**
3. **Improve the process by applying the lessons learnt by analysis phase.**
4. **Control and Observe the process.**
5. **Find Critical to quality parameters and perform pareto analysis.**

Customers:

Customers wants to send and receive their parcels and mails without any damage to them and also on correct time.

Major Known Risks:

Collection of data regarding the delivery times	**Low**
Finding real time problems faced by the company	**Medium**
Wrong database	**Medium**
Finding solutions	**High**

Stakeholders:

Owner – Government, corporation etc.

Project Members-

Staff- Part time and full-time workers

Customers-

Dependencies:

DPMO calculation and R&R analysis are based on the data collection from the published reviews

Pareto chart development is dependent on CTQ parameters and its frequencies.

Milestones:

Items	**Milestone**
Define phase	**28 September 2019 – 8 October 2019**
Measure phase	**9 October 2019 – 22 October 2019**
Improve phase	**23 October 2019- 30 October 2019**
Analyze phase	**31 October 2019- 13 November 2019**
Control phase	**14 November 2019- 19 November 2019**

Deliverables:

Items	**Description**

Define Phase	**Project charter** **SIPOC** **Critical to Quality parameters** **Process Map** **Pareto chart**
Measure Phase	**DPMO Calculation** **R&R** **Process Capability analysis** **QFD**
Analyze Phase	**Tree Diagram** **Cause and effect Diagram** **5 Whys Technique and Solutions** **Matrix Data Analysis**
Improve Phase	**Improve process flow** **Improve DPMO** **Improve process capability**
Control Phase	**Control charts** **Scatter Diagram**
Communication strategy:	
1. Whenever one level is completed, a progress report will be submitted **2. Final report needs to be sent weekly or completion of any task**	

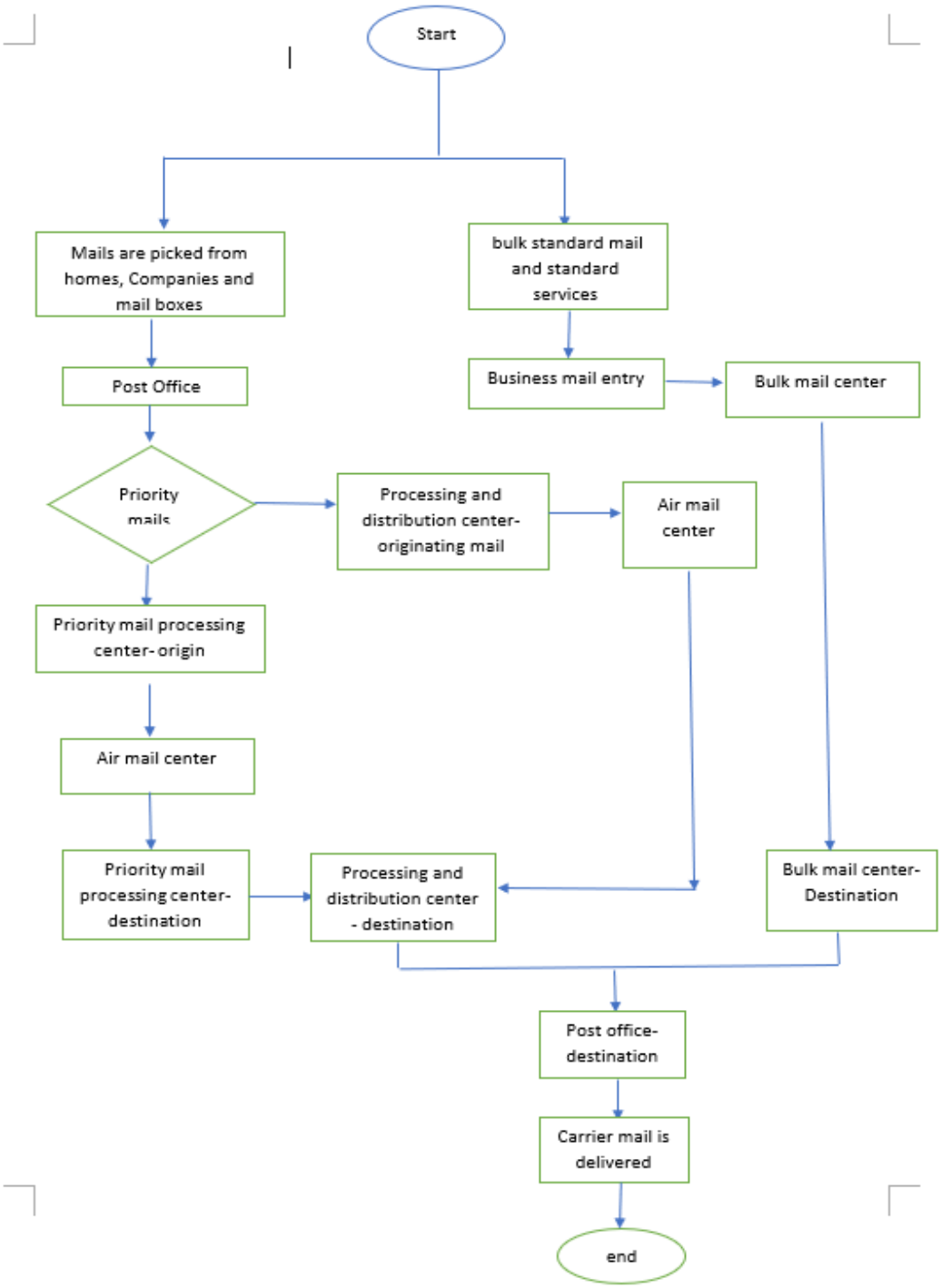
Signature of team members:	
Anjali Verma	Anjali verma
Varinder Singh	Varinder singh
Mohammed Faizan	Mohammed faizan
Balkaran singh Dhillon	Balkaran singh
Hari Ramasamy	Hari Ramasamy

SIPOC

Supplier	Input	Processes	Output	Customer
Packaging vendor	**Parcels**	**Mails gathered and received at main office**	**Payment Confirmation**	**People who send and receive mail**
Workplace provider	**Government mails**	**Weights of mails are checked and organized**	**Delivery confirmation**	**Online customers**
Banking services	**Publications**	**Separation of heavy and light mails is done**	**Customer feedback**	**Government organizations**

Transport provider	**Letters**	**Transportation of mails via air or road**		**Retail customers**
Packaging dealer	**Bulk Mails**	**Mails sent to delivery team**		
Road carriers		**Mails delivered**		
Employment team- full time and part time				

PROCESS MAP


Start
Mails are picked from homes, Companies and mail boxes
bulk standard mail and standard services
Post Office
Business mail entry
Bulk mail center
Priority mails
Processing and distribution center- originating mail
Air mail center
Priority mail processing center- origin
Air mail center
Priority mail processing center- destination
Processing and distribution center - destination
Bulk mail center- Destination
Post office- destination
Carrier mail is delivered
end

CRITICAL TO QUALITY PARAMETERS

After the mail was delivered successfully the feedback from the customers and the data from the reports were collected for the analysis to identify the key parameters that affected the delivery times. These are the Delivery Methods followed by Purolator delivery services. Data recorded below is per month.

PUROLATOR		
Delivery Method	**Number of addresses (In million)**	**% of total addresses**
Home delivery (older & urban areas)	**4.3**	**27%**
Rural mailboxes at the end of laneways	**4.0**	**26%**
Post office boxes and general delivery mail	**5.1**	**32%**
Community mailboxes	**1.8**	**11%**
Lock boxes found in apartment buildings etc.	**0.7**	**4%**
Total	**15.5**	**100%**

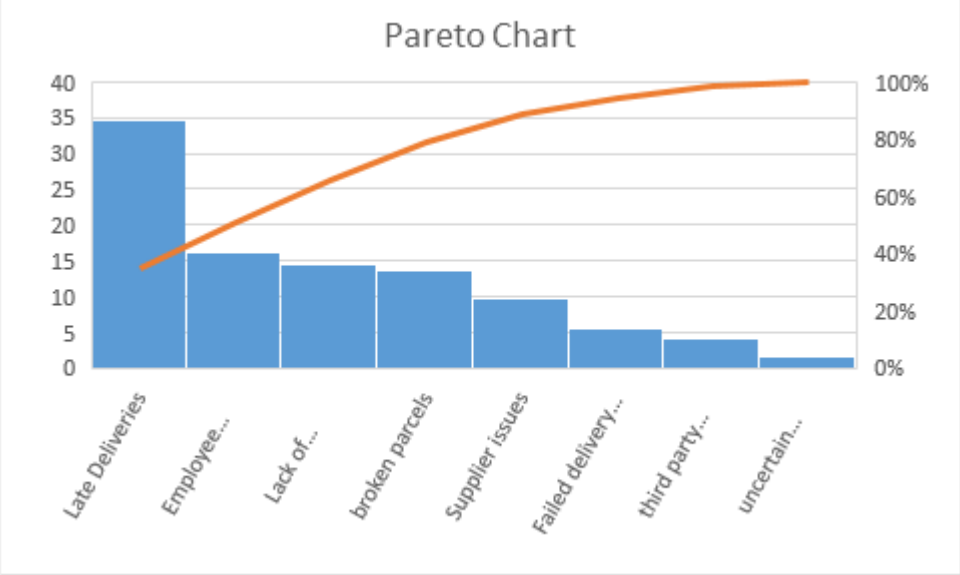
Workforce distribution:

Workforce distribution		
Type of work	**% of workforce**	**Approx. Head count**
Postmasters and assistants	**35%**	**17500**
Rural and suburban mail delivery	**26%**	**13000**
Mail processing	**15%**	**7500**
Clerical, technical and professional	**10%**	**5000**
Mail collection and delivery	**7%**	**3500**
Supervisor and operational support	**5%**	**2500**
Executive and management	2%	1000

Total	100%	50000

From these data a table was generated to understand the critical to quality parameters and the frequencies of problem occurring was identified. This data was computed using the literature reviews done as well. From this data Pareto chart was developed to narrow down to find the major causes and understand on the main CTQ that required attention.

Customer feedback	Cases Reported	Percentage	cumulative
Late deliveries	129M	34.67	34.67
employee relation problems	60M	16.12	50.79
Lack of experienced employees	54M	14.51	65.3
broken parcels	51M	13.71	79.01
supplier issues	36M	9.67	88.68
Failed delivery attempts	21M	5.64	94.32
Third party issues	15M	4.03	98.35
uncertain climatic conditions	6M	1.65	100
TOTAL	372M	100	



From the pareto chart we can see that 80% of the problems are caused by the Late deliveries, employee relation problems, Lack of experienced employees, broken parcels and supplier issues. We should take measures on these parameters initially and with this majority of problems will be resolved.

MEASURE PHASE

This phase focuses on how to measure the internal processes that impact CTQs.

DPMO CALCULATION USING MONTHLY SERVICE DATA

Defects per million opportunities for the data
given in table: Total number of defects = **1552**
Total number of opportunities for error = **12239**
Dpmo = (Number of defects discovered / Total number of opportunities) * 1000000
= (1552/ 12239) * 1000000
= 126807.7

Sigma level = NORMSINV (1 – 126807.745/ 1000000) + 1.5

Sigma level = 2.641612

Year	Number of Parcels Received to Deliver	Number of Parcels Not Delivered
1	410	78
2	355	79
3	438	66
4	427	68
5	418	31
6	447	17
7	427	57
8	394	65
9	426	57
10	351	31
11	415	37
12	439	68
13	376	12
14	439	28
15	409	42
16	427	51
17	447	69

18	395	63
19	385	61
20	385	21
21	389	71
22	360	61
23	369	32
24	374	25
25	442	71
26	398	63
27	420	79
28	427	37
29	410	80
30	440	32
TOTAL	12239	1552

Table 4 DPMO Calculation

R&R ANALYSIS

We have considered 2 business days as minimum and 5 business days as maximum to deliver a mail item successfully. In the table below, we have taken three different operators for two trials for handling ten mail items.

Gauge Repeatability & Reproducibility												
Number of Operators	3		Upper Specification Limit	5								
Number of trails	2		Lower Specification Limit	2								
Number of Mail Items	10											
Data	Employee (Operator 1)				Employee (Operator 2)				Employee (Operator 3)			
	Trial				Trial				Trail			
Mail Items (Number)	1	2	Average	Range	1	2	Average	Range	1	2	Average	Range
1	3	5	4	2	3	5	4	2	2	5	3.5	3
2	5	4	4.5	1	3	5	4	2	2	5	3.5	3
3	4	5	4.5	1	4	4	4	0	5	5	5	0
4	4	4	4	0	3	2	2.5	1	4	2	3	2
5	5	4	4.5	1	5	5	5	0	4	4	4	0
6	5	5	5	0	4	2	3	2	2	3	2.5	1
7	2	4	3	2	4	3	3.5	1	3	4	3.5	1
8	4	4	4	0	4	3	3.5	1	5	3	4	2
9	2	3	2.5	1	2	3	2.5	1	2	2	2	0
10	5	3	4	2	4	2	3	2	4	2	3	2
Sample Average			4				3.5				3.4	
Range Average			1				1.2				1.4	
Average Range	1.2								Tolerance Analysis			
X-bar range	0.6		Repeatability (EV)				5.472		182.40%			
			Reproducibility (AV)				1.061		35.37%			
			Repeatability & Reproducibility (R&R)				5.573		185.77%			
			Control limit for individual ranges				3.9204					

From the above R&R analysis, the values of EV, AV and R&R are 182.40%, 35.37% and 185.77% respectively. All values are above the acceptable limit. So, we have to proceed with six sigma to bring the value under an acceptable limit.

PROCESS CAPABILITY

The Process Capability Analysis was done by collecting the delivery time averages over the last 15 years from 5 Random postal Business Unit. From the data and Cp computation, it is found that Cpk < 1 which indicates that the process is not capable.

Nominal Specification	**3.5**	**Average**	**3.52**	**C_p**	**0.528665**
Upper Specification Limit	**5**	**Standard Deviation**	**0.945779**	**C_{pu}**	**0.521616**
Lower Specification Limit	**2**			**C_{pl}**	**0.535714**
				C_{pk}	**0.521616**

Table 5 Process Capability Analysis

DATA	BU 1	BU 2	BU 3	BU 4	BU 5
2003	4	2	2	3	3
2004	5	5	5	3	3
2005	2	3	4	5	5
2006	2	4	3	4	2
2007	4	5	4	4	3
2008	4	4	4	2	2
2009	5	4	5	4	4
2010	3	2	4	4	3
2011	2	5	2	3	3
2012	3	4	5	3	4
2013	2	5	3	2	5
2014	3	3	3	3	2
2015	4	5	5	5	4
2016	3	3	3	5	5
2017	2	4	2	2	4

Table 6 Data for Process Capability

QUALITY FUNCTION DEPLOYMENT (QFD)

House of Quality or QFD is a tool used to determine the relationship between the customer requirements and the technical requirements. Technical requirements are designed based on the customer requirements which are obtained from the CTQs.

In QFD the individual weights are assigned to the customer requirements respective to the technical requirements through which the raw score and relative ranking of technical requirements are calculated.

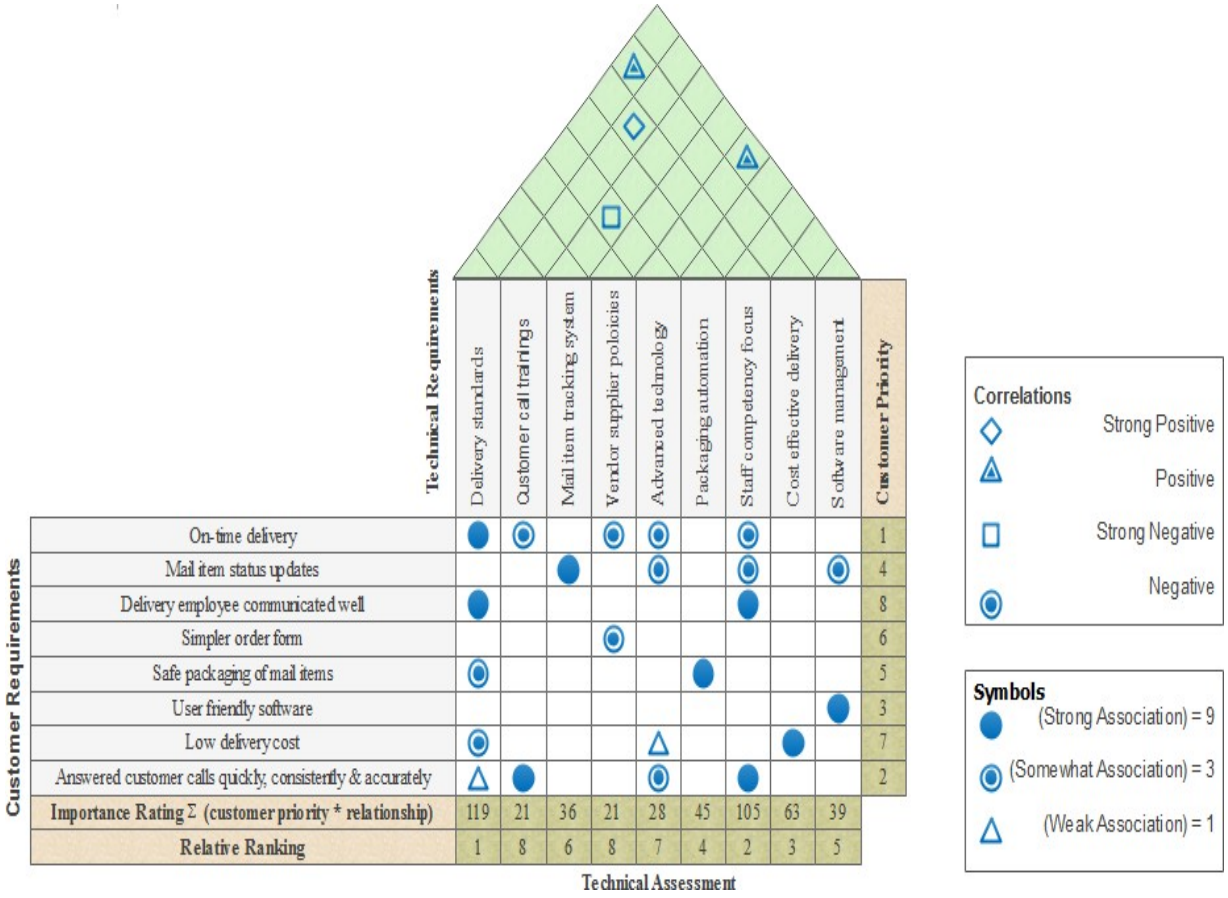


Figure 6 QFD Analysis

ANALYZE PHASE

Analyze is the third phase of DMAIC process. It is a deterministic stage that yields optimum output of the solution. It focuses on processes, facts and information to gain an understanding of why defects, errors or excessive variation occurs and finding opportunities for improvement. It involves developing flow charts, charting data, conducting experiments to verify hypothesized relationships. To tackle the variations in postal services, we are using cause and effect analysis and 5 whys technique.

The 4 tools that we are using for Analyze phase are -

1. Tree Diagram
2. Cause and Effect diagram
3. 5 Whys technique

4. Matrix Data Analysis

Tree Diagram

Tree Diagram helps to organize facts and ideas which have an affinity for each other into categories. It is a powerful technique for grouping and understanding the data.

We have used Tree diagram in this project to organize general information and consolidate information with respect to the criticality and complexity. The information gathered in the affinity diagram can be further used for other analyze phase techniques such as the Cause and Effect diagram and 5 Whys technique.

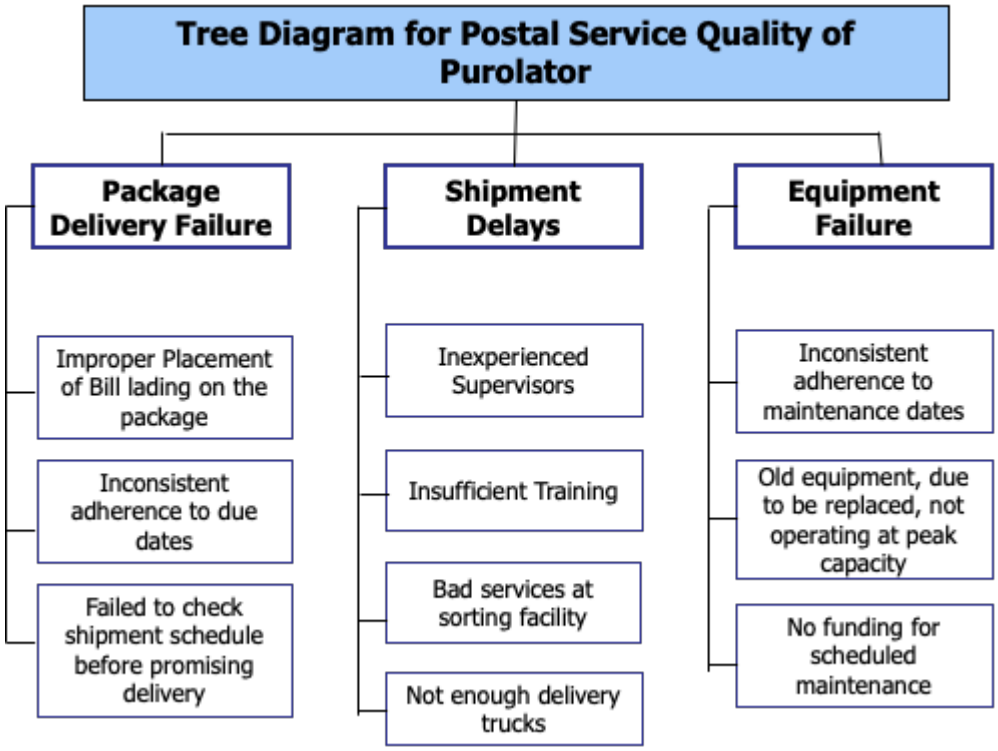


Figure 1: Tree Diagram for Postal Service Quality of Purolator

Cause and Effect diagram

The most common Analyze phase tool used is the fishbone diagram or the Ishikawa diagram. The Ishikawa diagram is a graphical representation of expected problems which can be identified with the causes and effects related to it. The tool is mainly used to stimulate the reasoning during brainstorming. The root cause can be the quality of service in Purolator that is leading the major impact and the Causes are listed as follows with the following effects.

1. Shipment Delays
2. Package Delivery Failure

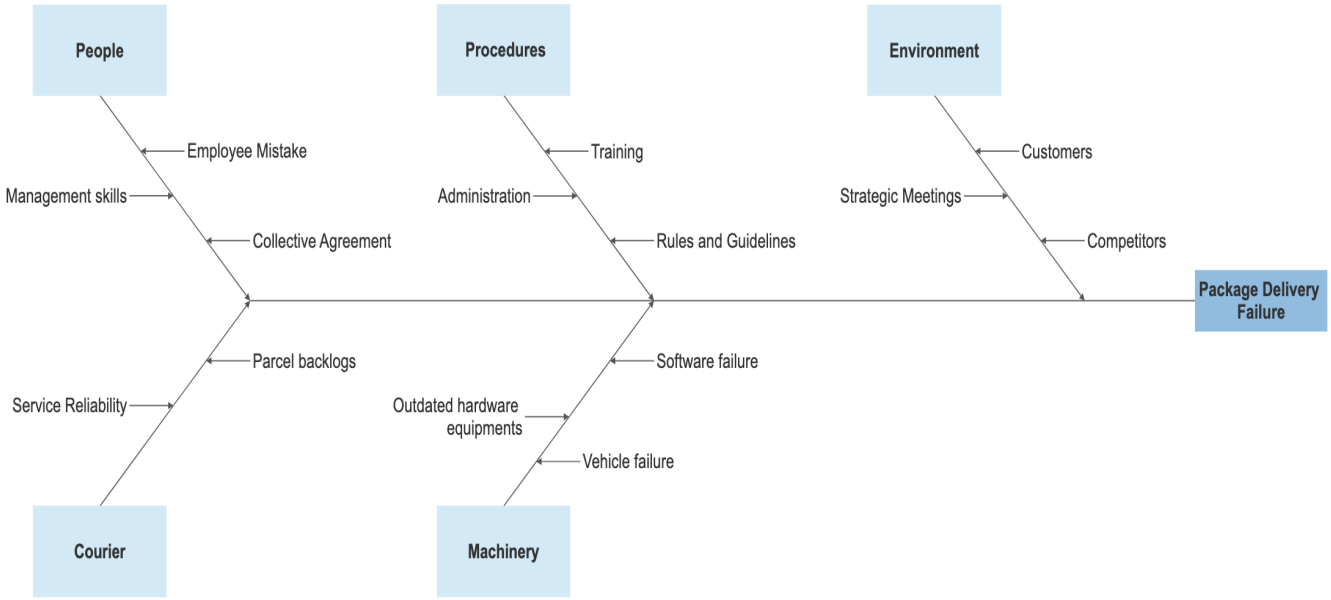


Figure 2: Ishikawa Diagram for Package Delivery Failure

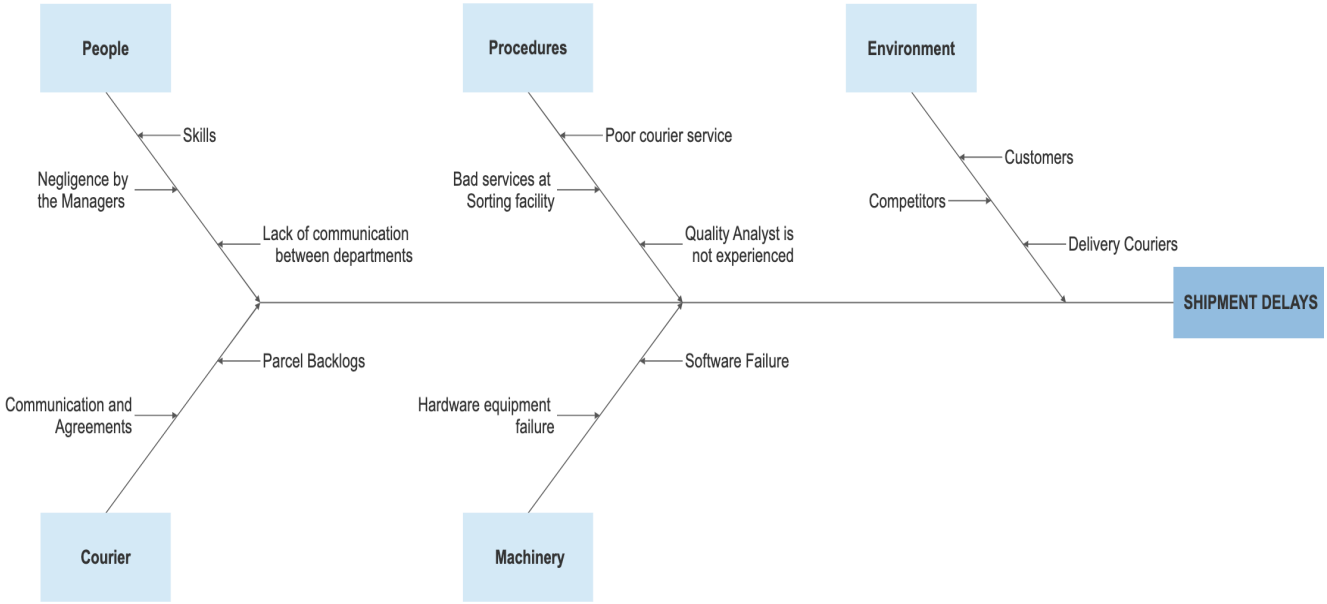


Figure 3: Ishikawa Diagram for Shipment Delays

Root Cause Analysis

Root cause analysis will help you to identify the actual cause in the data. It also helps in identifying the relationship between causes that occur. It also helps in finding the data without any statistical analysis this type of problem is driven by changes in behavior, process, measures, equipment or materials.

The 5 Whys technique is a simple brainstorming method that is used by a quality improvement team to identify the root cause(s) of a problem. Upon finding a problem either by Ishikawa diagram or process mapping, ask “why” question to identify the root causes of the

problem.

5 Why Question Table (Problem #1)	
PROBLEM: Package not delivered to the Receiver	
Why Question?	**Answers**
Why was the package not delivered to the Receiver?	Because of the Zero Delivery Attempts by the Driver.
Why there is a Zero Delivery Attempts by the Driver?	Because the driver was not able to scan or read the receiver's details.
Why was the driver not able to scan or read the receiver's details?	Because of improper placement of bill of lading on the package.
Why there is improper placement of bill of lading on the package?	Because the initial shipment was not properly examined by the Purolator Employee.
Why was the initial shipment was not properly examined by the Purolator Employee?	Because the Upper Management did not provide specific guidelines to the Purolator Drop Shipment Employees.
Recommended Solution: 1. Proper rules and guidelines should be made available to the Employees of Purolator postal service. 2. The employee must be trained to verify whether the package is fit for the shipment.	

5 Why Question Table (Problem #2)	
PROBLEM: Shipment delays in Purolator	
Why Question?	**Answers**
Why there is a delay in shipment?	Due to the delay in dispatching of orders at the Sort Facility.
Why there is a delay in dispatching of orders at the Sort Facility?	Because of the Sort Tunnel at the Processing Centre did not scan the package correctly.
Why did the Sort Tunnel at the Processing Centre did not scan the package correctly?	Because of the Sort Tunnel can scan only 5 sides of the package and the barcode was on the 6^{th} side of the package and was hidden.

Why was 6th side of the package hidden?	Because the packages were poorly organized on the conveyor belt by the Workers.
Why the packages are poorly organized on the conveyor belt by the Workers?	Because of untrained staff in Purolator Processing Centre.
Recommended Solution: 1. The Managers must make sure that the employed staff are trained, and also proper training must be given to new staff. 2. The Sort Tunnel machine must be upgraded in a cost-effective way to scan all dimensions of the at the package.	

Matrix Data Analysis

Persons Involved						**TOTAL**
Driver	●		○			12
Supplier	○	○	●			15
Counter Staff		●	△			10
General Manager	△	○	△	●	○	17
IT Specialist		△			●	10
Options	Delayed Delivery	Bill Lading Error	Damaged Parcels	Training	Website Design	

● - HIGH - 9 - (Prime Responsibility)
○ - MEDIUM - 3 - (Secondary Responsibility)
△ - LOW - 1 - (Kept Informed)

Figure 4: Responsibility Matrix Analysis Diagram for Purolator.

IMPROVE PHASE

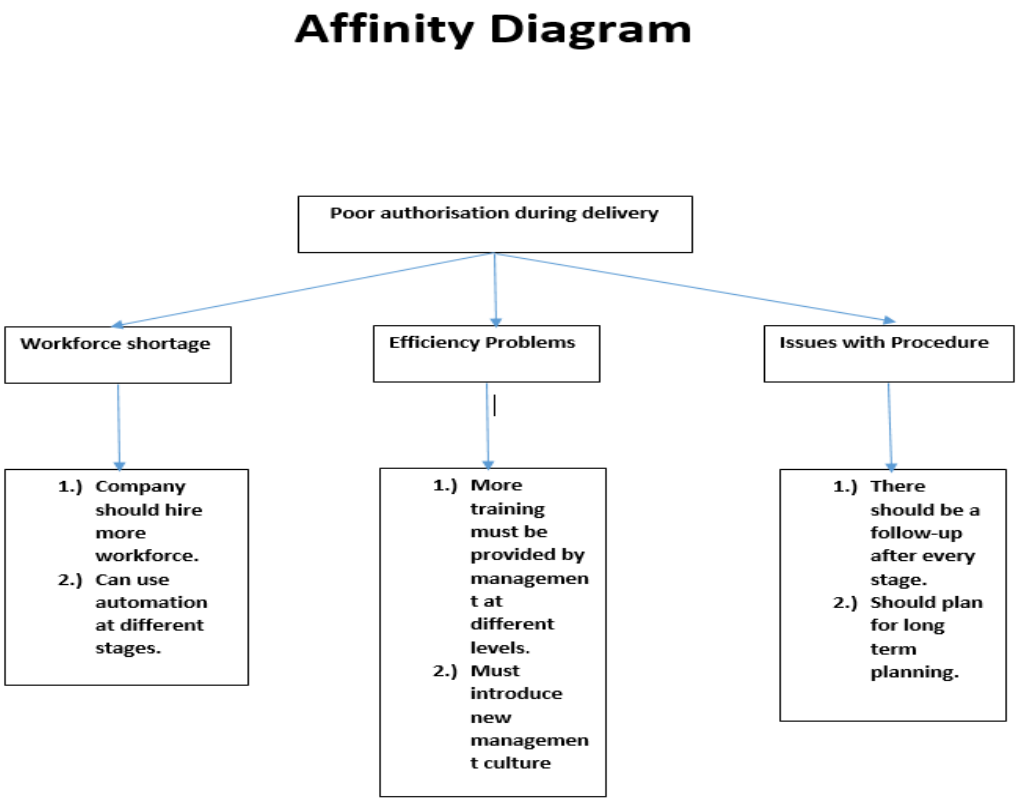
This stage focuses on removing or resolving the problem and improving the performance measures of the Critical to Quality parameters. Issue arrangement frequently involve specialized or organizational changes.

IMPROVE USING AFFINITY DIAGRAM

Affinity Diagram

Affinity Diagram helps to organize facts and ideas which have an affinity for each other into categories. It is a powerful technique for grouping and understanding the data.

We have used Affinity diagram in this project to organize general information and consolidate information with respect to the criticality and complexity. The information gathered in the affinity diagram can be further used for other analyze phase techniques such as the Cause and Effect diagram and 5 Whys technique.



IMPROVE USING 5'S TECHNIQUE

Sort	Remove Items	Manual intervention in folding ,Limited working hours, Workforce in deliveries, Scanning the received mails
Set	Prioritize	High - Manual Intervention, Workforce medium - working hours
Shine	Sweep	Remove the manual interbention by automated machines, 24*7 Customer support
Standardize	Conduct Meetings,Audits	Conduct quality practices, third party auditing
Sustain	Safety Measures	Quality standards

Figure 1) 5's Technique

IMPROVED DPMO

After using the 5's technique and by sorting with the issues recognized by analysis phase it is accepted that the delivery time of the package gets improved and reduce to some extent which in-case increase the sigma level and reduce the DPMO level.

The improved sigma level is 3.37

The improved data will be as follows

Year	Number of Parcels Received to Deliver	Number of Parcels Not Delivered
1	410	38
2	355	29
3	438	26
4	427	18
5	418	11
6	447	17
7	427	17
8	394	15
9	426	17

10	351	11
11	415	10
12	439	8
13	376	2
14	439	9
15	409	12
16	427	11
17	447	12
18	395	3
19	385	4
20	385	11
21	389	10
22	360	11
23	369	12
24	374	15
25	442	11
26	398	12

27	420	9
28	427	7
29	410	8
30	440	2
TOTAL	**12239**	**378**

Defects per million opportunities for the generated data**:**

Total number of defects = 378

Total number of opportunities = 12239

Formula used:

Defects/ Opportunities = 378/12239 = 0.03088487

DPMO = (Defects/ Opportunities) *1000000 = (378/12239) *1000000 = 30884.87

k = NORMSINV (1-DPMO/1000000) +SHIFT
k = NORMSINV (1-0.03088487) + 1.5

k = 1.87 + 1.5
k = 3.37
Sigma level = 3.37

Figure 2) Improved DPMO

IMPROVED PROCESS CAPABILITY

After our improvements, we measure the Process Capability Index and we found our Cpk > 1 which evidently shows that our process is very much stable than before.

Upper Specification Limit	**5**	**Average**	**3.933**	**C_p**	**3.558**
Lower Specification Limit	**2**			**C_{pu}**	**1.26571**
		Standard Deviation		**C_{pl}**	**2.293**
Nominal Specification	**3.5**		**0.843**	**C_{pk}**	**1.26571**

DATA	BU 1	BU 2	BU 3	BU 4	BU 5
2003	4	3	3	3	3
2004	5	5	5	3	3
2005	4	3	4	5	5
2006	3	4	3	4	4
2007	4	5	4	4	3
2008	3	4	4	4	5
2009	5	4	5	4	4
2010	4	3	4	4	3
2011	3	5	3	3	3
2012	3	4	5	3	4
2013	4	5	3	2	5
2014	3	4	3	3	4
2015	4	5	5	5	4
2016	6	5	3	5	5
2017	4	4	3	5	4

APPROXIMATED PROFIT ANALYSIS

Profit Raise (Annual)		
	Before Six Sigma	**After Six sigma**
No of Conformities	**12239-1552=10687**	**12239-378=11861**

Fixed cost	**$100,000**	**$100,000**

Delivery Price for Third Party Vendor	**50$**	**50$**
Average cost of all deliveries*	**35$**	**28$**
Profit*	**260305**	**360942**
Six Sigma Investment Cost (SSIC)= $40000		
Profit including Six Sigma cost = $360942 – SSIC = $320942		
Net Profit = Profit with Six Sigma as Investment – Profit before Six Sigma implementation		
= $320942 – $260305		
= $60637		

Figure 3) Profit Analysis

Delivery price for third party vendor* - Average delivery price hand over to the third-party vendors.

Average cost of all deliveries* - Average cost of all the deliveries handled.

Profit* - [(Delivery price for third party vendor) *(No. of Orders placed)]-[[(Average cost of all

deliveries)*(No. of Orders placed)] + [Fixed Cost]]

CONTROL PHASE

Control Phase is the last phase of DMAIC model. The main focus of this phase focuses on how to maintain the improvements over time. This can include establishing the new standards and procedures, training the workforce and instituting controls like checklists, periodic status reviews, statistical process control charts etc. The main tool used in Control Phase is Control charts.

We are considering a data sets which consist of the number of parcel the Purolator got to deliver and number of problems they encountered and then we are performing p-chart analysis to check the control of the process before and after the application of six sigma.

P-CHART BEFORE SIX SIGMA

Days	**Number of parcels are received to deliver**	**Number of problems related to parcel**	CL	P Bar	UCL	LCL
1	353	67	0.189802	0.13356	0.187878	0.079242
2	364	53	0.145604	0.13356	0.187051	0.080069
3	443	74	0.167043	0.13356	0.182047	0.085073
4	433	35	0.080831	0.13356	0.182604	0.084516
5	407	61	0.149877	0.13356	0.184146	0.082974
6	386	71	0.183938	0.13356	0.185504	0.081616
7	441	46	0.104308	0.13356	0.182157	0.084963
8	436	16	0.036697	0.13356	0.182435	0.084685
9	366	67	0.18306	0.13356	0.186904	0.080216

10	426	76	0.178404	0.13356	0.183005	0.084115
11	354	58	0.163842	0.13356	0.187801	0.079319
12	366	76	0.20765	0.13356	0.186904	0.080216
13	381	38	0.099738	0.13356	0.185844	0.081276
14	378	26	0.068783	0.13356	0.186051	0.081069
15	441	61	0.138322	0.13356	0.182157	0.084963
16	390	49	0.125641	0.13356	0.185237	0.081883
17	439	33	0.075171	0.13356	0.182267	0.084852
18	443	67	0.151242	0.13356	0.182047	0.085073
19	406	61	0.150246	0.13356	0.184208	0.082912
20	393	65	0.165394	0.13356	0.185039	0.082081
21	411	37	0.090024	0.13356	0.183899	0.083221
22	419	75	0.178998	0.13356	0.183416	0.083703
23	357	42	0.117647	0.13356	0.187572	0.079547
24	408	37	0.090686	0.13356	0.184084	0.083036
25	406	10	0.024631	0.13356	0.184208	0.082912
26	439	80	0.182232	0.13356	0.182267	0.084852
27	400	80	0.2	0.13356	0.184587	0.082533
28	380	30	0.078947	0.13356	0.185912	0.081208

29	416	57	0.137019	0.13356	0.183596	0.083524
30	380	63	0.165789	0.13356	0.185912	0.081208
	12062	1611				

Table 11 Computation for P-chart before six-sigma

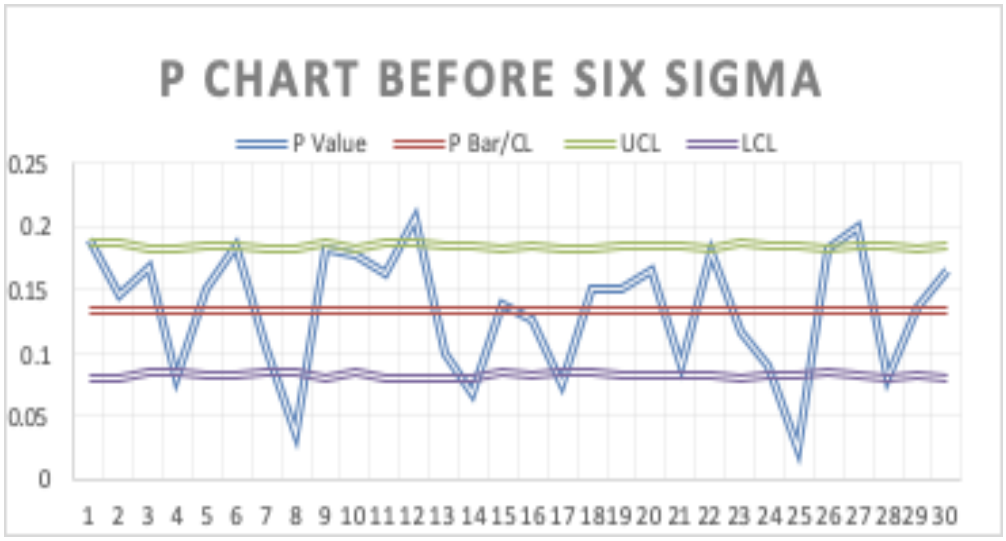


Figure 8 P-Chart before six-sigma

Almost 7 days in a month are found to be out of control before the application of the six sigma. This is not normal, and the process is way out of control

P-CHART AFTER SIX SIGMA

After the application of six sigma the process seems to be in control and has improved much more compared to the previous scenario.

Day	No of parcels received to deliver	No of parcels not delivered	P-Bar/CL	SD	P value	LCL	UCL
1	510	10	0.030	0.007661	0.019608	0.007818	0.053782
2	455	15	0.030	0.008111	0.032967	0.006468	0.055132
3	450	16	0.030	0.008156	0.035556	0.006333	0.055267
4	427	5	0.030	0.008372	0.01171	0.005683	0.055917
5	340	12	0.030	0.009383	0.035294	0.002652	0.058948
6	447	17	0.030	0.008183	0.038031	0.006251	0.055349
7	427	12	0.030	0.008372	0.028103	0.005683	0.055917
8	394	15	0.030	0.008716	0.038071	0.004652	0.056948
9	426	17	0.030	0.008382	0.039906	0.005654	0.055946
10	351	11	0.030	0.009234	0.031339	0.003097	0.058503
11	400	13	0.030	0.00865	0.0325	0.004849	0.056751
12	439	9	0.030	0.008257	0.020501	0.006029	0.055571
13	376	13	0.030	0.008922	0.034574	0.004034	0.057566
14	439	9	0.030	0.008257	0.020501	0.006029	0.055571
15	409	15	0.030	0.008555	0.036675	0.005136	0.056464
16	427	12	0.030	0.008372	0.028103	0.005683	0.055917
17	447	17	0.030	0.008183	0.038031	0.006251	0.055349
18	372	5	0.030	0.00897	0.013441	0.00389	0.05771
19	385	15	0.030	0.008817	0.038961	0.004348	0.057252
20	385	11	0.030	0.008817	0.028571	0.004348	0.057252
21	389	10	0.030	0.008772	0.025707	0.004485	0.057115
22	360	16	0.030	0.009118	0.044444	0.003445	0.058155
23	369	12	0.030	0.009006	0.03252	0.003781	0.057819
24	360	15	0.030	0.009118	0.041667	0.003445	0.058155
25	390	11	0.030	0.00876	0.028205	0.004519	0.057081
26	398	12	0.030	0.008672	0.030151	0.004784	0.056816
27	420	9	0.030	0.008442	0.021429	0.005475	0.056125
28	427	17	0.030	0.008372	0.039813	0.005683	0.055917
29	400	8	0.030	0.00865	0.02	0.004849	0.056751
30	420	19	0.030	0.008442	0.045238	0.005475	0.056125
TOT	**12239**	**378**					

Table 12 Computation for P-chart after six-sigma

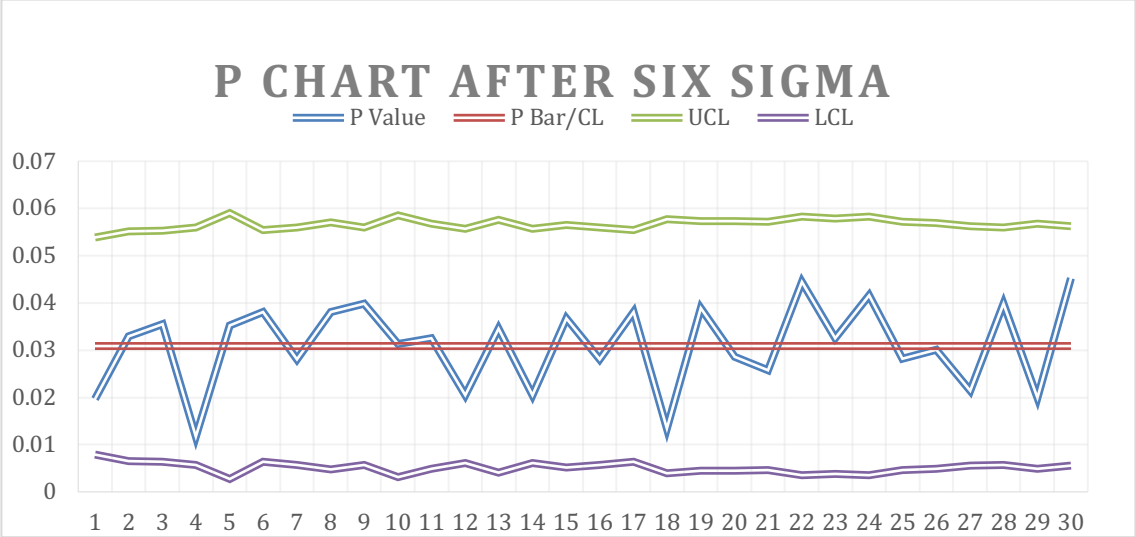


Figure 9 P-Chart after six-sigma

SCATTER PLOT

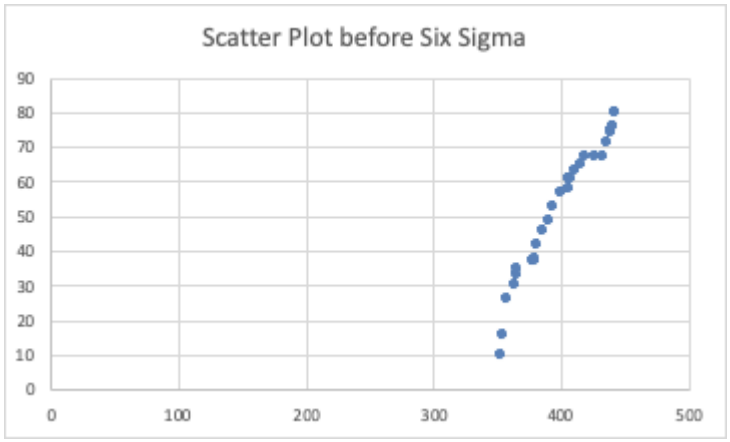


Figure 10 Scatter Plot before six-sigma

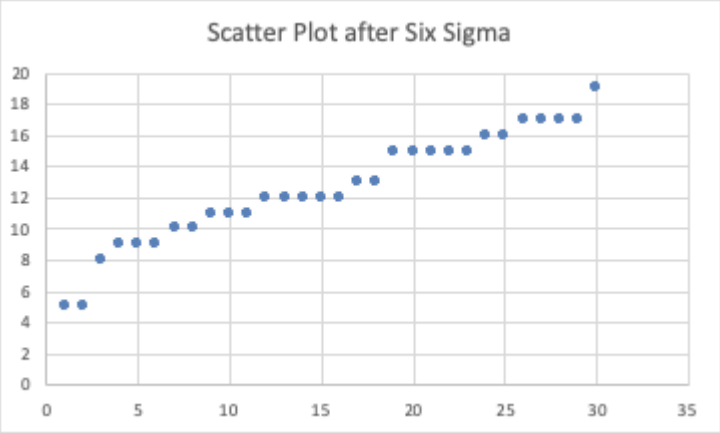
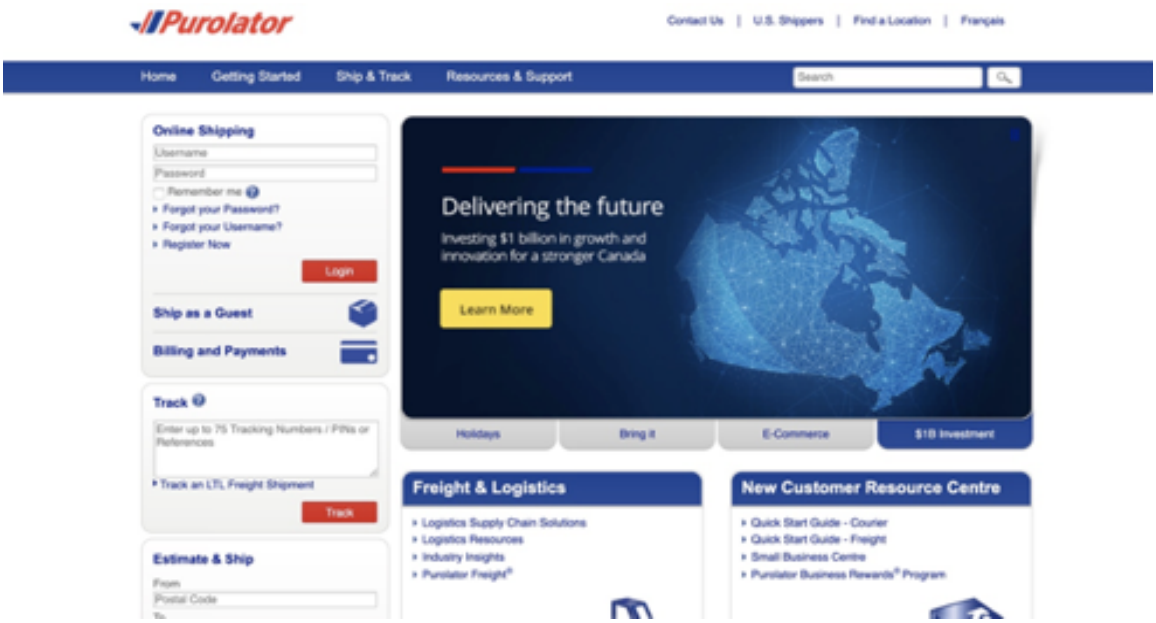
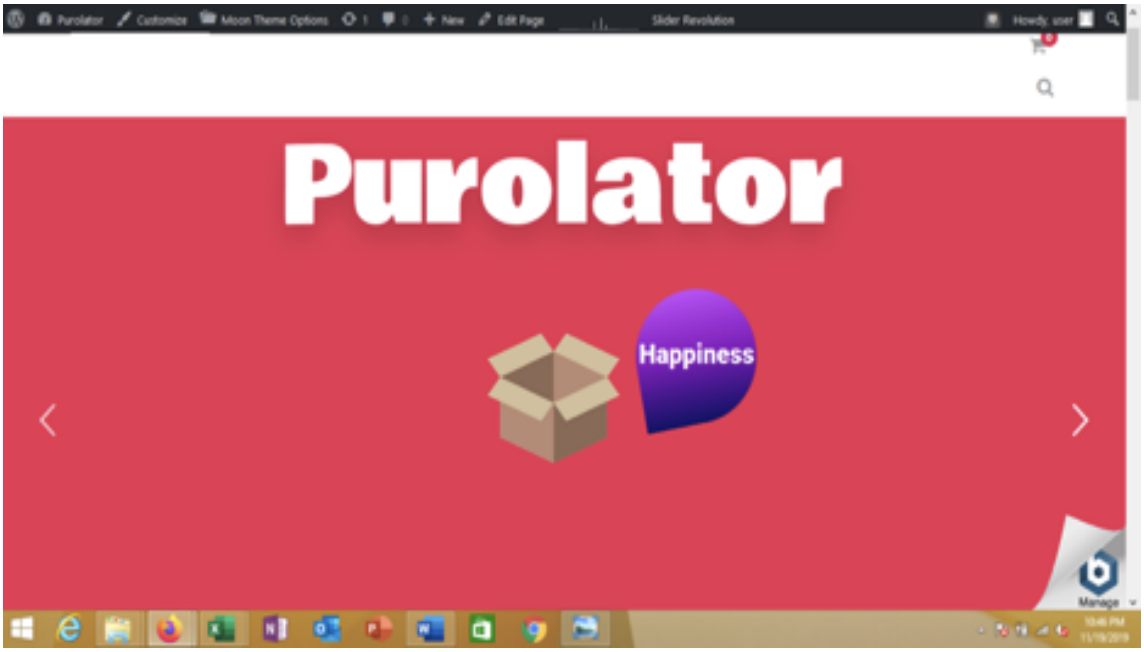


Figure 11 Scatter Plot After six-sigma

WEBSITE DESIGN



The Website design of Purolator is not user friendly and It should have more features. The response time of the website is slow.



CONCLUSION

- The application of DMAIC methodology has shown positive results by identifying the key issues and solving them using total quality methodologies.
- The study from the Purolator postal service showed that even though the process is out of control for more than 50 percentage, it can be brought to control by the implementation of six sigma through various techniques at various levels.
- DPMO, Process capability were all improved and brought into control by using 5's technique in the improved phase.

Some of the wastages removed by implementing 5's technique in the improved phase is as follows

- Transportation – not handling the packages properly.
- Waiting – time delays or idle time
- Over-processing – unnecessary processing steps
- Not using human resources – not implementing the ideas / suggestions of employees
- Motion – actions of people that do not add value
- The workers have a lack of Confidence.

LESSONS LEARNT

- **Quality Improvement is important throughout the lifecycle of the project and has an huge impact on its performance over a longer run.**
- **Six sigma methodologies and its implementation improve the project success rate and decreases uncertainties.**
- **Risk of project failure is decreased or avoided by direct implementation of six sigma processes.**
- **Changes, issues, problems and any differences in the project must be immediately attended and corrected for proper working of the project.**
- **Total Quality Methodology has a positive effect on employee satisfaction, customer satisfaction, product quality and project success etc.**
- **Six sigma methodologies and its implementation improve the project success rate and decreases uncertainties.**
- **Risk of project failure is decreased or avoided by direct implementation of six sigma processes.**
- **Changes, issues, problems and any differences in the project must be immediately attended and corrected for proper working of the project.**
- **Total Quality Methodology has a positive effect on employee satisfaction, customer satisfaction, product quality and project success etc.**

REFERENCES

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- **https://www.n49.com/biz/304799/purolator-on-ottawa-3330-hawthorne rd/?page=zBiqGLa**