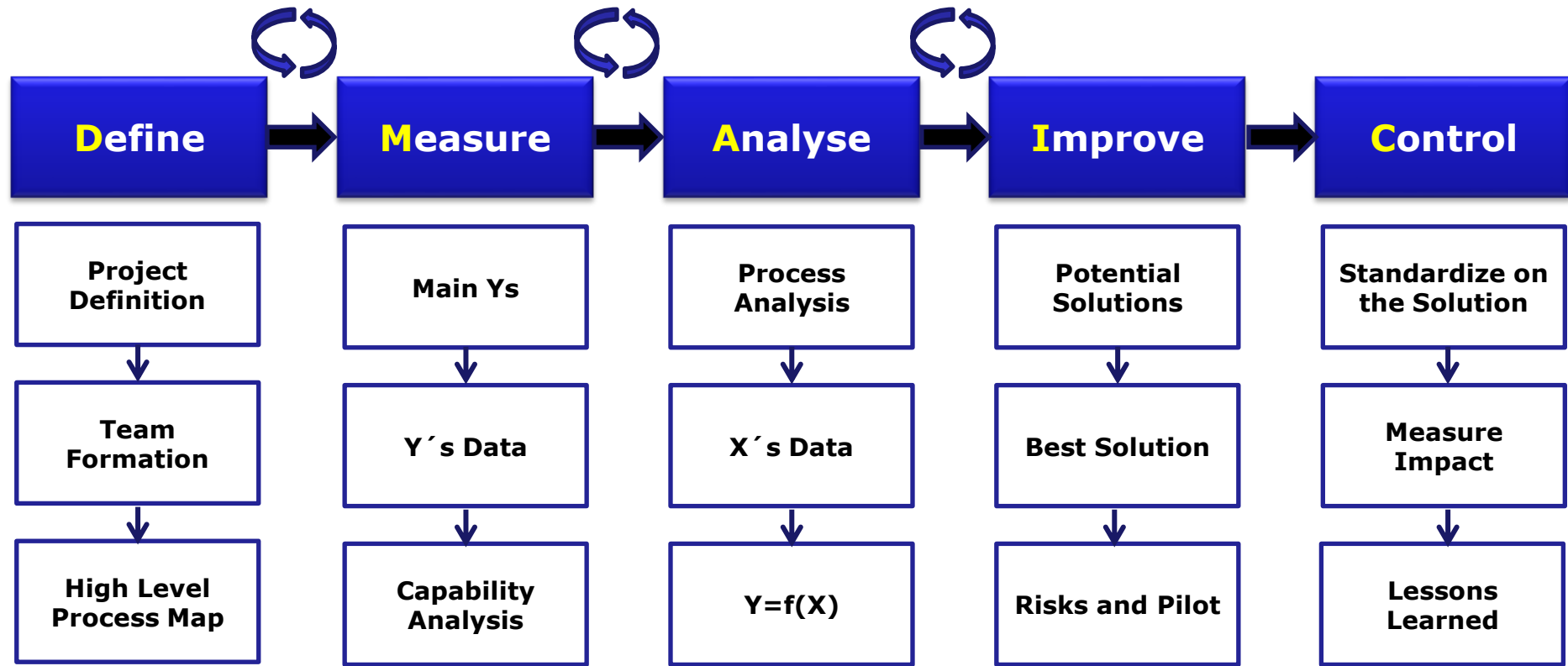


## DMAIC- MEASURE

Main Y's / Y's data / Capability analysis

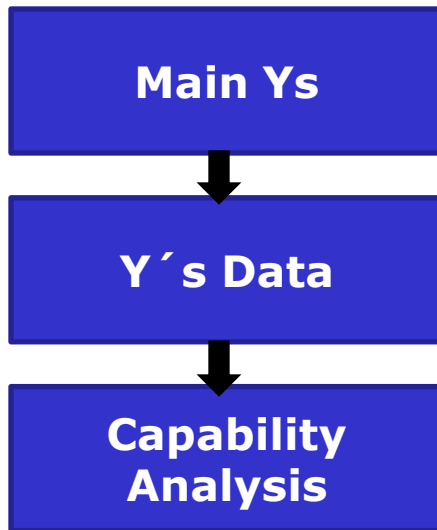
Green Belt's Training | June 2021

# Roadmap Six Sigma – DMAIC for improving products and processes



# MEASURE

# Y



Try Answering:

How to measure the problem?

What metrics are involved?

When and where to measure Y?

Is the data really representative of Y?

Is Y measurement correct?

What is the performance of Y-measures in relation to the customer?

**Do not try to look now for X causes. Focus on Y.  
Set Good Performance Measures!**

# Measure: Main Deliverable

- 1. Definition of Y's and their units**
- 2. Get the data for Y. How, when and where the Y's were obtained**
- 3. Performance of the Y's (Capability, DPMO, % Sigma Level, etc ...)**

**Y**

# Main Y's



In this phase the metrics Y (and its units) need to be defined. How many Y's represent the problem?

Several tools could help to define the metrics Y's: CTQ tree, SIPOC, Process mapping...



**Number of Ys**

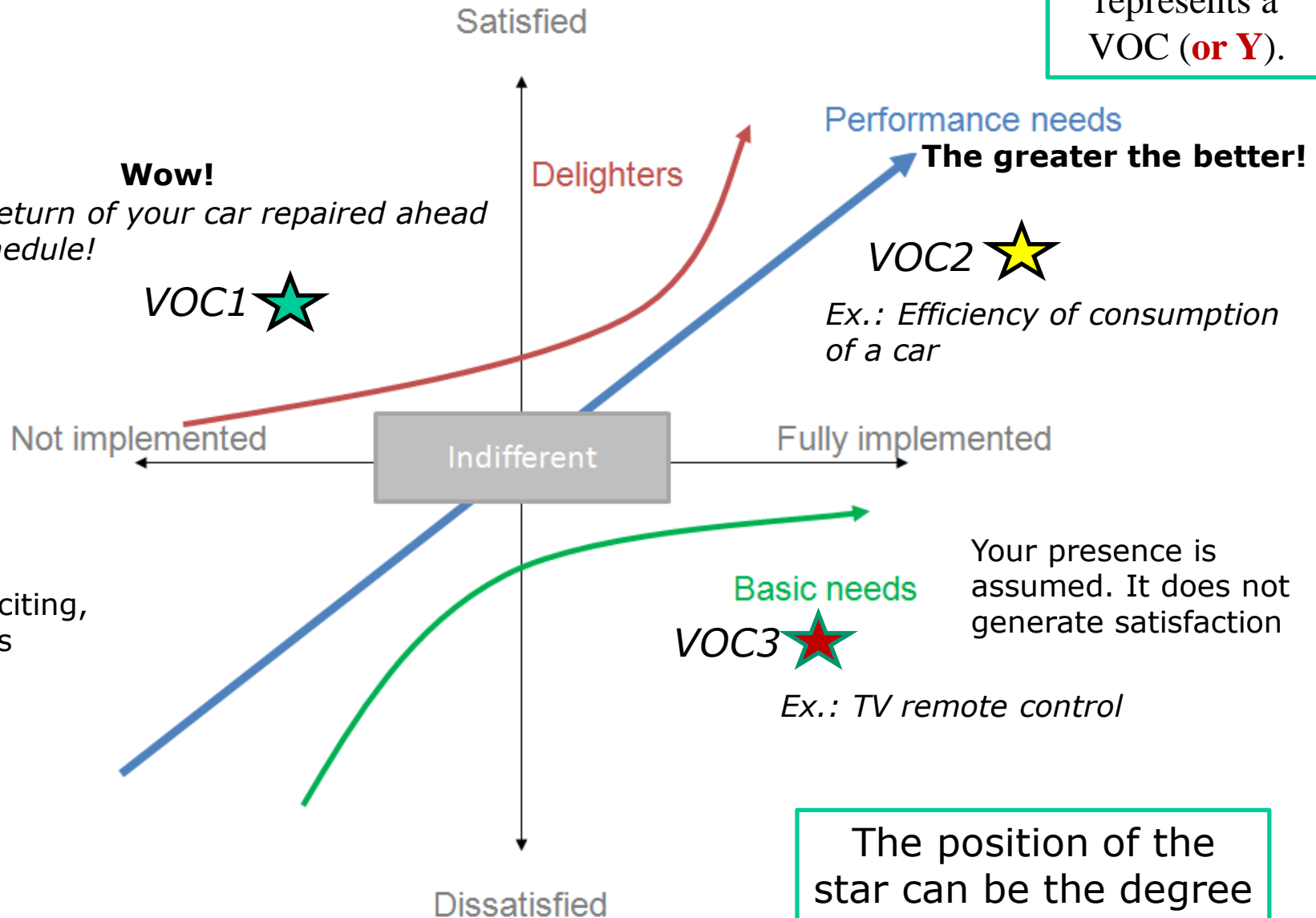
**and**

**Complexity**



# Y's by Kano Diagram

Each star represents a VOC (or Y).



The position of the star can be the degree of importance

Suggestion:

Veja <http://www.youtube.com/watch?v=XtbcuLrWync>

# Y's by thinking about wastes

Overproduction	Producing too much "stuff"	<b>Taichi Ono - 7 Wastes</b>
Waiting	People waiting for "stuff" to arrive	
Transporting	Moving "stuff"	
Over Processing	"Stuff" we have to do but doesn't add value	
Unnecessary Inventory	"Stuff" waiting in stock to be done	
Unnecessary Motion	Unnecessary human movement	
Defects (or Errors)	"Stuff" that's not right and needs fixing	
<b>Wasted Human Potential</b>	<b>Untapped potential / Damage to people</b>	<b>8 Wastes</b>
Wasted Energy	"Wasting energy" is not green!	
Pollution	Pollution is a hidden cost!	<b>Go Green!</b>
Wasted Space	Environmental destruction	
Delay Provision	Delay to provide a service	
Incorrect Inventory	Delay to provide an item	<b>Wastes for Service</b>
Duplication	Unnecessary data in service	



**Y's could come from here**

# Y's by using CTQ Tree

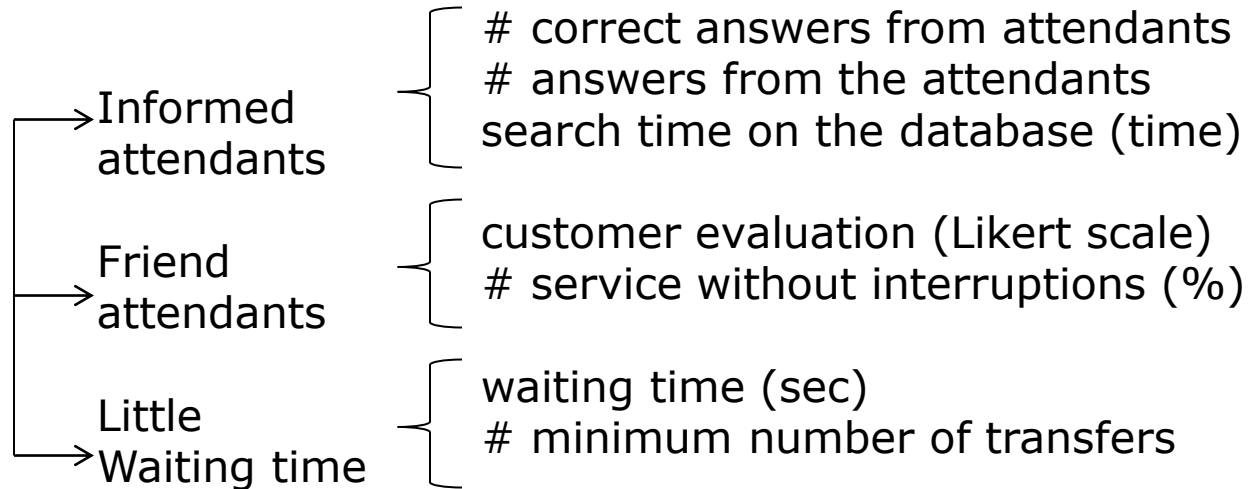
Client need (VOC)

Product/Service

Metrics (Y)



Good customer service



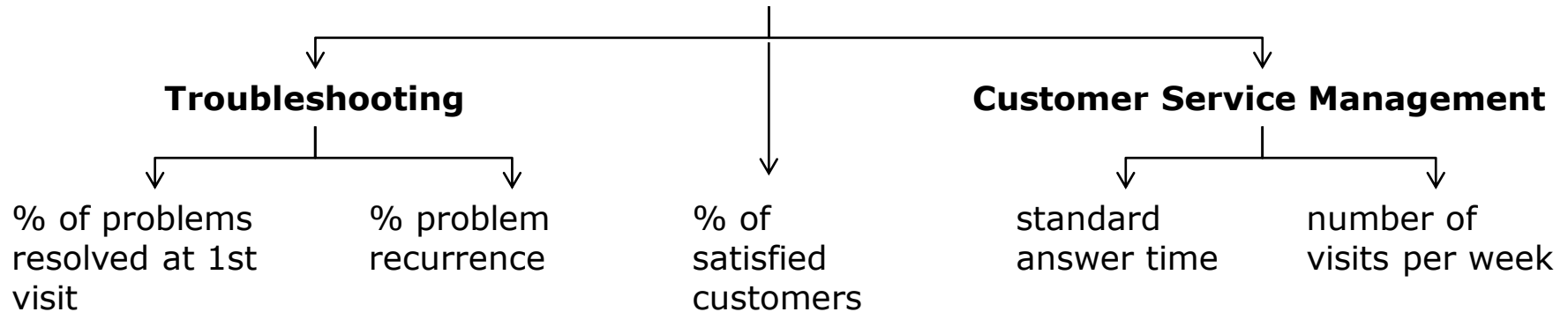
**Difficult to measure**

**Possible of measurement**



# Y's by using KPI

## Customer Service



**KPI1**

**KPI2**

**Y2**

**KPI3**

**Y1**



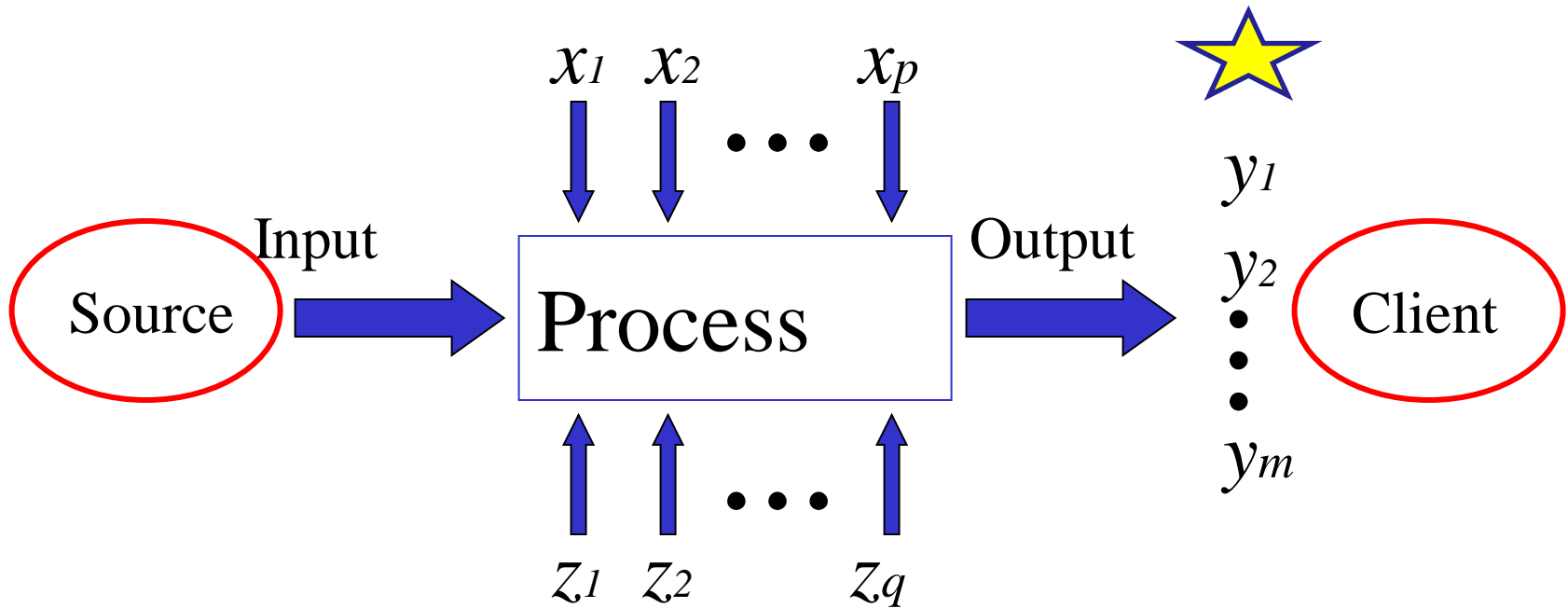
KPI1 → The greater the better

KPI2 → The lower the better

KPI3 → Nominal is the best

**Key Performance Indexes (KPI) are metrics!**

# Y's by using SIPOC

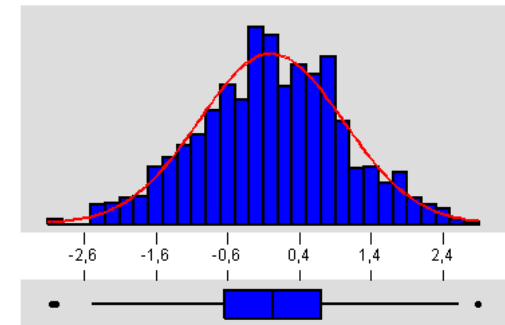
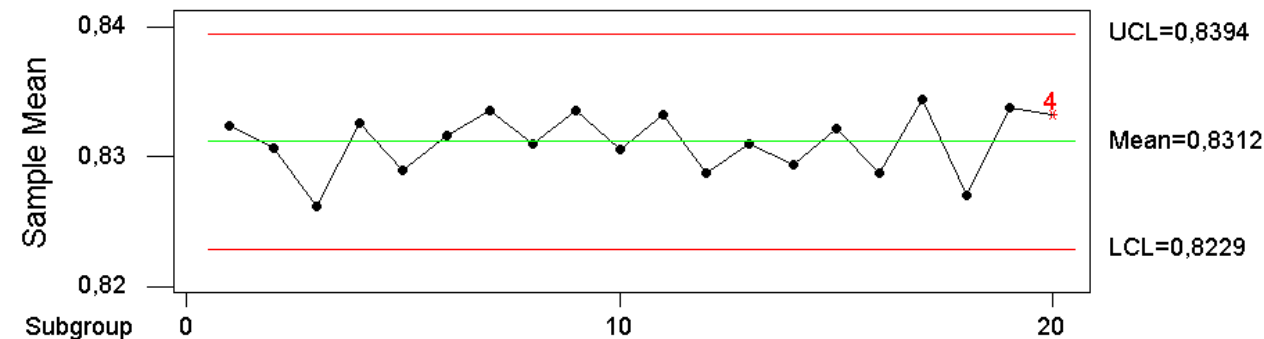


# Y's data



In this phase the main metrics Y's need to be measured.

Several tools could help to measure the problem in a correct way:  
**Operational definition, Sampling, Measurement System Analysis, Control Charts, Descriptive Statistics, Probability Distributions...**



# Operational definition

- An operational definition is an accurate description that tells you how to get a value for the characteristic you are trying to measure. Includes "What's That" and "How to Measure"
- Purpose:
  - Remove the ambiguity so that everyone has the same understanding
  - Provide a clear way to measure the feature:
    - Identifies what to measure;
    - Identifies how to measure;
    - Ensures that regardless of who makes the measurement, the results are essentially the same;
    - It should be helpful to both you and the customer.

***A clear definition of a defect is necessary***

**A graphic procedure can help**

# Data types

- Attributes or Discrete
  - Counts of Names or labels; # good, # bad ...# red, # white, # blue...
  - Counts Rank ordered; #good, #better, #best...



- Variables or Continuous
  - Measurements; Volts, distance, time, price...
  - Ratios, proportions; RPM, MPG, % butterfat...



# Minitab variable types

Discrete	Continuous	Ordinal	Nominal	Binary	Date
7	4,84409	I	Good	1	12/01
8	4,87944	II	Regular	1	10/02
8	5,50059	III	Regular	0	11/03
7	4,11946	III	Good	1	09/01
9	4,78396	II	Bad	1	08/03
5	4,75440	I	Bad	1	15/02
10	4,61150	II	Good	1	12/01
9	5,06728	II	Good	0	04/02
5	6,01144	I	Bad	0	03/01
9	3,93205	I	Average	1	04/01

Variables can also be coded and transformed.

See commands:

- **Change Data Type**
- **Code**
- **Standardize**

# Probability distributions of Ys



Normal



Triangular



Uniform



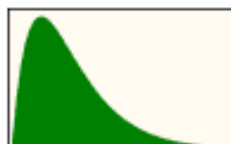
Lognormal



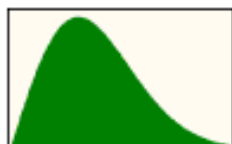
Beta



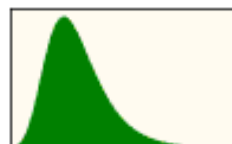
BetaPERT



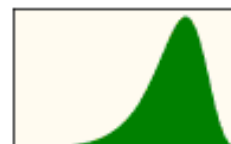
Gamma



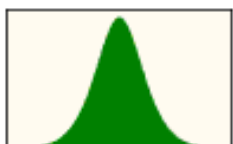
Weibull



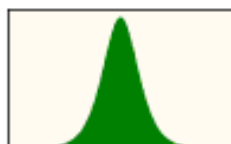
Max Extreme



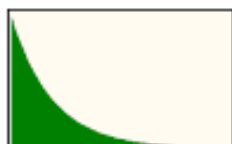
Min Extreme



Logistic



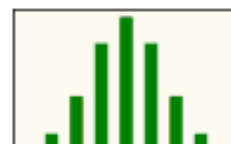
Student's t



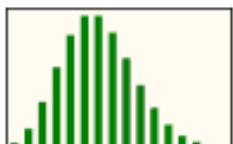
Exponential



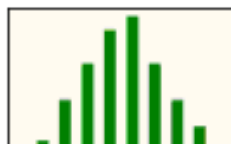
Pareto



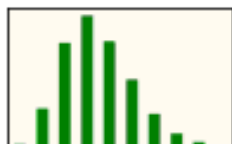
Binomial



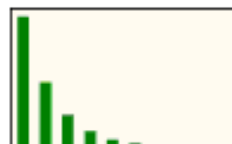
Poisson



Hypergeometric



Neg Binomial



Geometric



Discrete Uniform

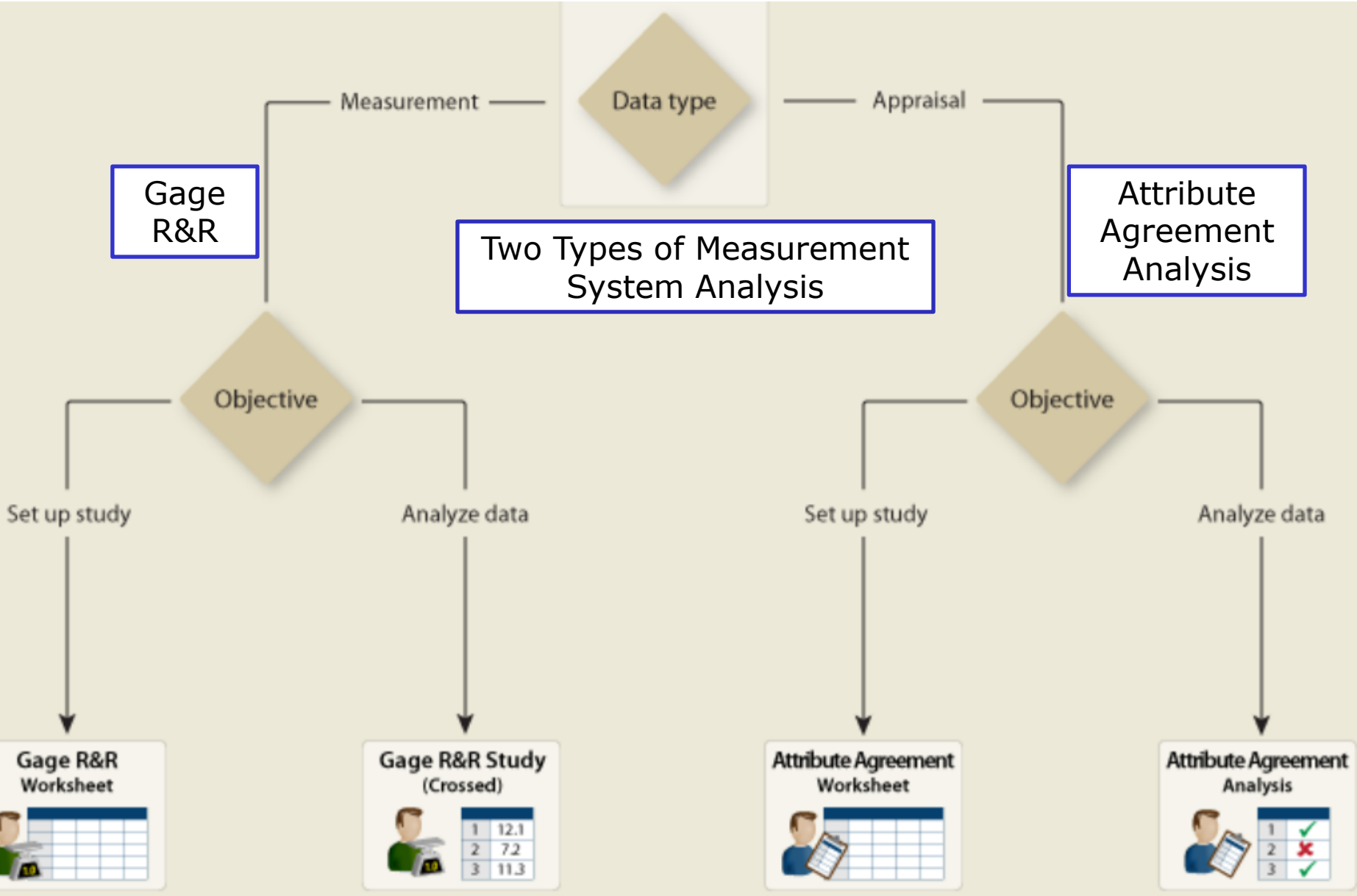


Yes-No



Custom

# MSA





# Capability analysis



In this phase you should estimate the sigma level of the main metrics Y

Several tools could be used here: Sigma level, Yield, capability metrics, ...

# Capability

