Marcus S. Parker Sr. PMP®, LSSBB,CSM®

February 10, 2015 American Society of Quality Baltimore, Maryland Section 0502

HOW QUALITY PROFESSIONAL'S CAN USE THE BASIC QUALITY TOOLS TO EFFECTIVELY COMMUNICATE TO EXECUTIVES

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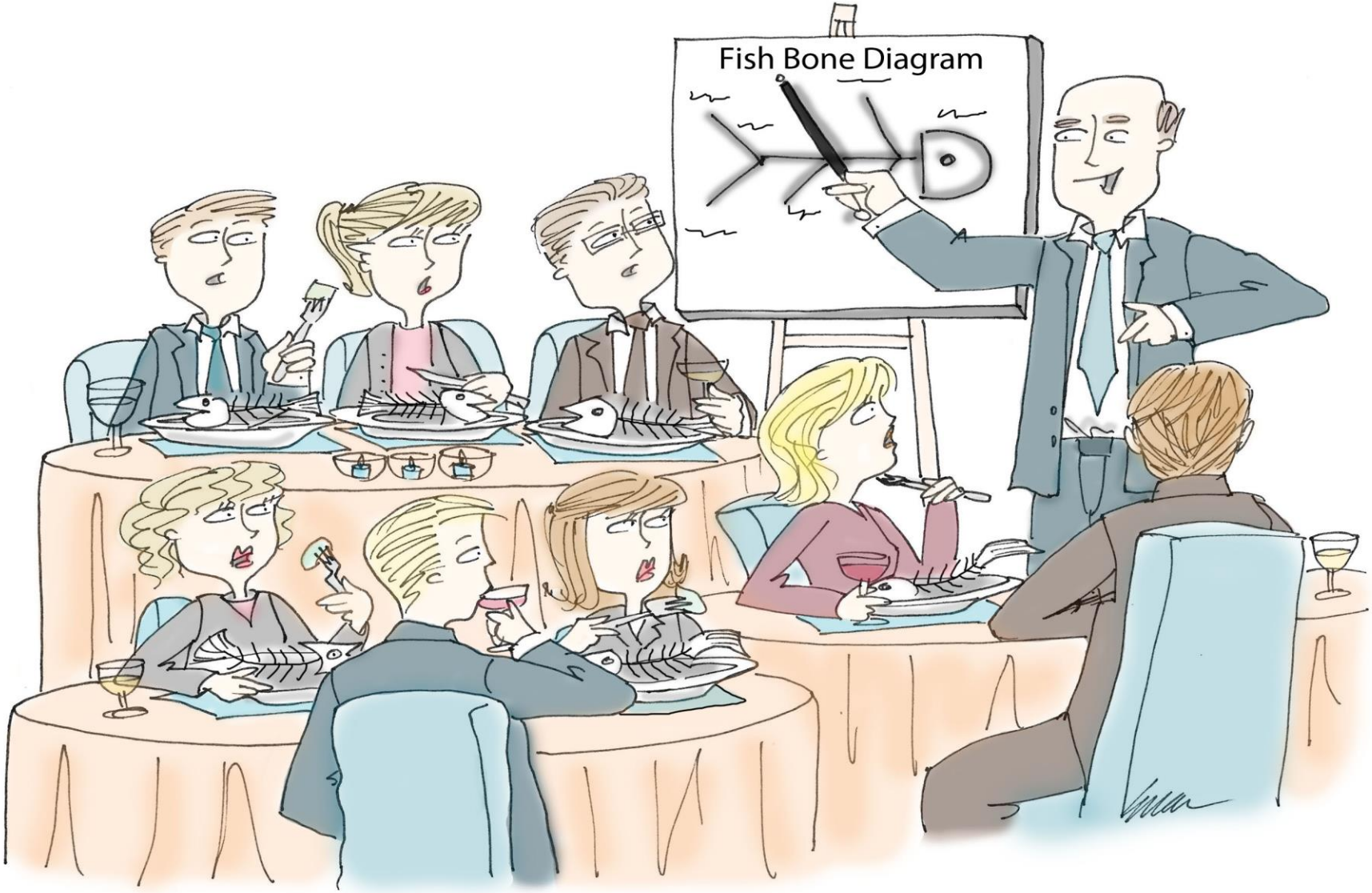

"Due to budget cutbacks we are combining our annual employee dinner with The Seven Basic Quality Control Tools Training."

Key Definitions

Project: is a temporary endeavor undertaken to create a unique product, service, or result.

PMBOK® Guide-Fourth Edition

Project management: The application of knowledge, skills, tools and techniques to a broad range of activities to meet the requirements of a particular project

ASQ.org/glossary

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Quality Management References

PMBOK Fifth Ed.
Pages 239

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Process Improvement Methodology

Activities

Define	Measure	Analyze	Improve	Control
• Review Project Charter • Validate Problem Statement & Goals • Validate Voice of Customer and Voice of Business • Validate Financial Benefits • Validate High-Level Value Stream Map and Scope • Create Communication Plan • Select and Launch Team • Develop Project Schedule	• Value Stream Map • Identify Key Input, Process and Output Metrics • Collect Baseline Data • Determine Process Capability	• Identify Potential Root Causes • Estimate Impact of Root Causes on Key Outputs • Prioritize Root Causes	• Evaluate, Select, and Optimize Best Solutions • Develop and Implement Pilot Solution • Develop Full Scale Implementation Plan	• Develop SOP's, Training Plan and Process Controls • Implement Solution & Ongoing Process Measurements • Transition Project to Process Owner

Identify and Implement Quick Improvements with Rapid Improvement Event (RIE)

Requires good Project Management Skills

Tools

Define	Measure	Analyze	Improve	Control
• Project Charter • Voice of the Customer • **SIPOC Map** • RACI and Quad Charts • Stakeholder Analysis • Communication Plan • Effective Meeting Tools • Inquiry and Advocacy Skills • Time Lines, Milestones, and Gantt Charting • Pareto Analysis	• Value Stream Mapping • Operational Definitions • Data Collection Plan • Statistical Sampling • Gage R&R • **Run Charts** • **Control Charts** • **Histograms** • Normality Test • Process Capability Analysis	• Process Constraint ID • **Fishbone Diagram** • FMEA • Hypothesis Tests/Conf. Intervals • Simple Regression • **Pareto** • ANOVA • Components of Variation • **Scatter Plot** • Queuing Theory	• Replenishment Pull/Kanban • Stocking Strategy • Process Flow Improvement • Process Balancing • Analytical Batch Sizing • Production Maintenance • Design of Experiments (DOE) • Solution Selection Matrix • Piloting and Simulation	• Mistake-Proofing/ Zero Defects • Standard Operating Procedures (SOP's) • Process Control Plans • **Visual Process Control Tools** • **Statistical Process Controls (SPC)** • Solution Replication • Project Transition Model • Team Feedback Session

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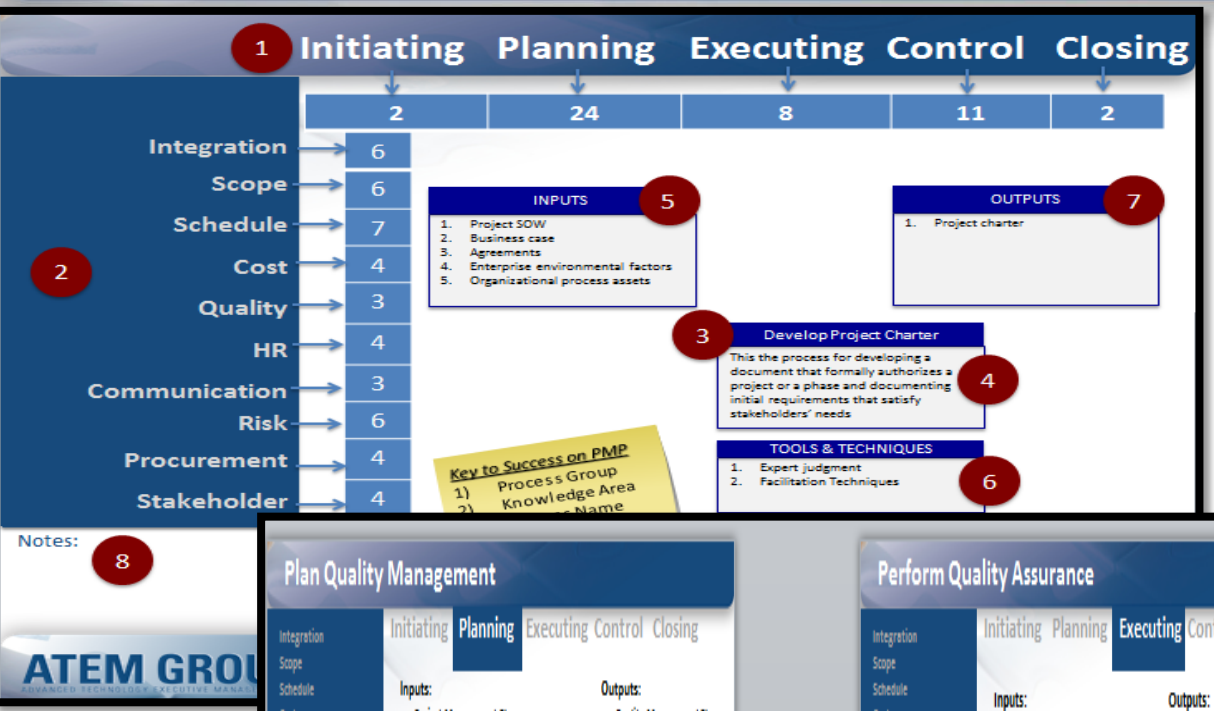
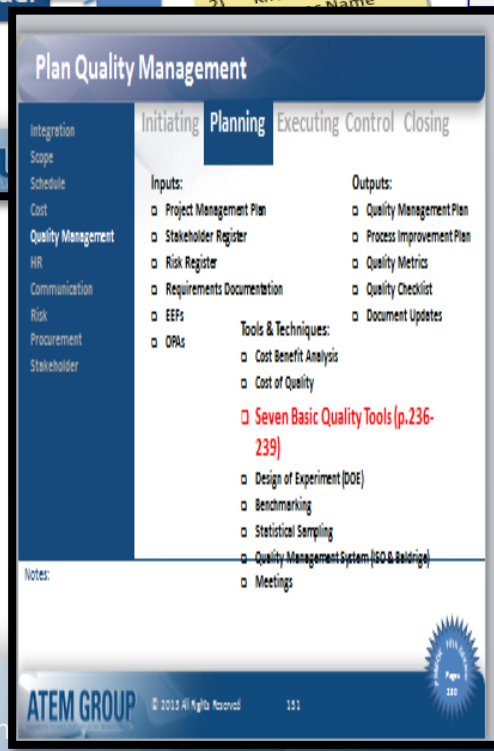
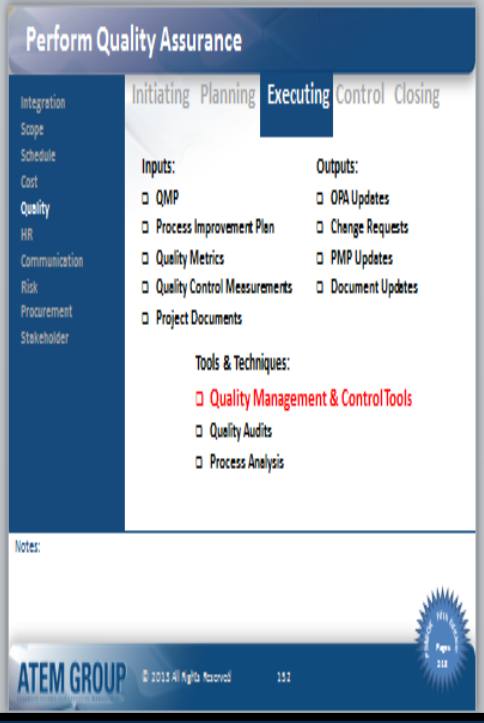
Project Management Framework







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Triple Constraints (TC + 3)

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Triple Constraints (TC + 3)

PM must understand there are several ways to express Project Constraints

- **Project Constraints** represent limits on:
  1. Available Skilled Resources
  2. Budget
  3. Scope
  4. Quality
  5. Schedule
  6. Risk Factors

PMI ism

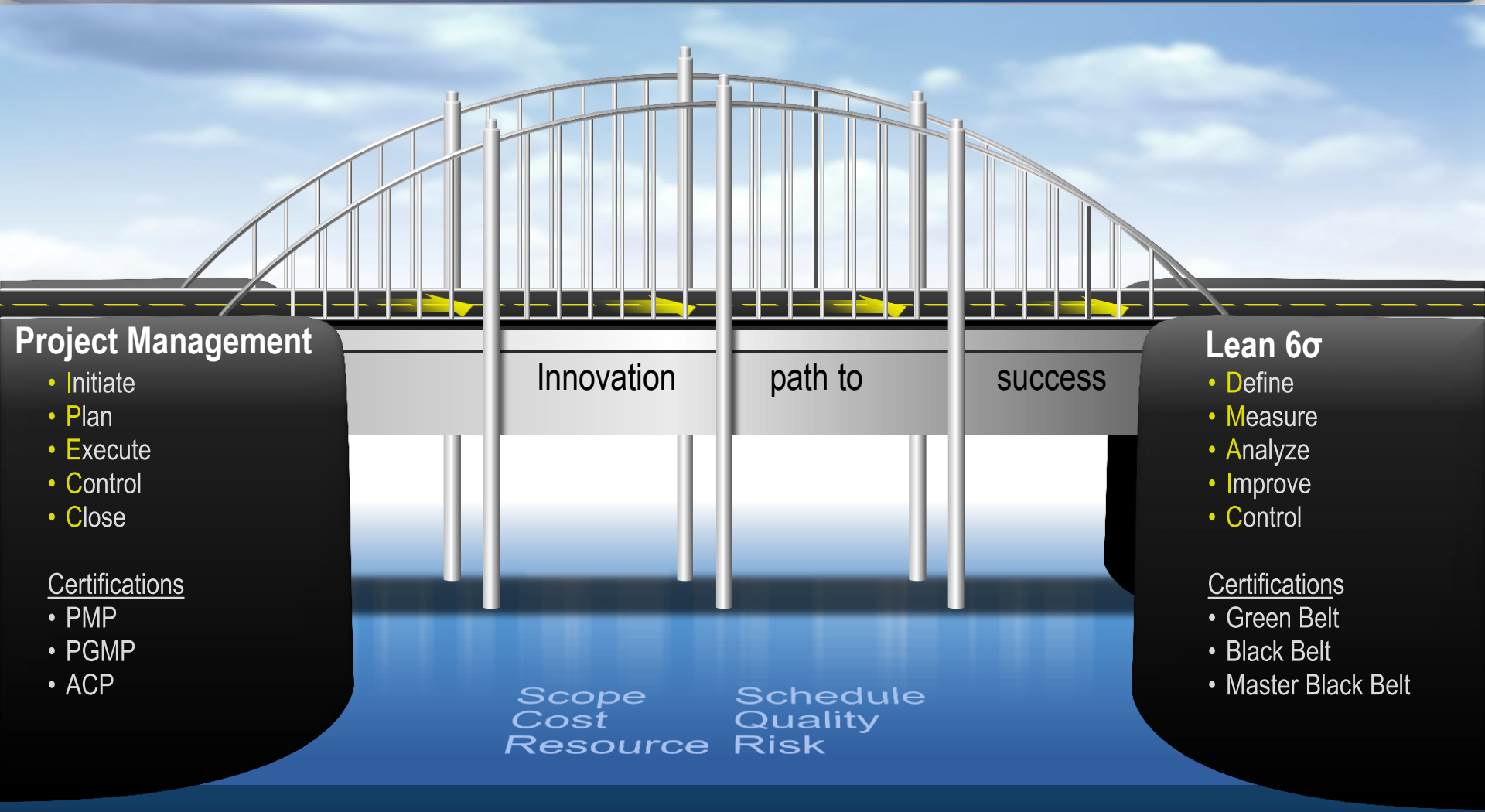
S/S/C
S/S/C/Q
S/S/C/Q/R/R

Triple Constraints Historically

Scope/Schedule/Cost
&
Quality

PMBOK Fifth Edition
Pages
6

Bridging the Gap



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Interactive Poll: ASQ Section 0502 do you know the 7 Basic Quality Tools?

Your poll will show here

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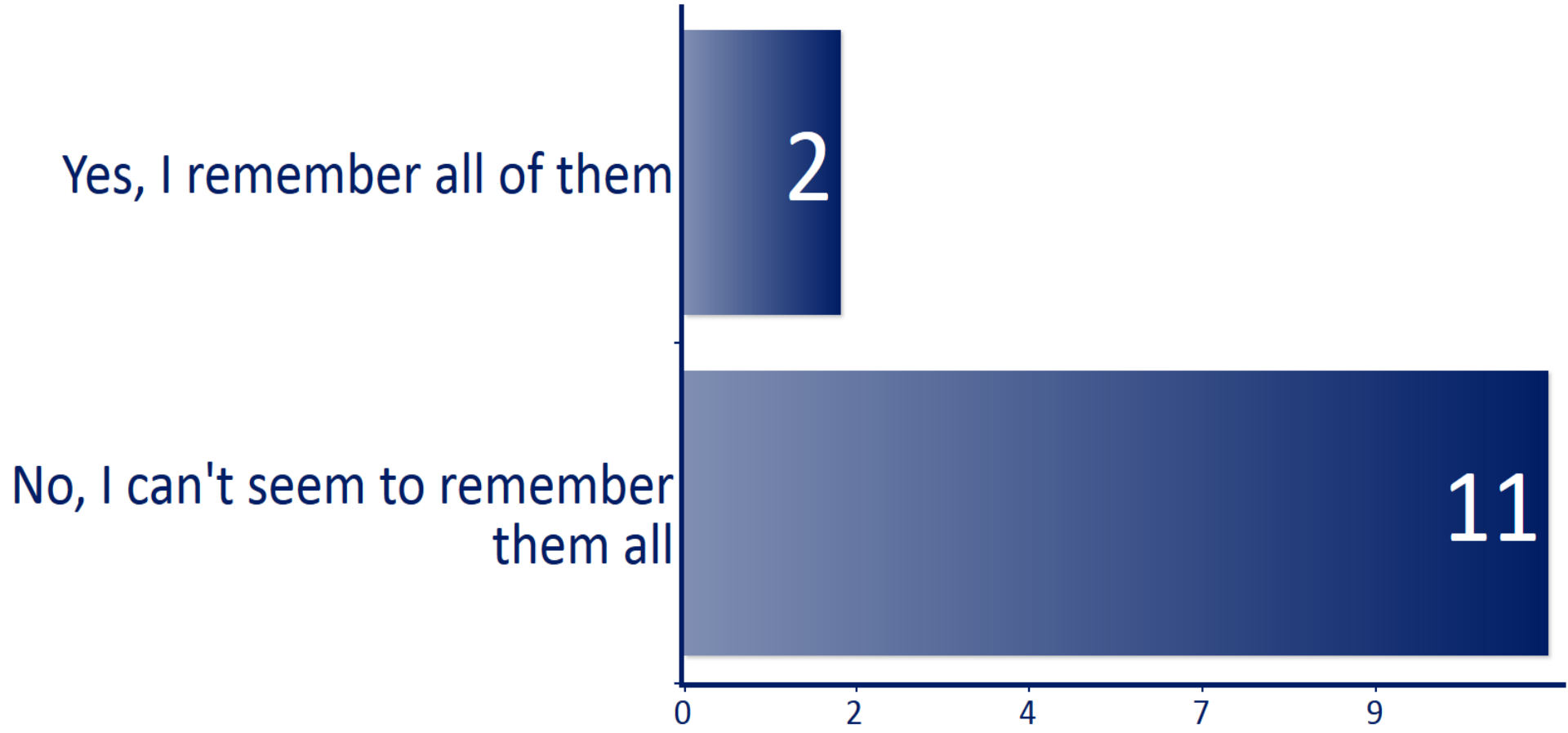
QAAM Do you know what the Seven Basic Quality Tools Are?

Start this poll to accept responses



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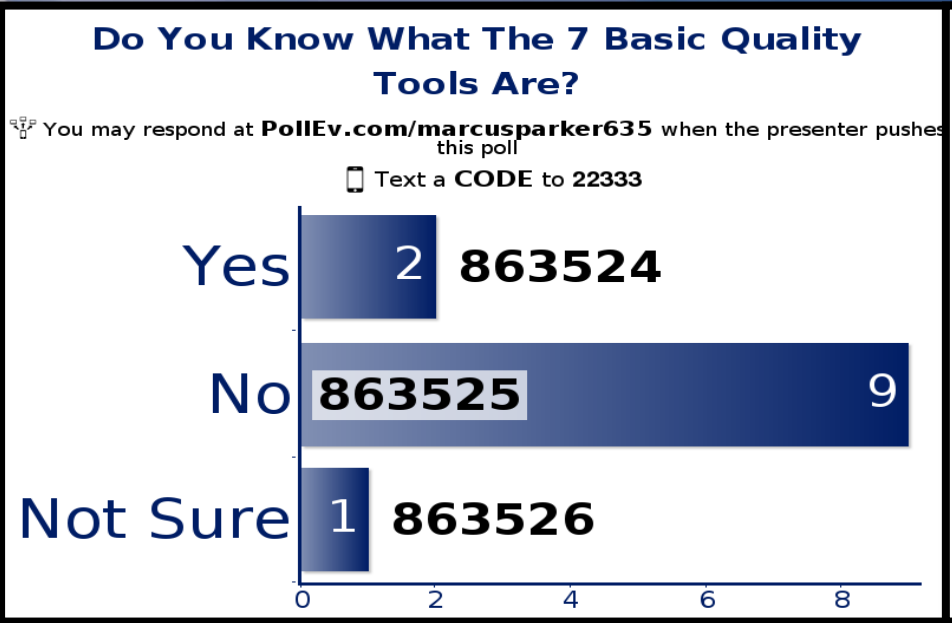
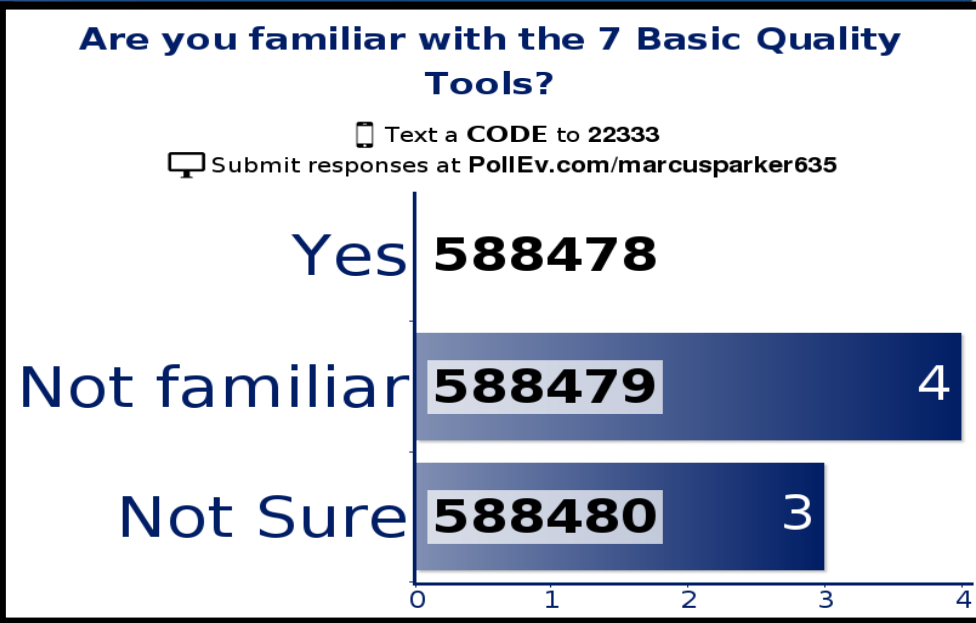
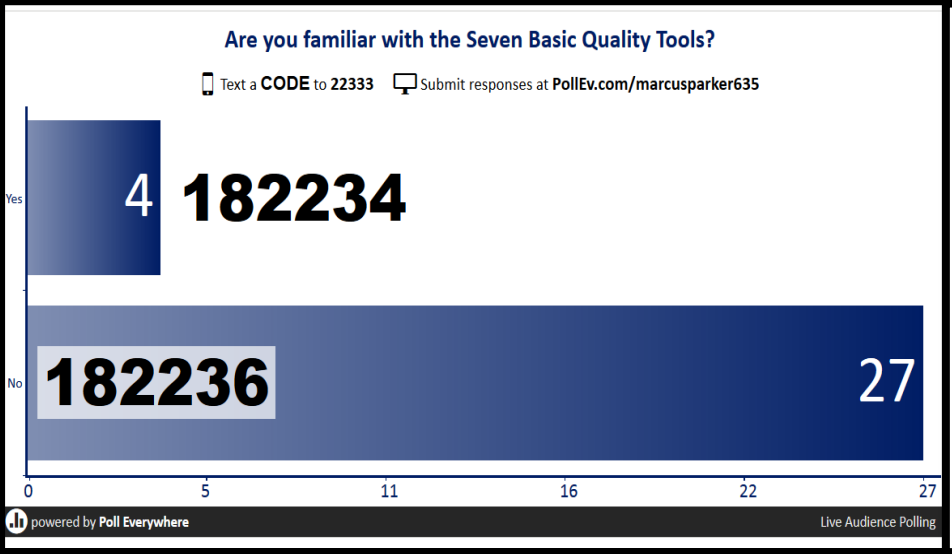
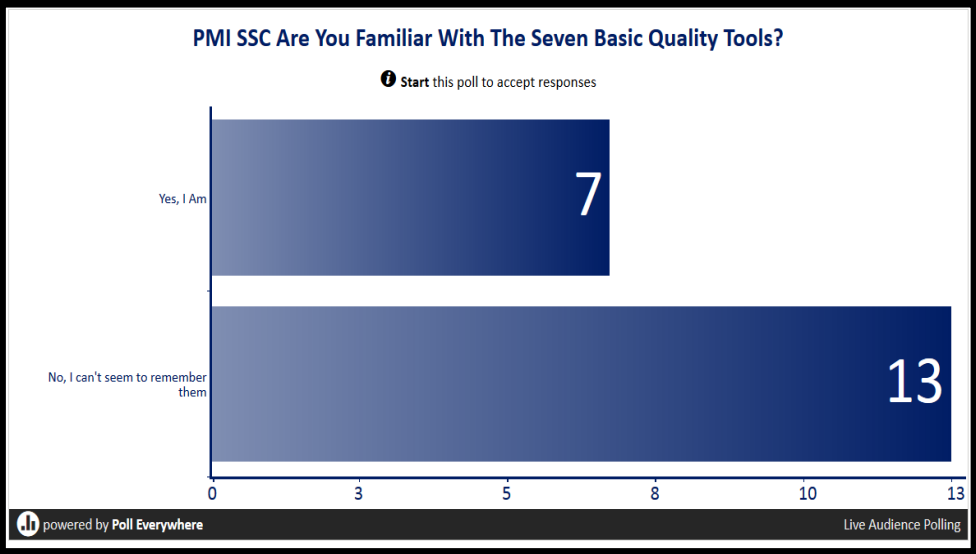
Interactive Poll Results - 13 Yes, 53 No, and 4 Not Sure









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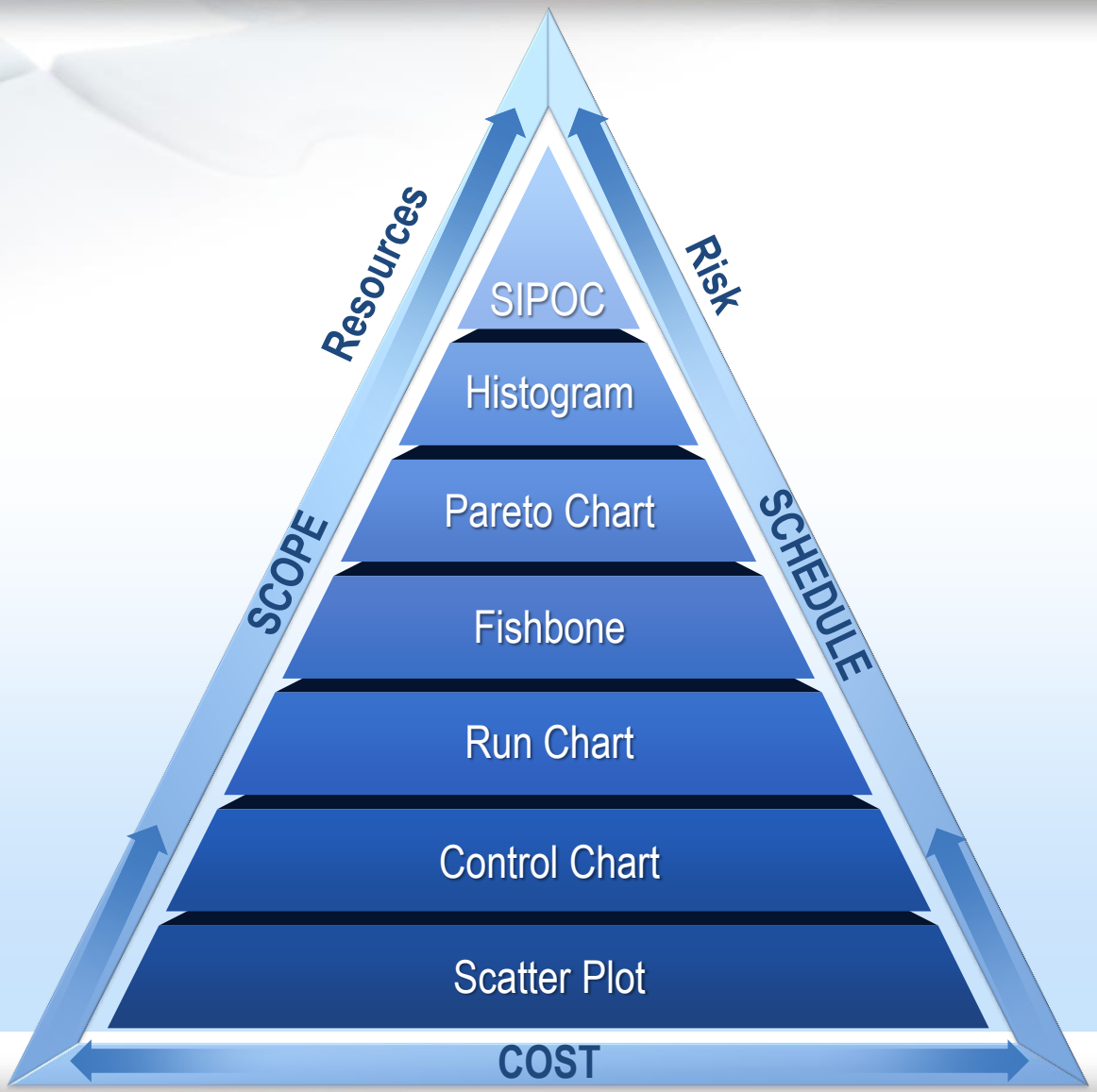
7 Basic Quality Tools



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7 Basic Quality Tools

American Society of Quality

1) Check Sheet
2) Histogram
3) Pareto
4) Fishbone
5) Run Chart
6) Control Chart
7) Scatter Plot

Nancy R. Tague's The Quality Toolbox, Second Edition, ASQ Quality Press, 2005, page 15

Project Management Institute

1) SIPOC
2) Histogram
3) Pareto
4) Fishbone
5) Run Chart
6) Control Chart
7) Scatter Plot

PMBOK 5th Edition, Project Management Institute, Chapter 8

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Interactive Poll: ASQ Section 0502

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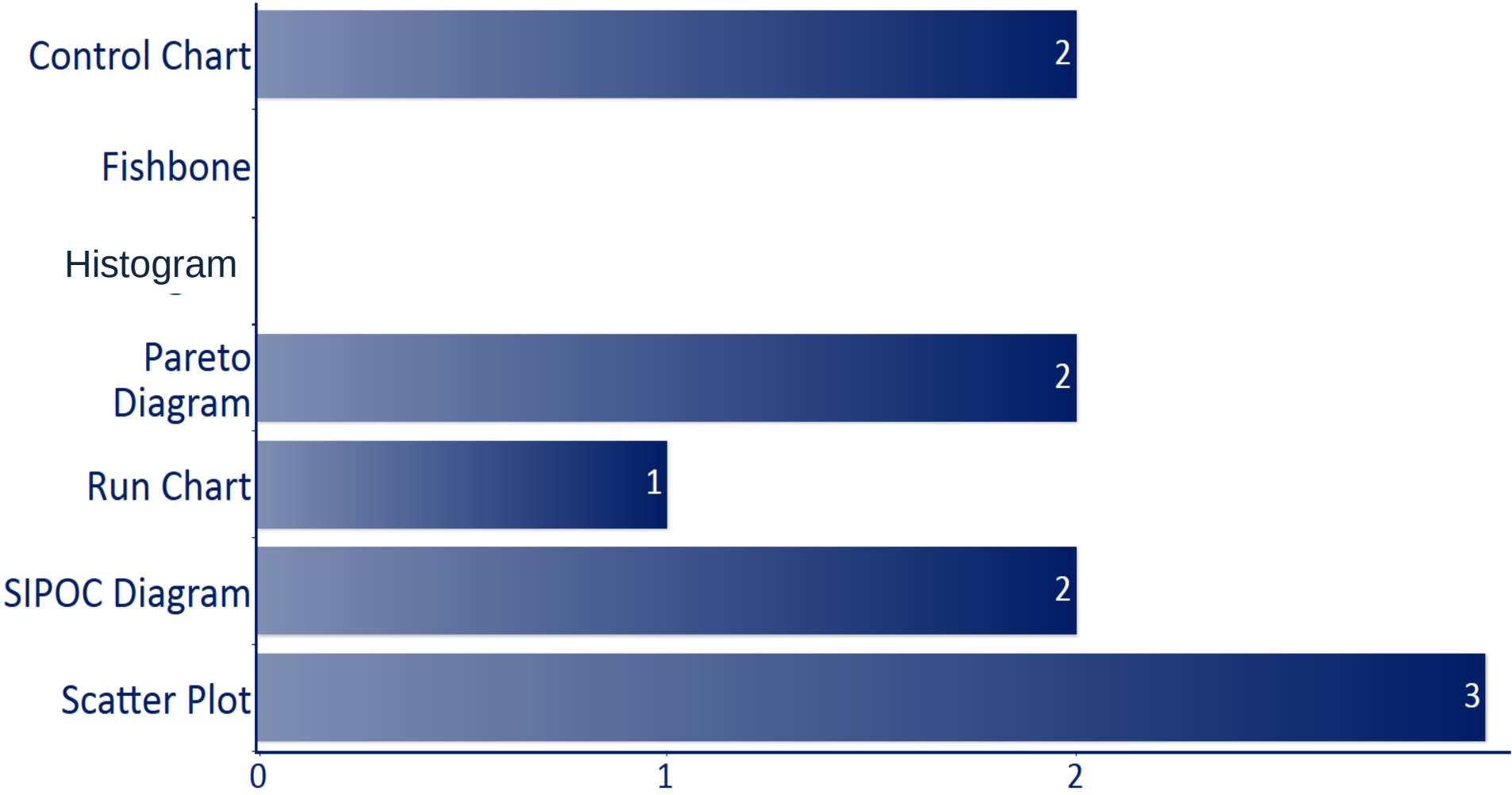
Which Basic Quality Tools Do you know the least about?

Start this poll to accept responses



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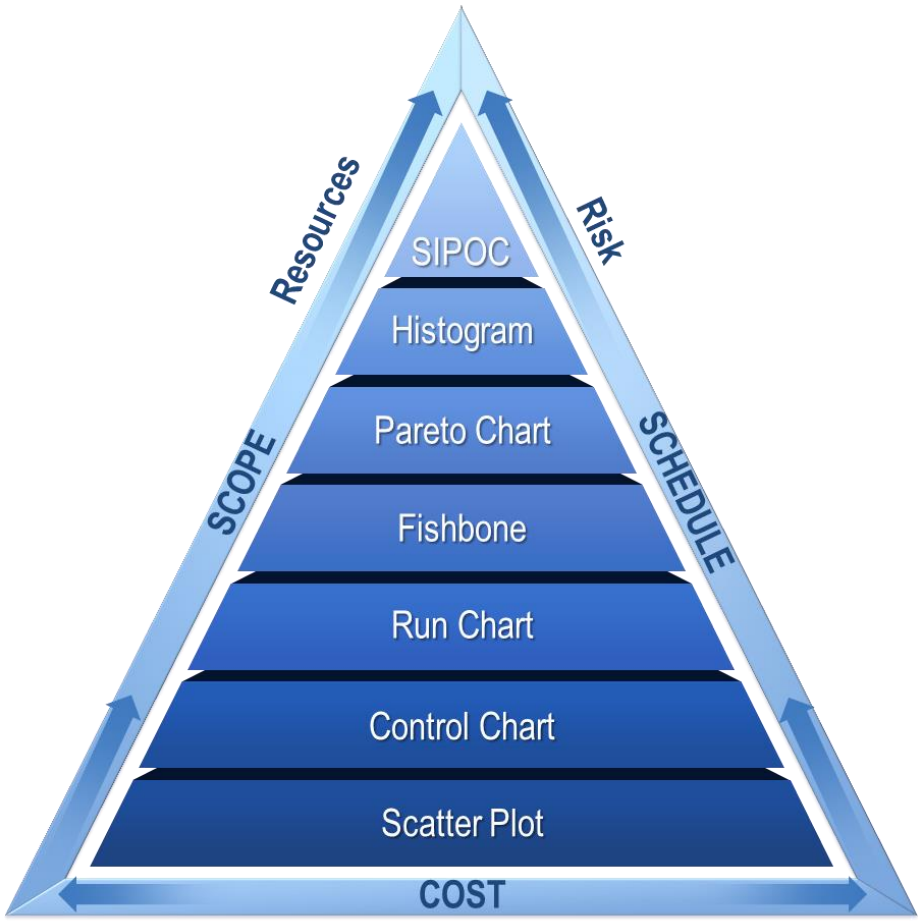
(S)uppliers (I)nputs (P)rocess (O)utputs (C)ustomers

Overview:

When To Use:

Result:

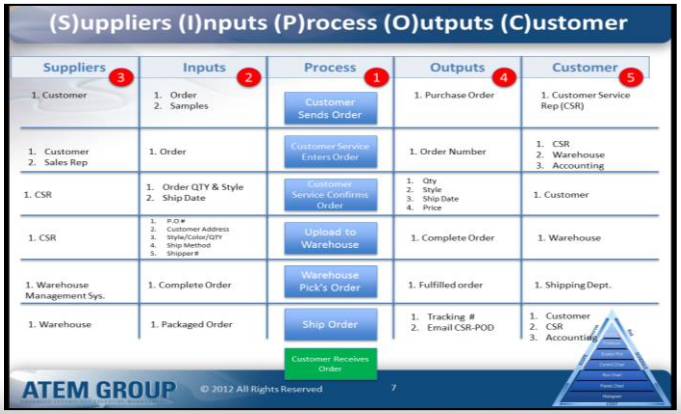


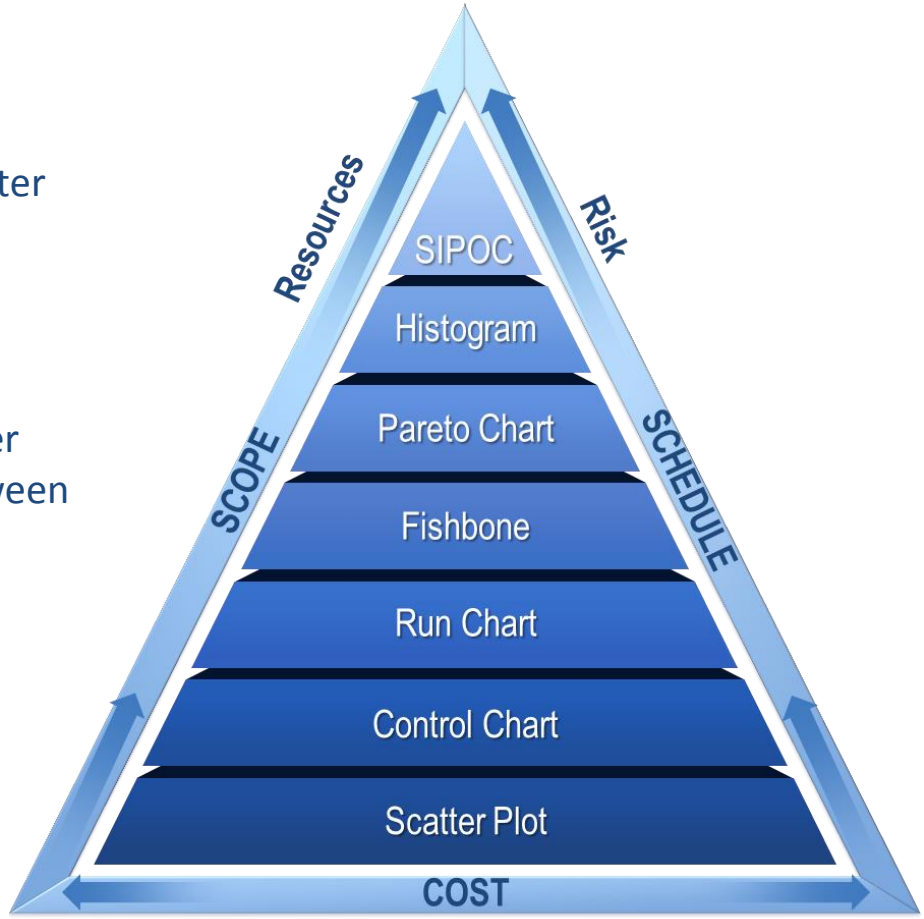
(S)uppliers (I)nputs (P)rocess (O)utputs (C)ustomers

Overview- High-level Process Mapping Tool used to decompose complex process into 5 to 7 high level steps and identify (S)uppliers, (I)nputs, (O)Outputs and (C)ustomer's

When To Use- When you have a group of subject matter experts who know the process very well. It will help identify process characteristics such as Trigger Event, Gaps, Business Rules

Result- Team Building, Understanding of where further detail process mapping is required, relationships between Supplier's and Customer's , Inputs, and Outputs



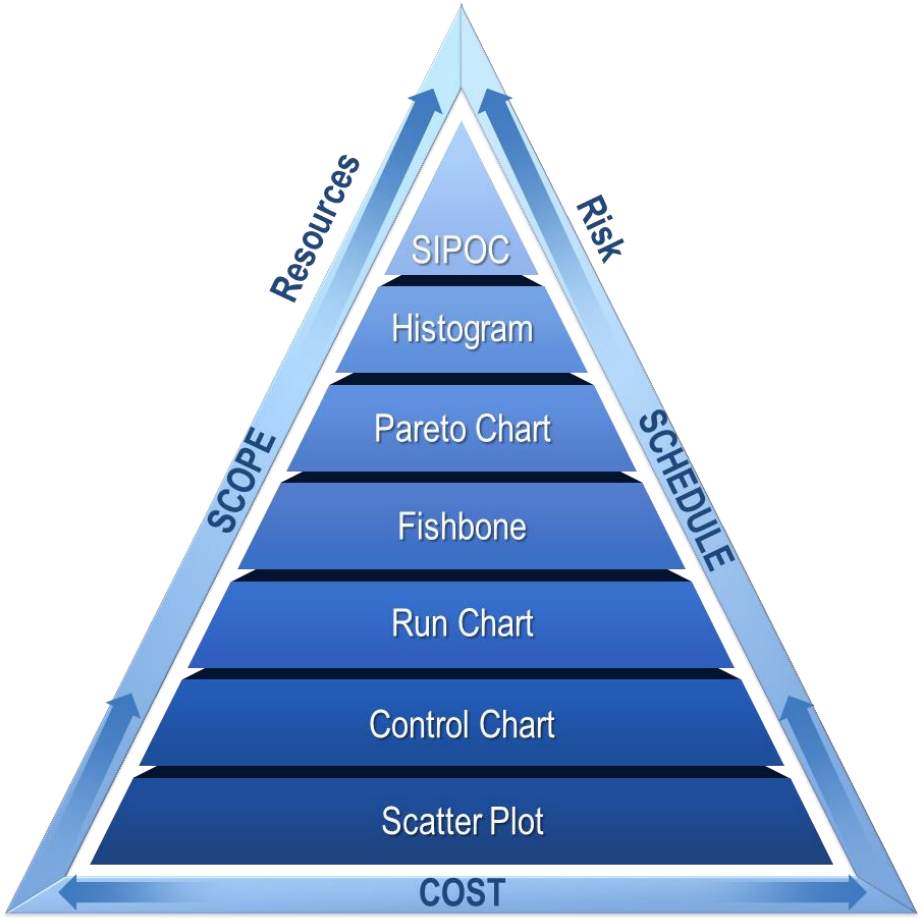


Histogram

Overview:

When To Use:

Result:

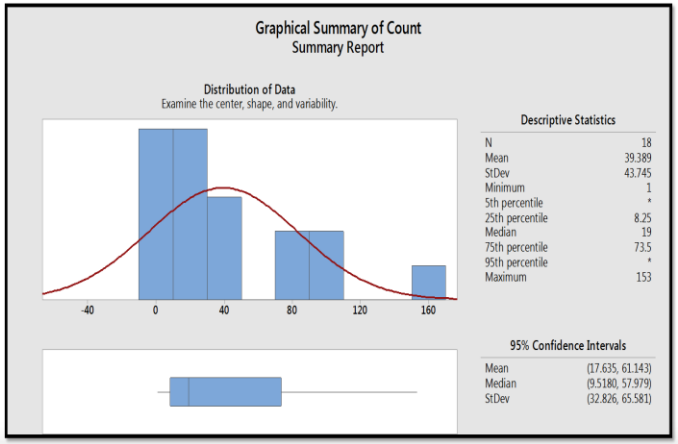


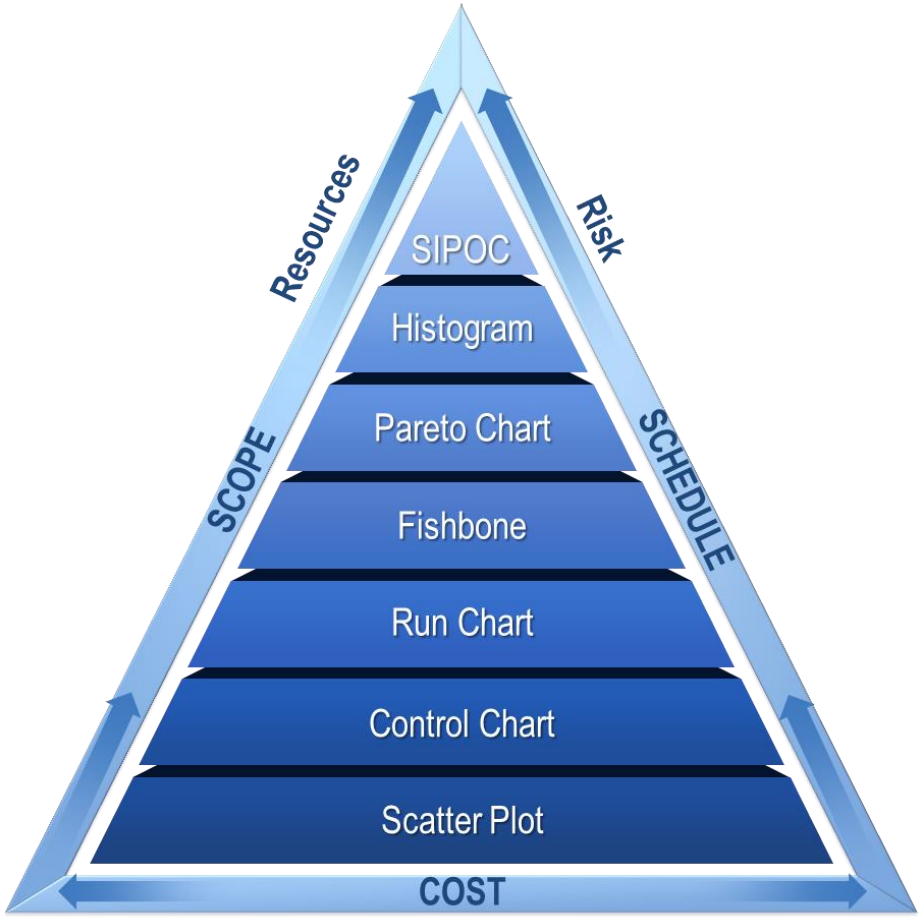
Histogram

Overview- Bar chart that displays the frequency, distribution, and central tendency of a data set over a period of time

When To Use- To identify changes or shifts in the process and understand variation. Used also to determine if the process is capable of meeting customers requirements

Result- With enough data if can represent the populations, can interpret centering variation or spread, is the shape “normal” or “skewed”, and process capability



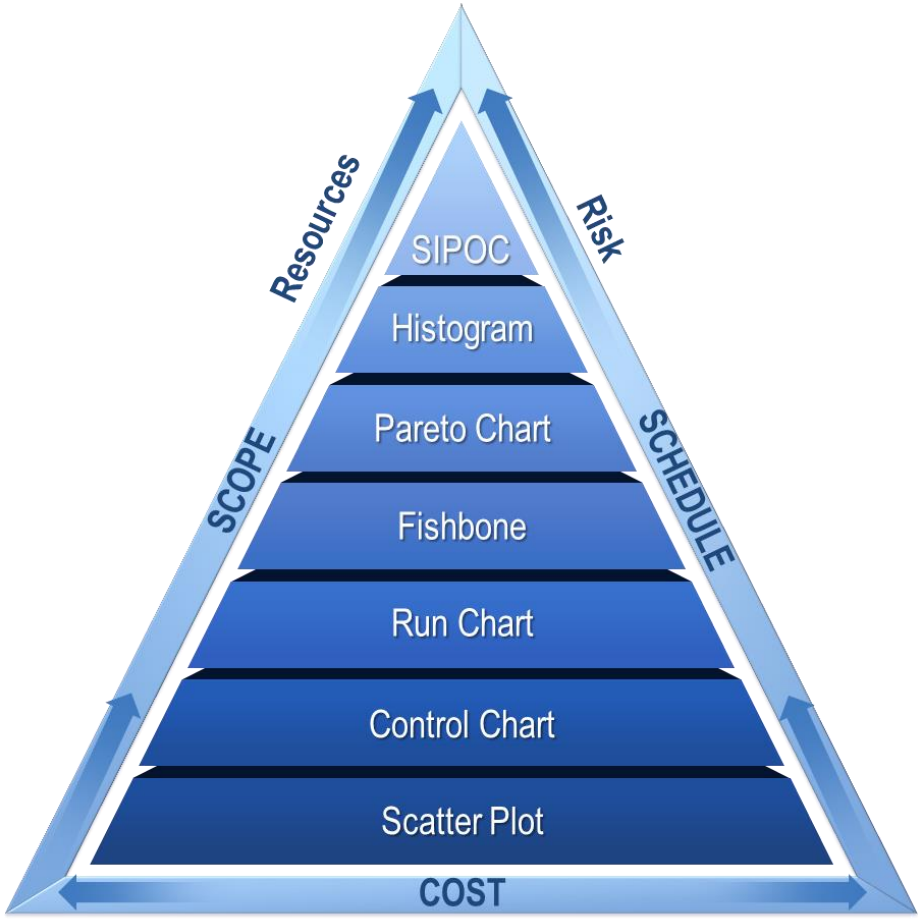


Pareto Chart

Overview:

When To Use:

Result:

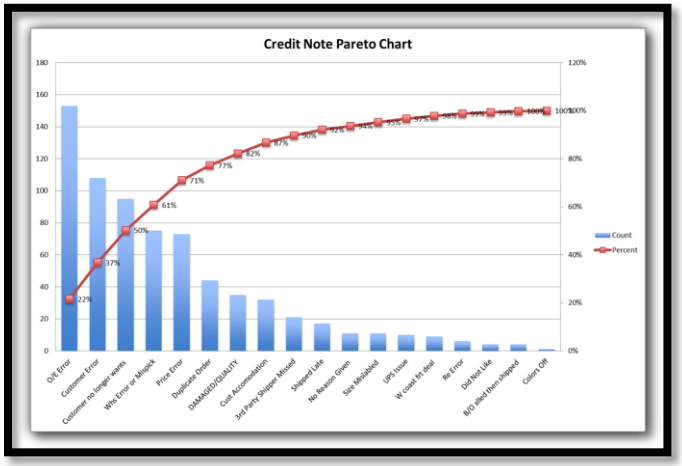


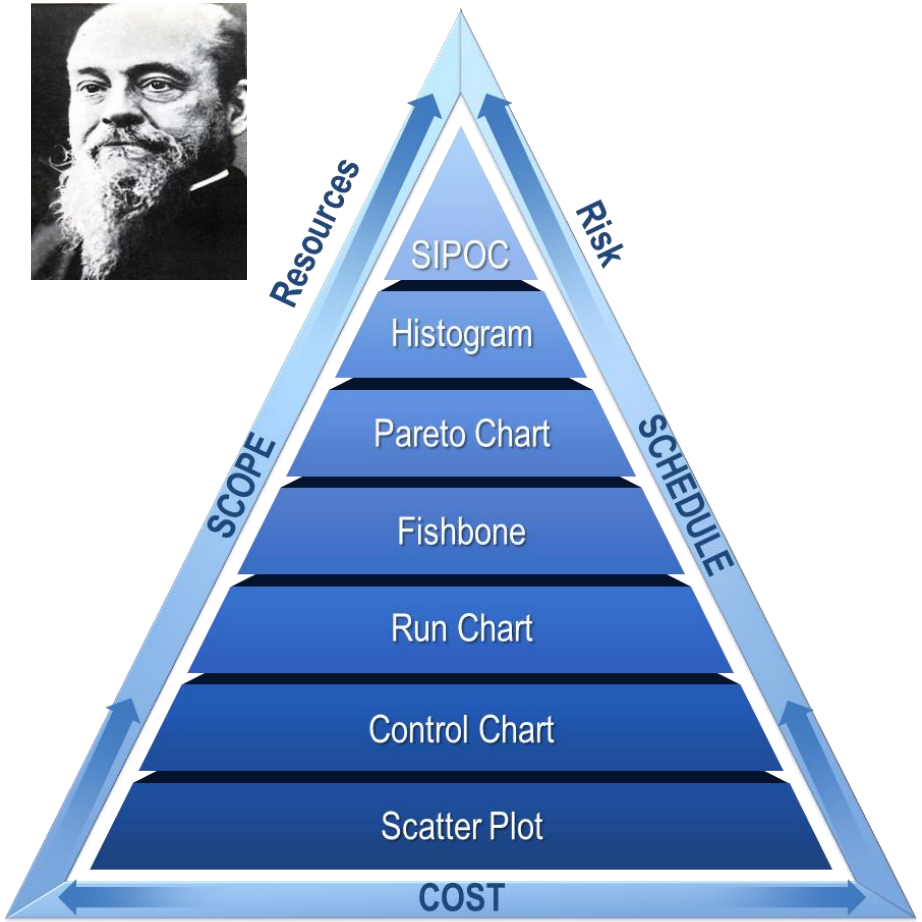
Pareto Chart

Overview- Named after Vilfredo Pareto, a 19th Century Italian economist who postulated that large share of wealth is owned by a small percentage of the population. It is a series of bars whose heights reflect the frequency or impact of problems

When To Use- It breaks down big problems down into manageable pieces. Its helps identify the "vital few" problems for the team to focus on

Result- 80% of the issues/problems are generated by 20% of the process steps



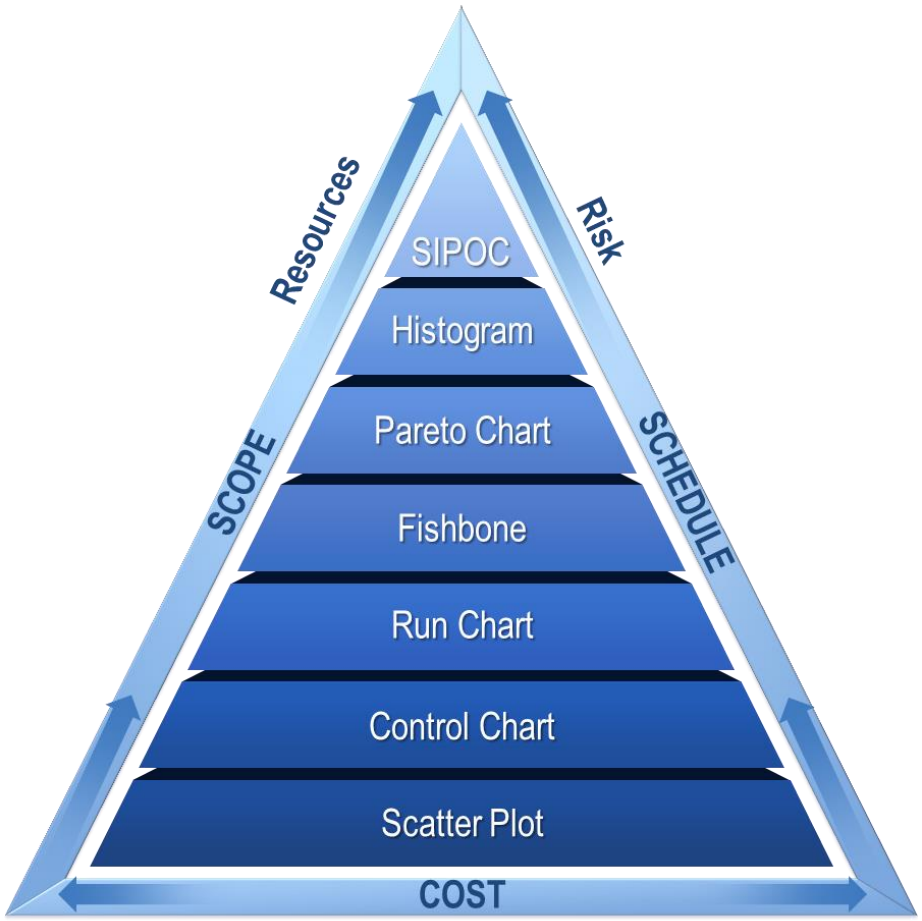


Ishikawa Fishbone Diagram

Overview:

When To Use:

Result:

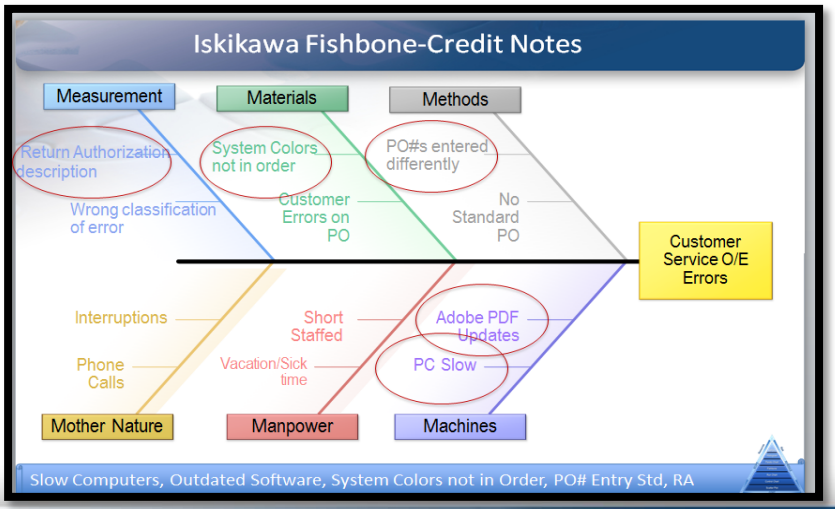


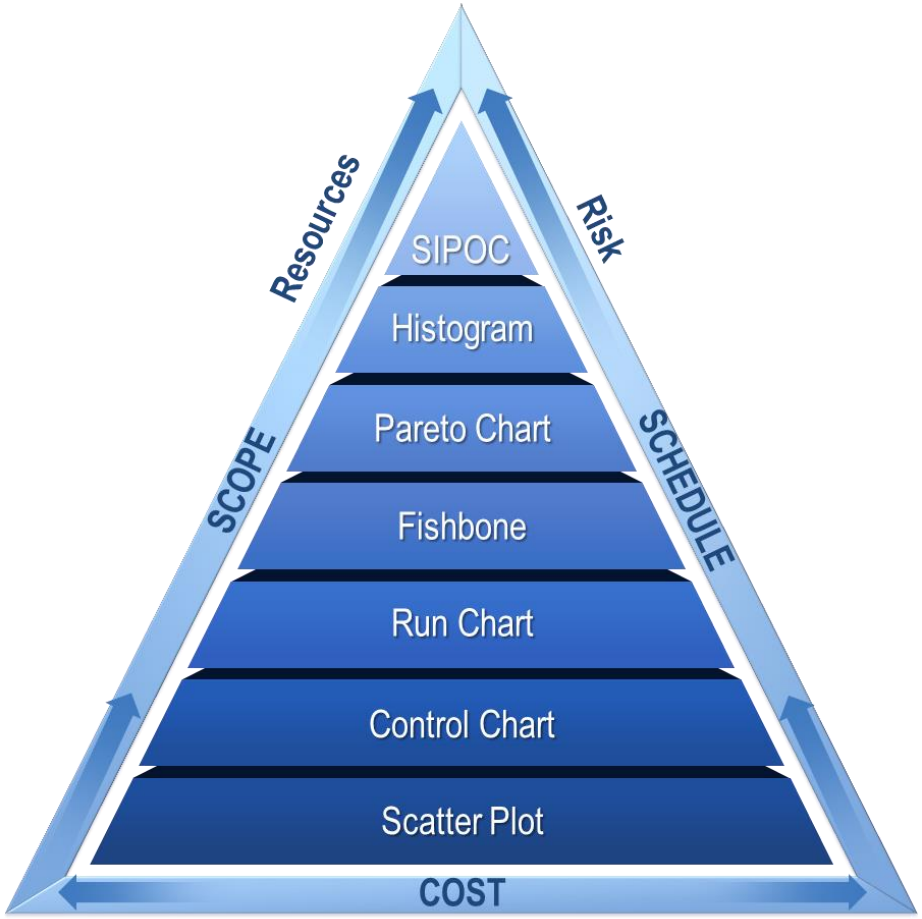
Ishikawa Fishbone Diagram

Overview- Cause-and-Effect diagram to provide structure to cause identification, ensures that balance list of ideas have been generated during brainstorming

When To Use- Once a focused operational definition of the problem exist, or during braining storming to prevent future problems from happening (proactive)

Result-Allows focused discussion of most critical causes for further investigation



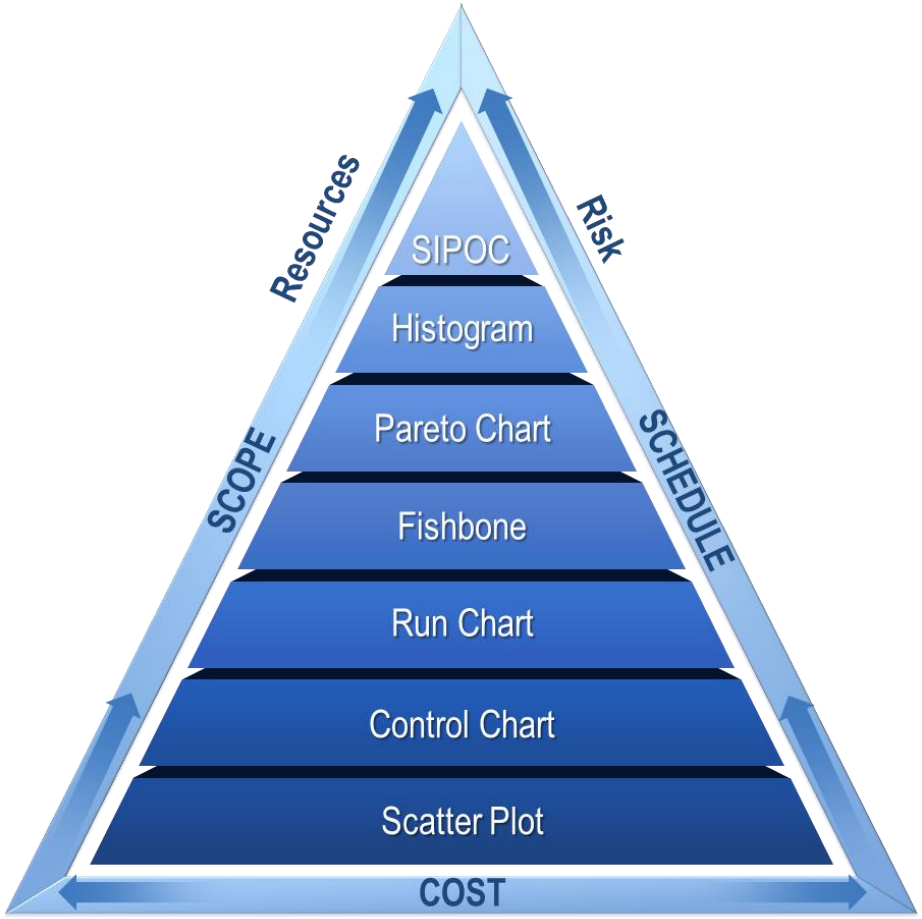


Run Chart

Overview:

When To Use:

Result:

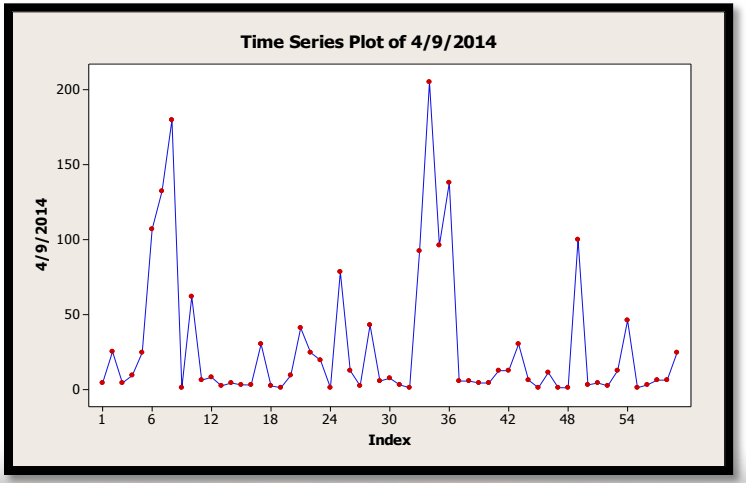


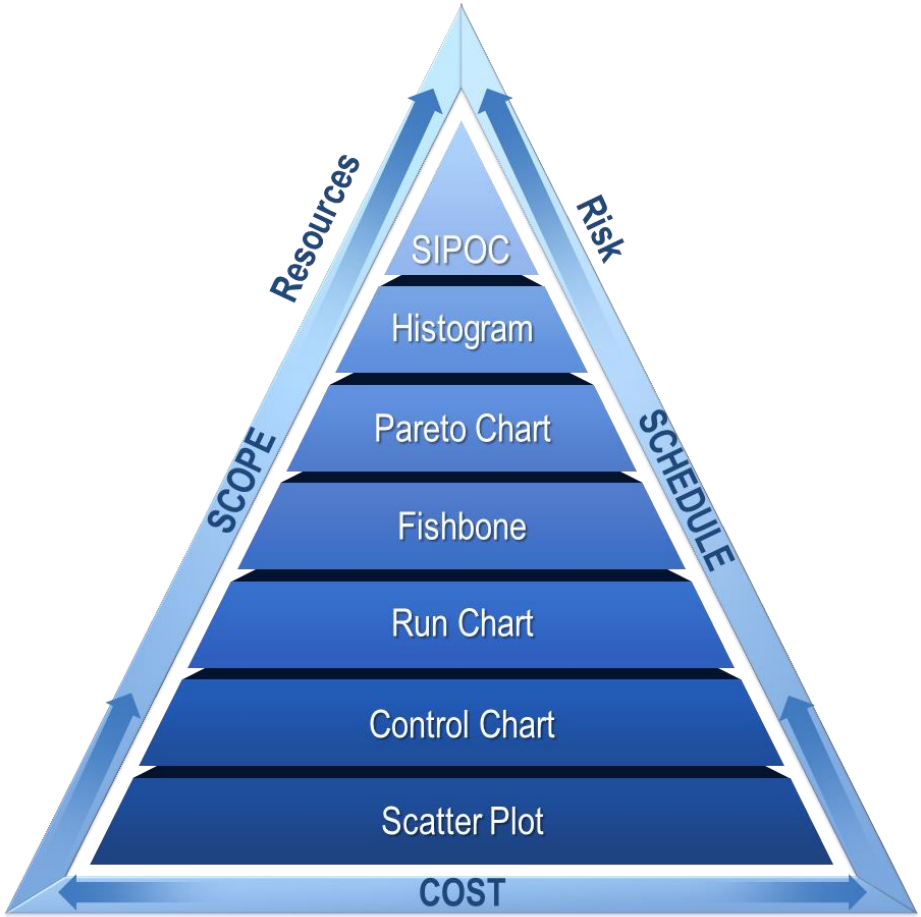
Run Chart

Overview- Is a time series plot used to show data points in the order in which they occur, also shows how the process changes over time

When To Use- When getting to know the process, easy to construct b/c you don't know as many points for a control chart

Result- Used to detect trends in the data, also can easily see significant changes in the data which can be attributed to the underlying process



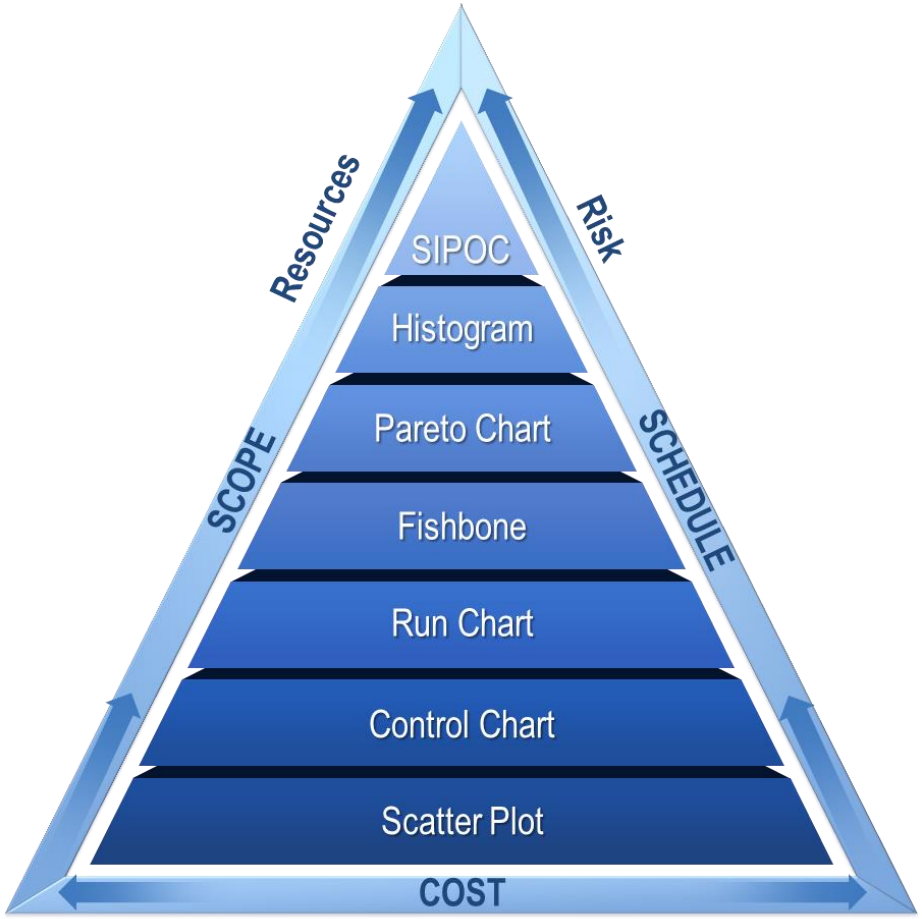


Control Chart

Overview:

When To Use:

Result:



Control Chart

Overview- Similar to run charts, but also displays the average, control limits (Upper & Lower) which are ±3 standard deviations of the average (99.7% of the points in normally distributed data will fall between the limits

When To Use- To establish a process measurement baseline, detect special cause variation, ensure process stability, and enable predictability

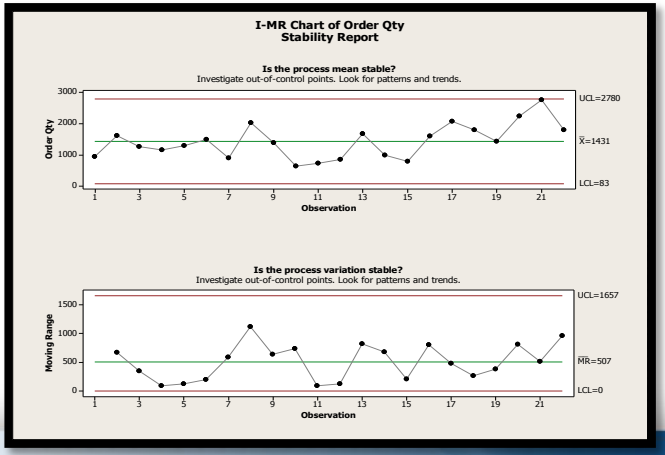
Result- Continuous or Discrete Data Analysis

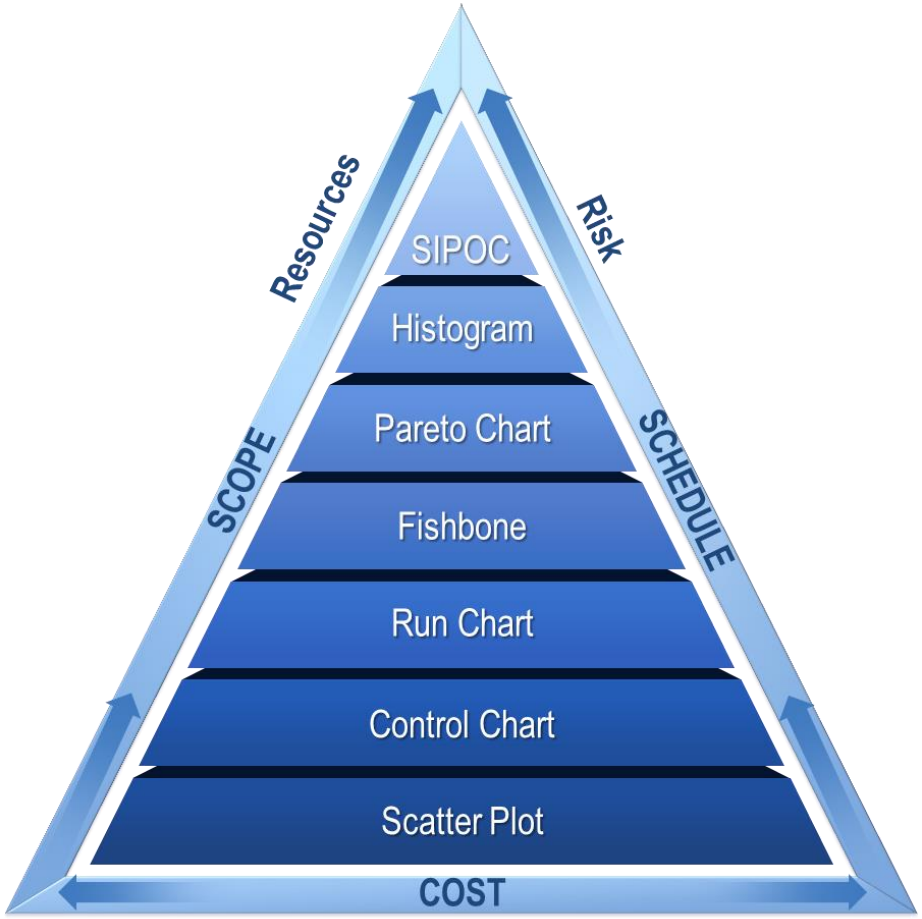
X-R=Continuous when the sample size of each subgroup is approx. <10

I-MR= large sample sixe for more sensitive charts

X-s Chart P Chart u Chart

np Chart c Chart



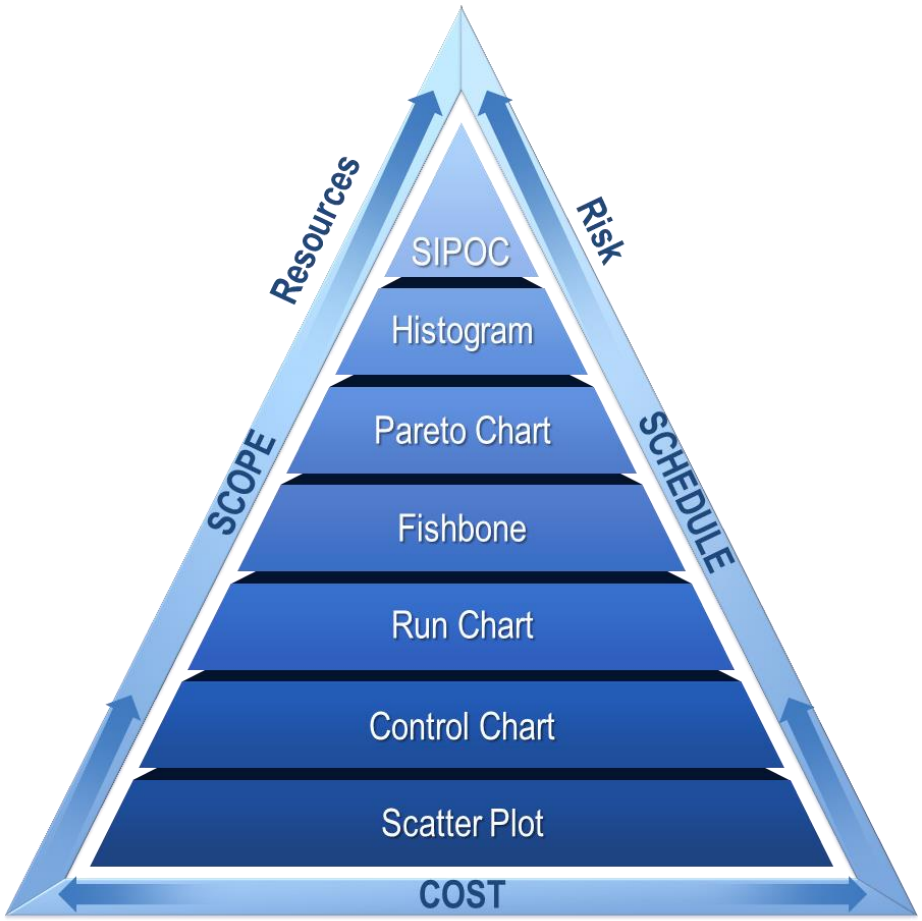


Scatter Plot Diagram

Overview:

When To Use:

Result:

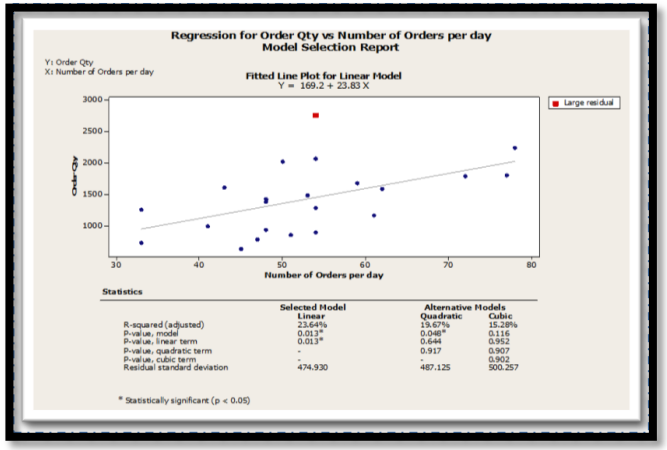


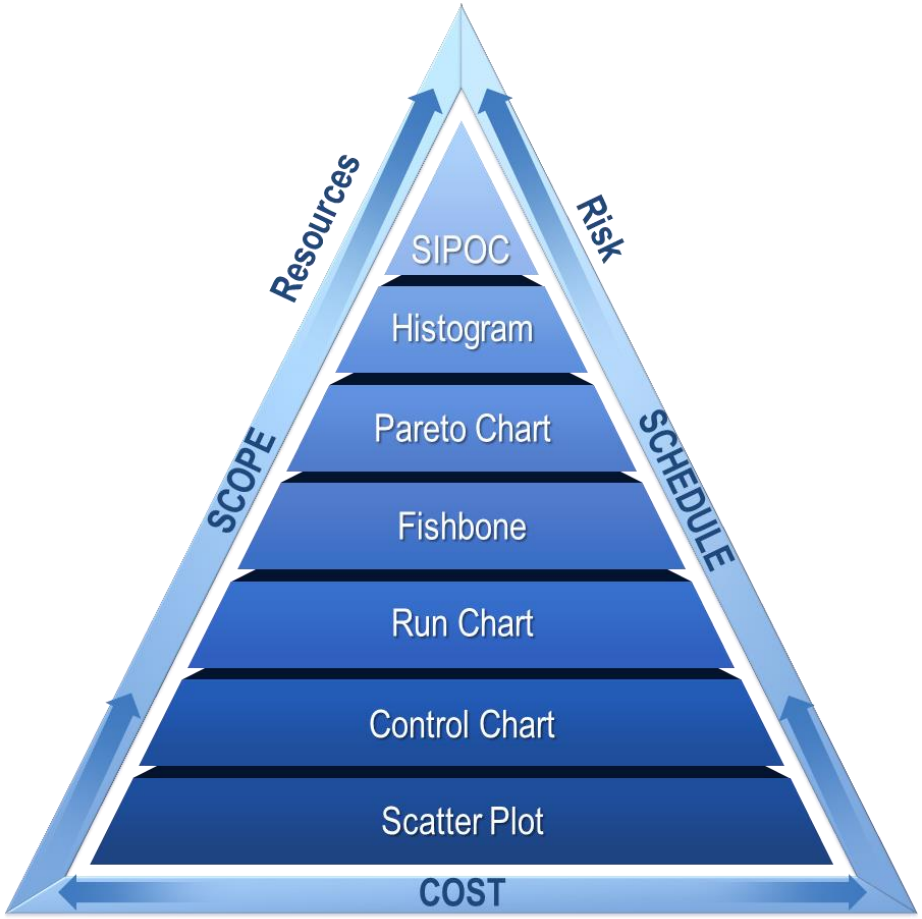
Scatter Plot Diagram

Overview- A graphic that shows correlation between tow variables through patterns in data

When To Use- To determine if there is a statistical relationship between two independent variables

Result- No Correlation, Positive Correlation, Negative Correlation, Other





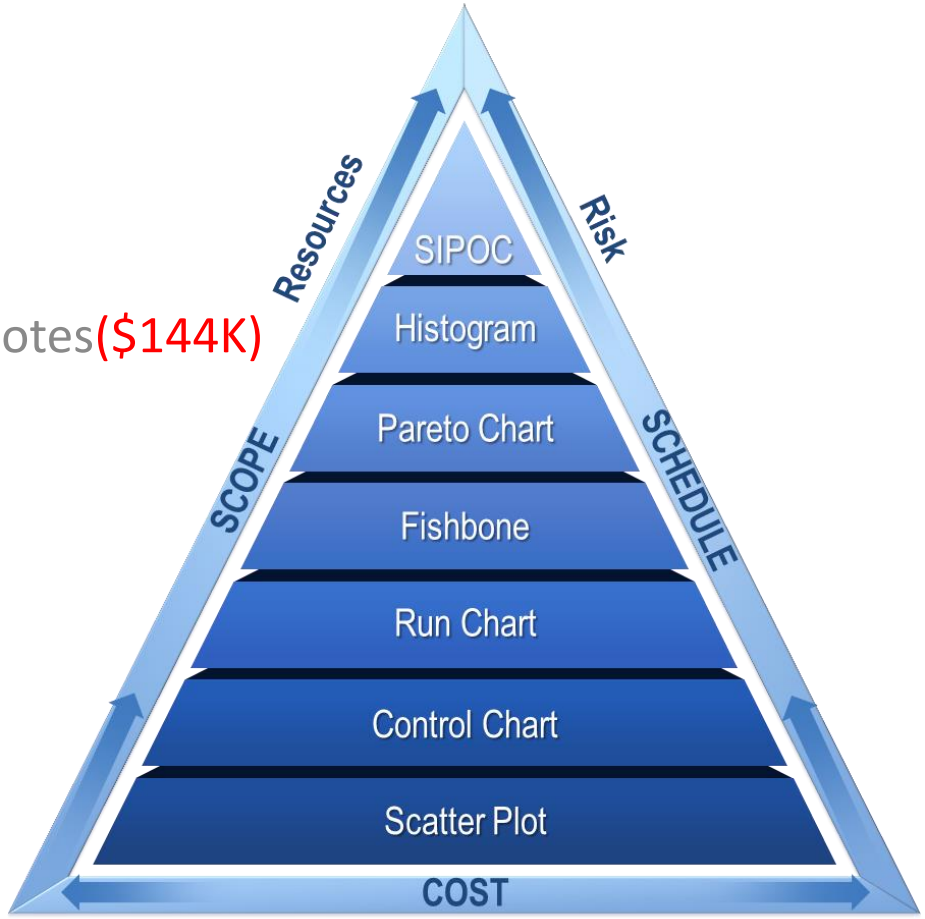
CASE STUDIES- APPAREL PRODUCT DIRECTOR

1. Customer Service Order Entry Errors: Credit Notes on Invoices
2. Daily Order and Shipping Analysis

DESCRIBE YOUR BIGGEST ACCOMPLISH— MENT FROM YOUR LAST JOB.
I MADE SOME PHONE CALLS AND STUFF. I THINK I MADE A DIFFERENCE.
DO YOU WANT THIS JOB?
NAH. JUST LONELY.
Dilbert.com DilbertCartoonist@gmail.com
4-16-14 ©2014 Scott Adams, Inc./Dist. by Universal Uclick

Customer Service Order Entry Errors: Credit Notes($144K)

SIPOC
HISTOGRAM
PARETO
FISHBONE



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(S)uppliers (I)nputs (P)rocess (O)utputs (C)ustomer

5 Suppliers	4 Inputs	Process 1	Outputs 2	Customer 3
1. Customer	1. Order (Trigger) 2. Samples	Customer Sends Order	1. Purchase Order	1. Customer Service Rep (CSR)
1. Customer 2. Sales Rep	1. Purchase Order	Customer Service Enters Order	1. Order Number	1. CSR 2. Warehouse 3. Accounting
1. CSR	1. Order QTY & Style 2. Ship Date	Order Acknowledgement	1. Qty 2. Style 3. Ship Date 4. Price	1. Customer
1. CSR	1. P.O # 2. Customer Address 3. Style/Color/QTY 4. Ship Method 5. Shipper #	Upload to Warehouse	1. Complete Order	1. Warehouse
1. Warehouse Management Sys.	1. Complete Order	Warehouse Pick's Order	1. Fulfilled order	1. Shipping Dept.
1. Warehouse	1. Packaged Order	Ship Order Customer Receives Order	1. Tracking # 2. Email CSR-POD	1. Customer 2. CSR 3. Accounting

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SIPOC on Whiteboard

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Raw Data Credit Note (credit on invoice)

Category	Count
Order Entry	153
Customer Error	108
Customer no longer wants	95
Warehouse Error or Mispick	75
Price Error	73
Duplicate Order	44
Damaged or poor Quality	35
Cust Accommodation	32
3rd Party Shipper Missed	21
Shipped Late	17
No Reason Given	11
Size Mislabeled	11
UPS Issue	10
W coast frt deal	9
Re Error	6
Did Not Like	4
B/O xlled then shipped	4
Colors Off	1

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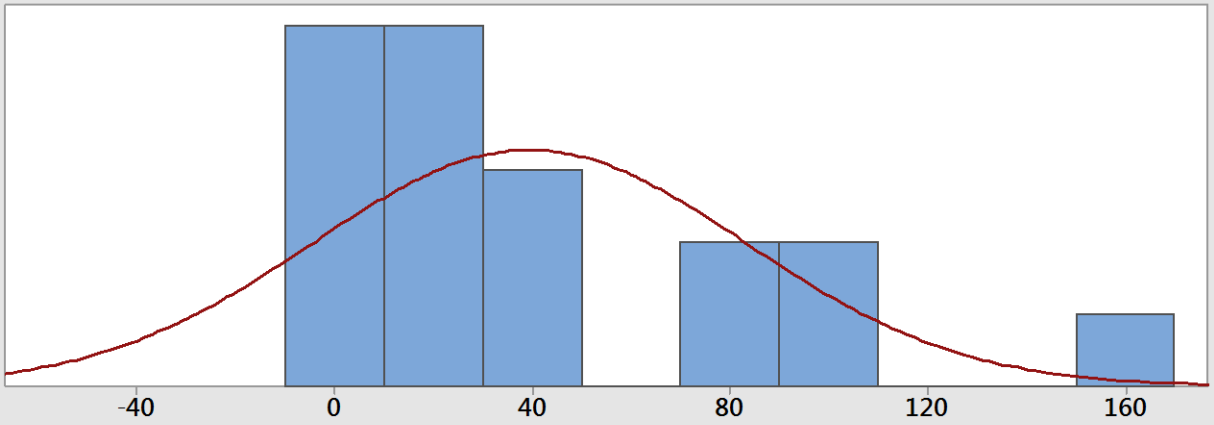
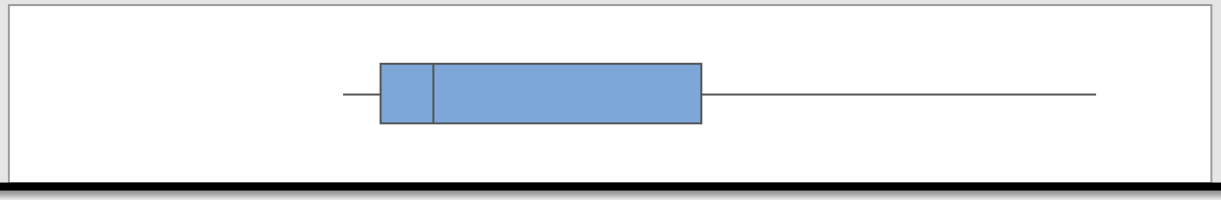
Histogram-Credit Note (credit on invoice)

Graphical Summary of Count
Summary Report

Distribution of Data
Examine the center, shape, and variability.





Descriptive Statistics

N	18
Mean	39.389
StDev	43.745
Minimum	1
5th percentile	*
25th percentile	8.25
Median	19
75th percentile	73.5
95th percentile	*
Maximum	153

95% Confidence Intervals

Mean	(17.635, 61.143)
Median	(9.5180, 57.979)
StDev	(32.826, 65.581)

Data is not normally distributed P-value < 0.005

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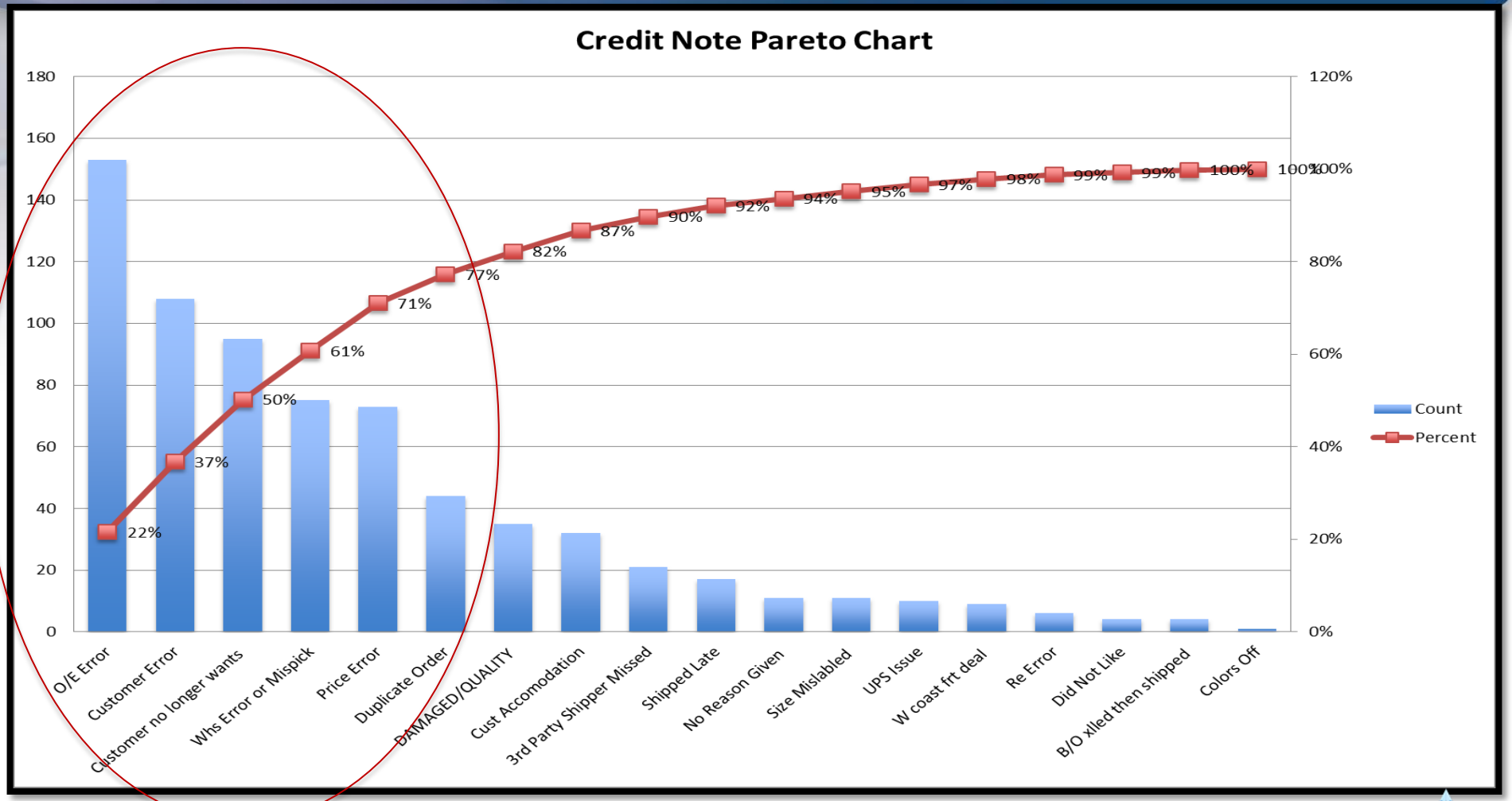
Pareto Analysis-Credit Notes



77% Errors Order Entry/ Customer/ Warehouse / Price /Duplicate =124K

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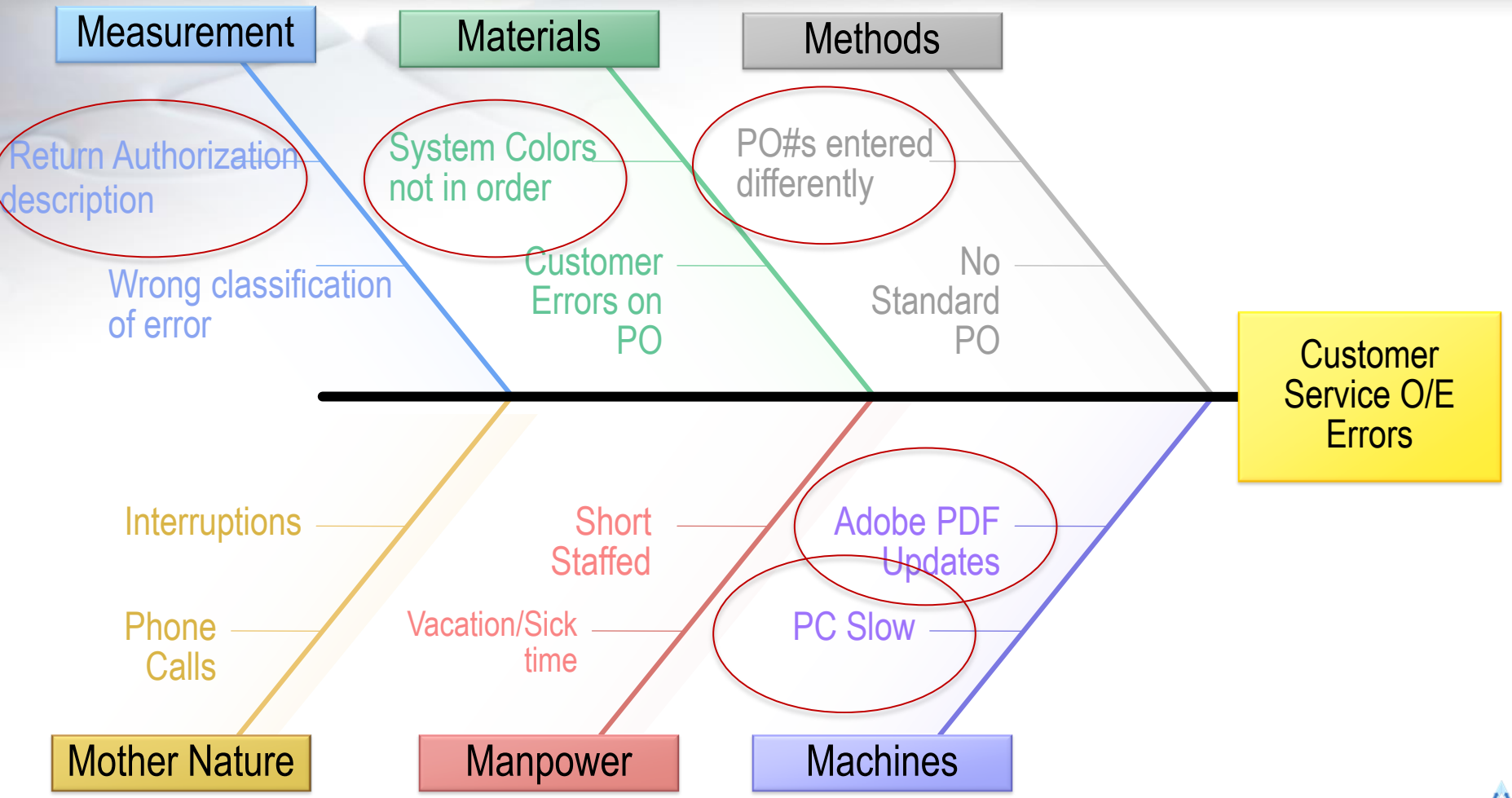
Iskikawa Fishbone-Credit Notes



Slow Computers, Outdated Software, System Colors not in Order, PO# Entry Std, RA

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Results from Credit Note Improvement Effort

Quality Tools

SIPOC

Histogram

Pareto

Fishbone

- 10% Reduction in Credit Notes
- System Configured w color in numerical order
- Created SOP's (Standard Work)
  - PO Entry
  - Return Authorization Process
- Updated Computers
- Updated Software

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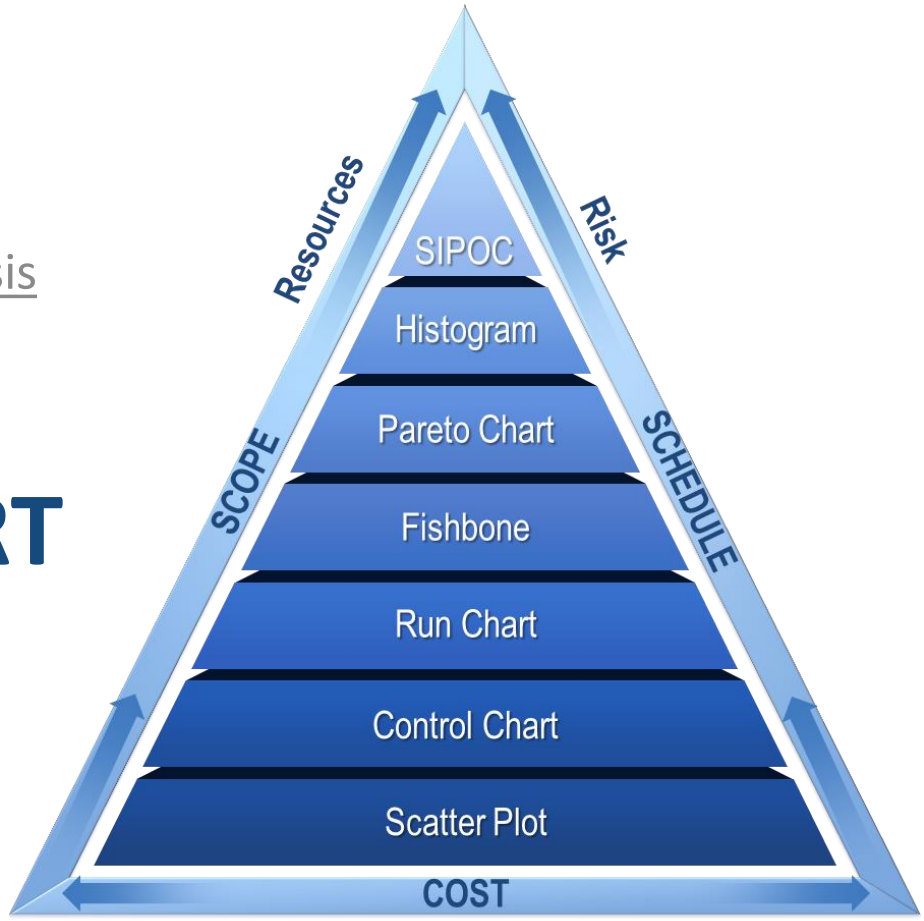
Daily Order and Shipping Analysis

RUN CHART
CONTROL CHART
SCATTER PLOT



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Raw Data Daily Order and Shipping

1	3/24/2014	3/25/2014	3/26/2014	3/27/2014	3/28/2014	3/31/2014	4/1/2014	4/2/2014	4/3/2014	4/4/2014	4/7/2014	4/8/2014	4/9/2014	4/10/2014	4/11/2014
2	12	17	2	1	1	7	7	2	12	3	24	3	4	5	50
3	1	12	340	1	21	1	1	14	1	1	4	8	25	11	3
4	1	4	4	1	1	44	2	22	3	5	1	16	4	8	2
5	4	2	4	10	1	3	5	4	11	2	25	7	9	11	1
6	5	12	1	6	1	3	5	1	8	6	2	28	24	1	8
7	5	12	2	1	3	4	2	2	1	12	3	34	107	4	3
8	17	120	6	6	3	4	1	1	10	12	1	44	132	9	3
9	5	3	3	6	1	1	3	2	1	6	44	84	180	2	4
10	2	13	3	23	1	21	36	100	2	11	48	185	1	15	3
11	54	10	4	1	30	12	1	2	1	1	4	2	62	48	6
12	6	6	5	38	35	10	13	2	6	4	48	9	6	1	6
13	4	1	191	82	50	14	2	5	2	1	50	2	8	4	2
14	49	18	44	11	10	2	1	40	1	3	2	1	2	1	4
15	8	3	12	1	34	23	1	1	4	4	80	6	4	2	5
16	24	413	6	2	6	112	13	44	26	5	5	21	3	1	6
17	84	2	10	2	50	6	1	87	10	1	6	1	3	6	2
18	6	5	169	1	18	3	66	2	1	1	2	8	30	1	1
19	9	30	24	2	2	1	7	11	16	4	1	2	2	8	1
20	11	2	1	1	12	15	18	8	37	4	4	22	1	4	4
21	24	44	1	4	12	36	190	8	13	14	23	10	9	168	43
22	6	5	4	12	2	25	31	2	3	25	33	1	41	130	9

Sheet1

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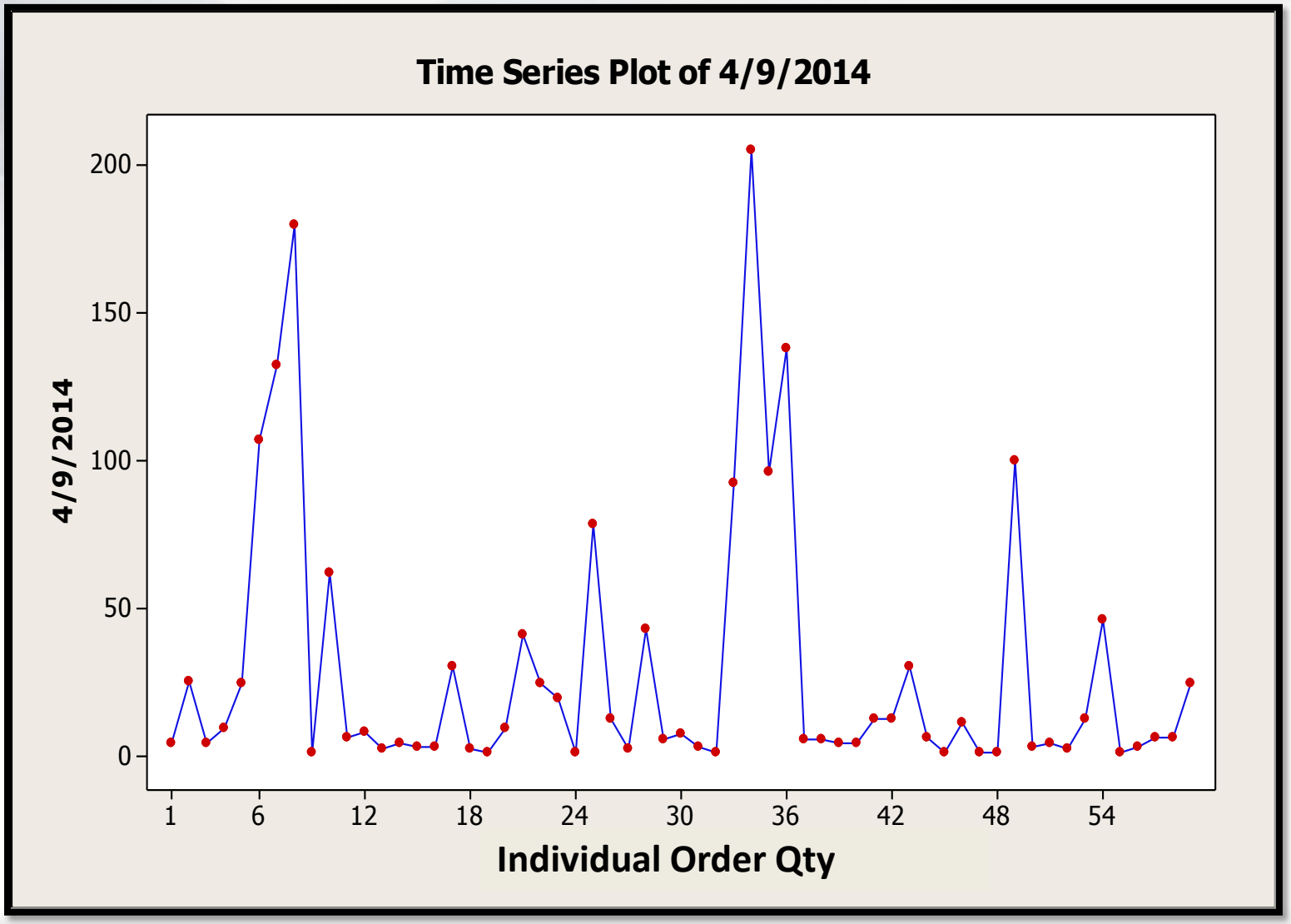
Run Chart



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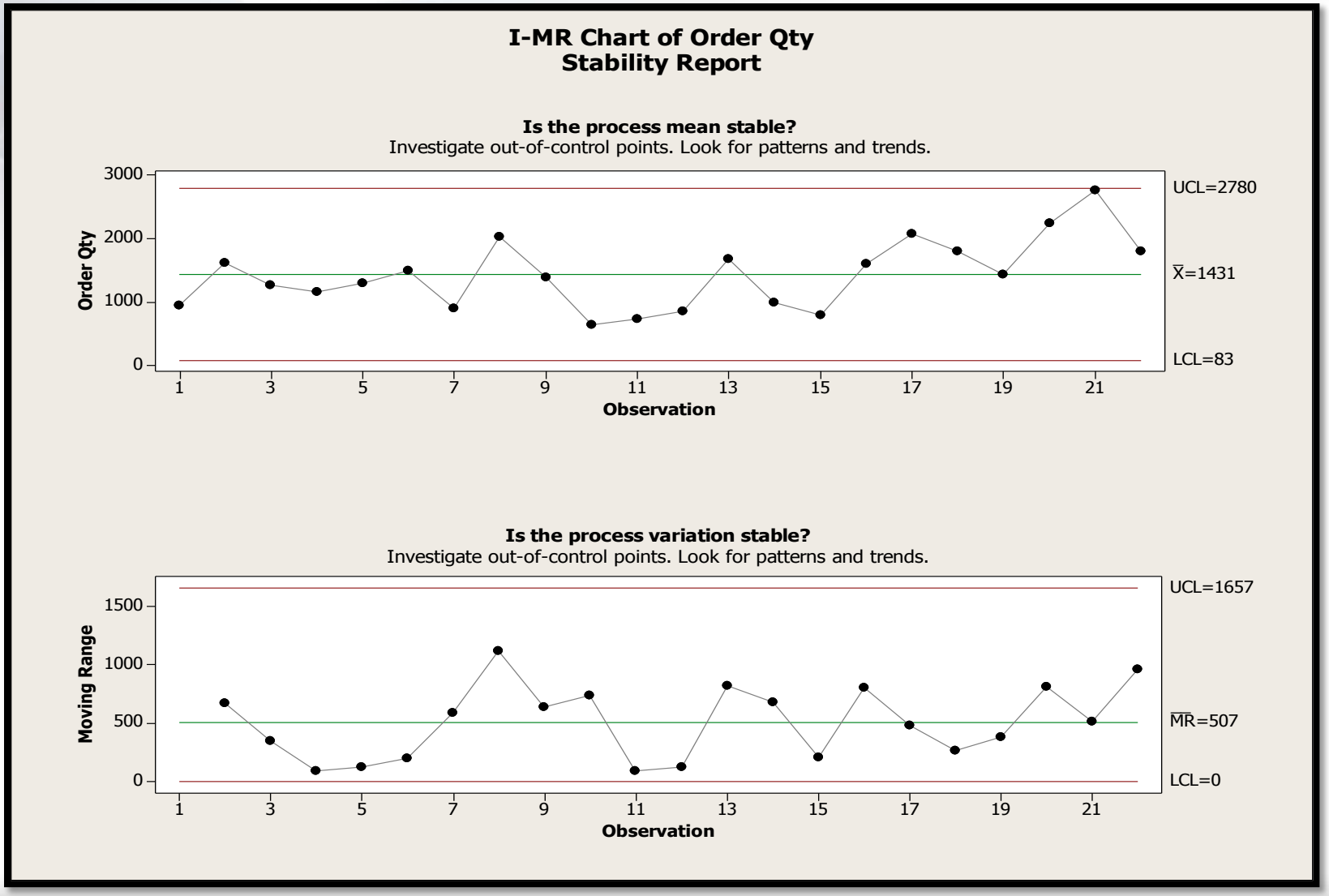
Control Chart



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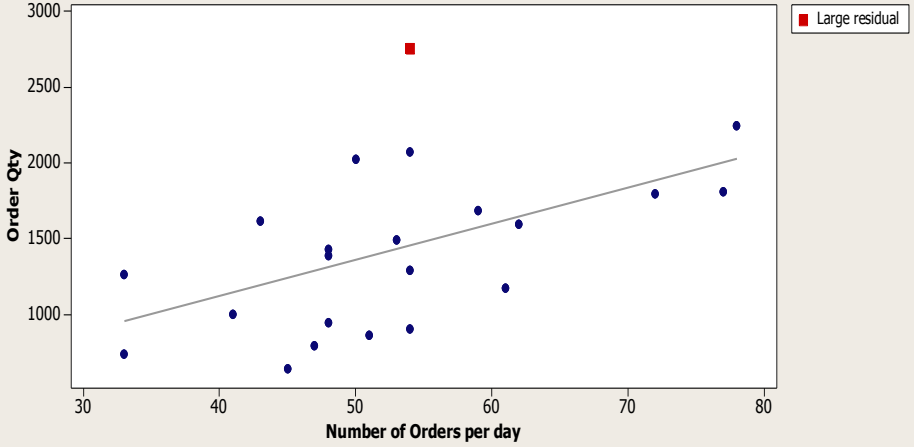
Scatter Plot

Regression for Order Qty vs Number of Orders per day
Model Selection Report

Y: Order Qty
X: Number of Orders per day

Fitted Line Plot for Linear Model
Y = 169.2 + 23.83 X



Statistics

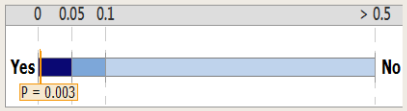
	Selected Model	Alternative Models	
	Linear	Quadratic	Cubic
R-squared (adjusted)	23.64%	19.67%	15.28%
P-value, model	0.013*	0.048*	0.116
P-value, linear term	0.013*	0.644	0.952
P-value, quadratic term	-	0.917	0.907
P-value, cubic term	-	-	0.902
Residual standard deviation	474.930	487.125	500.257

* Statistically significant (p < 0.05)

Regression for Order Qty vs Date
Summary Report

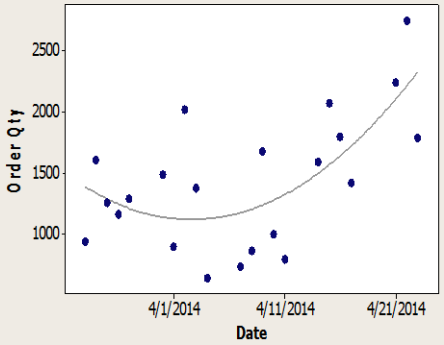
Y: Order Qty
X: Date

Is there a relationship between Y and X?

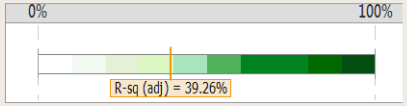


The relationship between Order Qty and Date is statistically significant (p < 0.05).

Fitted Line Plot for Quadratic Model
Y = 5.08E+09 - 243328 X + 2.915 X**2



% of variation accounted for by model



39.26% of the variation in Order Qty can be accounted for by the regression model.

Comments

The fitted equation for the quadratic model that describes the relationship between Y and X is:
Y = 5.08E+09 - 243328 X + 2.915 X**2
If the model fits the data well, this equation can be used to predict Order Qty for a value of Date, or find the settings for Date that correspond to a desired value or range of values for Order Qty.

A statistically significant relationship does not imply that X causes Y.

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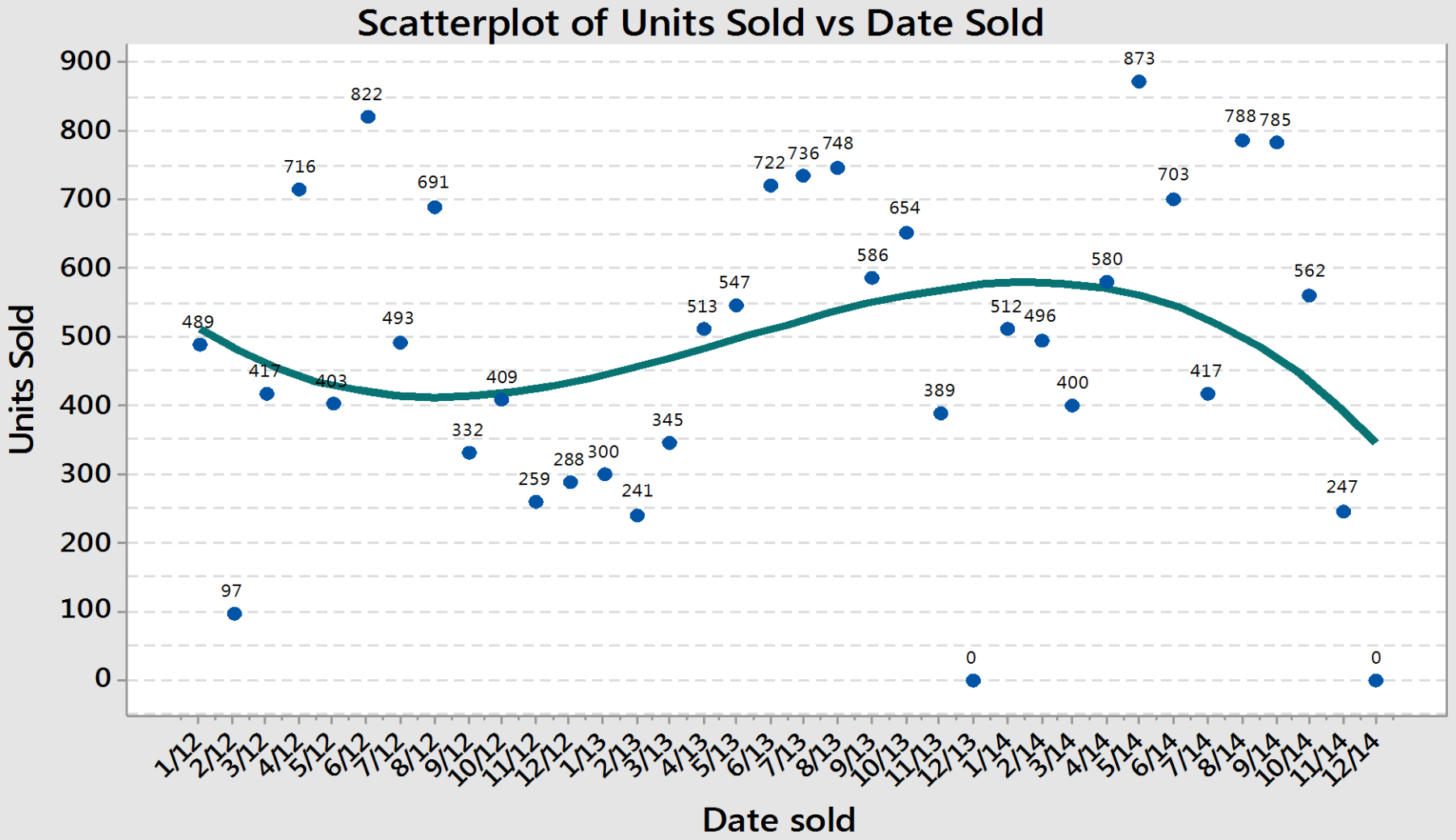
Scatter Plot



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Results from Daily Order and Shipping Improvement

Pickup Time 5:30PM

Quality Tools

Run Chart

Control Chart

Scatter plot

- Setup cut off times
  - Noon for order >50 (ship next day)
  - 2pm for order <50 (same day)
- Added resources on day crew
- Added night crew to process orders
- Determined there is an relationship between
  - Order QTY & Date
  - Unit Sold and Date Ordered
- Avg. Number of Units per day is 1431 Units

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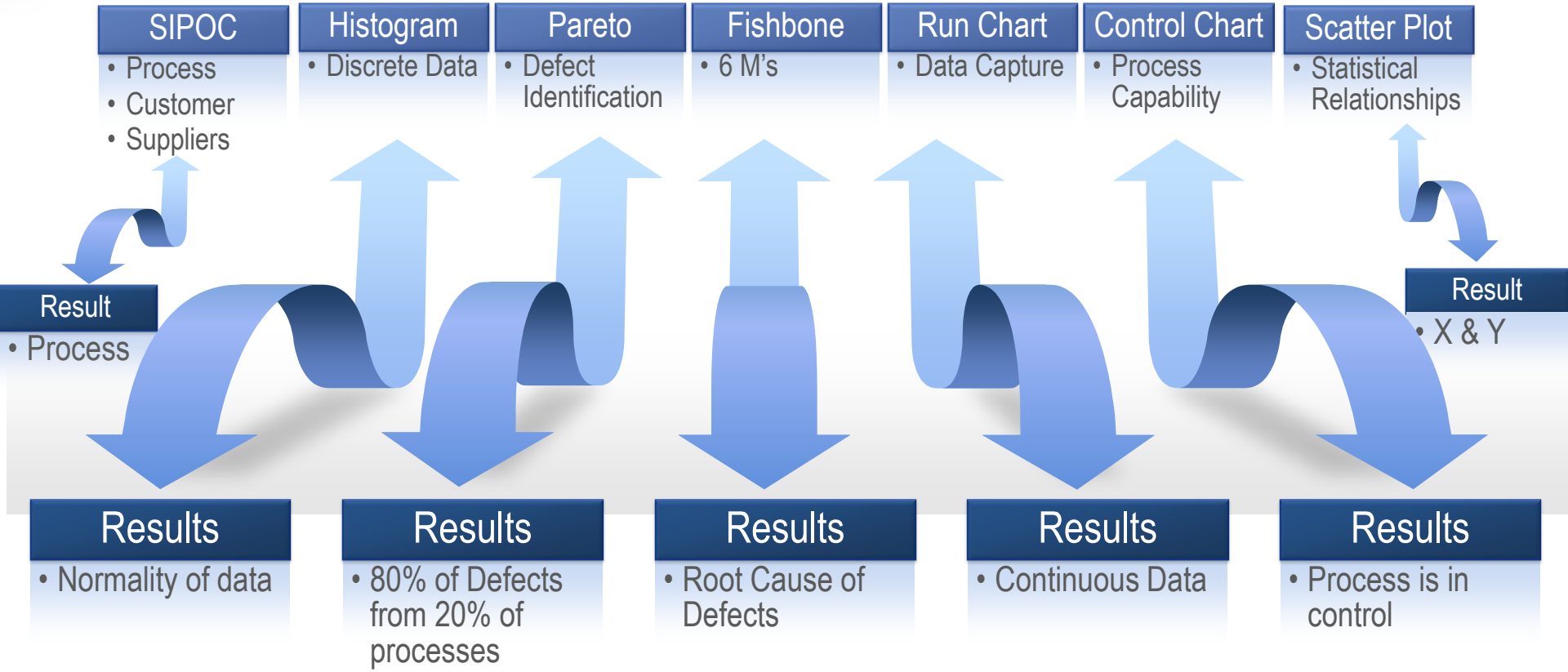
7 Basic Quality Tools

Had a positive impact on the business by providing the Product Director the data analysis tools to make fact based decisions



Fact Based Management

Process-Data-Analysis-Results

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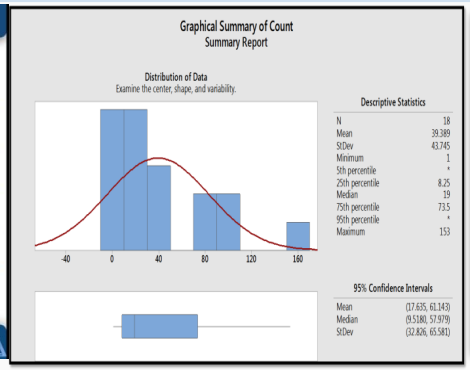
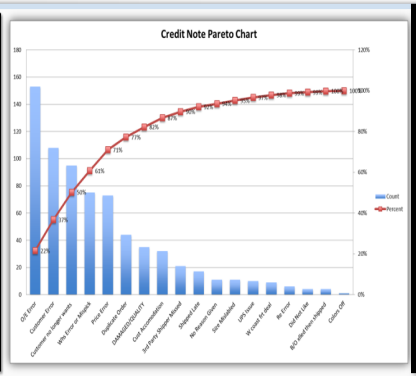
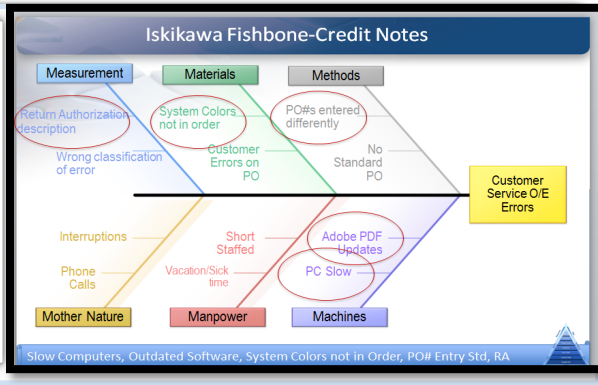
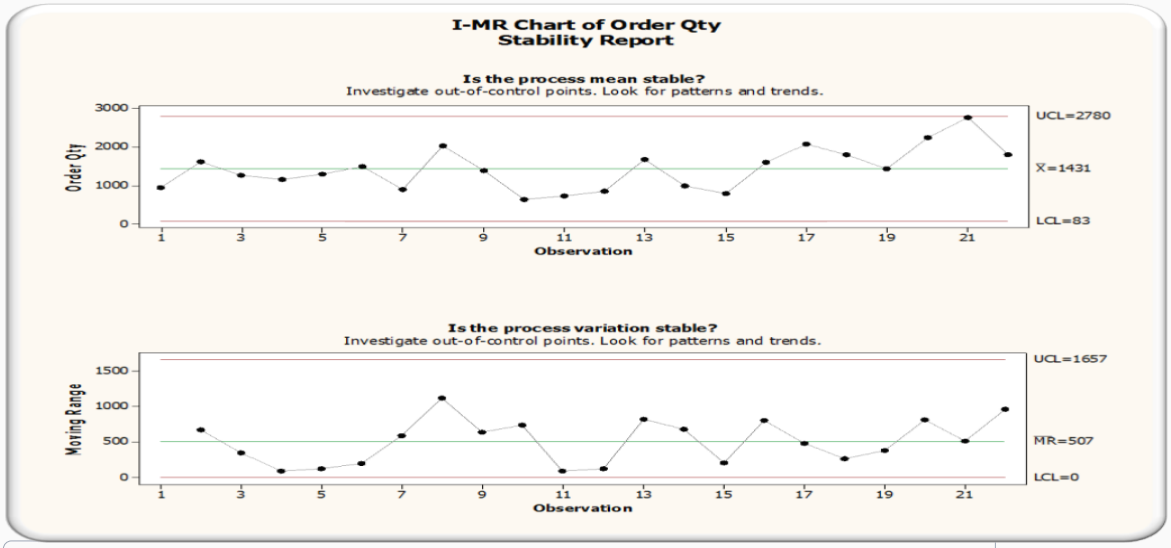
7 Basic Tools Dashboard for Continuous Improvement





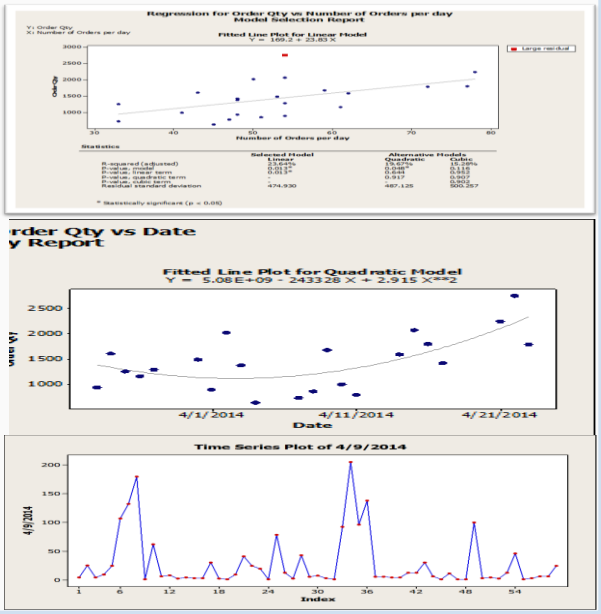


Control Charts



Product A Product B Product C Product D

Statistically Significant Relationships



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Thanks for your time and participation

QUESTIONS

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REFERENCES:

Body of Knowledge-Six Sigma Black Belt Certification -CSSBB

Project Management Body of Knowledge (PMBOK 5th edition)

American Society of Quality

Lean Six Sigma Pocket Tool Book (2005)

Data Courtesy of Dynamic Design

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Team Building

KUERIG SIPOC EXERCISE

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Team Building Exercise

KUERIG FISHBONE DIAGRAM

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Team Building

KUERIG SIPOC EXERCISE

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