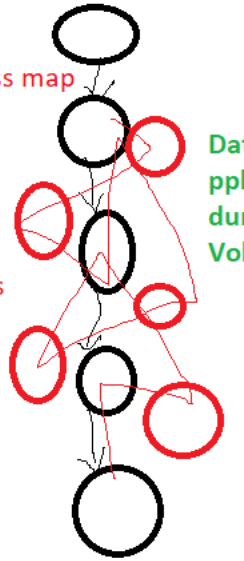
What you think it is

What it is actually

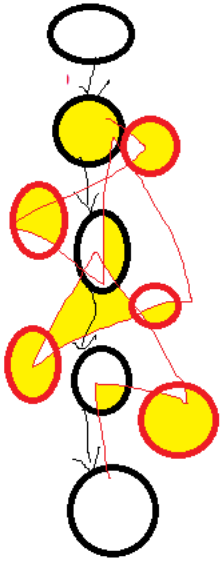
As- Is Process map
CVSM
SD

45 minutes



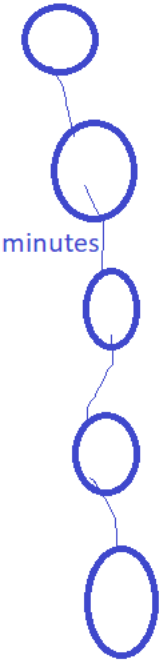
Data
ppl
duration
Volume

Identify waste or NVA



Proposed Map
Ideal VSM

15 minutes



To- Be map
Should Be map
FVSM

20 minutes

- **Overall Equipment Effectiveness (OEE) =** A* P* Q, where A is Machine Availability, P is Performance efficiency & Q is Quality rate

A = Operating time/Planned production time

P = (Total pieces / operating time) / Ideal run rate

Q = Good pieces produced / total pieces produced

A, P & Q factor for down time loss, speed loss & Quality loss respectively. The **OEE value** is a **Lean / TPM metric,** which can also be used to prioritise a process for improvement projects. **World class OEE value** is taken as **85%** & individual values for A, P & Q are 90%, 95% & 99.9% respectively.

OEE Factor	Shift 1	Shift 2
Availability	90.0%	95.0%
Performance	95.0%	95.0%
Quality	99.5%	96.0%
OEE	85.1%	86.6%

OEE - Overall Equipment Efficieny
OEE = A*P*Q

Availibility =
Performance =
Quality=

WC = 85%
Ind std = 50-60%

Data for OEE calculation

Particulars	Data/ value
Shift length	480 mins
Short breaks	2 @ 15 mins = 30 mins
Meal break	30 mins
Down time	47 mins
Ideal run rate (IRR)	60 pieces per min
Total pieces	19,722 pieces
Reject pieces	453 pieces
Planned prodn time	Shift length – total breaks
Operating time	Pl prodn time - down time
Good pieces	Total pieces – reject pieces
Availability	Op time / pl prodn time
Performance	(Tot pieces/op time) / IRR
Quality	Good pieces/total pieces

OEE calculation

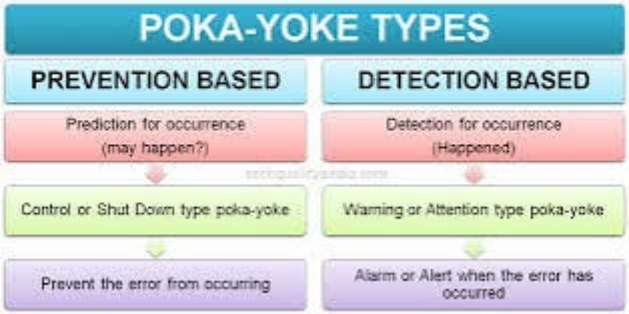
- Planned prodn time = 420 mins
- Operating time = 373 mins
- Good pieces = 19,269

- A = 373/420 = 0.8881
- P = (19722/373)/60 = 0.8812
- Q = 19269/19722 = 0.97703

So, A = 88.81%, P = 88.12% & Q = 97.70%

OEE = 76.46%

We see that A (Machine Availability) & P (Performance) needs to be improved to improve OEE value further. And among A & P, P needs more improvement.



From Sarah to Everyone 05:09 PM

equipment "pinch point" warning label

From Nick to Everyone 05:09 PM

We use a 2" hose and a 3" hose to ensure the incorrect tank does not get attached

From Trey Case to Everyone 05:10 PM

Coastal uses an 8mm x 8mm notch that is wire cut into foam design

From Jake\ Koetsier to Everyone 05:10 PM

lot codes could be scanned in by a barcode rather than manually typing

D

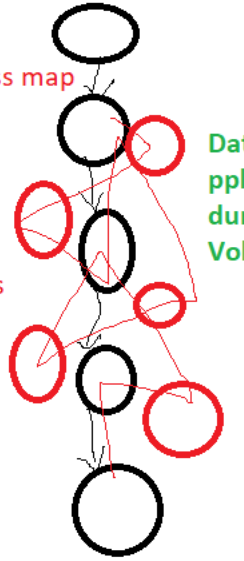
What you think it is

M

What it is actually

As- Is Process map
CVSM
SD

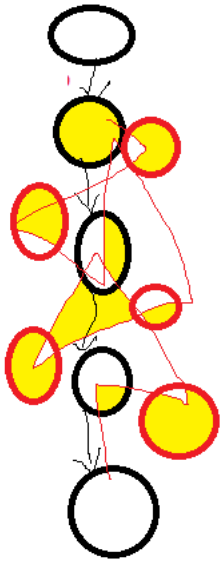
45 minutes



Data
ppl
duration
Volume

A

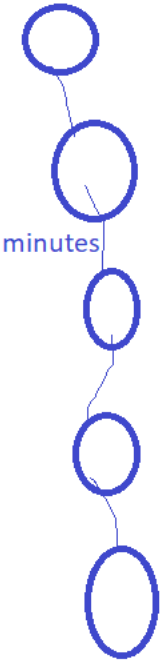
Identify waste or NVA



I

Proposed Map
Ideal VSM

15 minutes



C

To- Be map
Should Be map
FVSM

20 minutes

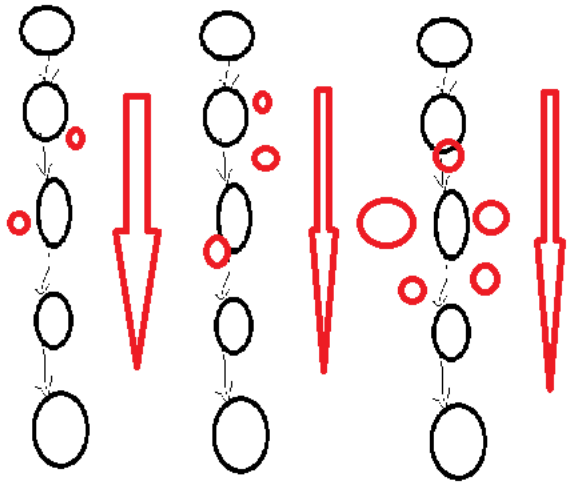
SMED

100 units per hour = 700 units per day
3 dies * 15 minutes = 45 minutes
3 dies * 10 minutes = 30 minutes
3 dies * 5 minutes = ~~15 minutes~~
3 dies * 3 minutes = 9 minutes

30 minutes
3 minutes
30 seconds
10 seconds

Seconds
Nano-Seconds

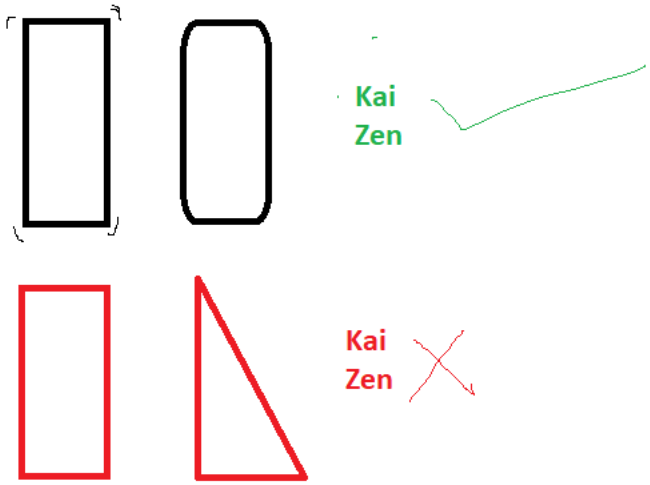
Single minute (digit)
SMED - SIngle minute Exchange of Dies



F1 car race- Pit stop
Racer- Productive
Change of tyres= UnProductive

1 to 2 hours
45 mins
30 mins
15 mins
10 mins
5 mins
3 mins
2 seconds

Kaizen
Kai- change/modify
Zen - good / better



Toyota
TPS - Toyota Production System
TPS - Thinking People's Solution

Empower their people at their levels.

TT, C-team, Janitors, HK
MMT, SMT , Associates

Lean Tool

No Cost
Low Cost
Less Time
Less Resources
Low Risk

Kaizen

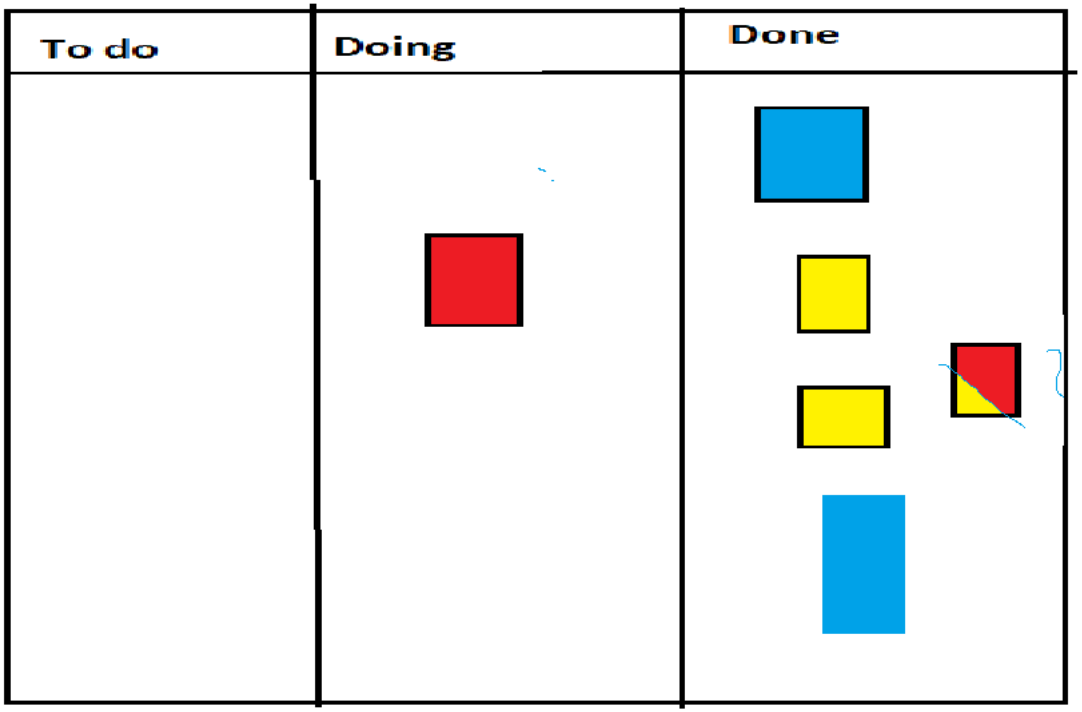
lots of smaller change

Kaikaku

big change

Kakushin

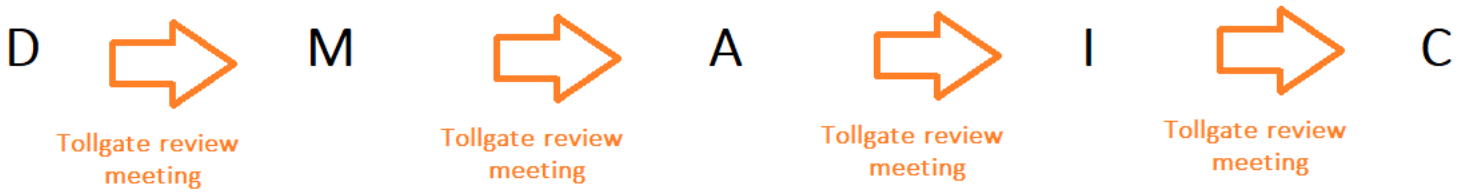
something new!!!



Day 3:-

What you can't measure, you can't improve, You can't manage.

Toll-Gate Review



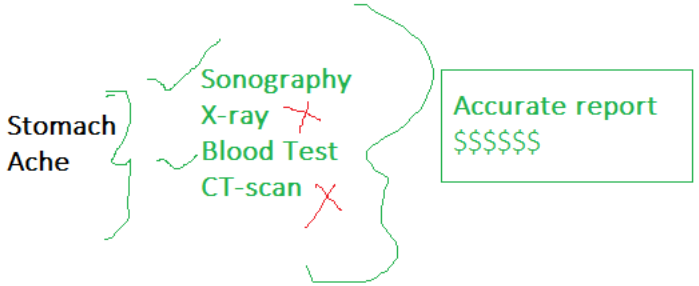
y = f(x)
coffee = f(brand of coffee)

y = f(x1, x2,x3,x4....)
coffee = f(water, milk, sugar,coffee)

y = f(x)
sale coffee = f(taste of coffee)

y = f(x1, x2,x3,x4....)
sale of coffee = f(taste, color, aroma, quantity, hygiene, price)

Not about measuring it right
But to measure the right things



Examples of y=f(x1,x2,x3….)

From Gabe TeBos to Everyone 03:34 PM

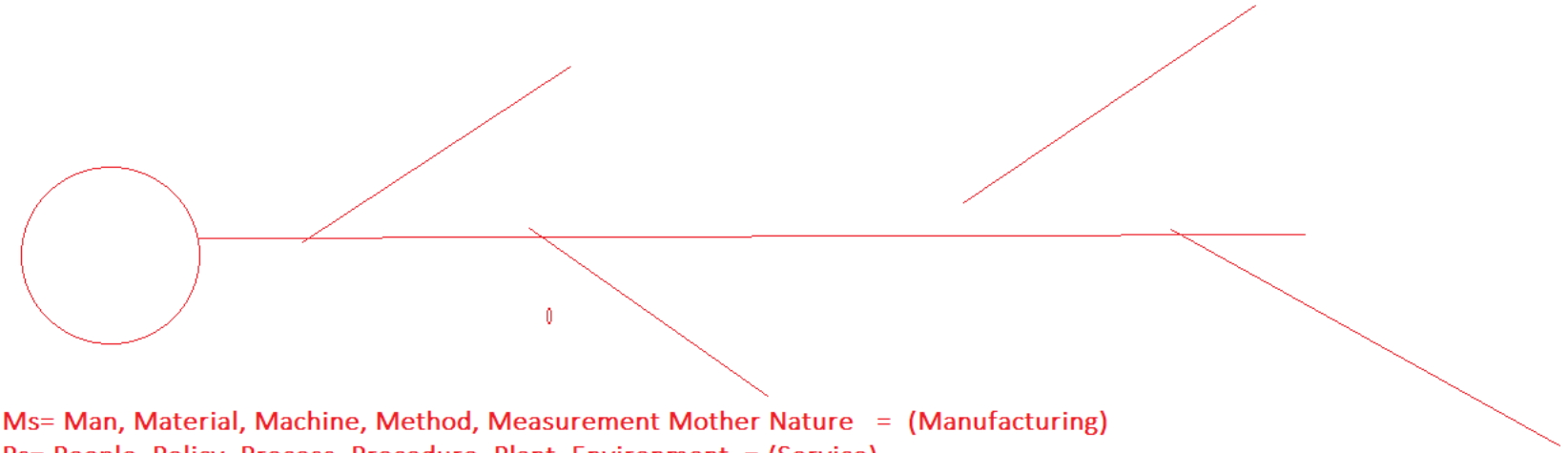
Y=**Wire Delivery**

Wire Delivery =f(Wire accuracy, Delivery Timeliness, Product condition)

From Jake Koetsier to Everyone 03:35 PM

Blending = f(raw materials, formula, technicians, blenders)

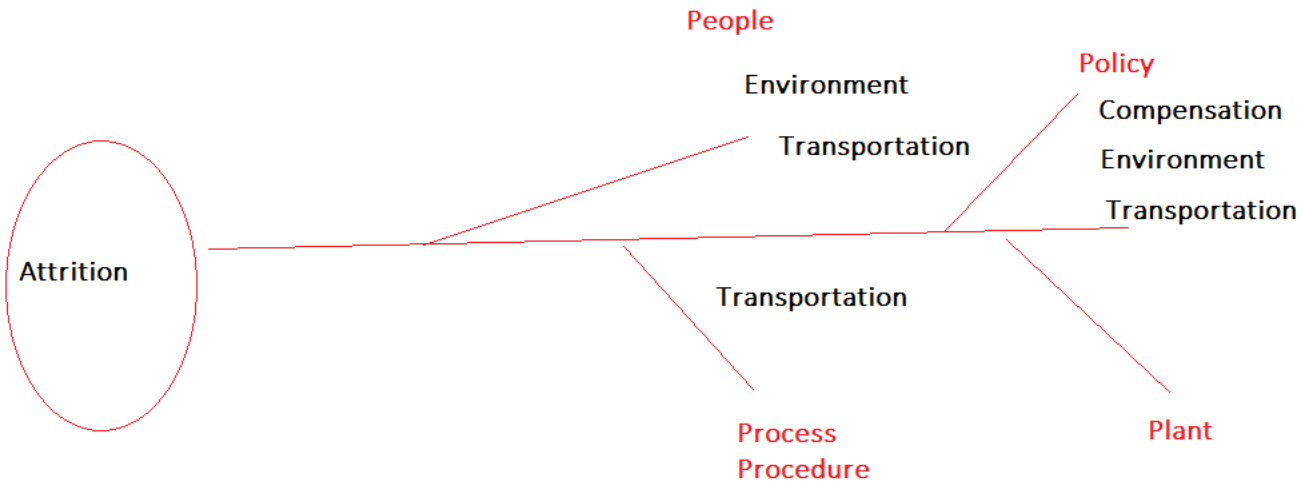
Fishbone



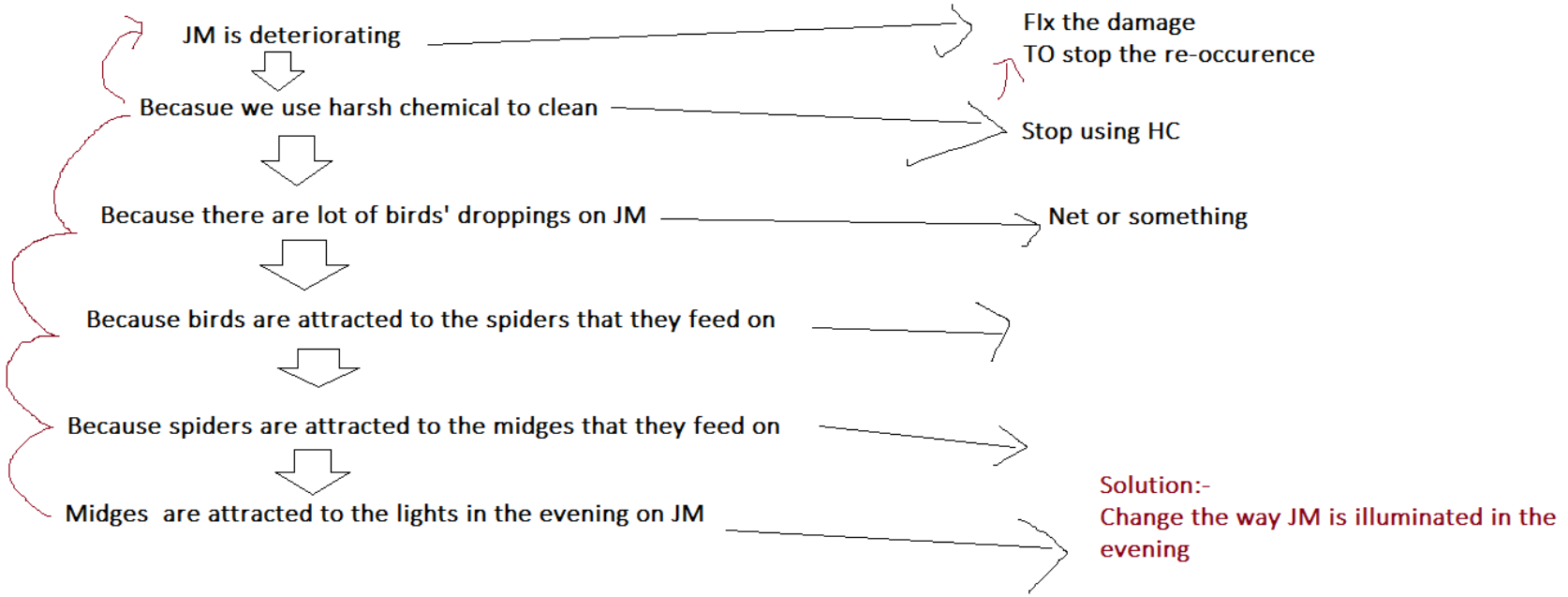
Ms= Man, Material, Machine, Method, Measurement Mother Nature = (Manufacturing)
Ps= People, Policy, Process, Procedure, Plant, Environment = (Service)
Use both for any industry

E =
S =

Fishbone - https://www.youtube.com/watch?v=mLvizyDFLQ4F


People
Environment
Transportation
Policy
Compensation
Environment
Transportation
Attrition
Transportation
Process
Procedure
Plant

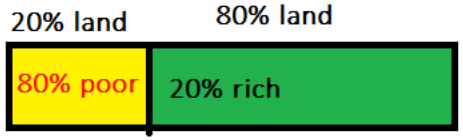
5 -Whys
3-7-9 Whys
Why-Why Analysis



Pareto:-

Pareto - Priortising tool

Vilfredo Pareto - Italian economist



peas	pods
pods	plants
plants	garden
garden	soil
produce	garden
sales	product
profit	sales
sales	customer
complaint	customer
Issues	cause

80:20 rule, pareto
pareto graph
prioriting tool
vital few and trivial many

80:20
70:30
60:40

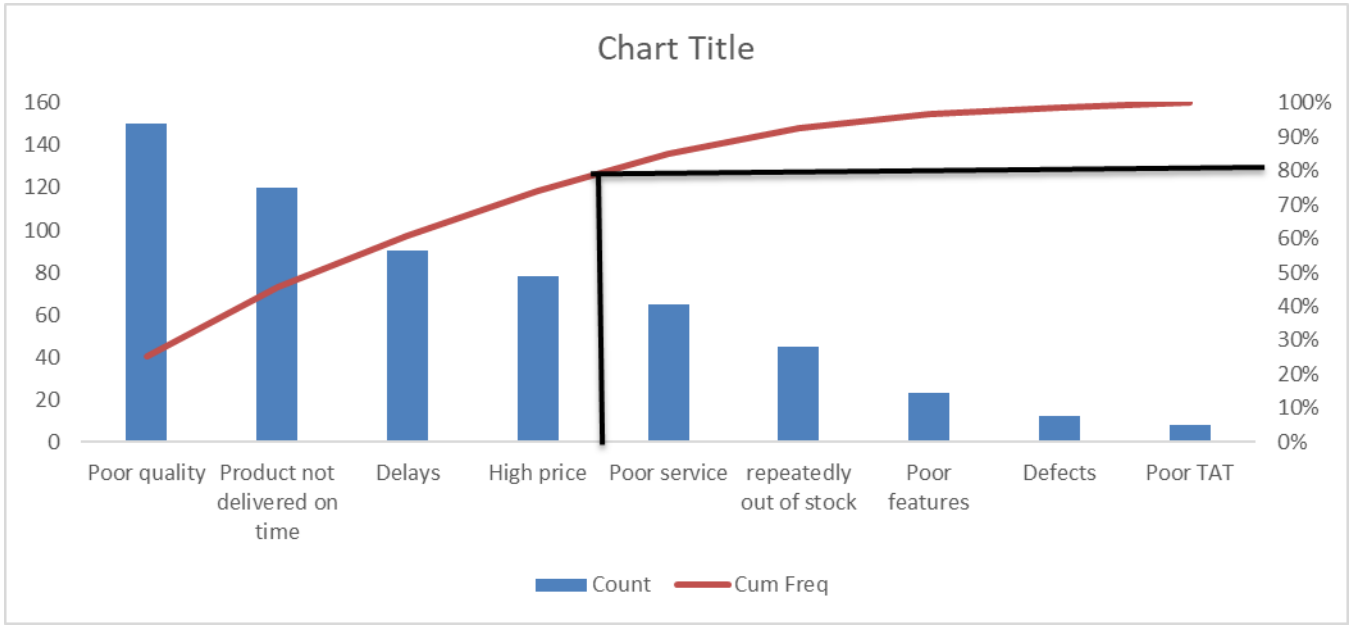


Chart Title
160
140
120
100
80
60
40
20
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Poor quality
Product not delivered on time
Delays
High price
Poor service
repeatedly out of stock
Poor features
Defects
Poor TAT
Count
Cum Freq

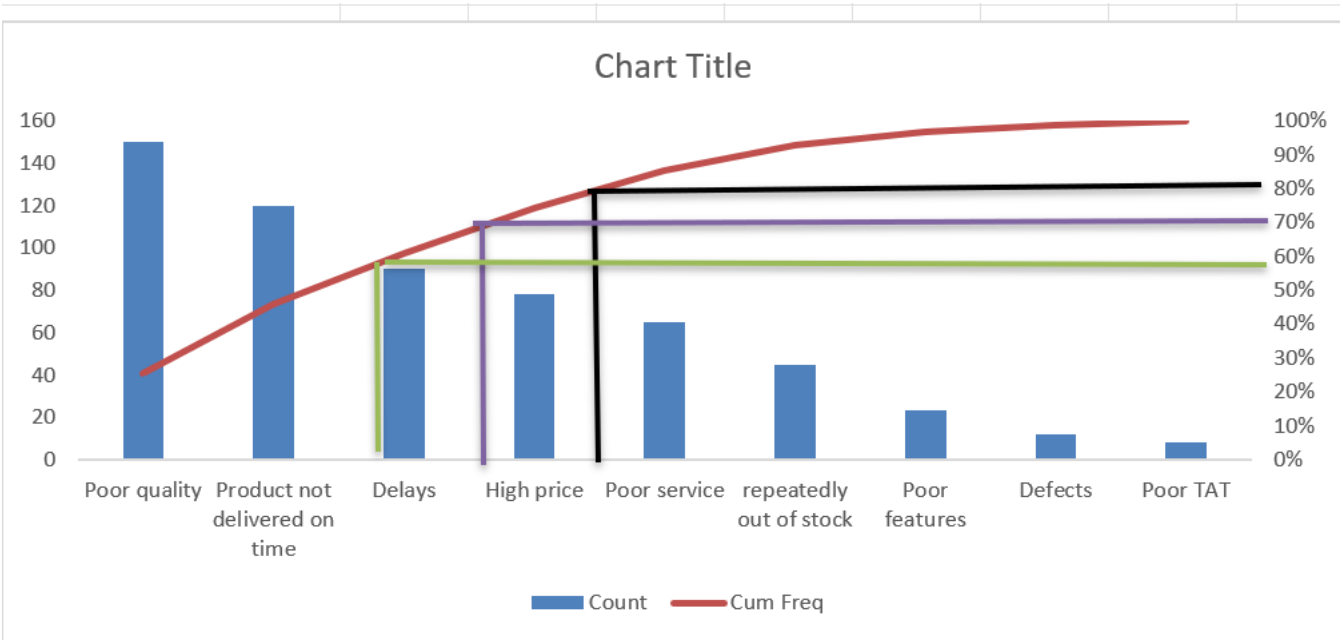
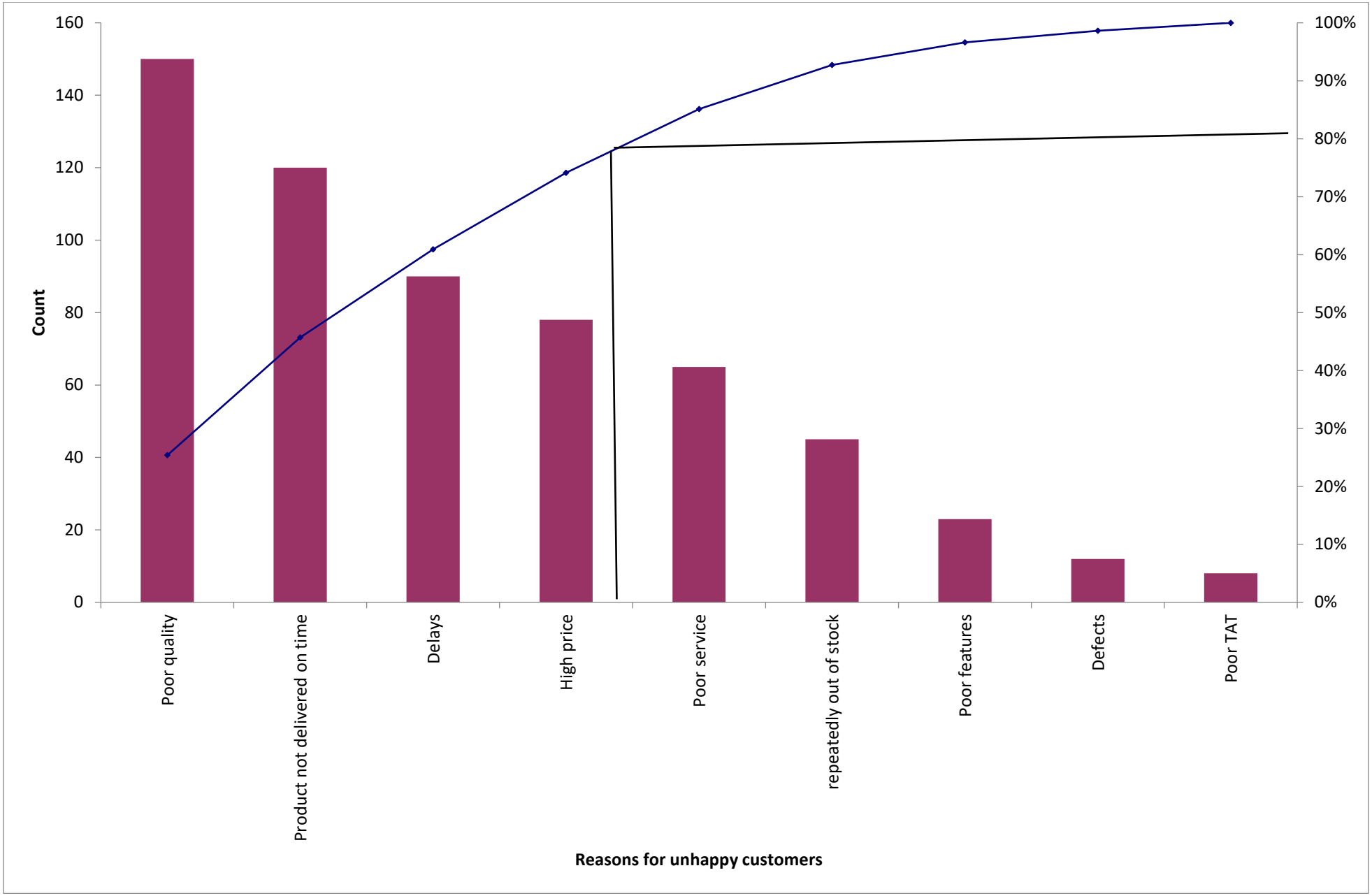
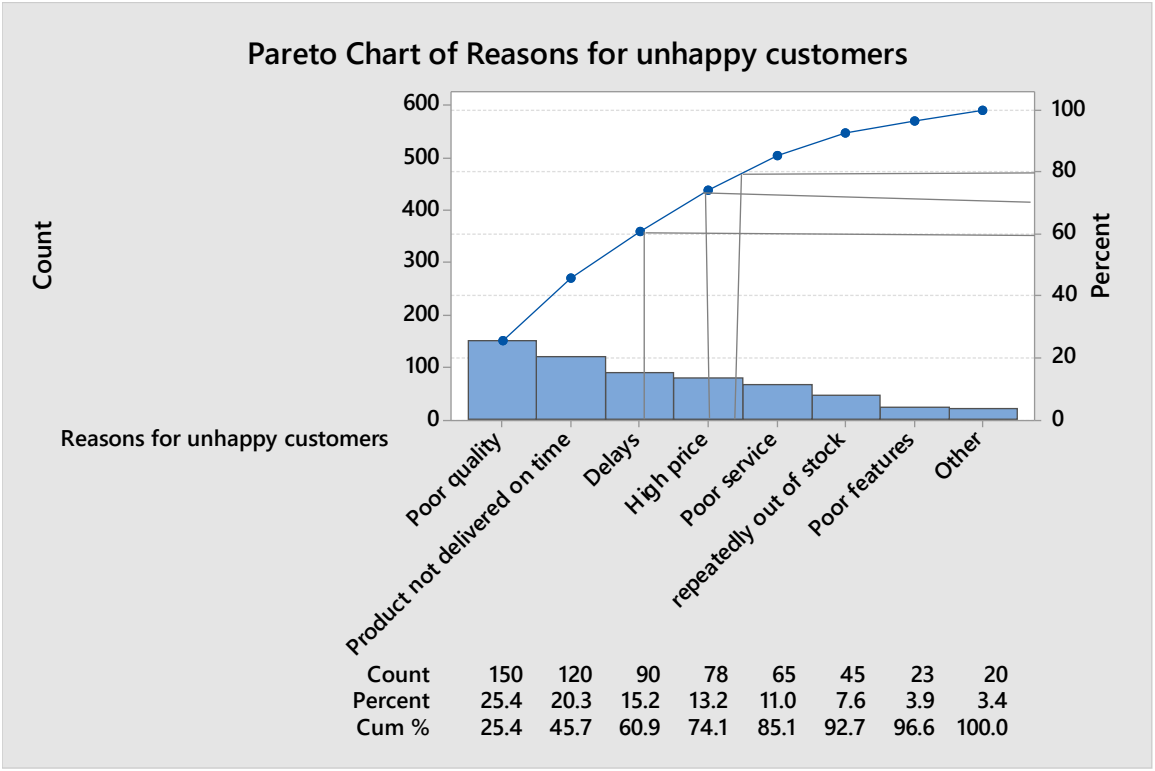


Chart Title
160
140
120
100
80
60
40
20
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Poor quality
Product not delivered on time
Delays
High price
Poor service
repeatedly out of stock
Poor features
Defects
Poor TAT
Count
Cum Freq


160
140
120
100
80
60
40
20
0
Count
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Poor quality
Product not delivered on time
Delays
High price
Poor service
repeatedly out of stock
Poor features
Defects
Poor TAT
Reasons for unhappy customers


Pareto Chart of Reasons for unhappy customers
Count
Percent
600
500
400
300
200
100
0
100
80
60
40
20
0
Reasons for unhappy customers
Poor quality
Product not delivered on time
Delays
High price
Poor service
repeatedly out of stock
Poor features
Other
Count 150 120 90 78 65 45 23 20
Percent 25.4 20.3 15.2 13.2 11.0 7.6 3.9 3.4
Cum % 25.4 45.7 60.9 74.1 85.1 92.7 96.6 100.0

FMEA - Risk Assesment tool

RPN - Rish Priority Number

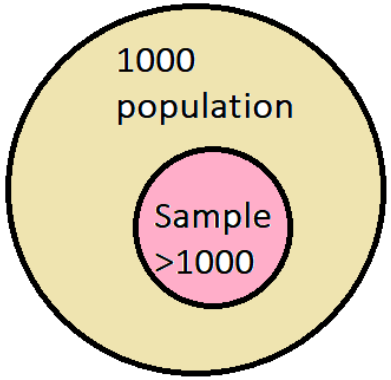
RPN = S*O*D

Severity 1-10
Ocurence 1-10
Detection 1-10

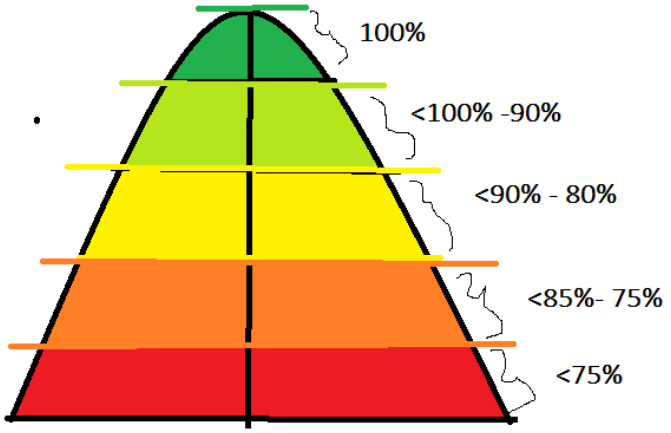
Least RPN = 1*1*1 = 1
Max RPN = 10*10*10 =1000
RPN range from 1 to 1000

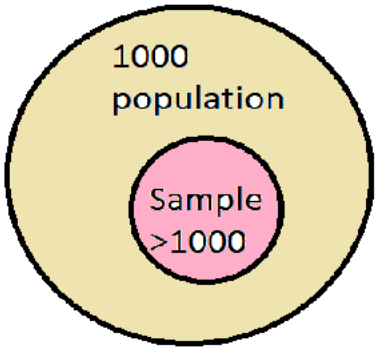
When RPN is 100 or more, we need recomendation

FMEA VIDEO https://www.youtube.com/watch?v=rlGRd4VlCw4

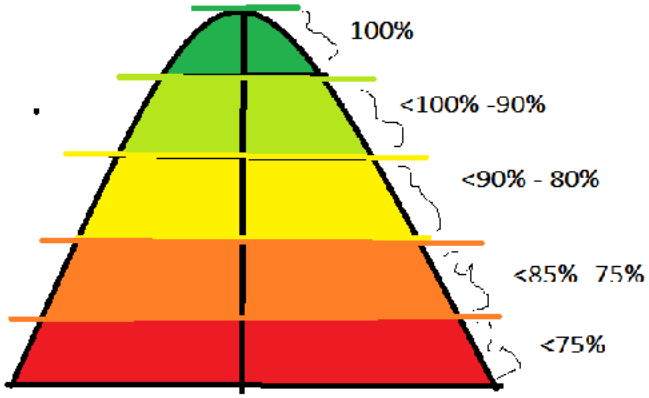


Normal Curve
Normal Distribution
Bell Curve

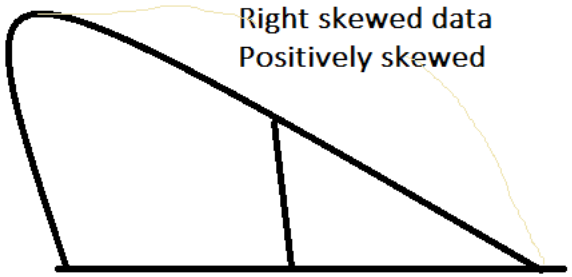


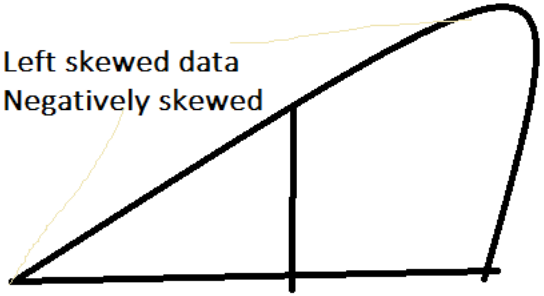


Normal Curve
Normal Distribution
Bell Curve

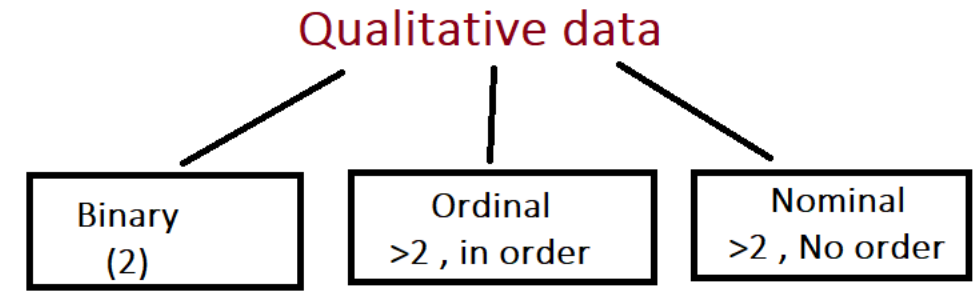


Non-normal curves





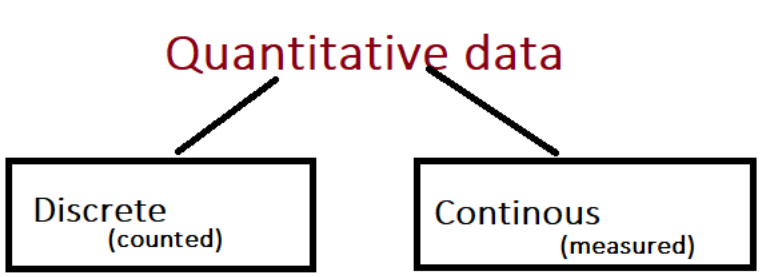
Types of Data:-



F,M
Adult, Kids
Like, Dislike
Hired, Rejected
True,False,
Return,Replacement
Profit,Loss

S,M,L,XL,XXL
Q1, Q2, Q3, Q4
P,B,G,VG,Exc
Ranking
Jan,Feb,Mar,April
NB,Toddler, Teenagers

F,M,O
Hired, Rejected, On hold
Profit,Loss, Breakeven
Black,Green,White, Red



15 members

4 bottles
5 bottles
10 bottles

Defects
Defectives
Returns
Claims

How many?

67% trainees

5 litres
6 litres
8 litres

Profit
Loss
H,W,L,B
Revenue

How much?

Qualitative data

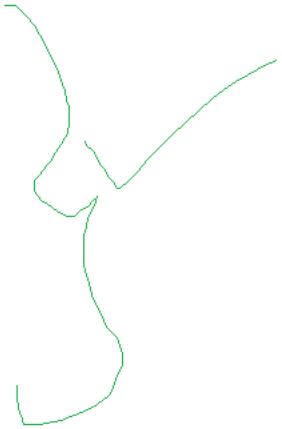
Are you over the age of 16 years?

Y
Y
N
N
N
Y
Y
Y
Y
N
N
Y
N
Y

Quantitative data

How old are you?

12
21
34.5
56
67.5
89
34
54
23
12
34
54
32
12.5
2.5



Population

N

μ

σ

Parameters

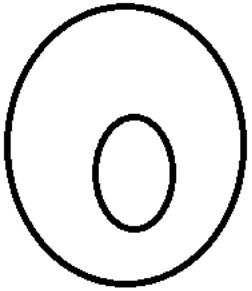
Sample

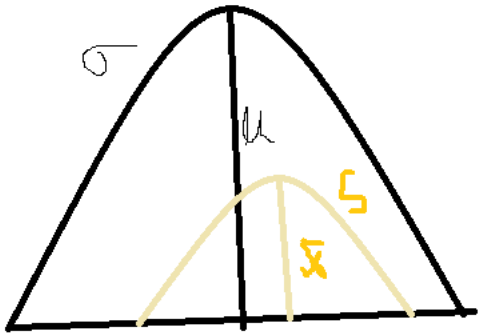
n

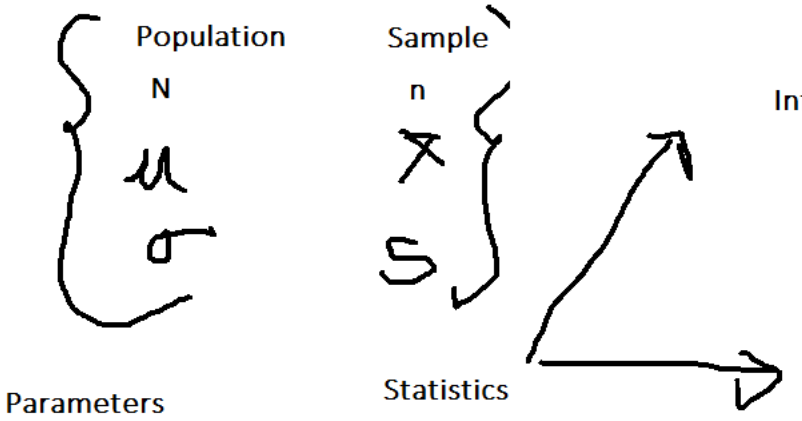
$\bar{x}$

s

Statistics



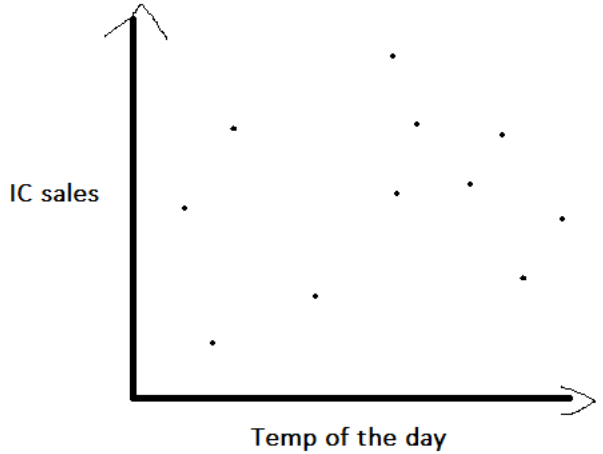




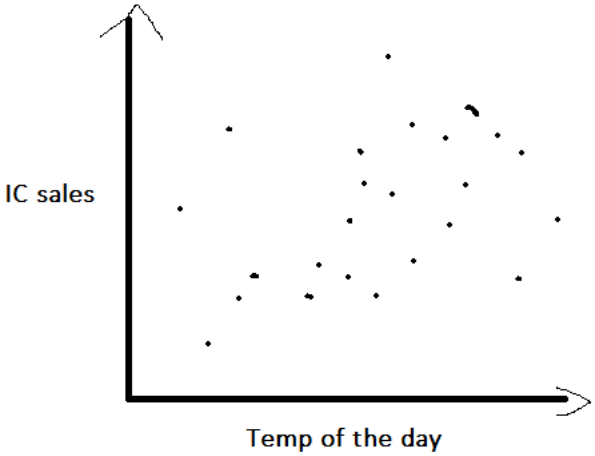
Population			Sample
1000 shirts			100 shirts
120	12%	Buttons	12
50	5%	Pockets	5
160	16%	Sleeves	16
20	2%	color	2

Describes
mean, median,
graph
std dev

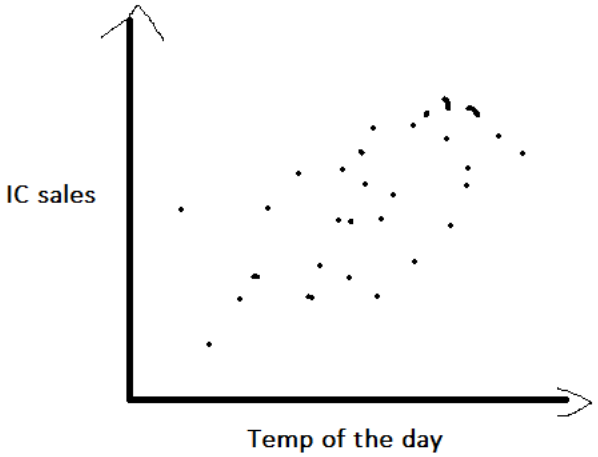
Box Plots and Multiple X Boxplots - https://www.youtube.com/watch?v=GKBBqAvH9p4&ab_channel=SigmaXLInc.



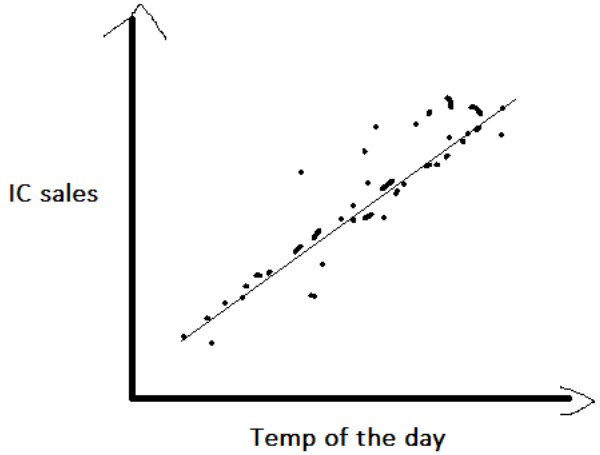
No correlation



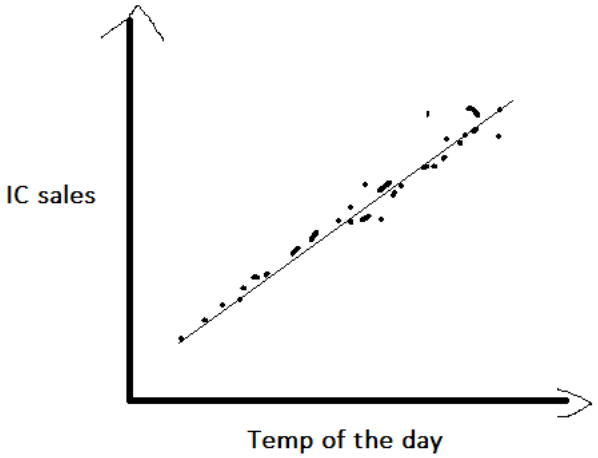
Weak



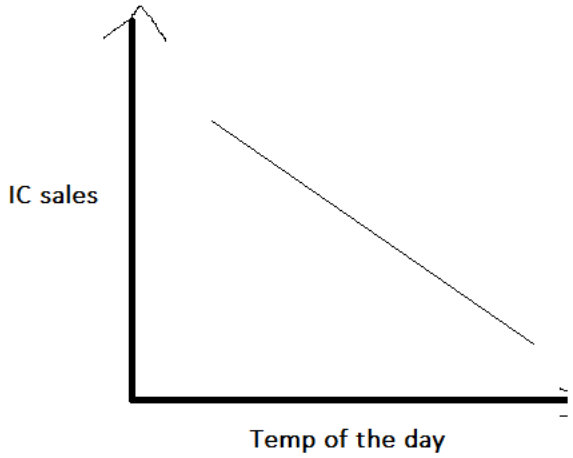
Moderate



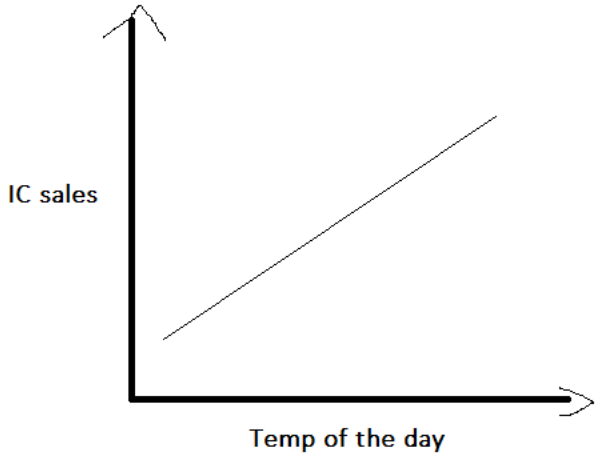
Strong



Perfect/ Strong correlation



Negative correlation



Positive correlation

Scatter Plot

r-value
Coefficient of correlation
ranges from -1 to +1

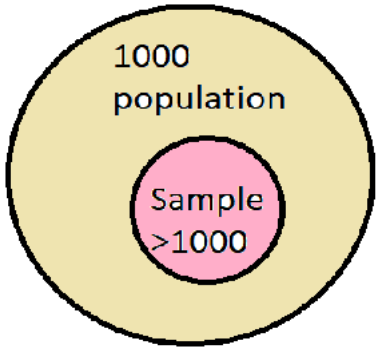
-1 = strong negative correlation
+1 = strong positive correlation
0 = No correlation
0.2 to 0.7 = Weak to moderate
0.8 and above - strong

Positive correlation
(+) (+) , (-) (-)

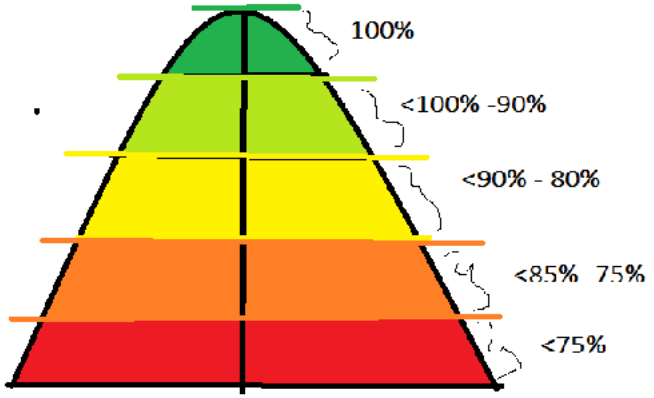
High temperature , More IC sales
Less defects, Less complaints
Low quality, Less Sales
More sales, More profit
More Replacement, More loss
More rework, More cost
Less waste , Less cost

Negative Correlation
(inversely proportional) (+) (-) , (-) (+)

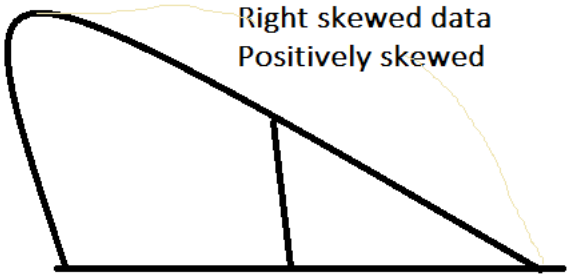
Low temp, high hot coffee sales
More sales, Less Over time
More production, Less waiting
Low price, more sales

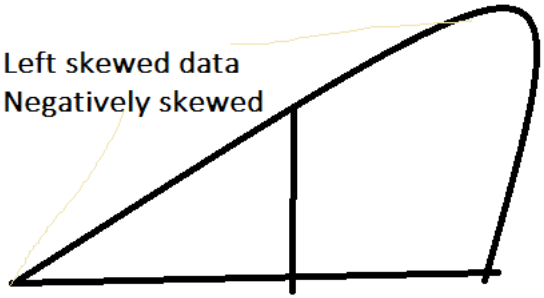


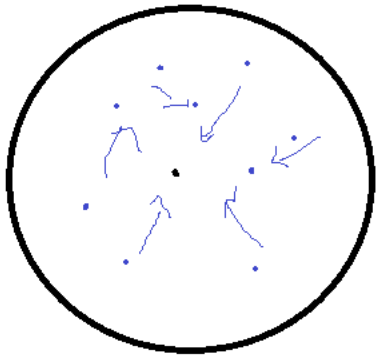
Normal Curve
Normal Distribution
Bell Curve



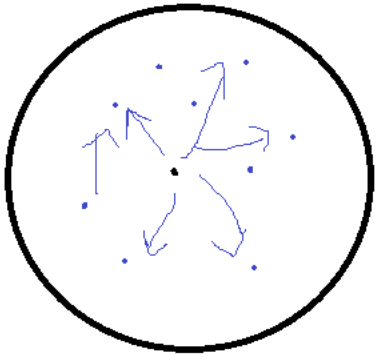
Non-normal curves







Measure of central tendency
Mean, Median, Mode



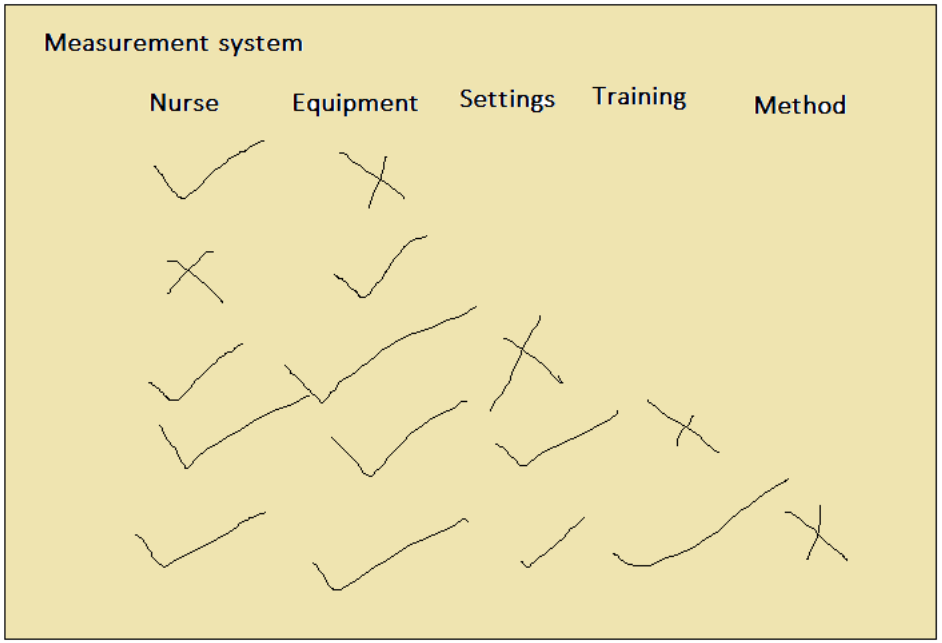
Measure of dispersion
Range, Std dev, Variance

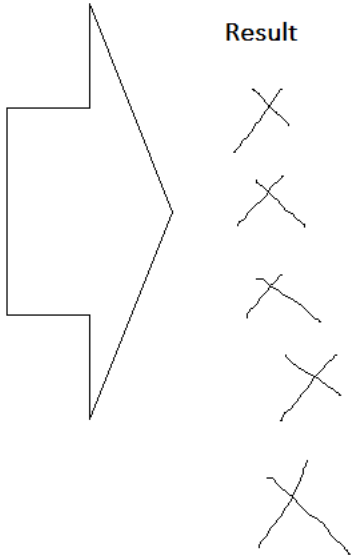
MSA

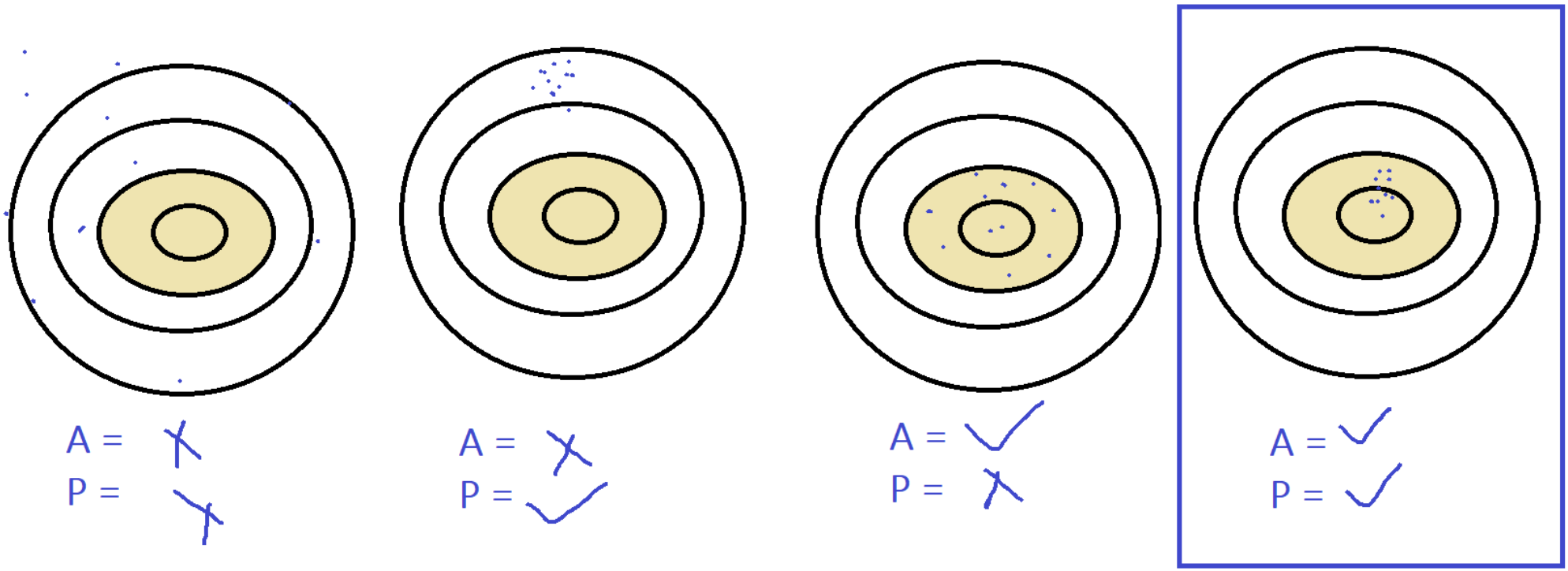
Measurement system Analysis

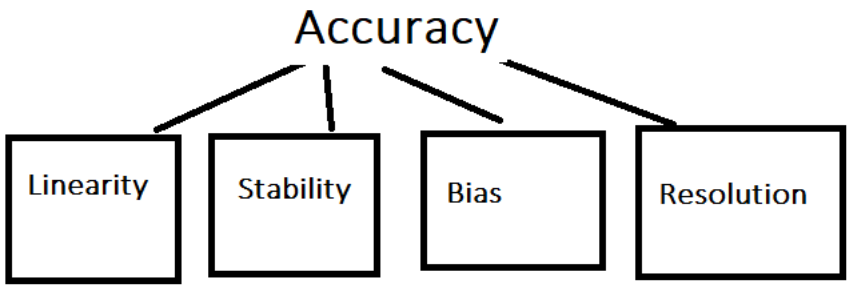
H -70
C-71
G- 71.5

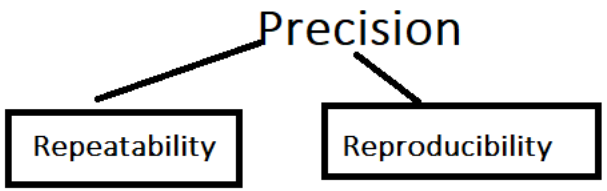
Gym-
1- 72.5
2-71
3-71.5



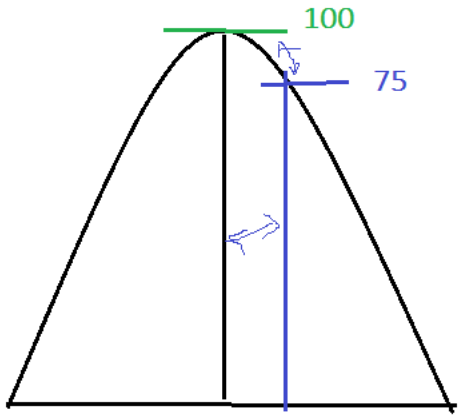



A =
P =
A =
P =
A =
P =
A =
P =


Accuracy
Linearity
Stability
Bias
Resolution


Precision
Repeatability
Reproducibility

cp - process capability	Potential	30%		80	100
cpk - process capability index	Actual	25%	10%	75	75



	A	B	C	D	E
cp * 3 = zst	2.2	3	5	5	4.5
cpk *3 = zlt	2	2.5	3	4	2
	0.2	0.5	2	1	2.5

z-shift = zst - zlt

1.5 (1.4 to 1.6)

cp/cpk

0.5*3 = 1.5 sigma

1*3 = 3 sigma

1.33 * 3 = 3.99 (4 Sigma)

2 *3 = 6 sigma

cp = (USL - LSL) / (6 * SD)

cpk = (Closest SL - Mean) / (3*SD)

	A	B
USL	**44**	**9.2**
LSL	**35**	**8**
Mean	**40**	**8.5**
Std dev	**2.6**	**0.09**
cp	0.577	
cpk	0.513	
zst	1.73	
zlt	1.54	

zlt

Process Capability Indices - Continuous Data

(Assumes that data are normally distributed)

Sample Data (user inputs):		
Mean	**x-bar**	**0**
Standard Deviation	**s**	**1**
Upper specification limit	**USL**	**3**
Lower specification limit	**LSL**	**-3**
Results:		
Cp, Pp		**1.00**
Cpu, Ppu		**1.00**
Cpl, Ppl		**1.00**
Cpk, Ppk		**1.00**

Factors = Inputs (x)
water, milk, sugar, coffee...

Response - output (y)
Hot coffee
Cold Coffee

Level (2/3)
high/low
on/off

high/medium/Low

Process Capability Indices and Confidence Intervals - Continuous Data (Assumes that data are normally distributed)					
Sample Data (user inputs):					
Mean	x-bar	1	Upper Specification Limit	USL	3
Standard Deviation	s	1	Lower Specification Limit	LSL	-3
Sample Size	n	30	Confidence Level (enter .95 for 95%)		95.0%
Sigma Shift (typically +1.5)		1.5			
Process Sigma Level Results:			**Process Capability Results:**		
Expected ppm > USL		22,750.1	Cp, Pp		1.00
Expected % > USL		2.28%	Lower Limit Cp, Pp		0.74
Expected ppm < LSL		31.7	Upper Limit Cp, Pp		1.26
Expected % < LSL		0.00%	Cpu, Ppu		0.67
Expected ppm (overall)		22,781.8	Cpl, Ppl		1.33
Expected yield (overall)		97.72%	Cpk, Ppk		0.67
			Lower Limit Cpk, Ppk		0.46
Process Sigma Level		3.499	Upper Limit Cpk, Ppk		0.88