dcm THE LEARNING EXPERTS

Member Events

Lean Yellow Belt Operational Excellence

3

Measuring &Continual Improvement

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What's Coming Up?

Delivered Live via Zoom | All Sessions Recorded | Free and unrestricted for DCM Members

2pm - 5pm

Sept 18

Making Lean Work For Your Organisation

2pm - 5pm

Oct 16

Problem Solving & Eliminating of Wasteful Procedures

2pm - 5pm

Nov 13

Measuring & Continual Improvement

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Contact Us

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ruth@dcmlearning.ie

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Session Schedule

- 2.00pm – 2.50pm
- 3.00pm – 3.50pm
- 4.00pm – 5.00pm
- Resources

TODAYS – SLIDE DECK

THE LEARNING EXPERTS

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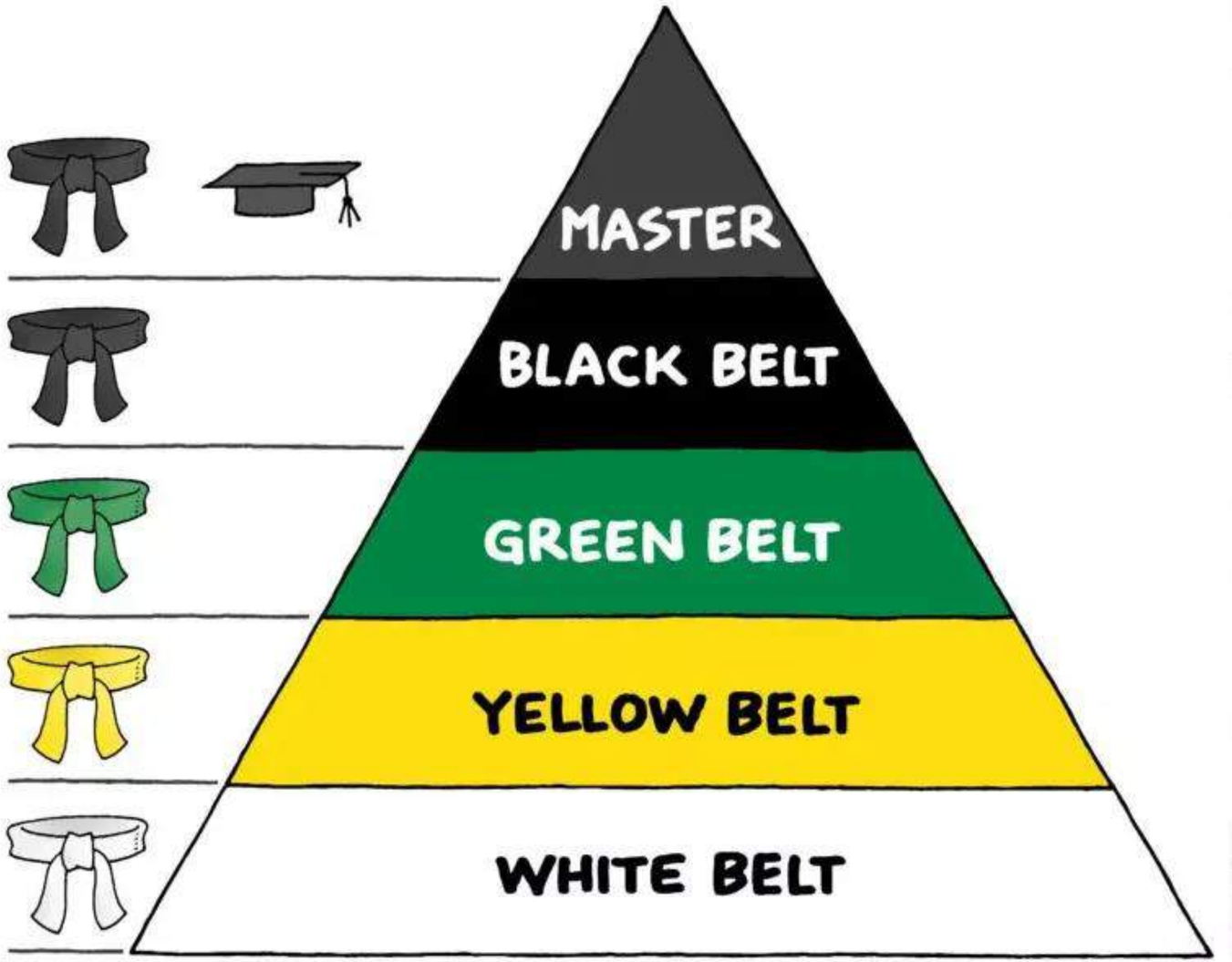
Session Content

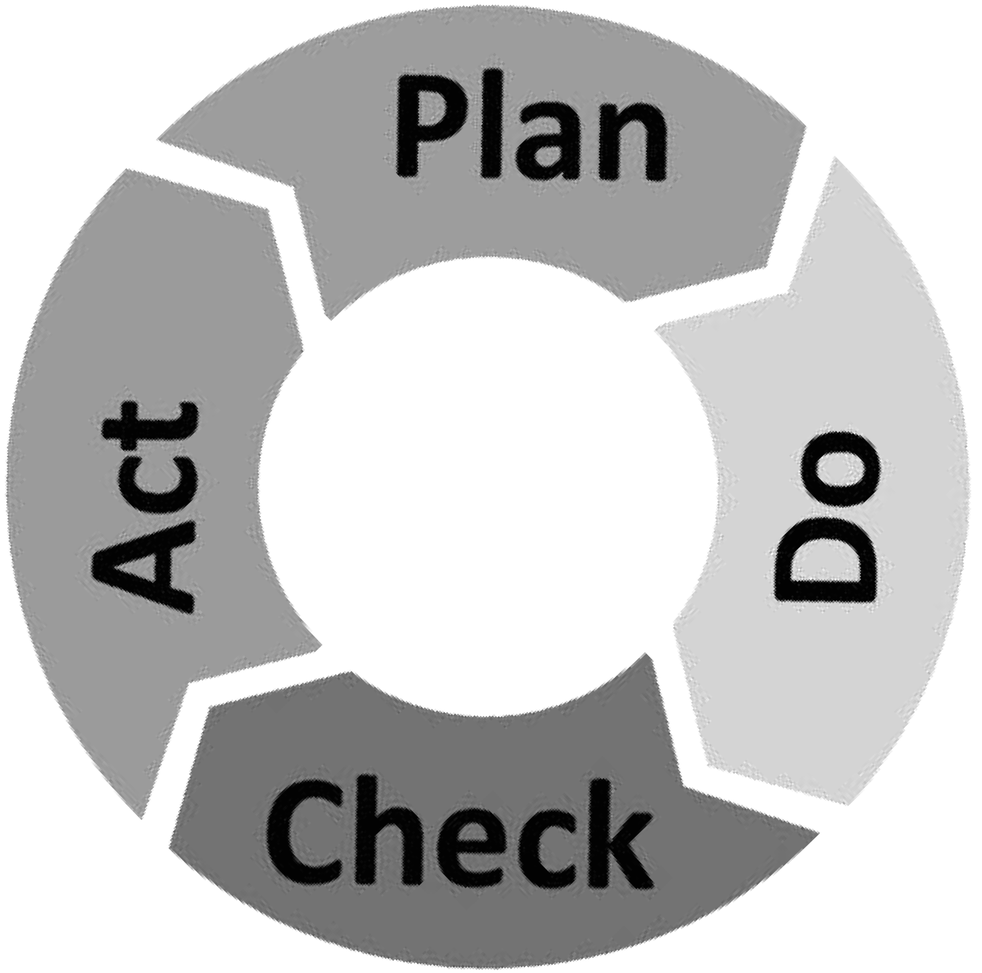
- Measurement Systems & Data Collection
- Using Data Correctly
- Controlling a Process

RECAP

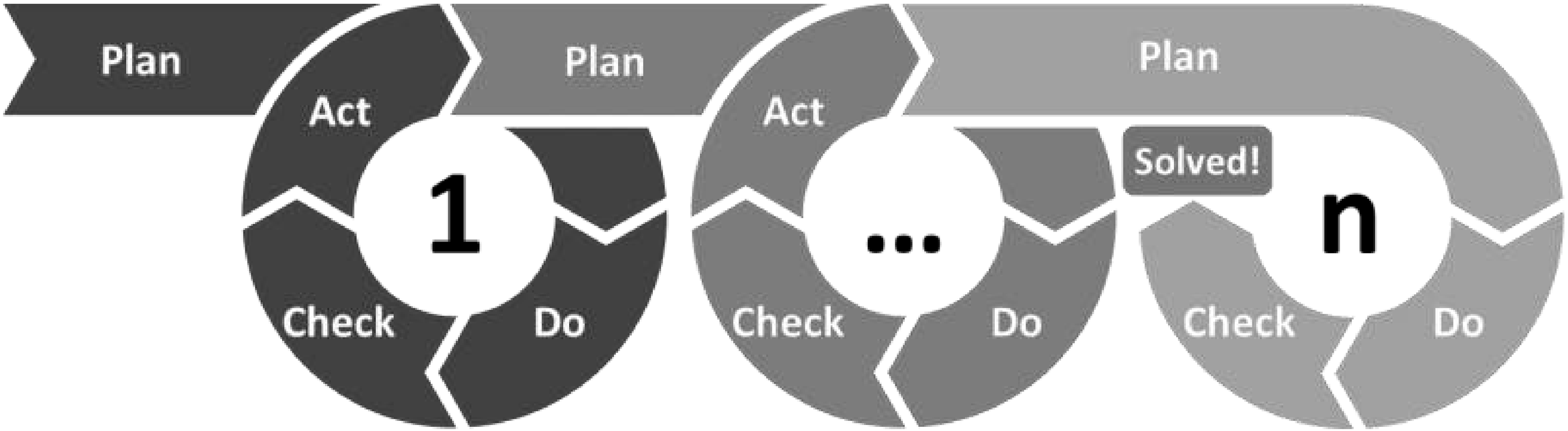
Yellow Belts



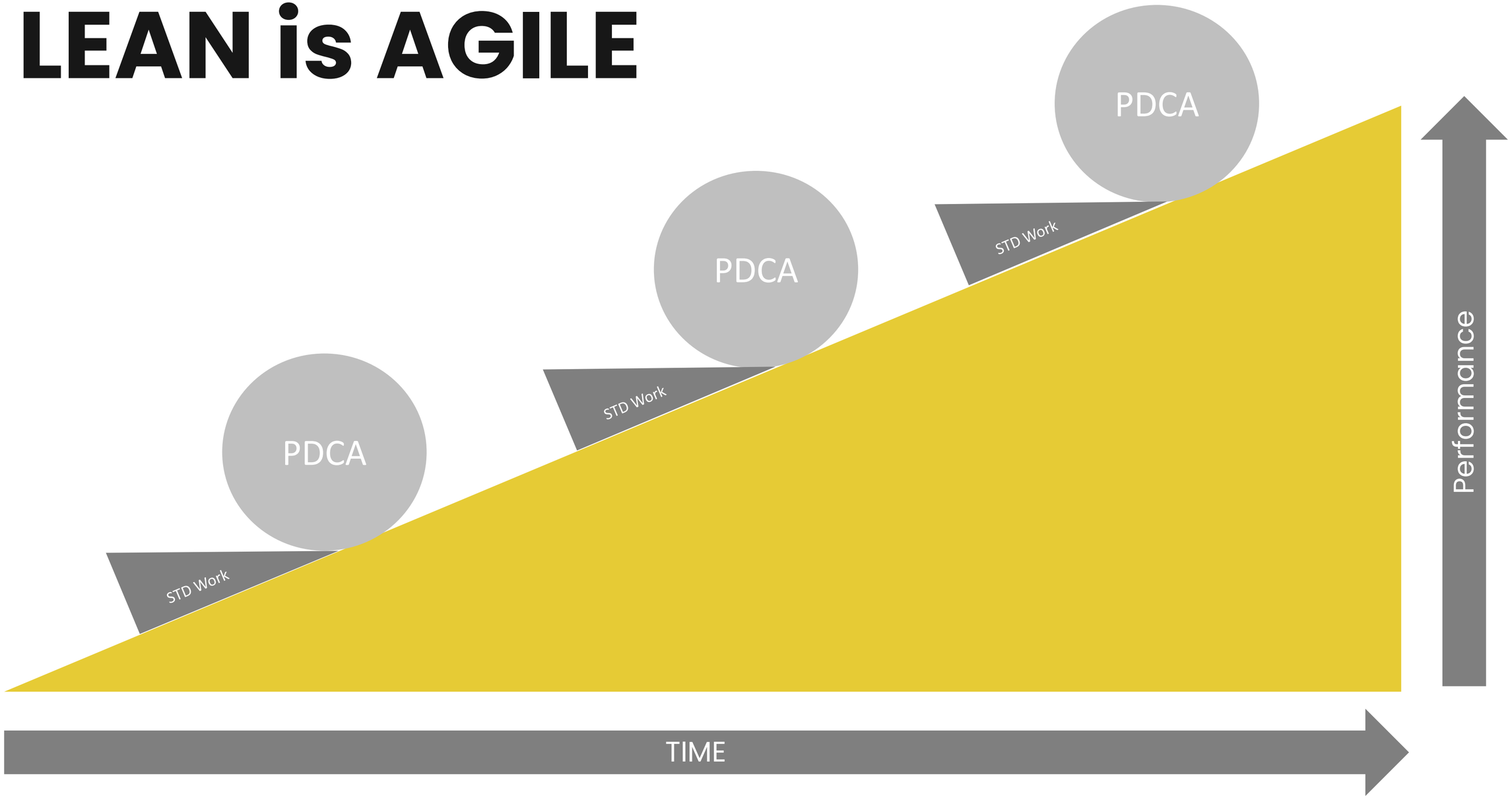
The Deming Cycle



The Deming Cycle



LEAN is AGILE



LEAN Principles

The nature of “FLOW”

Step 1

Step 2

Step 3

Cynefin Model

Simple Problems

Known Knowns — OBVIOUS

Chaotic Problems

Unknowable's — NOVEL

Complicated Problems

Known Unknowns — BEST Practise Experts

Complex Problems

Unknown Unknowns — PROBE / SENSE AGILITY

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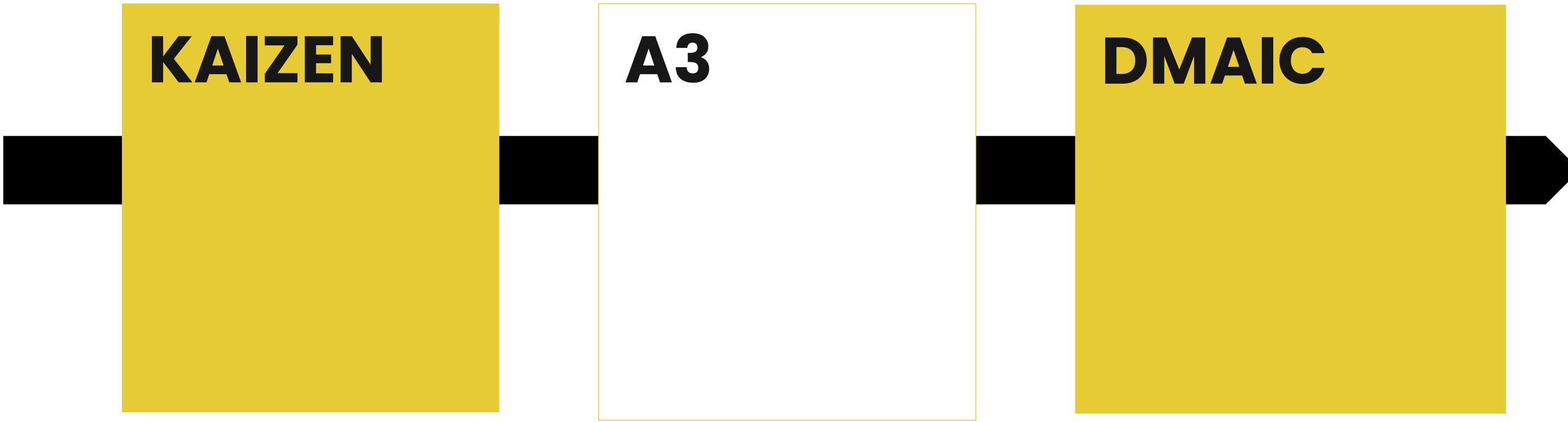
LEAN Teams

Different problems require different solutions



KAIZEN

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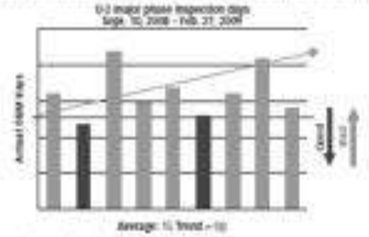
A3 Storyboards

Example of completed problem-solving A3 / ONLINE FIGURE 1

1. Clarify and validate the problem.

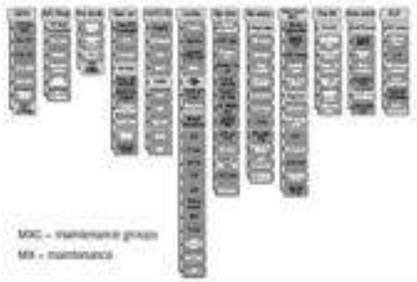
The U-2 major phase inspection is averaging 15 days, exceeding the 13-day inspection target, and it cannot efficiently sustain worldwide U-2 aircraft operational requirements.



OMM – operations and maintenance

2. Break down the problem/identify performance gaps.

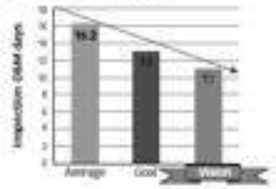
- Lack of communication and schedule between phase and MXG results in personnel availability
- Ancillary tasks reduce maintainer availability
- Current work procedures, attention to detail drive excess MX and inefficiencies



MXG – maintenance groups
MX – maintenance

3. Set improvement target.

Achieve 13-day major phase by July 27, 2010.



OMM – operations and maintenance

4. Determine root cause.

FOD – foreign object damage

5. Develop countermeasures.

Action	POC	Start	End	Status	Remarks	Do-it
Spaghetti diagram and process time for A/C tear down	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Spaghetti diagram and process time for TCs/ TCTO process	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Spaghetti diagram and process time for Locks	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Spaghetti diagram and process time for Ops checks	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Spaghetti diagram and process time for reassembly	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Spaghetti diagram and process time for post dock work cards	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Time in motion study	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26			X
Quality assurance pass rates	Tiger Barnard	Jan. 15	Jan. 21			X
Phase roll out stats	Mr. Rowan	Jan. 15	Jan. 15			X
Paper doll	Mr. Rowan	Jan. 15	Jan. 15			X
Consumable usage data for kitting				C/W		

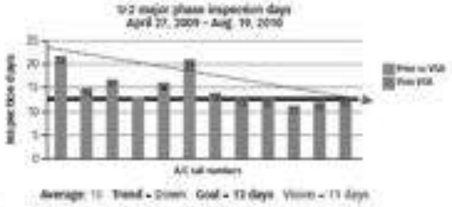
A/C – aircraft
TO – time change item
TCTO – time compliance technical order
POC – point of contact
Ops – operations
C/W – complied with

6. See countermeasures through.

Action	POC	Start	End	Status	Remarks	Do-it
Spaghetti diagram and process time for A/C tear down	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Spaghetti diagram and process time for TCs/TCTO process	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Spaghetti diagram and process time for Locks	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Spaghetti diagram and process time for Ops checks	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Spaghetti diagram and process time for reassembly	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Spaghetti diagram and process time for post dock work cards	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Time in motion study	Mr. Harrington Mr. Rowan	Jan. 23	Jan. 26	C/W		X
Quality assurance pass rates	Tiger Barnard	Jan. 15	Jan. 21	C/W		X
Phase roll out stats	Mr. Rowan	Jan. 15	Jan. 15	C/W		X
Paper doll	Mr. Rowan	Jan. 15	Jan. 15	C/W		X
Consumable usage data for kitting				C/W		

A/C – aircraft
TO – time change item
TCTO – time compliance technical order
POC – point of contact
Ops – operations
C/W – complied with

7. Confirm results and process.

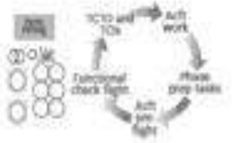


Average: 18 Trend – Down Goal – 13 days Vision – 11 days

VSA – value stream analysis
A/C – aircraft

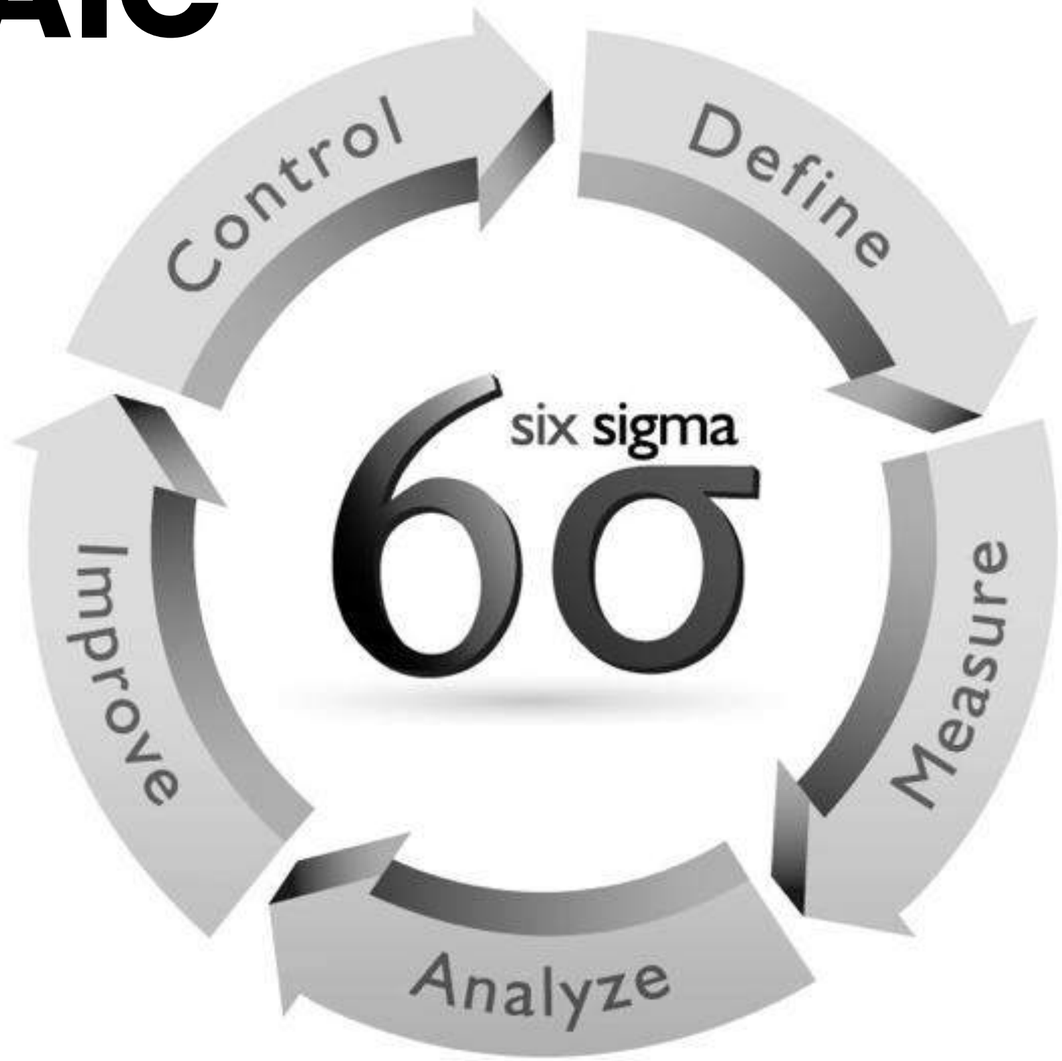
8. Standardize successful processes.

- Implemented in-house training manager and plan.
- Created standard inspection task flowchart.
- Established biannual ancillary block training week.
- Realign critical inspection tasks to proper shift.
- Reassigned aircraft phase prep tasks among AMXS and MXG.
- Acft refuel and defuel in hanger.
- Standardized parts kits.
- Event A3 uploaded to CPI MT.



AMXS – aircraft maintenance squadron
MXG – maintenance squadron
CPI MT – continuous process improvement management tool
Acft – aircraft
TCTO – time compliance technical order
TO – time change item

DMAIC



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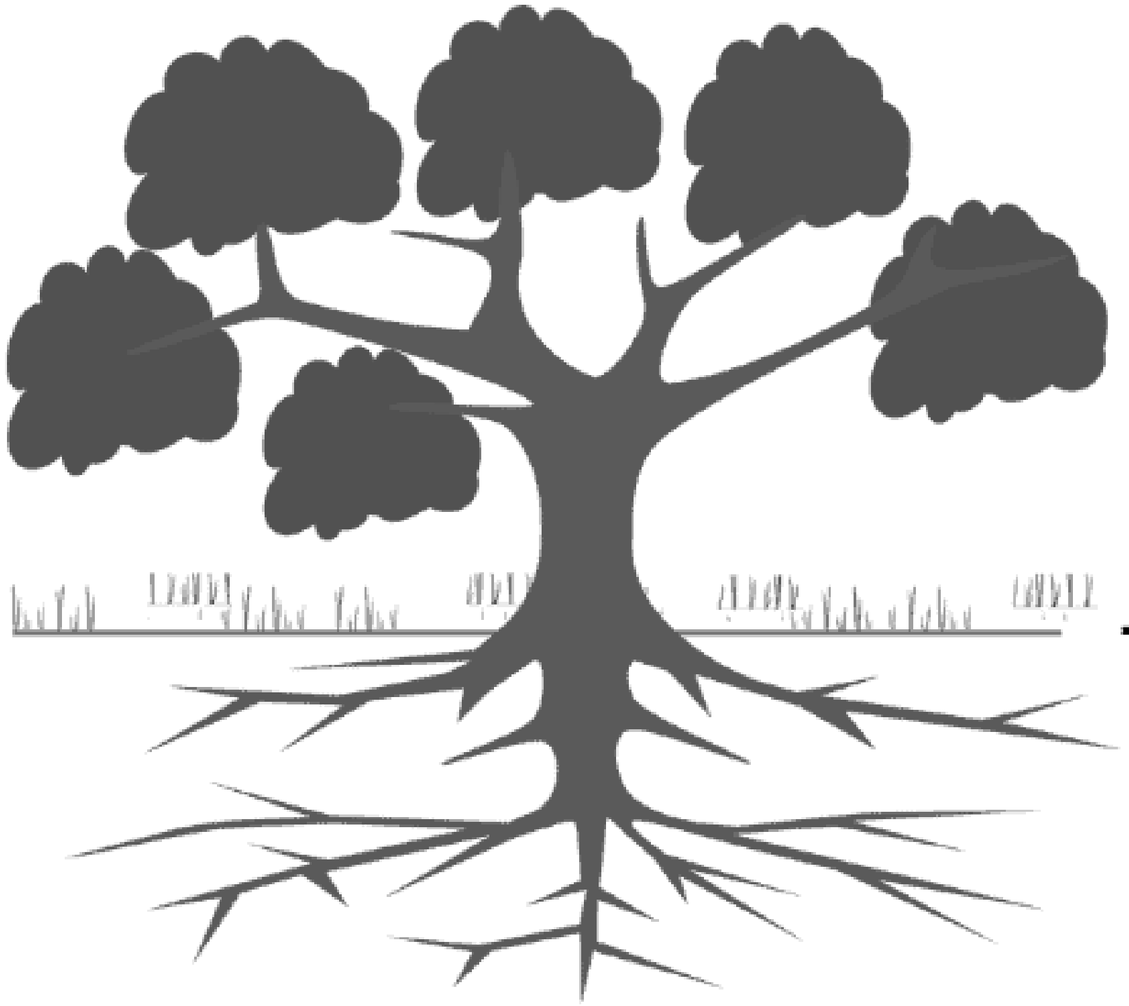
What is a Problem



Above the surface you see the

Symptoms

of the problem

Dig deeper to find the

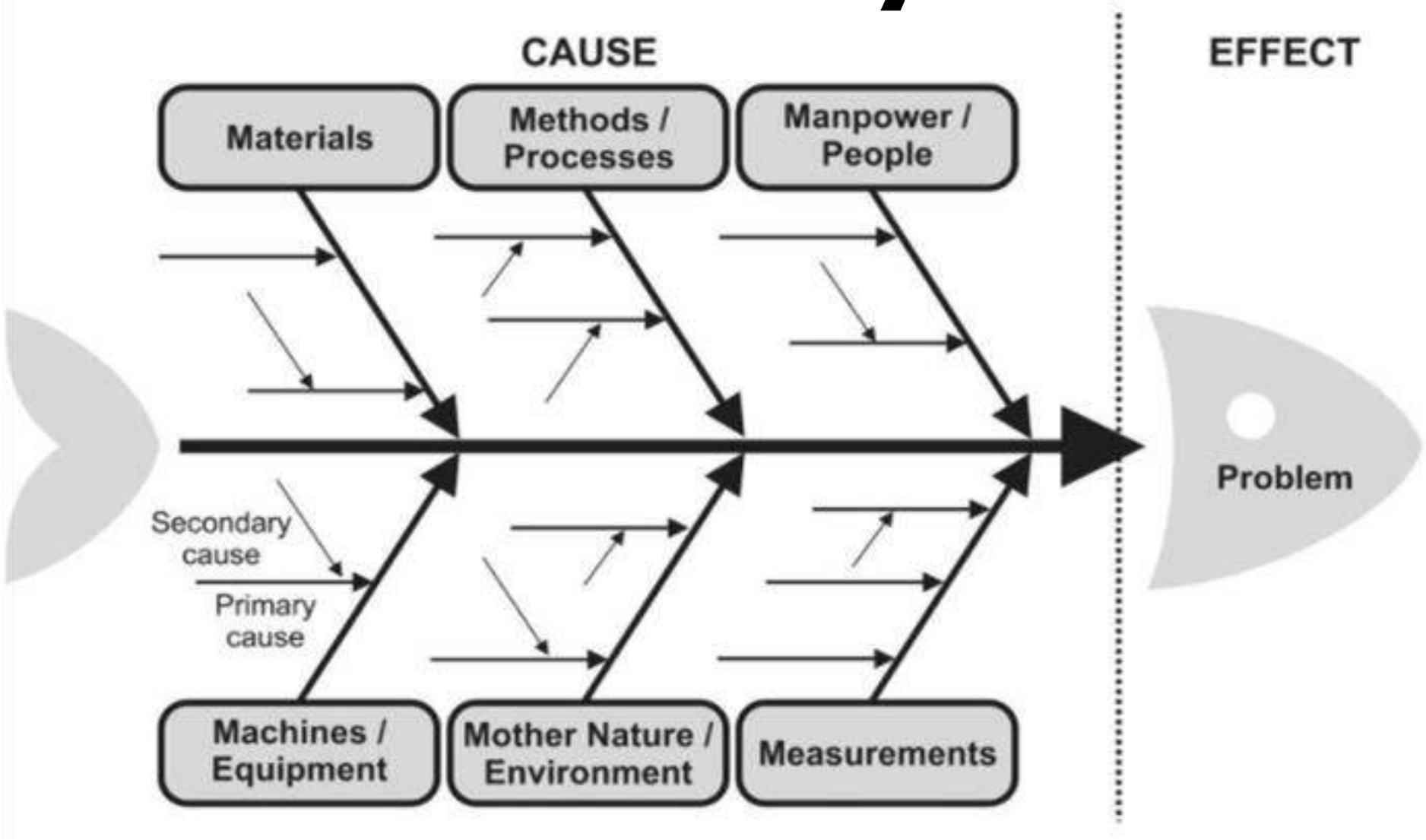
Root Cause

of the problem

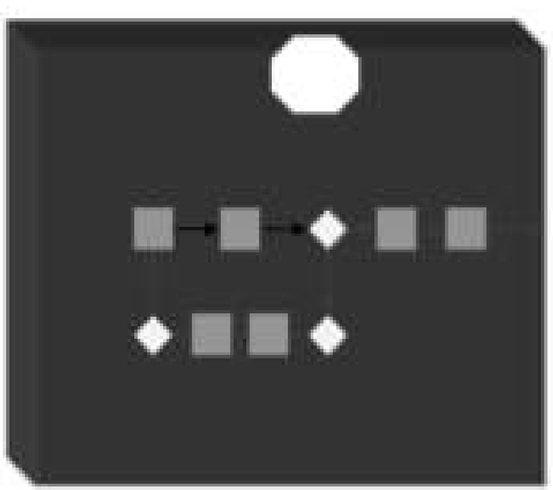
Construct a Statement

- Problem Statement
- A GOOD Problem Statement should
  - State the current undesired situation
  - Quantify the problem
- A GOOD Problem Statement should NOT
  - Assume the cause
  - Assume the solution
  - Assume any blame

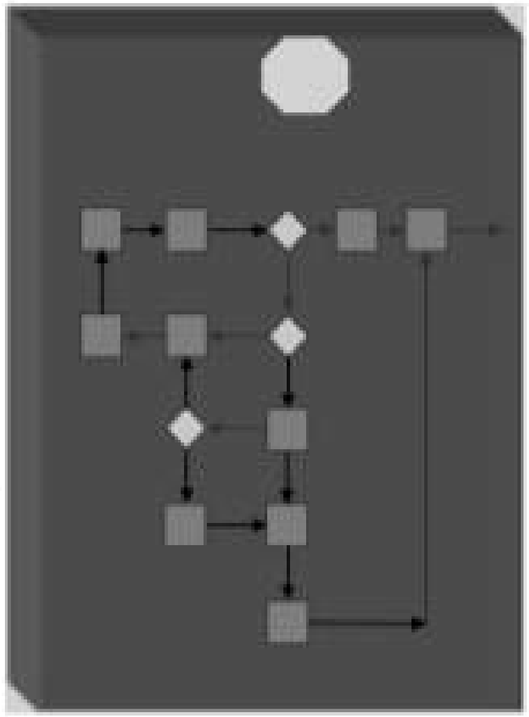
Fishbone Analysis



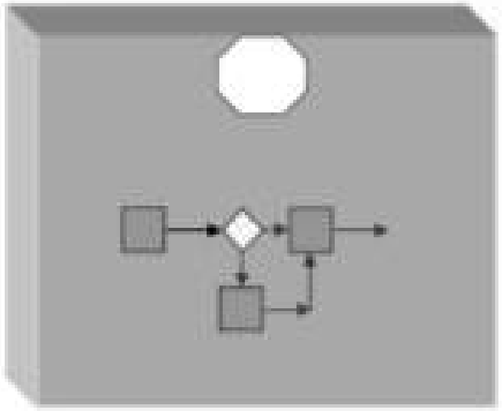
Process mapping



What you *THINK* it is..

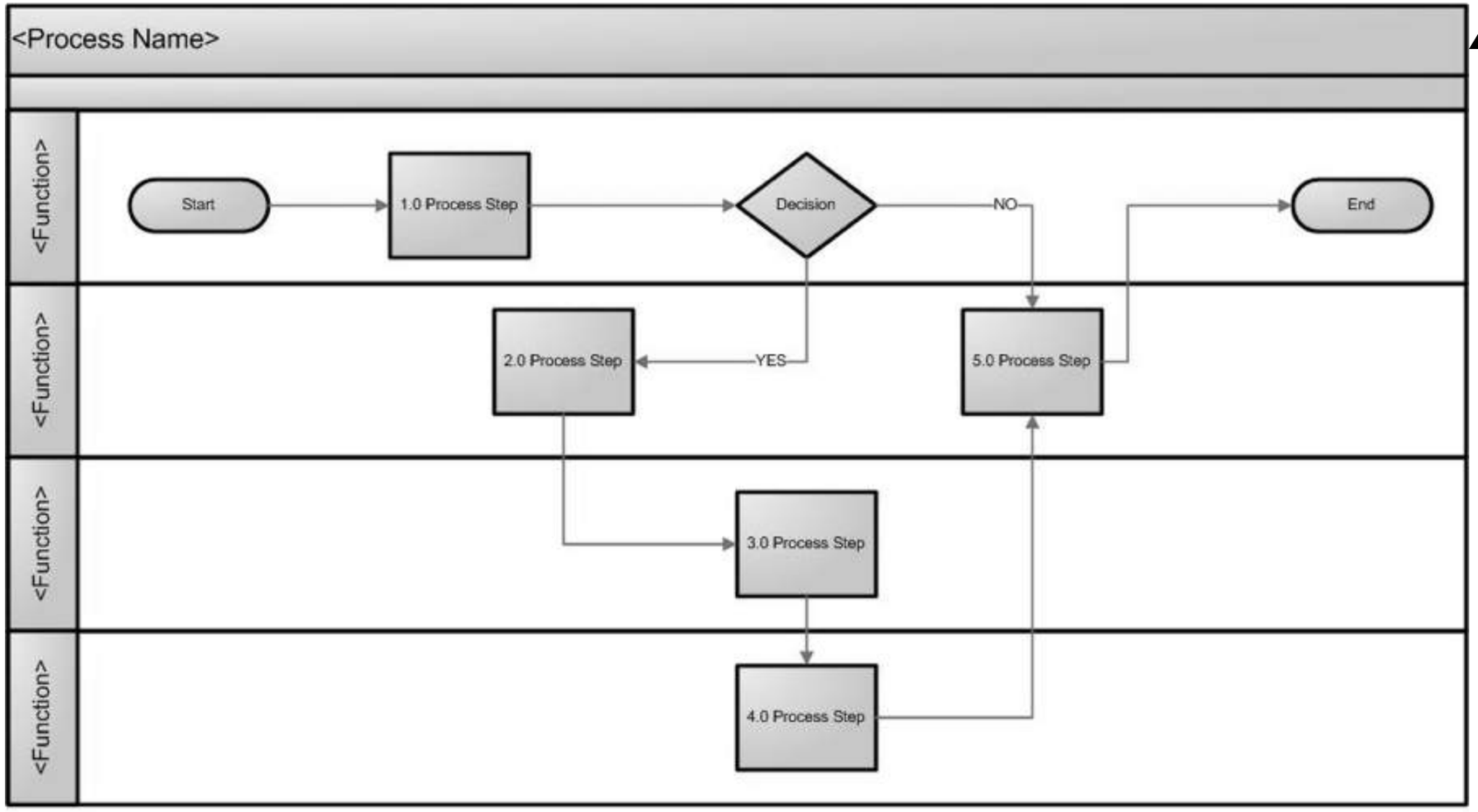


What it ACTUALLY is..



What it SHOULD be..

Process mapping



PART 1

THE LEARNING EXPERTS

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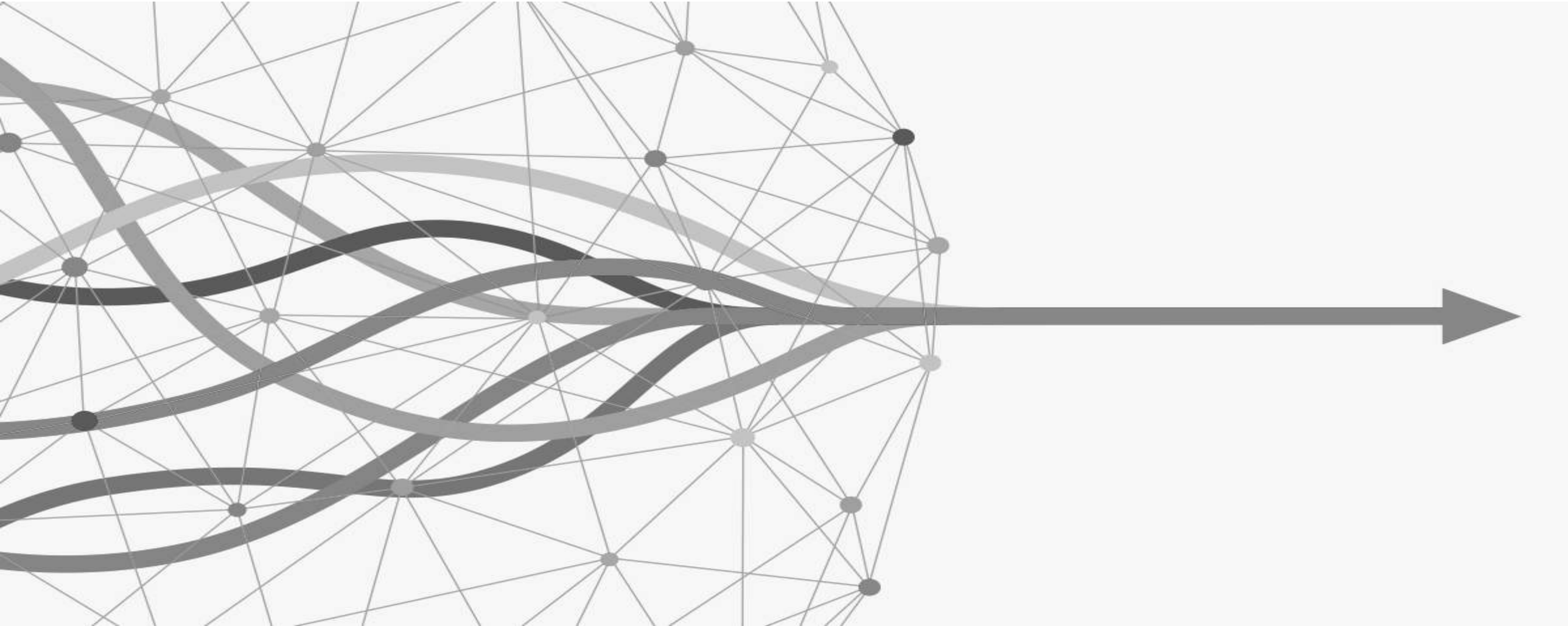
Data driven decisions



Find the “truth”

Category	Metrics
Performance	Output, first-pass yield, field failures, returns
Quality	Yield, defects, C_{pk}, returns, rework/repair
Schedule	Missed dates, fill rate, process cycle time
Cost	Product cost, support cost, scrap cost
Customer	Retention, receivables turns, complaints
Materials	Inventory cost, Expedite $, Inventory turns
Labor	Overtime, absenteeism, grievances
Operations	Productivity, safety incidents, QA audit findings
Logistics	Shipping cost, damage cost, shipping cycle time

Why “Y” = function(Xi)

To control Output Y

All critical inputs must be

Identified & Controlled

Only then will we have ”control” of the Variation in and performance of a process

Measurement Systems

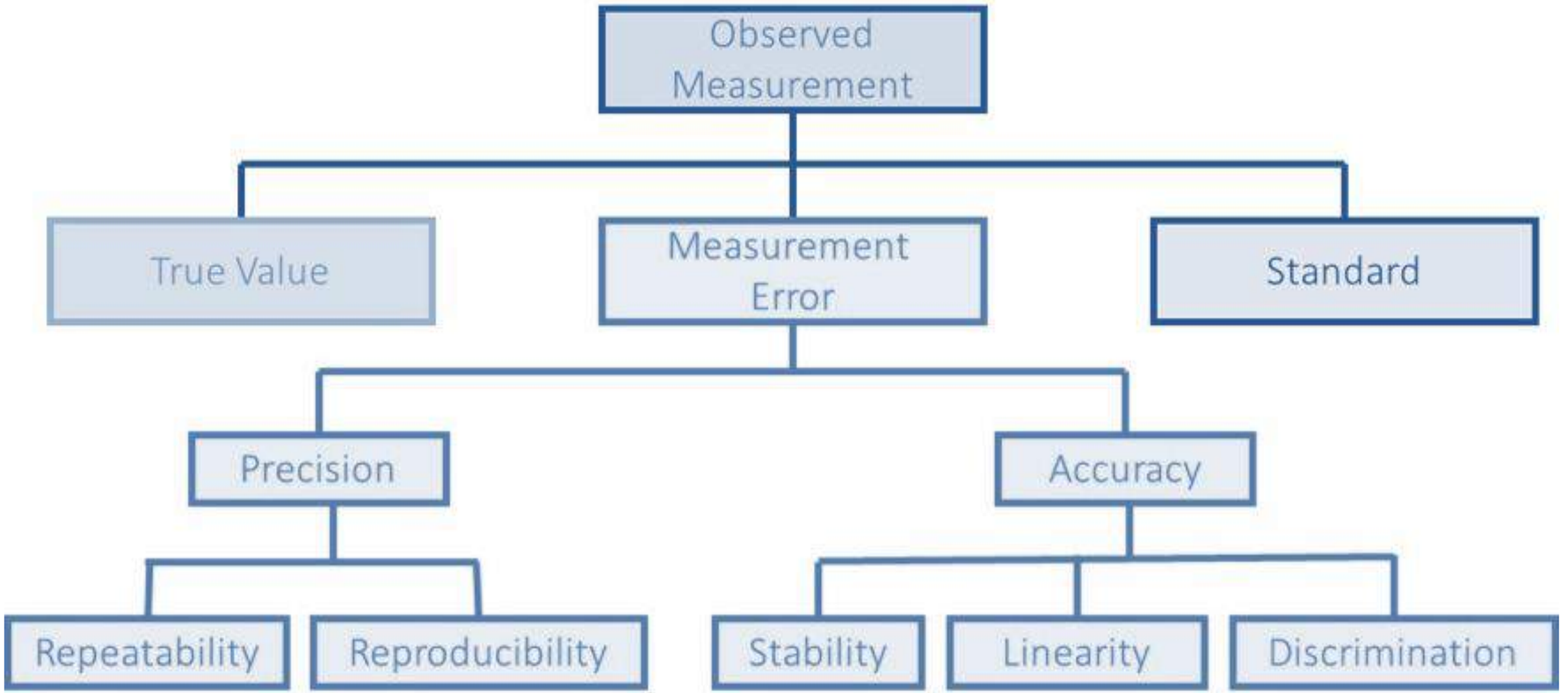
$$\sigma_m^2 = \sigma_p^2 + \sigma_e^2$$

σ_m = the measured standard deviation of the item.

σ_p = the true standard deviation in the item being measured.

σ_e = the standard deviation of the measurement error.

Measurement Systems



Measurement Systems

low accuracy
high precision

high accuracy
high precision

high accuracy
low precision

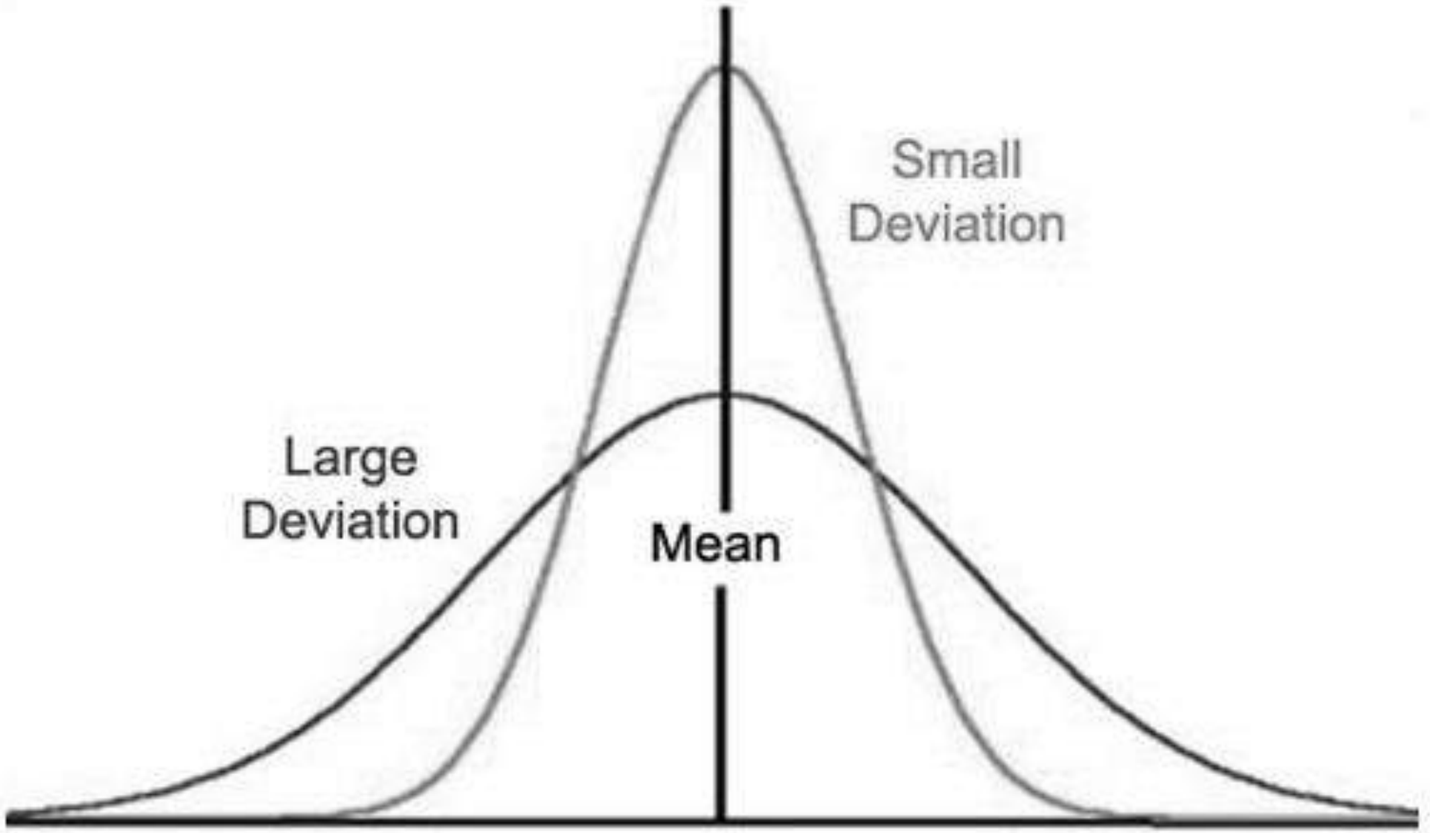
low accuracy
low precision

Problem with Average

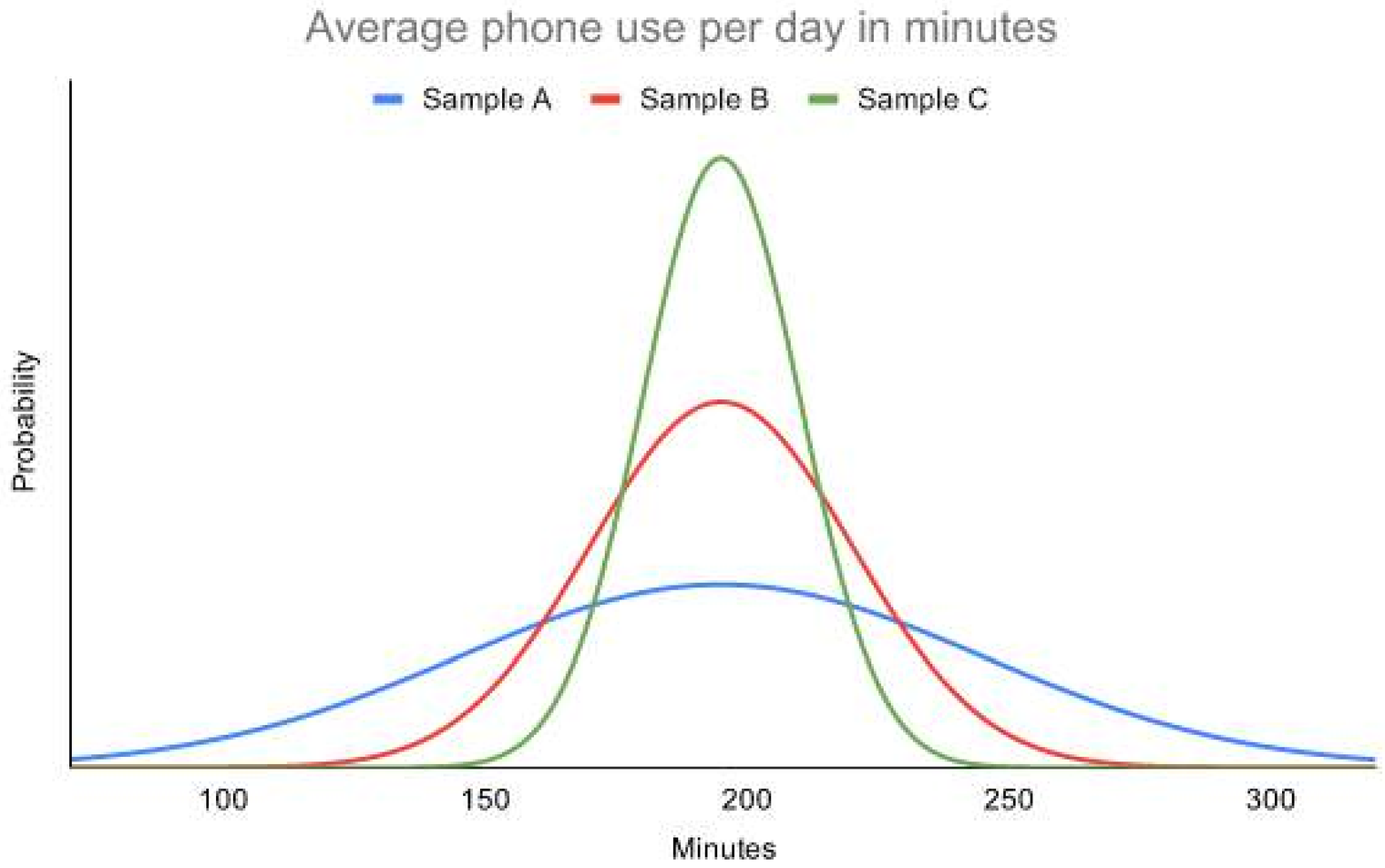
Problem with Average

20, 30, 50, 70, 80.

Problem with Average



Problem with Average



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Standard Deviation

1, 2, 3, 4, 5, 6, 7, 8, 9

Standard Deviation

1, 2, 3, 4, 5, 6, 7

-3, -2, -1, 0, +1, +2, +3

Standard Deviation

Formula

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$

σ = population standard deviation

N = the size of the population

x_i = each value from the population

μ = the population mean

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Problem with Average

Find the best route to work every day

Day	Route A	Route B
Mon	22	13
Tue	19	18
Wed	20	23
Thu	21	19
Fri	16	27
Mon	17	28
Tue	24	12
Wed	21	13
Thu	16	23
Fri	24	14
Average	20	19

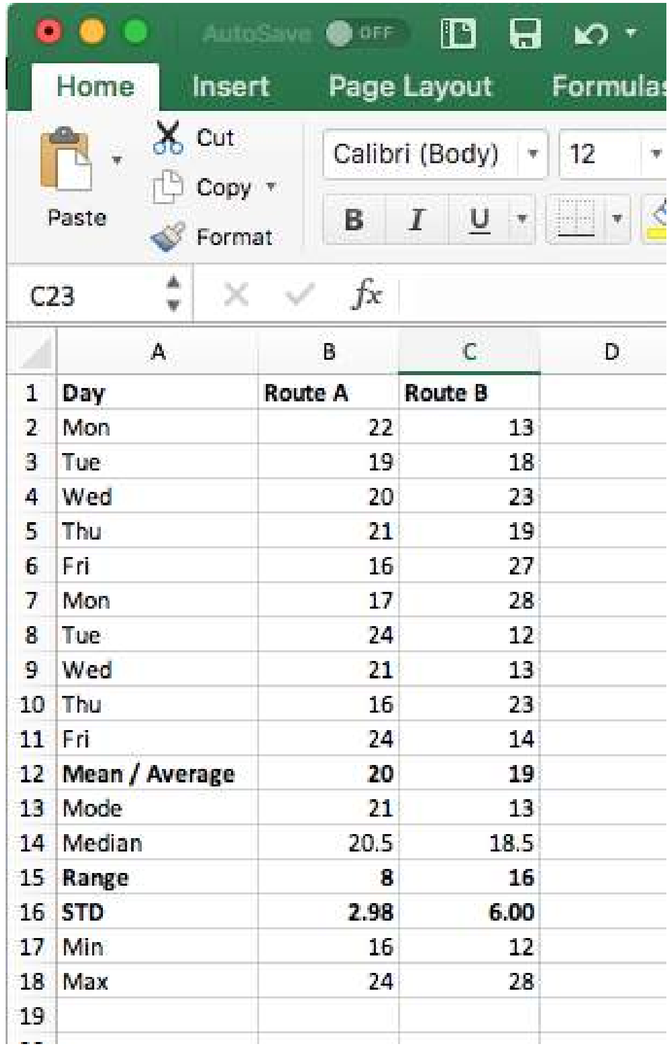
You record the travel time over a 2 week period

Route A has an average Of 20 mins

Route B has an average Of 19 mins

Which Route do you pick ?

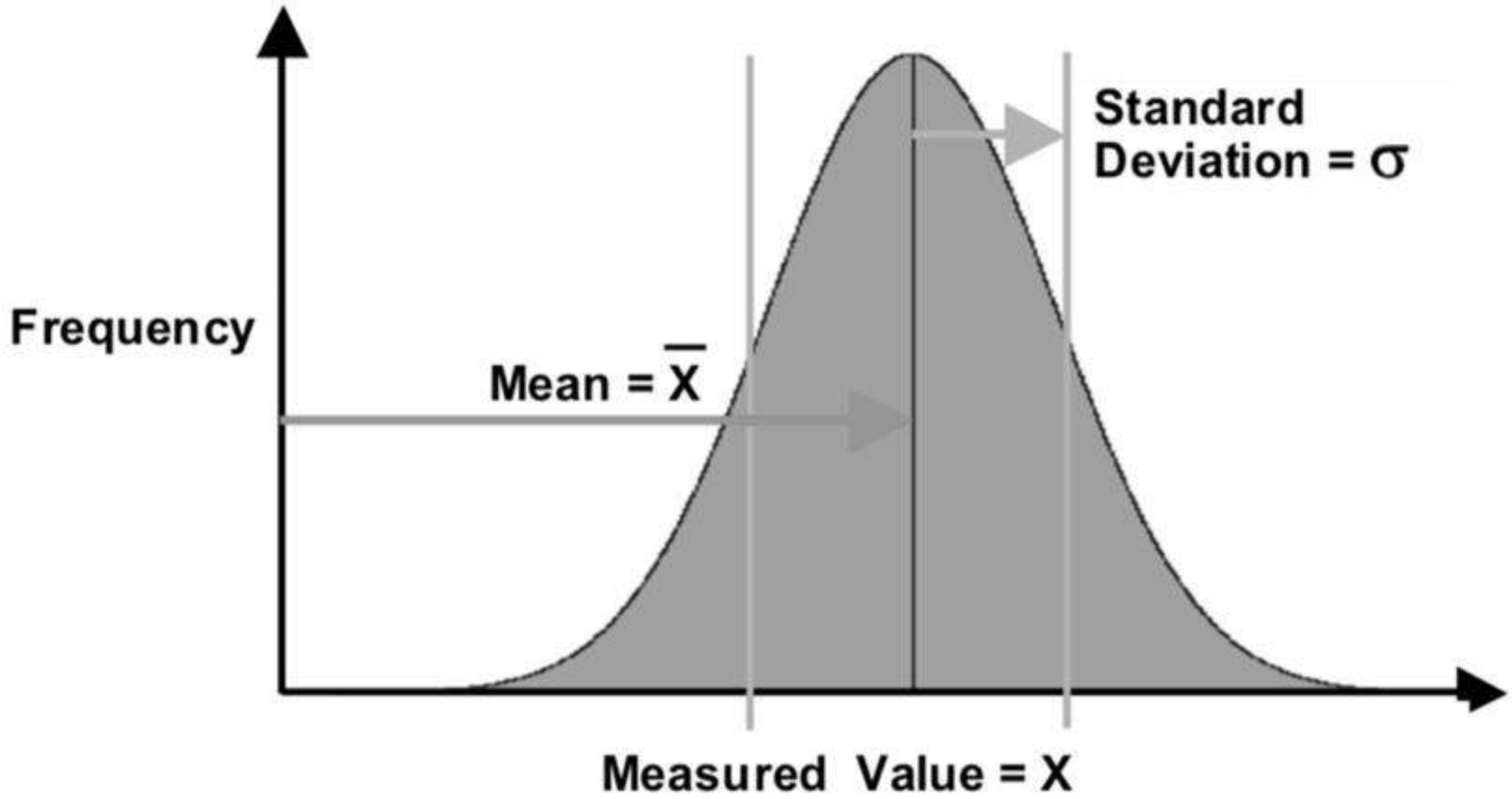
Problem with Average



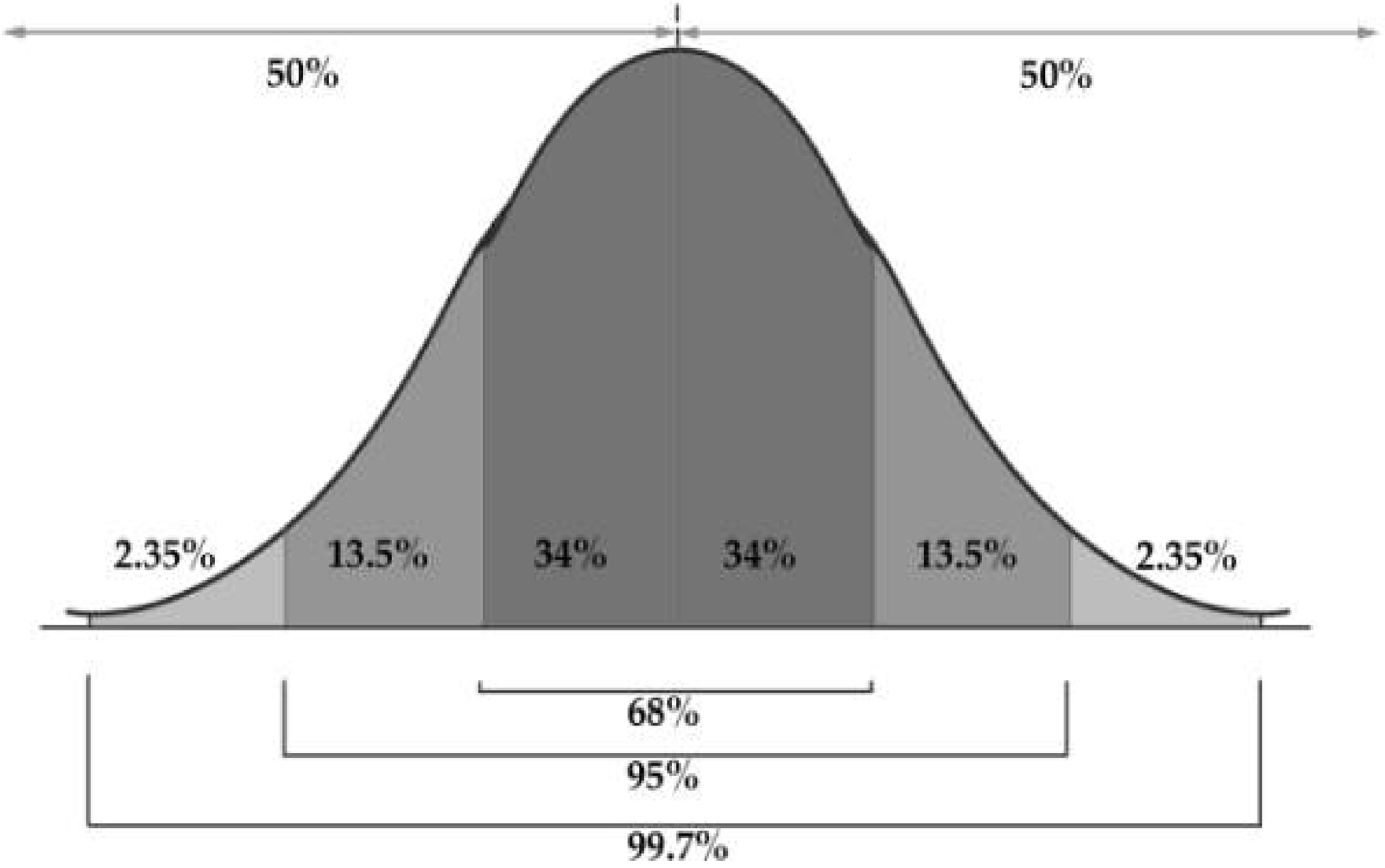
	A	B	C	D
1	**Day**	**Route A**	**Route B**	
2	Mon	22	13	
3	Tue	19	18	
4	Wed	20	23	
5	Thu	21	19	
6	Fri	16	27	
7	Mon	17	28	
8	Tue	24	12	
9	Wed	21	13	
10	Thu	16	23	
11	Fri	24	14	
12	**Mean / Average**	**20**	**19**	
13	Mode	21	13	
14	Median	20.5	18.5	
15	**Range**	**8**	**16**	
16	**STD**	**2.98**	**6.00**	
17	Min	16	12	
18	Max	24	28	
19				

Day	Route A	Route B
Mon	22	13
Tue	19	18
Wed	20	23
Thu	21	19
Fri	16	27
Mon	17	28
Tue	24	12
Wed	21	13
Thu	16	23
Fri	24	14
Average	20	19

Standard Deviation



Empirical Rule



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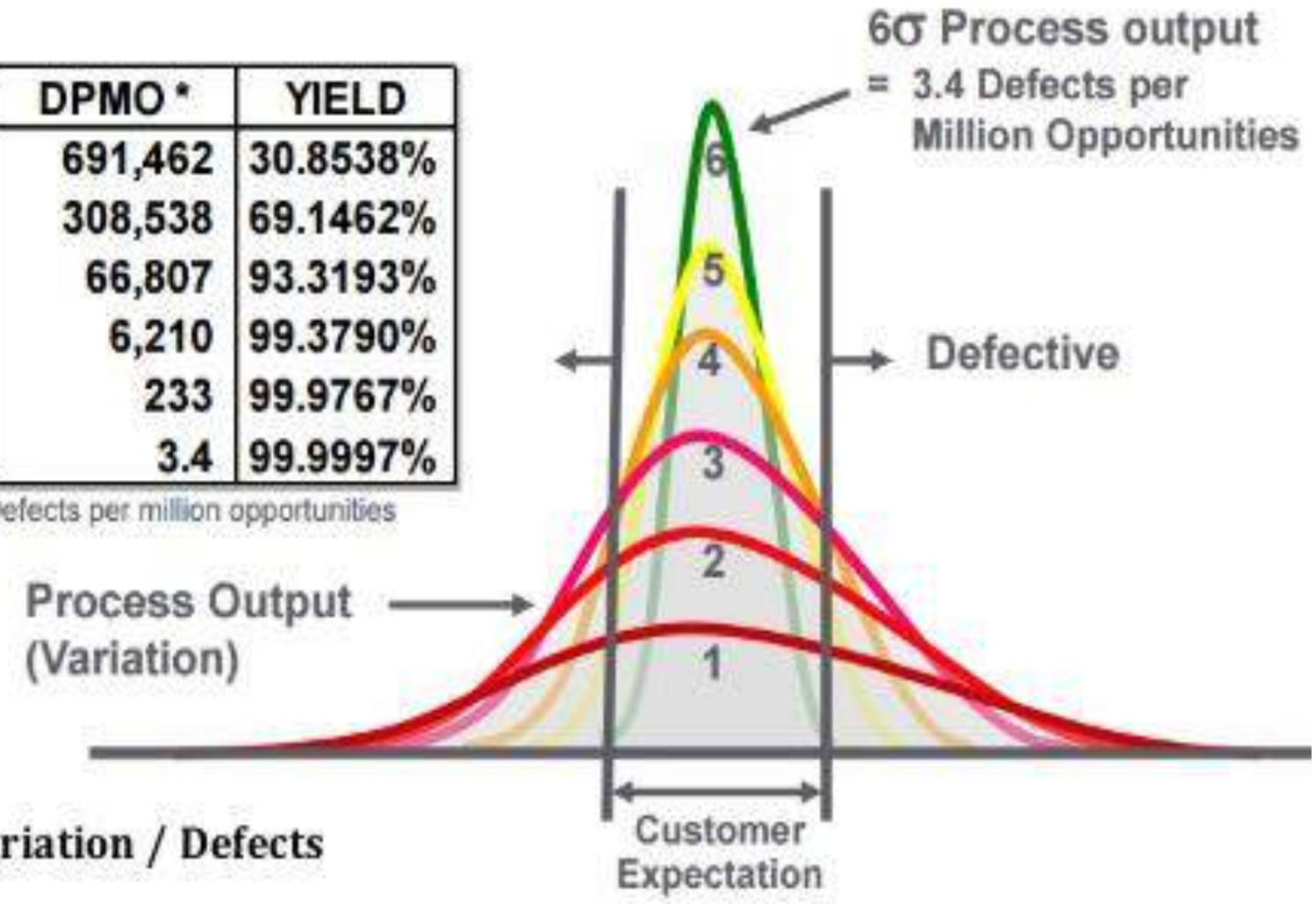
6 Sigma Applied to Calls

Empirical Rule

SIGMA	DPMO *	YIELD
1.0	691,462	30.8538%
2.0	308,538	69.1462%
3.0	66,807	93.3193%
4.0	6,210	99.3790%
5.0	233	99.9767%
6.0	3.4	99.9997%

* DPMO = Defects per million opportunities



Opportunities ⇔ Variation / Defects

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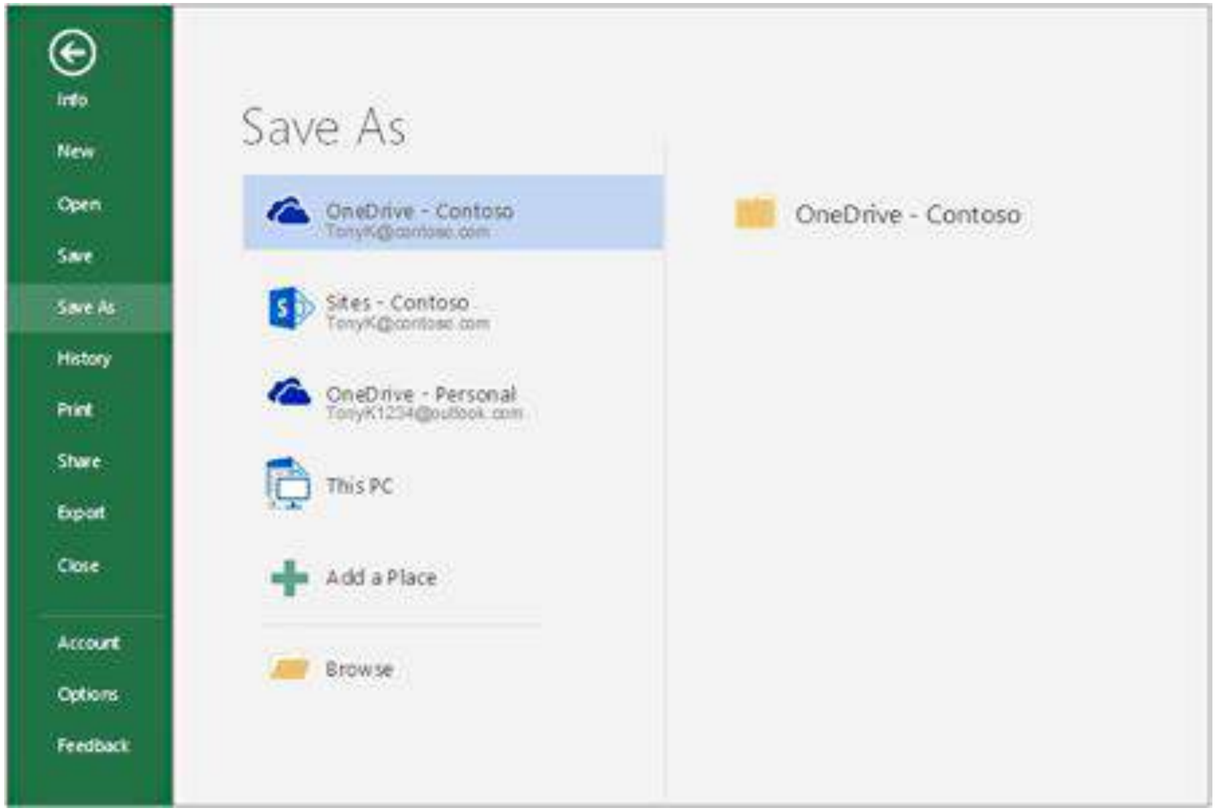
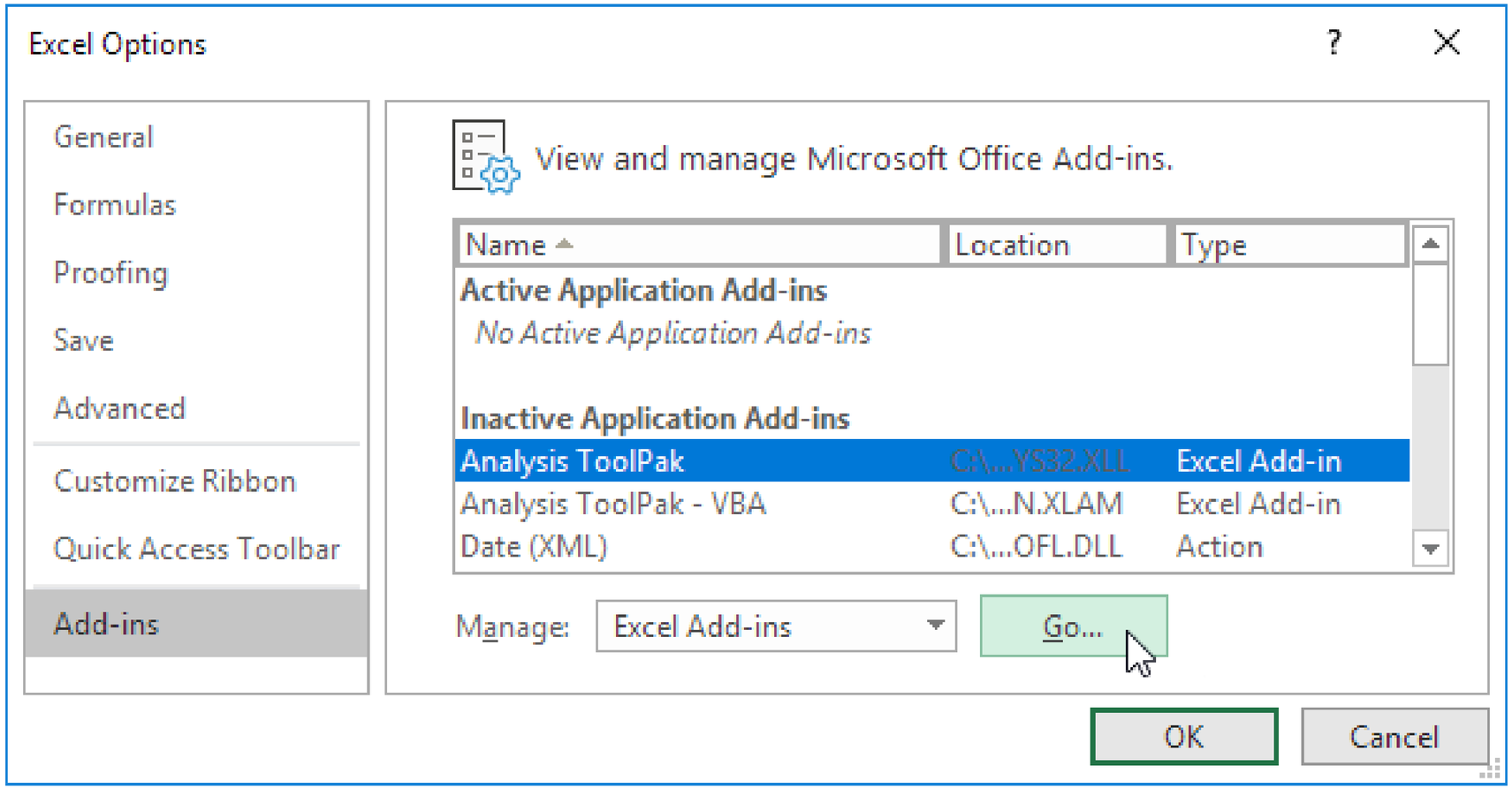
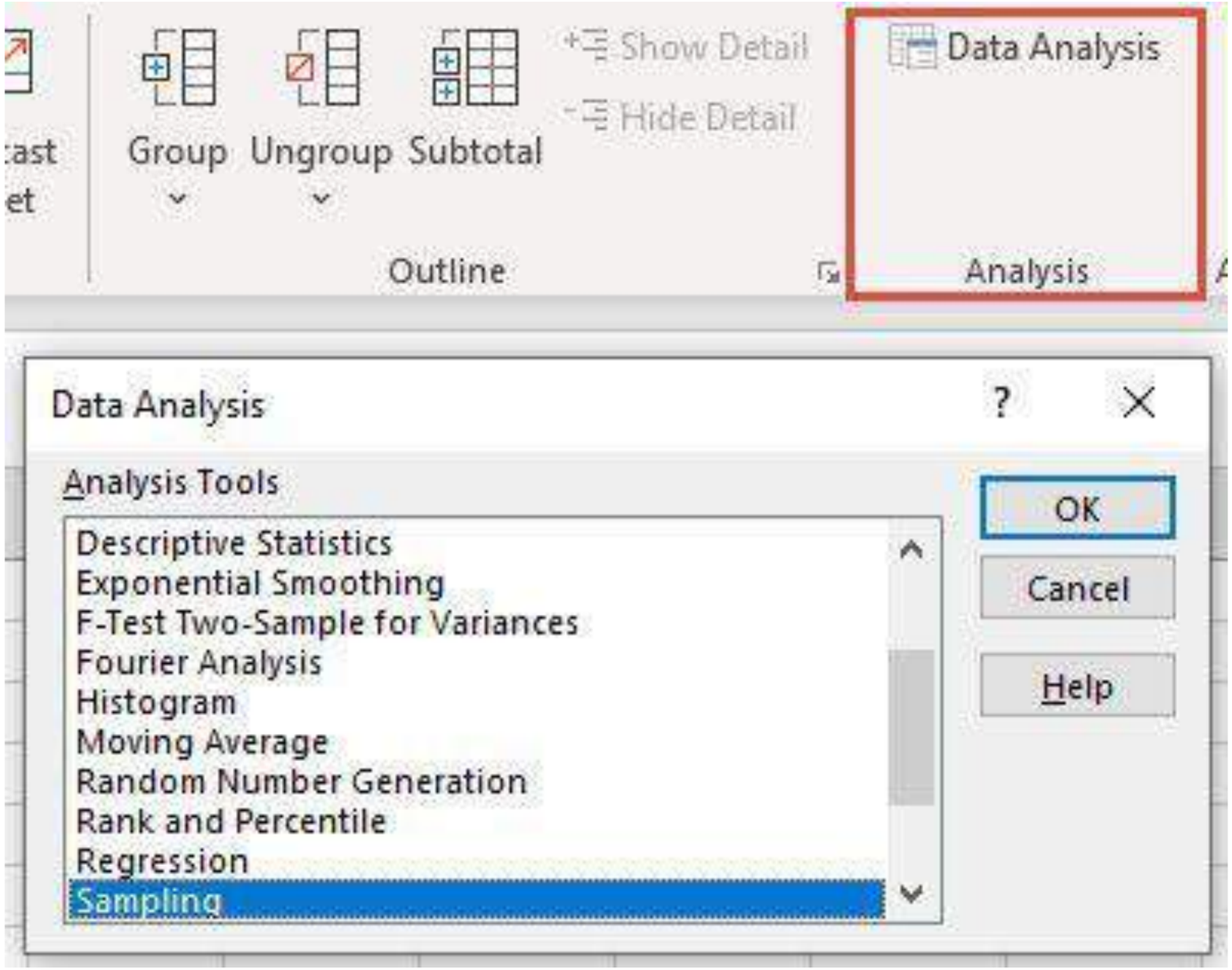
Using EXCEL



Using EXCEL


Excel Options
General
Formulas
Proofing
Save
Advanced
Customize Ribbon
Quick Access Toolbar
Add-ins
View and manage Microsoft Office Add-ins.
Name
Location
Type
Active Application Add-ins
No Active Application Add-ins
Inactive Application Add-ins
Analysis ToolPak
C:\...YS32.XLL
Excel Add-in
Analysis ToolPak - VBA
C:\...N.XLAM
Excel Add-in
Date (XML)
C:\...OFL.DLL
Action
Manage:
Excel Add-ins
Go...
OK
Cancel

Using EXCEL


Group
Ungroup
Subtotal
Show Detail
Hide Detail
Data Analysis
Outline
Analysis
Data Analysis
Analysis Tools
Descriptive Statistics
Exponential Smoothing
F-Test Two-Sample for Variances
Fourier Analysis
Histogram
Moving Average
Random Number Generation
Rank and Percentile
Regression
Sampling
OK
Cancel
Help

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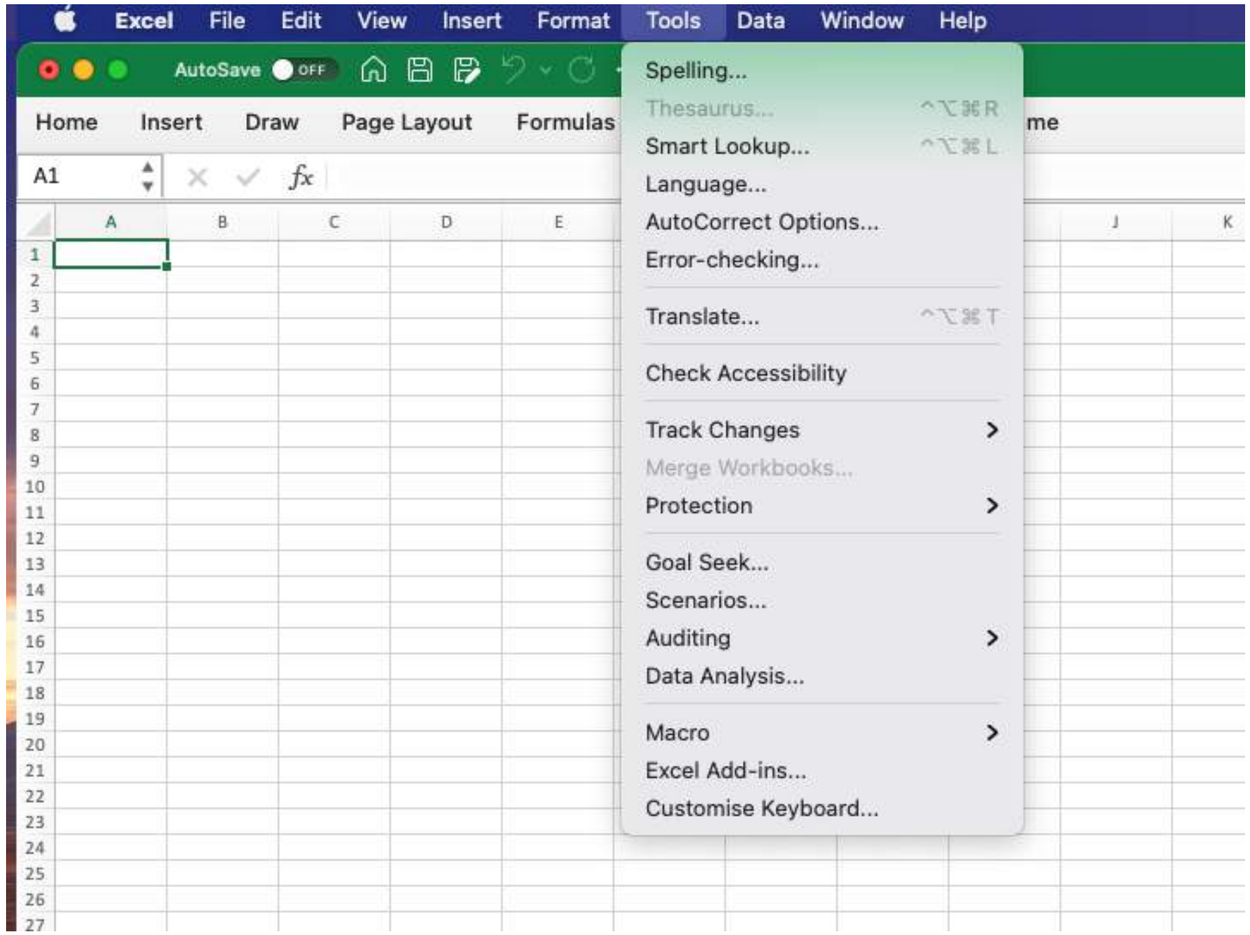
Using EXCEL



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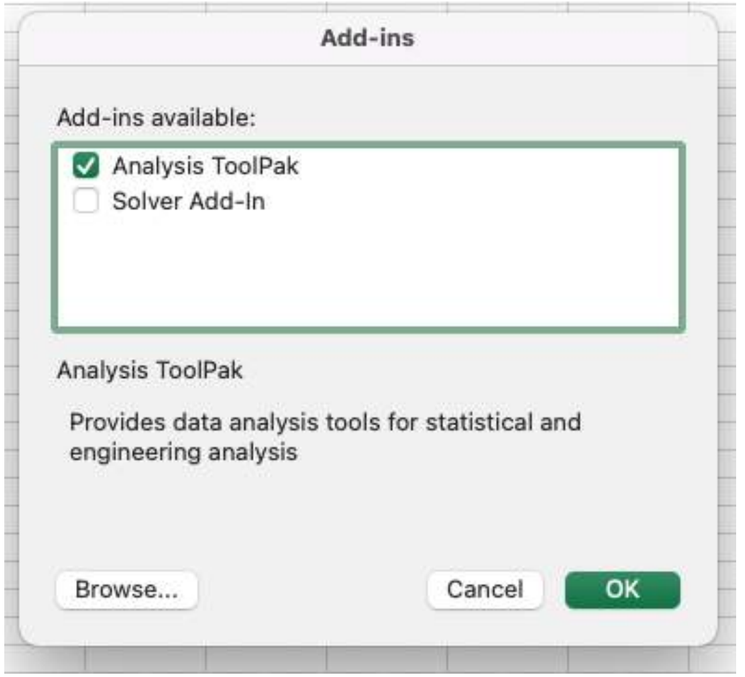
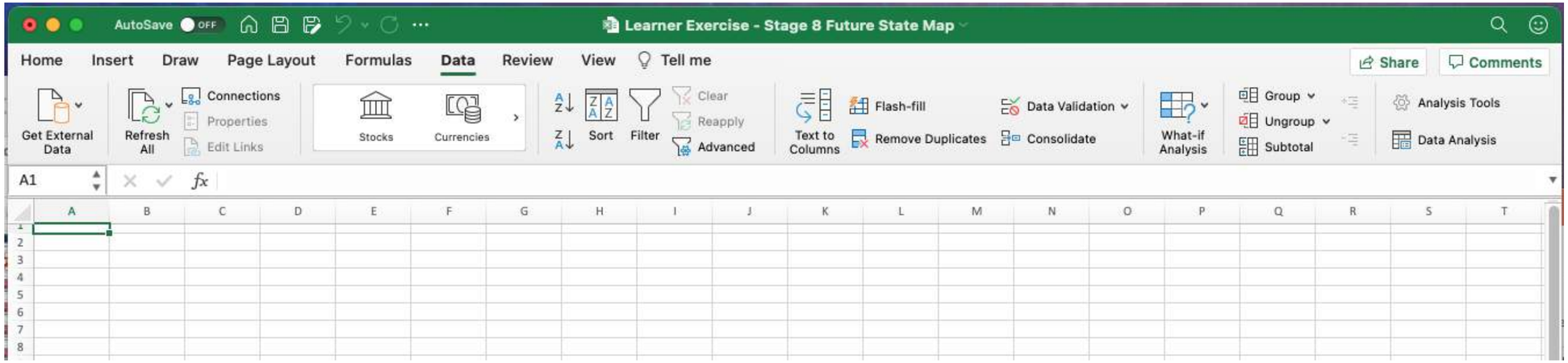
Using EXCEL

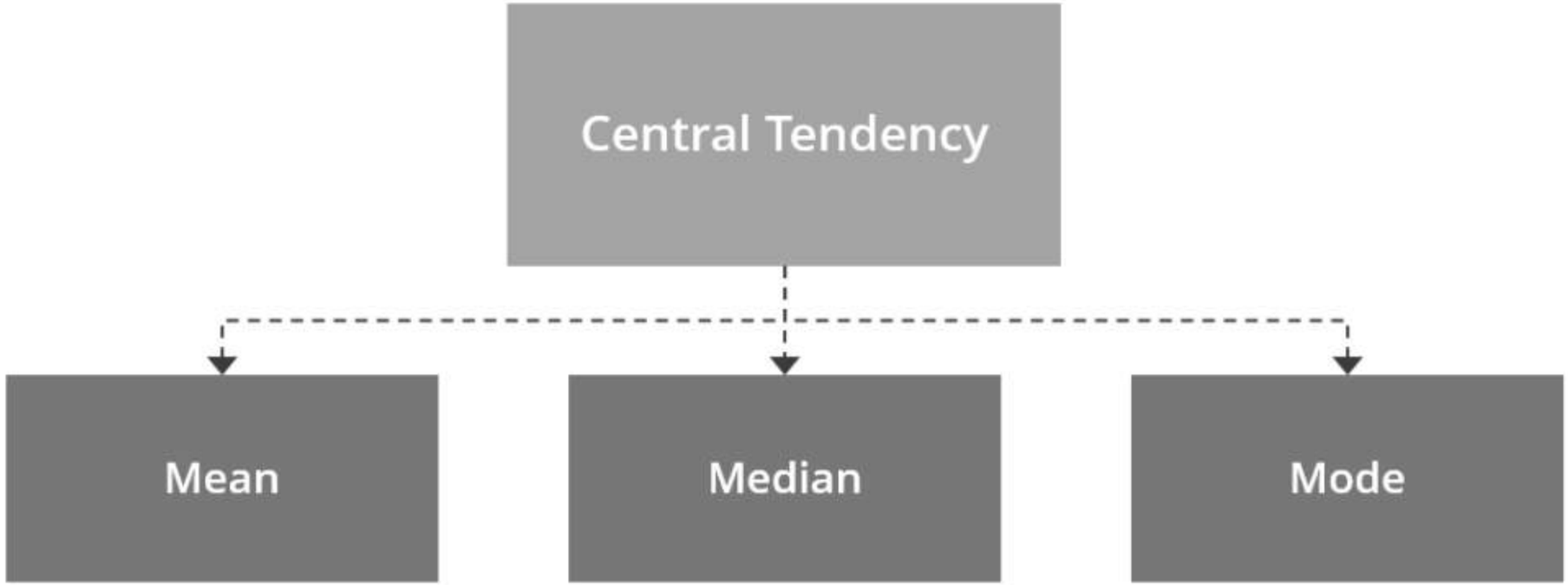




PART 2

THE LEARNING EXPERTS

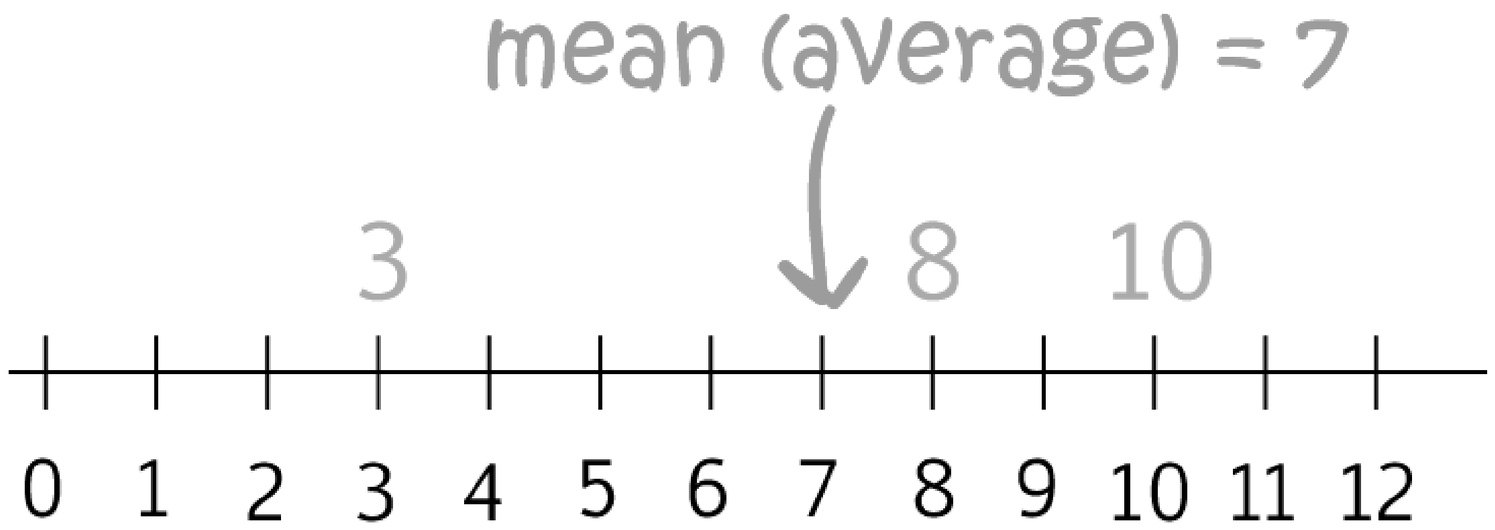
Data analysis



Data analysis

Data & Statistics – Mean

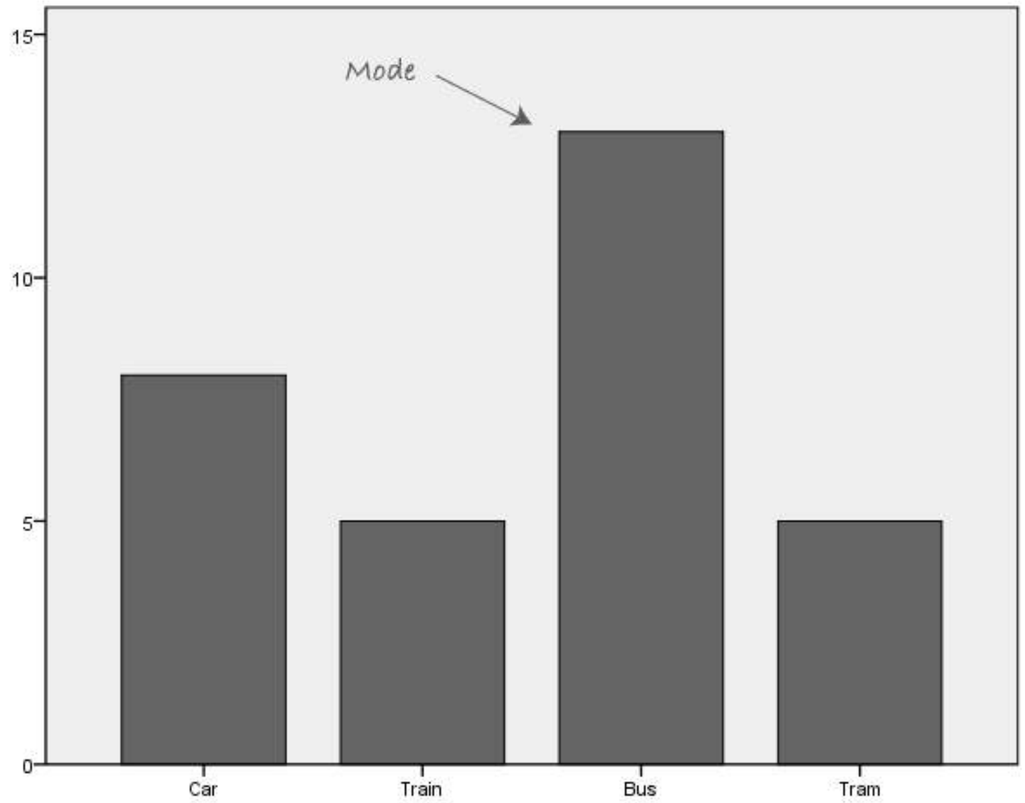
- The “Balance Point”



Data analysis

Data & Statistics – MODE

- The most frequently occurring



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Data analysis

Data & Statistics – MEDIAN

- The 50th Percentile
- The midpoint of a series

1, 3, 3, **6**, 7, 8, 9

Median = 6

1, 2, 3, **4**, **5**, 6, 8, 9

Median = (4 + 5) ÷ 2

= 4.5

Data analysis

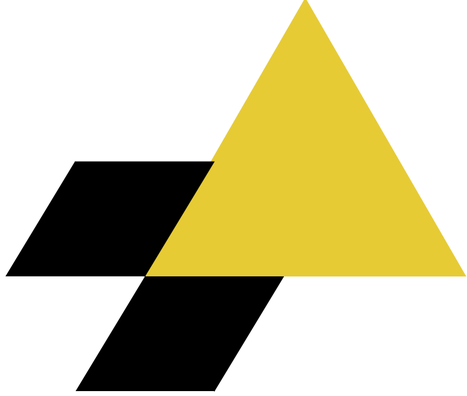
1, 2, 3, 4, 4, 4, 5, 6, 7

Mean = 4

Mode = 4

Median = 4

Data analysis



1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Mean = 5.5

Mode = ?

Median = 5.5

Data analysis

20, 30, 40, 60, 65, 75

Mean = 48.33

Mode = ?

Median = 50

Data analysis

20, 20, 30, 40, 60, 65, 75

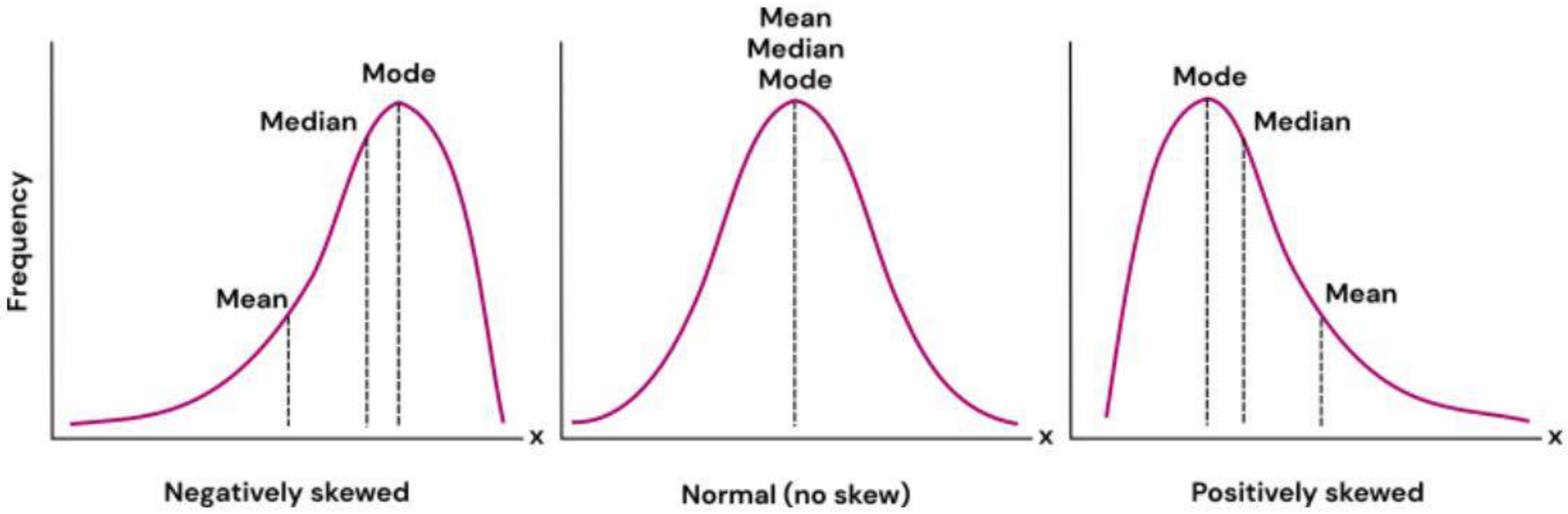
Mean = 44.28

Mode = 20

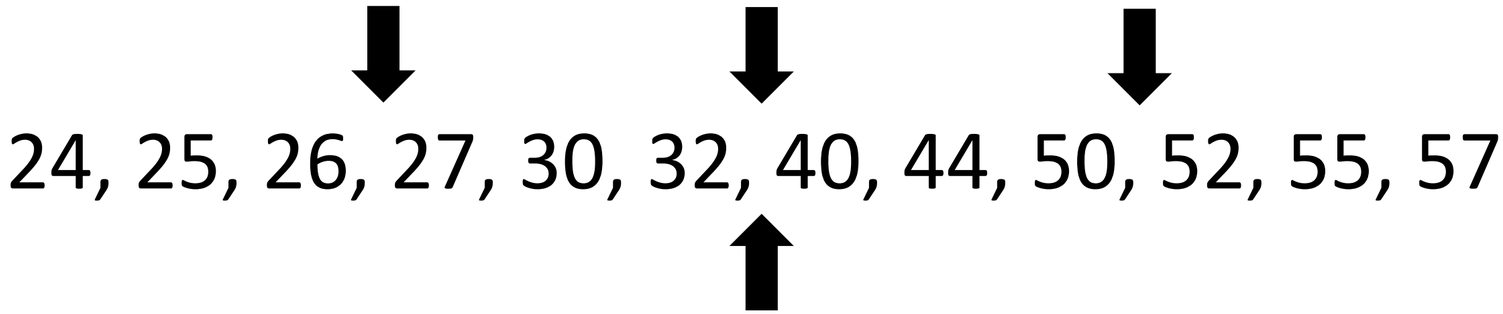
Median = 40

Data analysis

Data & Statistics – Measures of Location – Central Tendency



Data analysis



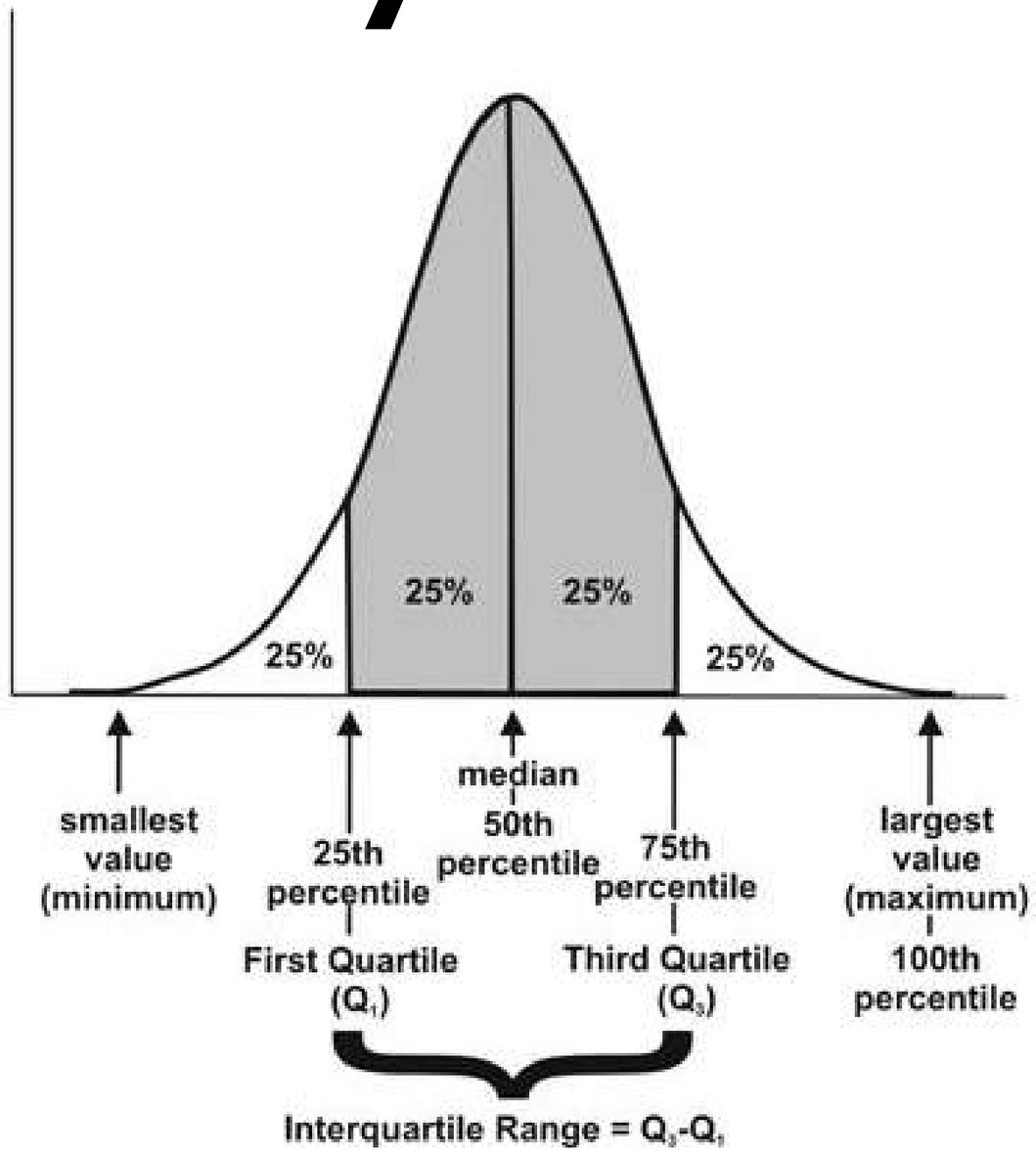
Median = 36 = Second Quartile

First Quartile = 26.5

Third Quartile = 51

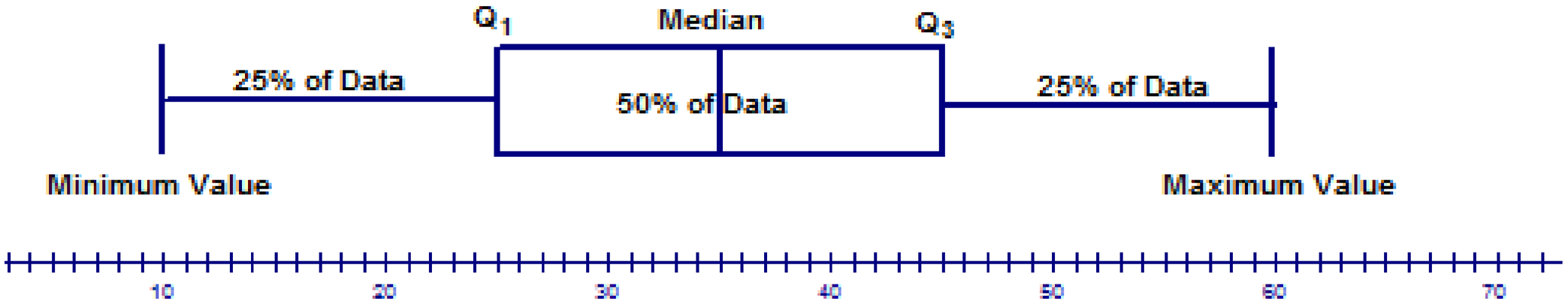
IQR = 24.5

Data analysis



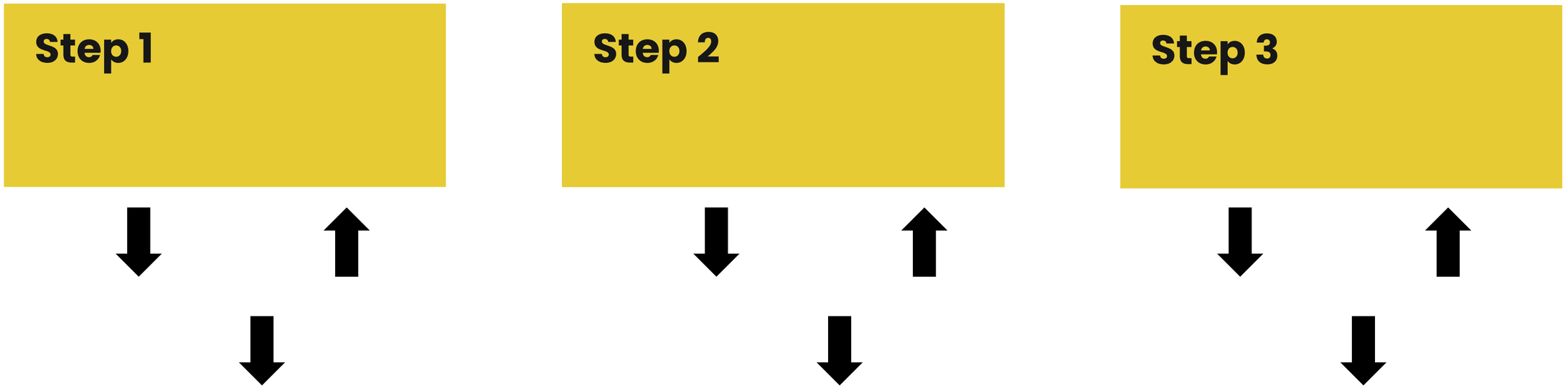
Data analysis

24, 25, 26, 27, 30, 32, 40, 44, 50, 52, 55, 57



Yield - Simple

Yield - Compound



Why to consider DPMO

Data Collected	Jan	Feb	Mar
Issues Reported	50	70	90
Number of Transactions	1000	1500	2000

DPMO

$$DPMO = \frac{OBSERVATIONS}{OPPORTUNITIES} \text{ X 1 Million}$$

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DPMO

OBSERVATIONS

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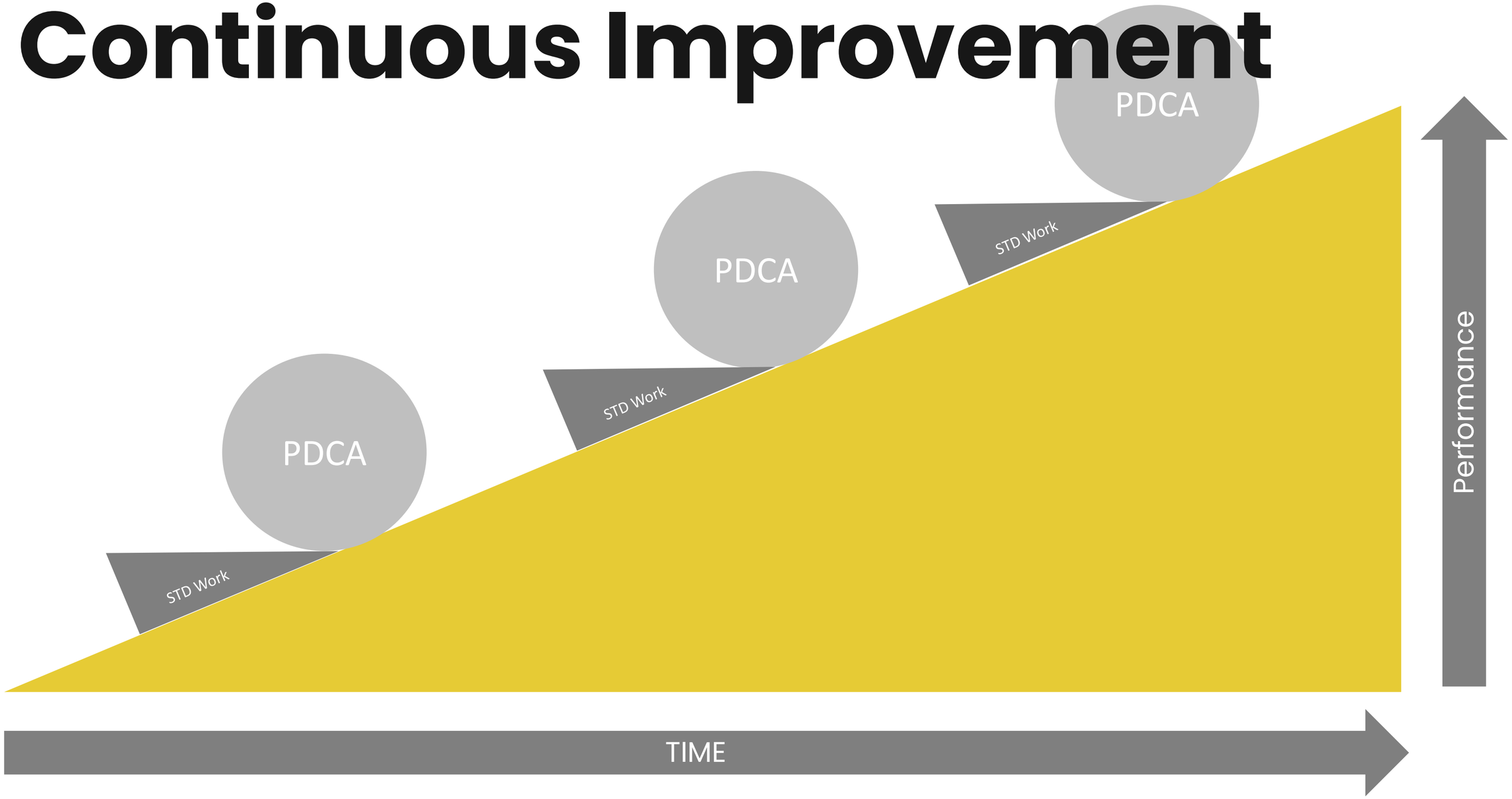
DPMO OPPORTUNITIES

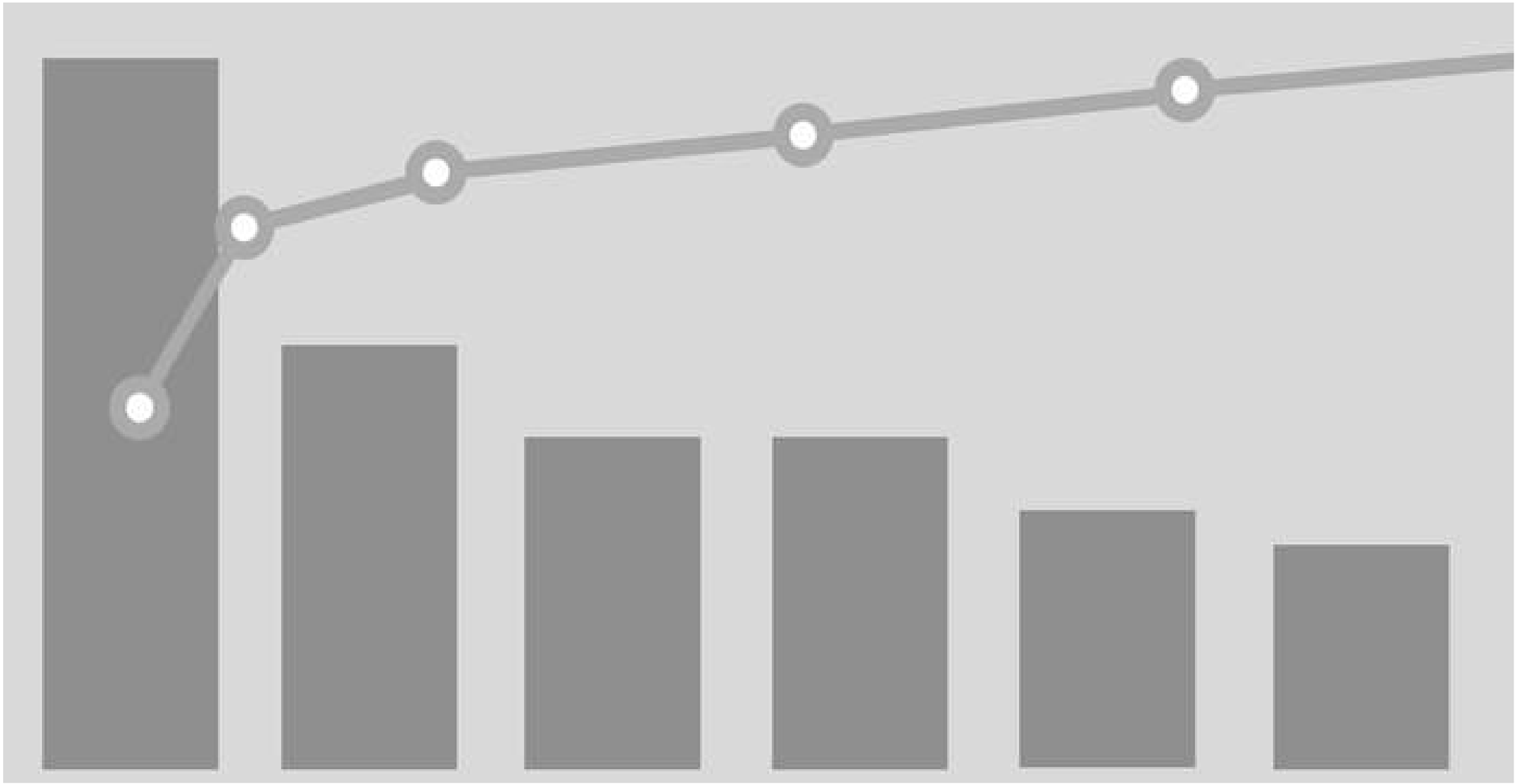
PART 3

Continuous Improvement



Pareto

Pareto



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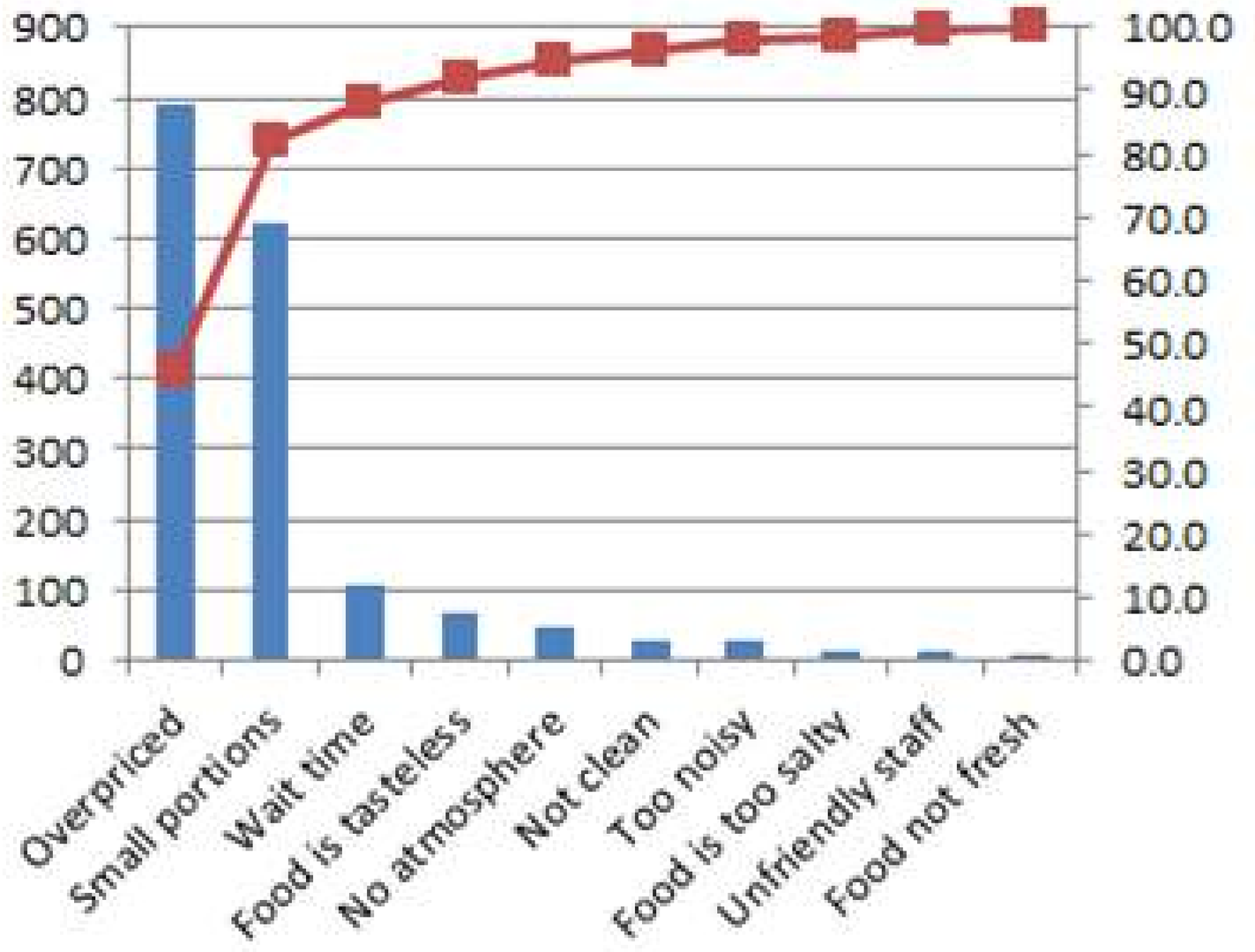
Pareto

Complaint Category	Number of Complaints
Too Noisy	27
Overpriced	789
Food is tasteless	65
Food is not fresh	9
Food is salty	15
Not clean	30
Poor service	12
Long wait times	109
No atmosphere	45
Small Portions	621

Pareto


900
800
700
600
500
400
300
200
100
0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Overpriced
Small portions
Wait time
Food is tasteless
No atmosphere
Not clean
Too noisy
Food is too salty
Unfriendly staff
Food not fresh

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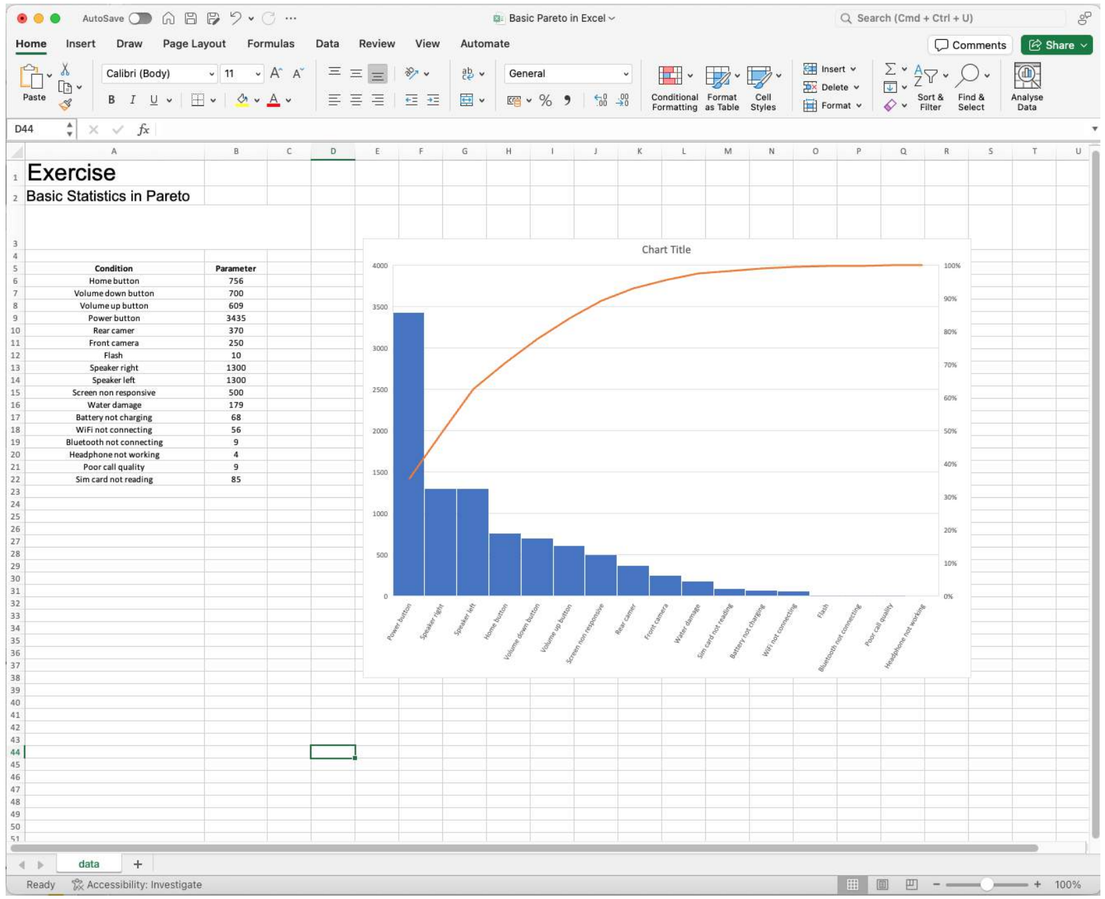
Using EXCEL for Pareto



Condition	Parameter
Home button	756
Volume down button	700
Volume up button	609
Power button	3435
Rear camer	370
Front camera	250
Flash	10
Speaker right	1300
Speaker left	1300
Screen non responsive	500
Water damage	179
Battery not charging	68
WiFi not connecting	56
Bluetooth not connecting	9
Headphone not working	4
Poor call quality	9
Sim card not reading	85

Plan for Control

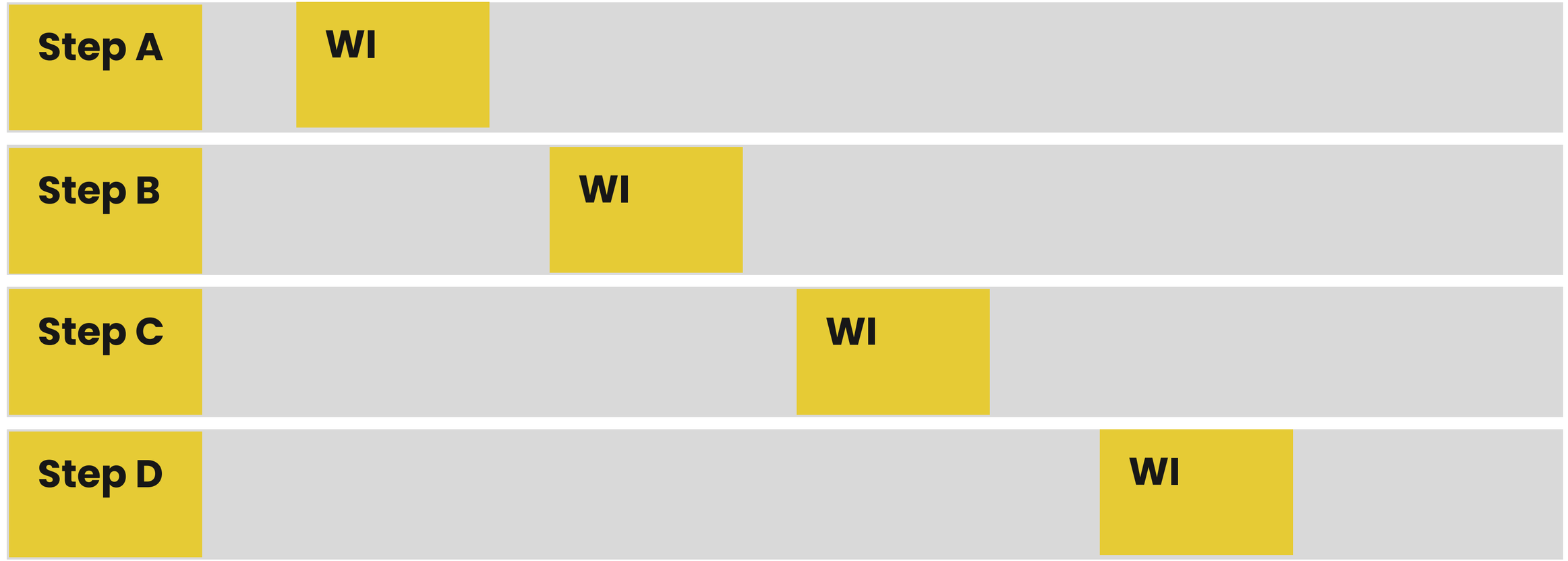
Plan for Control

- Your Organisation has 1 Critical Business process
- You are aware of the process
- You have evaluated the process and identifies 3 critical performance variables
- You have set performance targets for each variable
- You have established data collection for each Variable
- You have a graph on public display which illustrates the live status of each variable

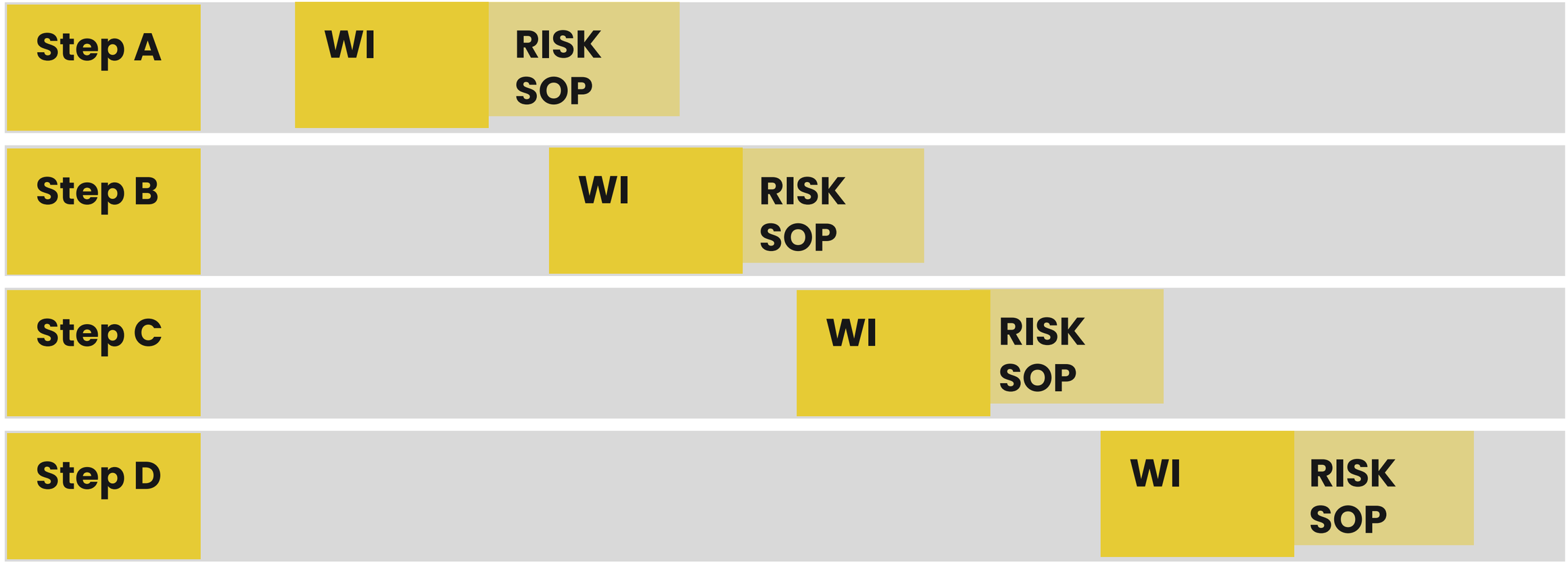
- **Is your Process Controlled ?**

- **Not Until**
- You have an escalation plan
- You have a response plan
- You can return the process to safe operational levels

Plan for what should happen



Plan for what might happen



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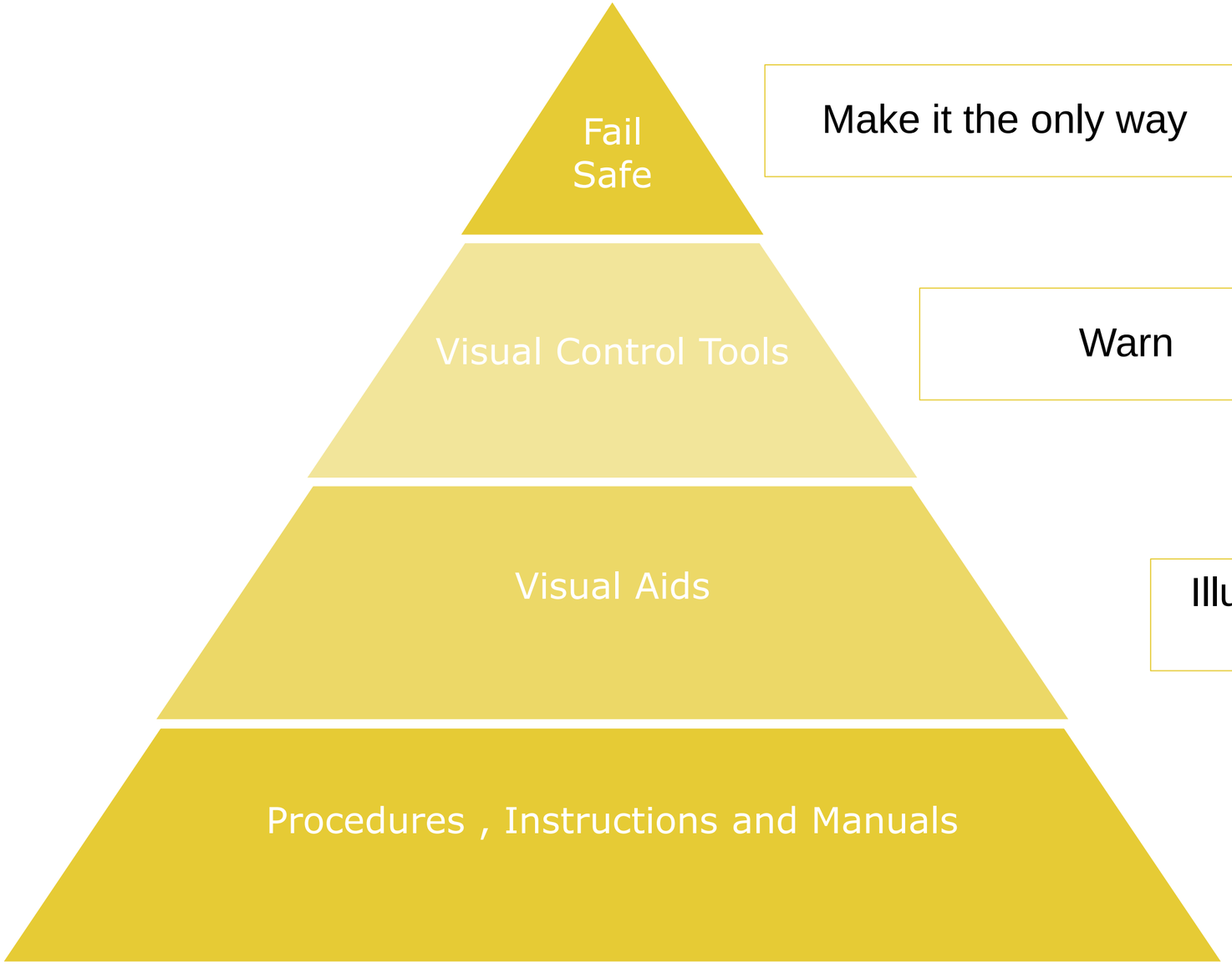
Standardise Work



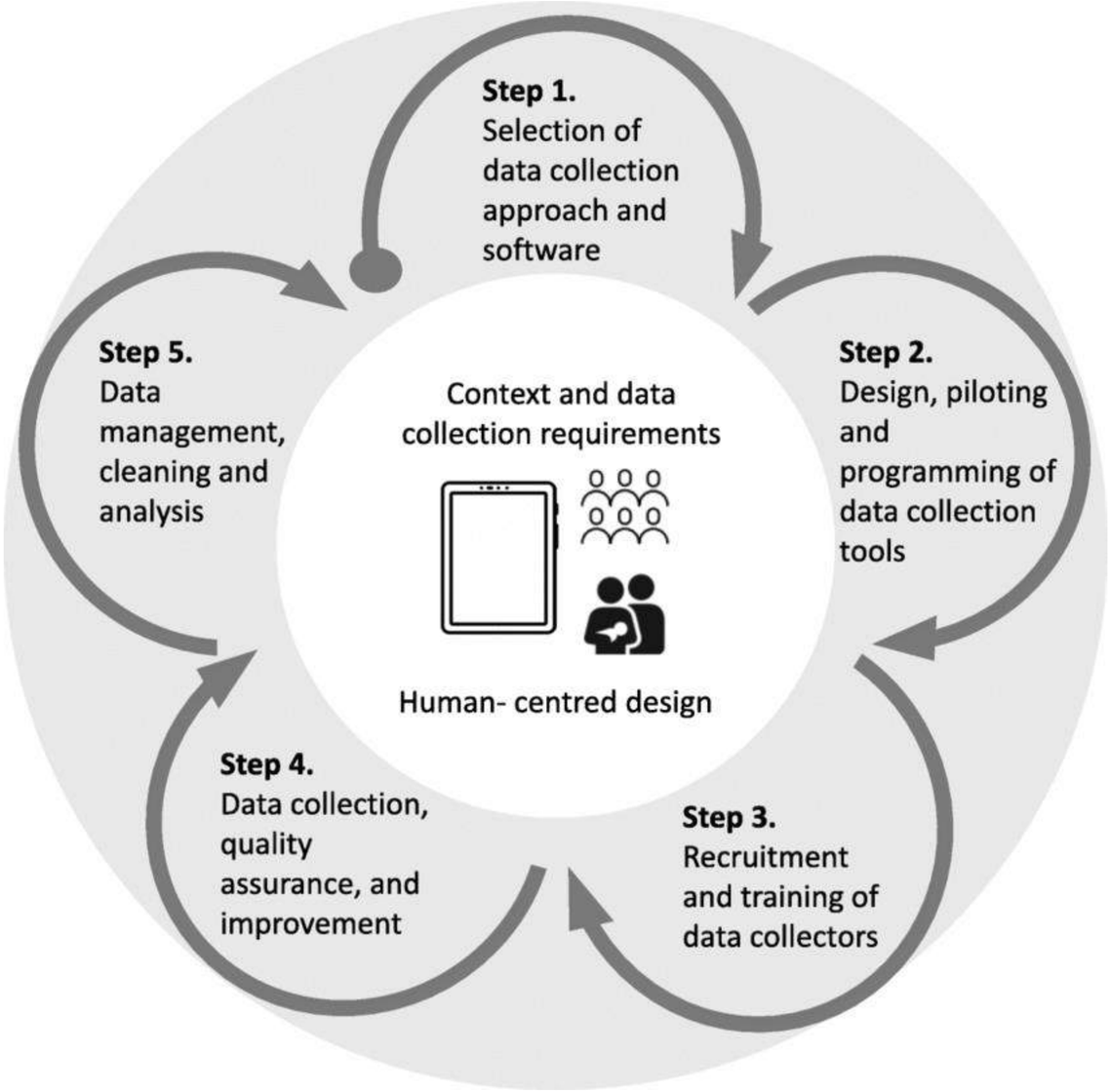
Make it the only way

Warn

Illustrate

Describe

Plan for measurement



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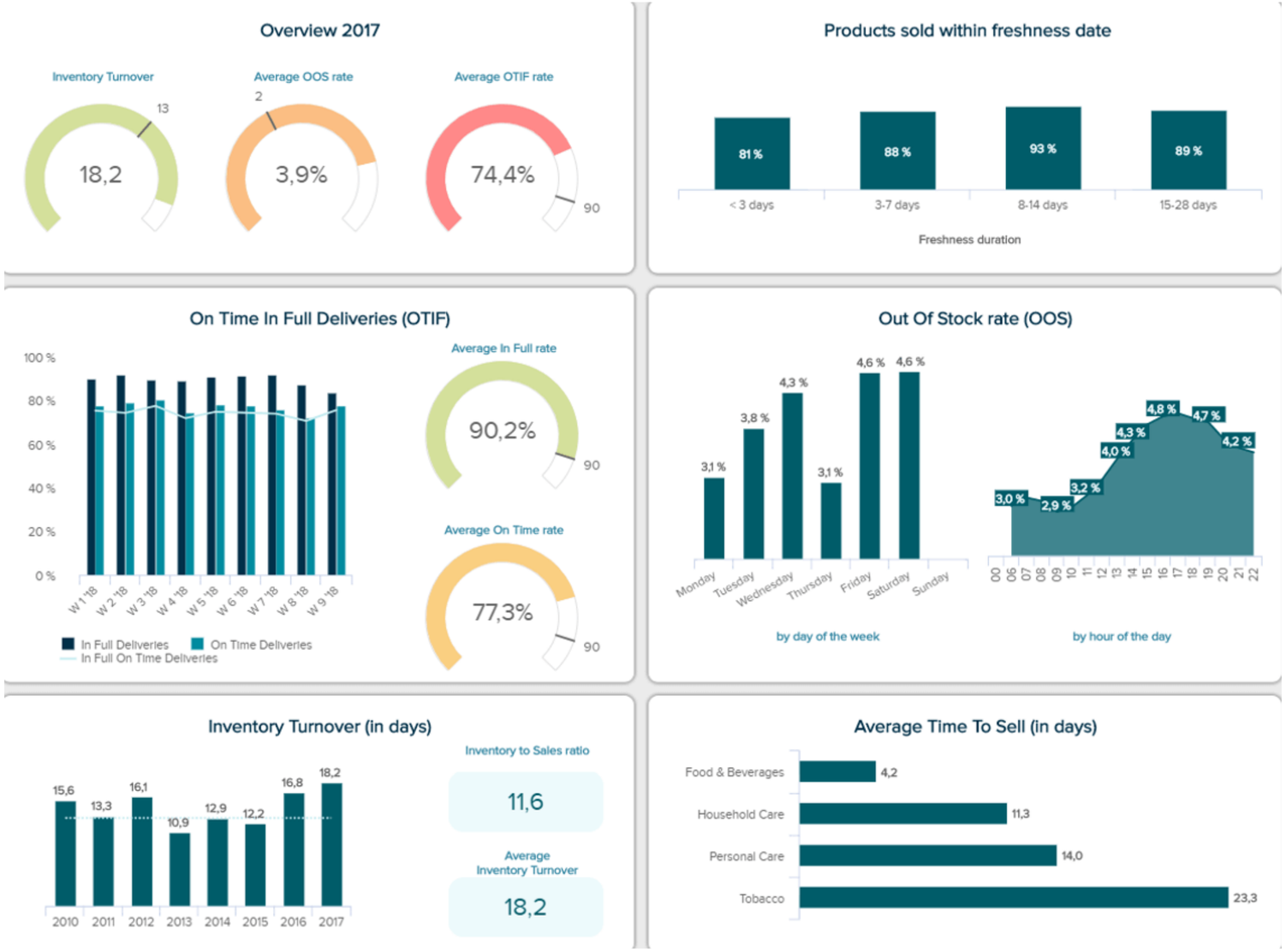
Plan for survaillance



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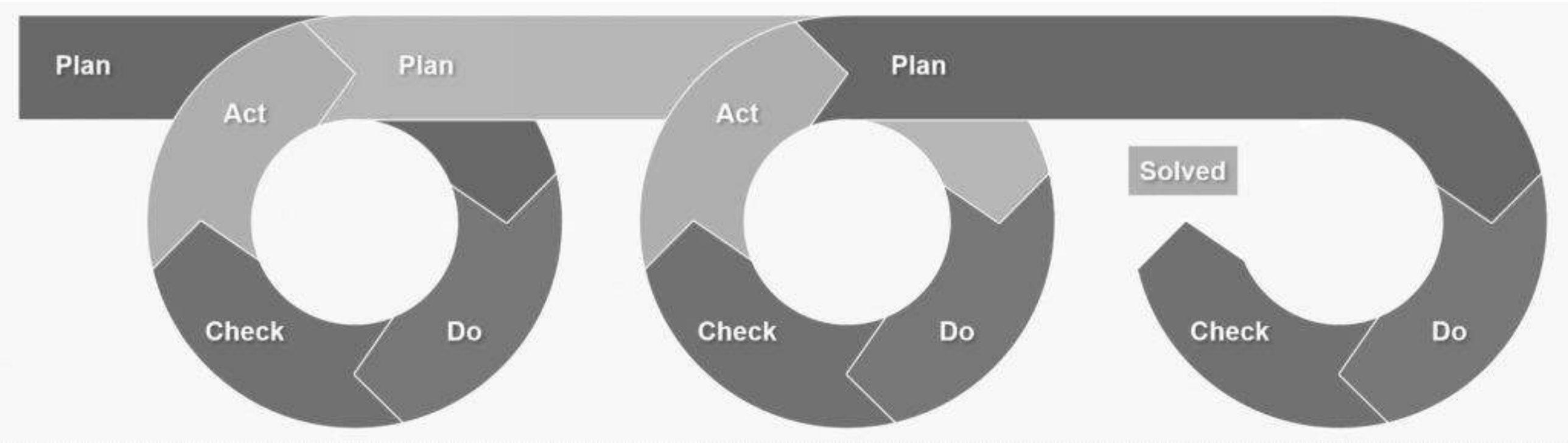
Plan for Cadence



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DEFINE:

Charter
SIPOC
Stakeholder Mgmt
Team selection
RACI
Current State Map
Voice of Customer

MEASURE:

Data Types
MSA
DPMO
FTY
RTY
OEE
Activity Ratio
PCE
TAKT Time
Process Maps
Cp / Cpk

ANALYSE:

Averages
Standard Deviation
Bell Curve
Pareto
Run Charts
Control Charts
Isikawa
5 W's
5 Whys
SPC

Measures Central T
Mean / Mode / Median
Range
Quartiles / IQR
Hypothesis Test
AD Test
T-TEST & ANOVA
MultiVary Study
PICK Chart
DOE

IMPROVE:

Kaizen
5-S
SMED
KanBan
Poka Yoke
Visual management
ANDON
GEMBA
TPM
SPC
FMEA

CONTROLS:

Standard Work
Future State Map
Audits
KPI's & Control Charts
SPC
Quality Plan
Response Plan
Reward & Recognize

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Thank You

Q & A Discussion

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