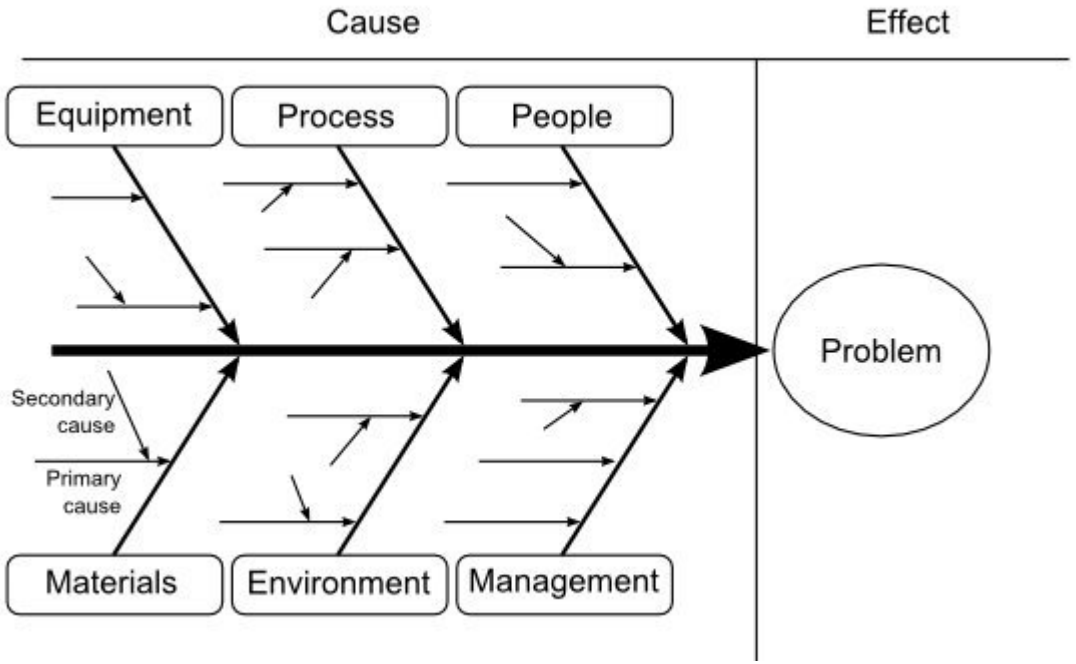


# EPITA Information Management Master

## Introduction to Six Sigma 6σ

## Module 3

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Source : Photo Afidium

# Course Schedule

- **3 Theoretical sessions : Jan 11, Jan 25**
- **1 Practical session with a game : Jan 12**

# Exam

- **Participation to the 4 modules/sessions ( 40% of your score )**
- **Practical session ( game play ) 40%**
- **Quiz ( 20 questions ) with no document 20%**

# DMAIC

- **DEFINE – Clarify opportunities/issues, set goals, make sure we're working on the right things. Understand and balance stakeholder needs.**
- **MEASURE – Target the right facts and data to build understanding, improve decisions, evaluate results**
- **ANALYZE – Assess relationships between actions and results, reasons for problems, potential impact of new solutions or innovations**
- **IMPROVE – Develop effective new ways to get things done that gets results**
- **CONTROL – Ensure solutions and innovations last, and can be leveraged to maximize benefit**

# ANALYZE

- **In the Analyze phase, the team reviews data collected during the measure phase. The goal is to narrow down and verify root causes of waste and defects**
  - **Process Analysis**
  - **Brainstorm Root Causes**
  - **Pareto Charts**
  - **Develop Hypothesis**
- **Analyze the data to investigate and verify cause-and effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.**

# Analyze

- **What might be causing the problem?**
- **How can we pinpoint the root cause?**
- **Have we verified the cause(s)?**

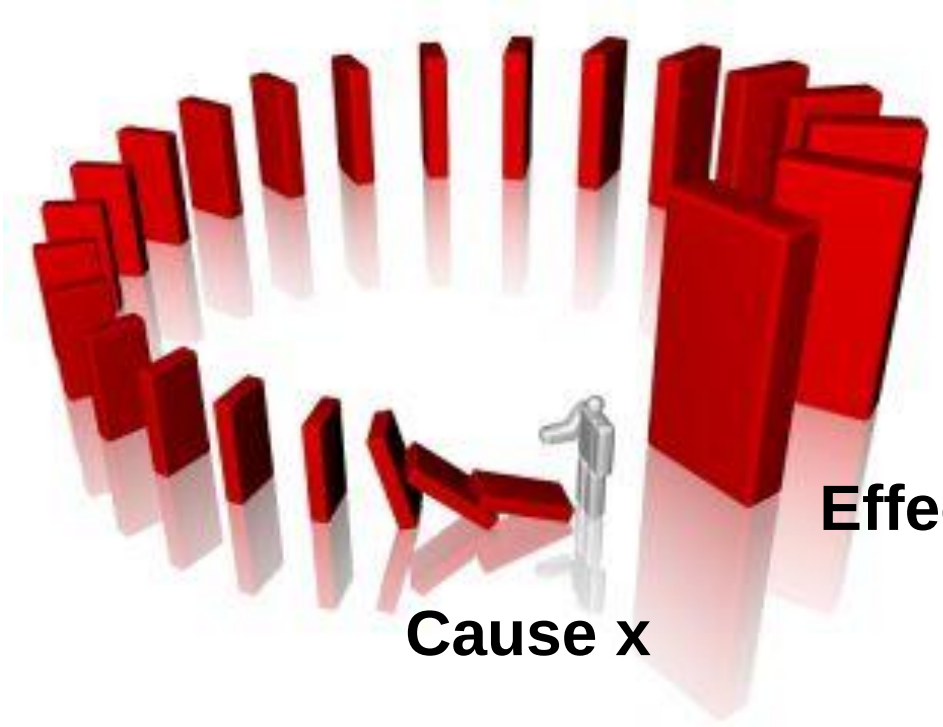
# Analyze objectives

- **Use data and process knowledge to identify contributors to/causes of problems**
- **Verify analysis using facts and data**
- **For design efforts, clarify the key Xs that will drive the Ys**
- **How to best achieve the goal and vision?**
- **Refine Project SMART Objective as needed**
- **Prepare to develop/execute effective solutions**

## Analyze

## Analyze

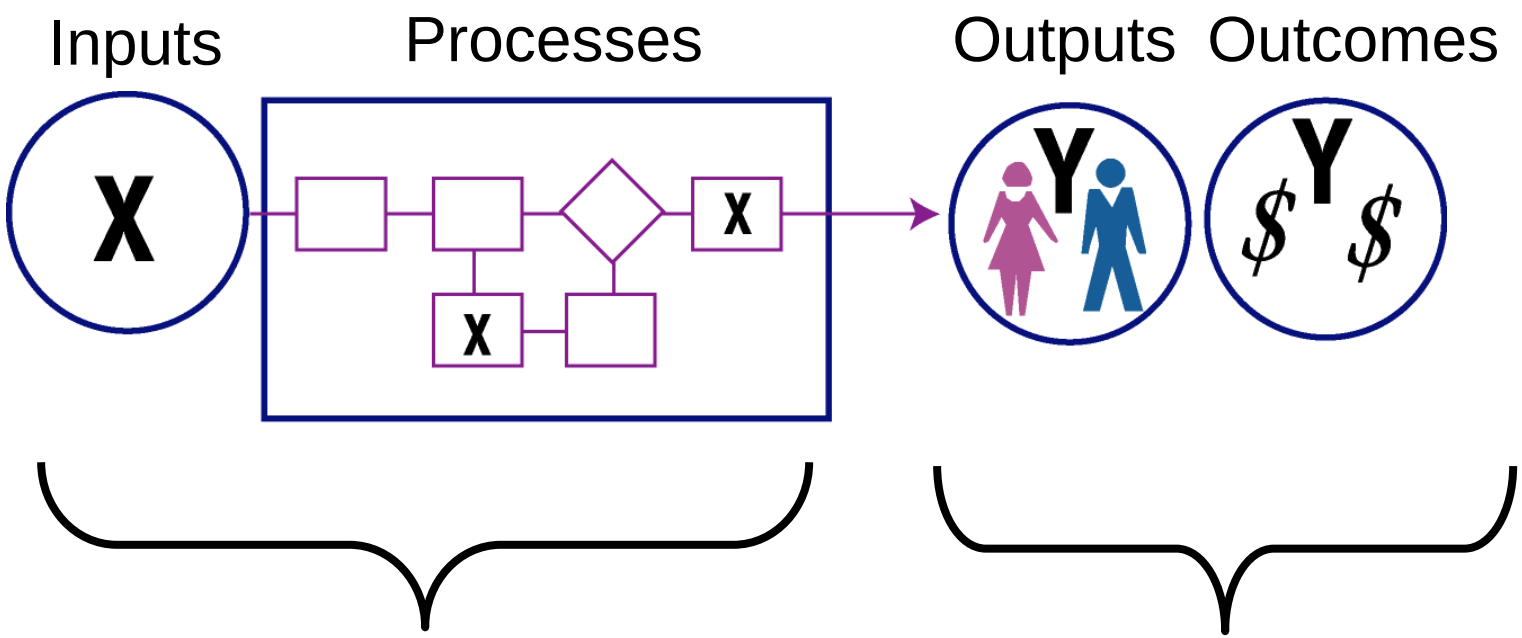
## Find the root cause y=f(x)



**Effect y**

**Cause x**

**Y=f(X)**




**Which factors *here*…**

Are really impacting results *here*?

*(i.e., causing downtime, delays, defects etc.)*

# Things to remember

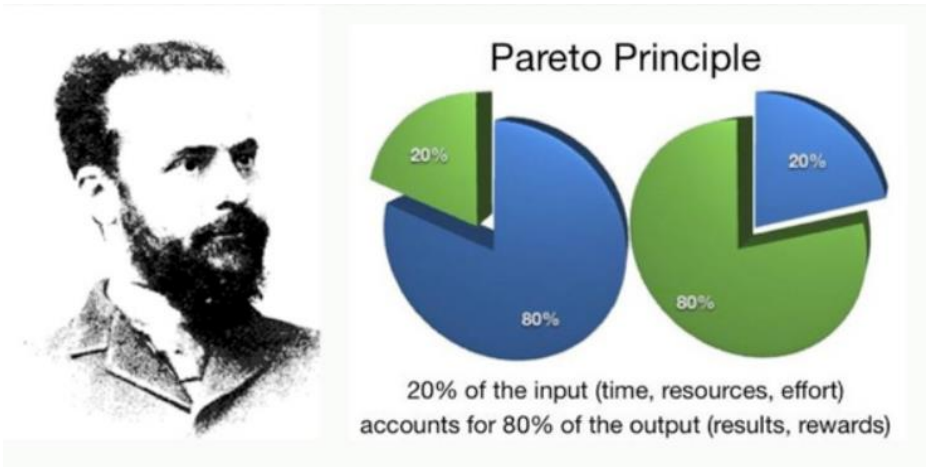
- **Goal is to understand the problem and process so you can develop and implement effective solutions**
- **It's like a investigating a mystery**
  - **You're the detective!**
- **Adjust level of effort to the situation**
  - **Higher complexity & Risk = More careful analysis**
- **Don't let the case go on too long**
  - **No 100% proof in solving for cause**

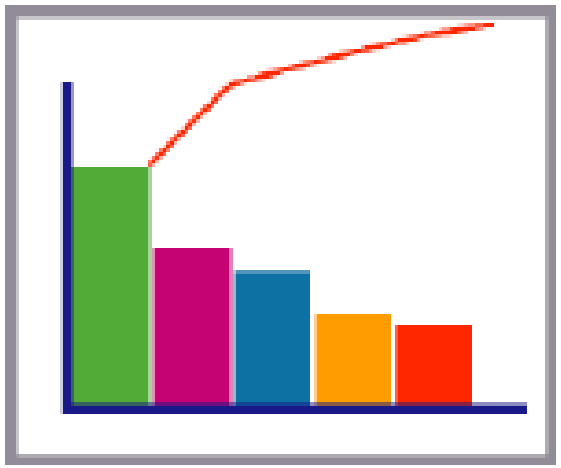
# Cause Type Examples

- **Problem/Situation: High staff turnover**
  - **Common Causes: Working conditions, local economy, ongoing training programs, caliber of supervisors**
  - **Special Causes: New local employer, benefit cutbacks, change in leadership**
- **Problem/Situation: Lost shipments**
  - **Common Causes: Address database, mail room/department communication, size of packages**
  - **Special Causes: Change in tracking system, influx of new staff, opening of new facilities**

# Pareto Chart & Analysis

- **Based on "Pareto Principle"**
- **Built on stratified data**
  - **Discrete (error types, region, season)**
  - **Continuous, when grouped (income levels)**
- **Allows quantitative comparison of factors relating to the process and/or problem**
- **Orders groupings from largest to smallest**



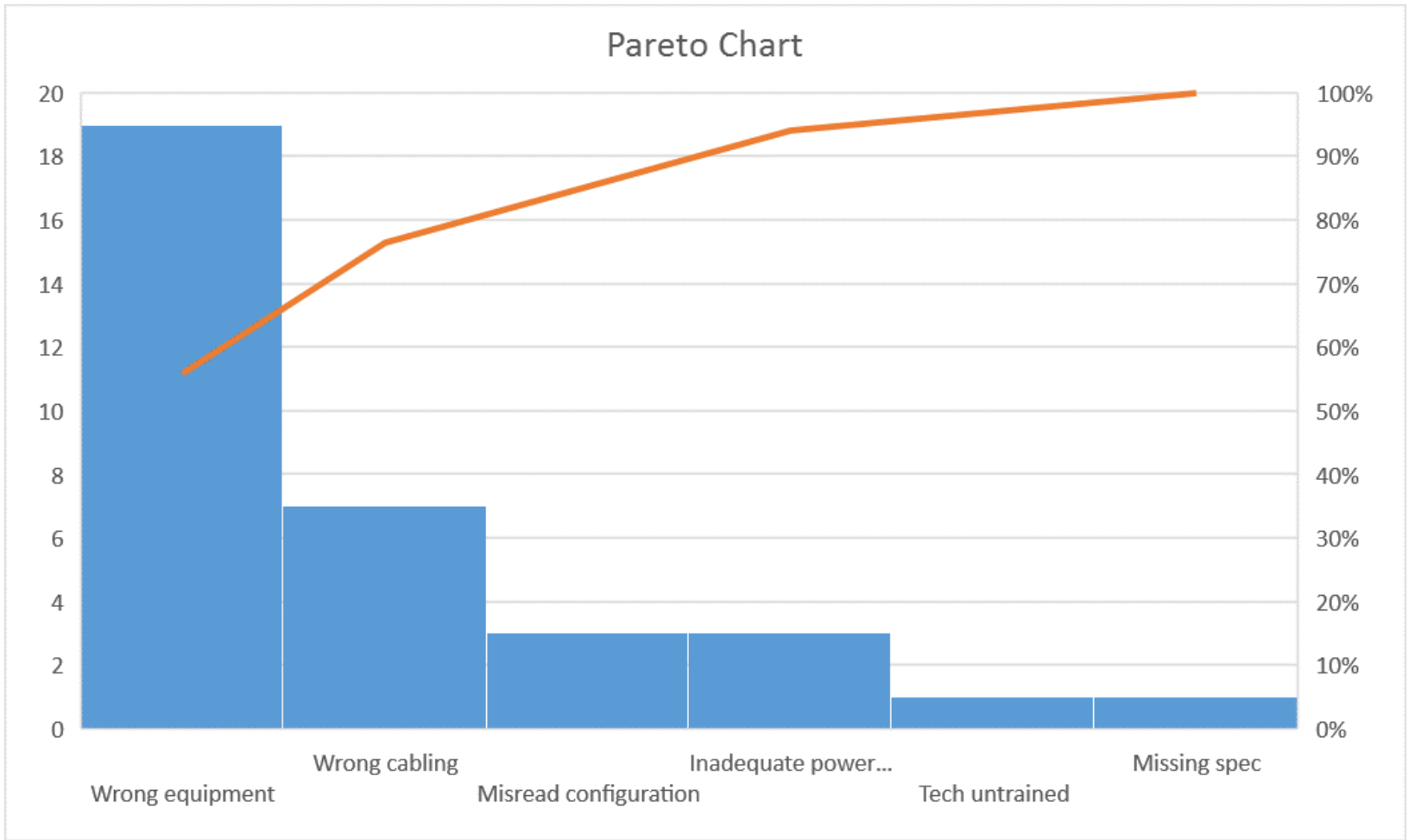



# Exercise Pareto (spreadsheet)

- **Classify 34 incidents using the following predefined categories**
- **Group them and calculate the # of incidents per category**

- **Represent the Pareto chart graphically**
- **Conclusions ?**

# Exercise Pareto (spreadsheet)

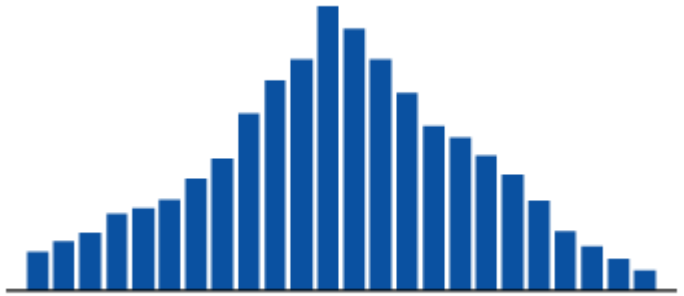


# Histograms

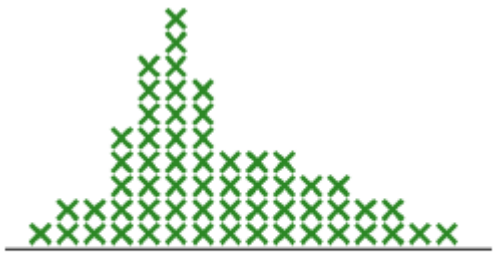
- **Provides a “snapshot” of the process for a period of time**
- **Demonstrate pattern and amount of variation**
- **Allows easy comparison between process capability and customer specifications**
- **Illustrates the operations of the process**
  - **Frequency of occurrence of specific values**
  - **Amount and type of variation**

# Histogram Types & Characteristics

- **“Standard” Histogram**
  - Use continuous data (min 50–100 data points)
  - Plots ranges in a continuous scale on x-axis
  - Examples: Weight (grams) — 0-5, 5.1-10, 10.1-15, etc;
  - Percent — 0-1.9%, 2.0-3.9%, 4.0-5.9%
- **Frequency Plot**
  - Use count data
  - Plots items on an ascending “discrete” scale
  - Examples: Number of Defects — 0-10, 11-20, 21-40 etc;
  - Orders/Week — 0-3, 4-6, 7-9, etc.

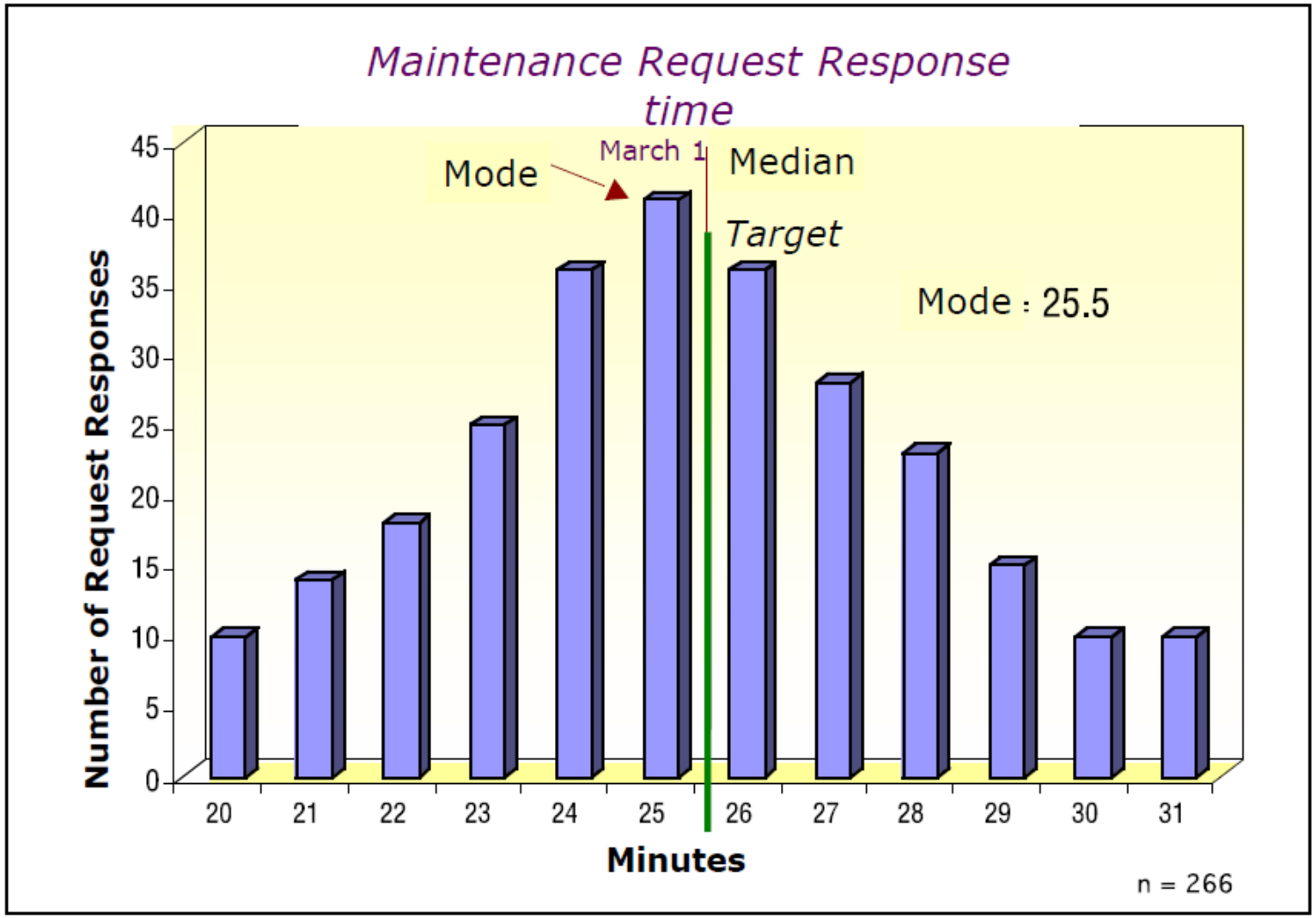


Phone Charges per Room



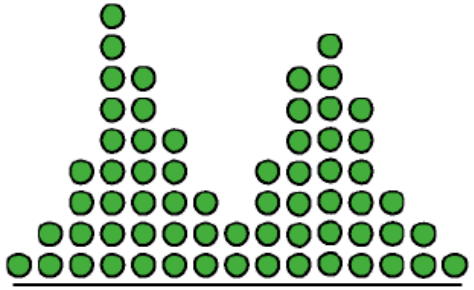
Number of Items per Order

# 6σ

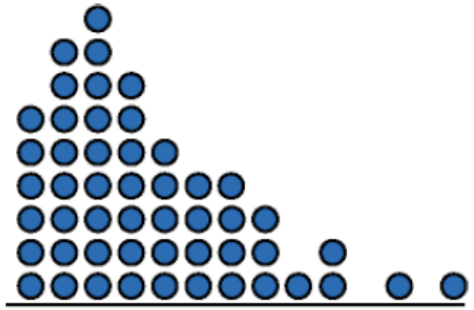

Maintenance Request Response time
Mode
March 1
Median
Target
Mode : 25.5
Number of Request Responses
45
40
35
30
25
20
15
10
5
0
20
21
22
23
24
25
26
27
28
29
30
31
Minutes
n = 266

# Typical Shapes and Patterns

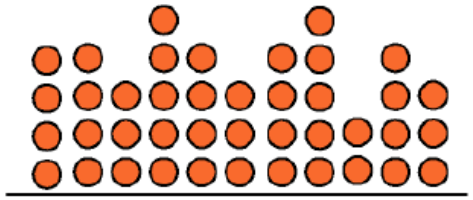
Normal distribution
(Symmetrical)



Bimodal distribution
(Two peaks in the data)



Skewed distribution
(Data clusters near one end,
tails off in the other direction)

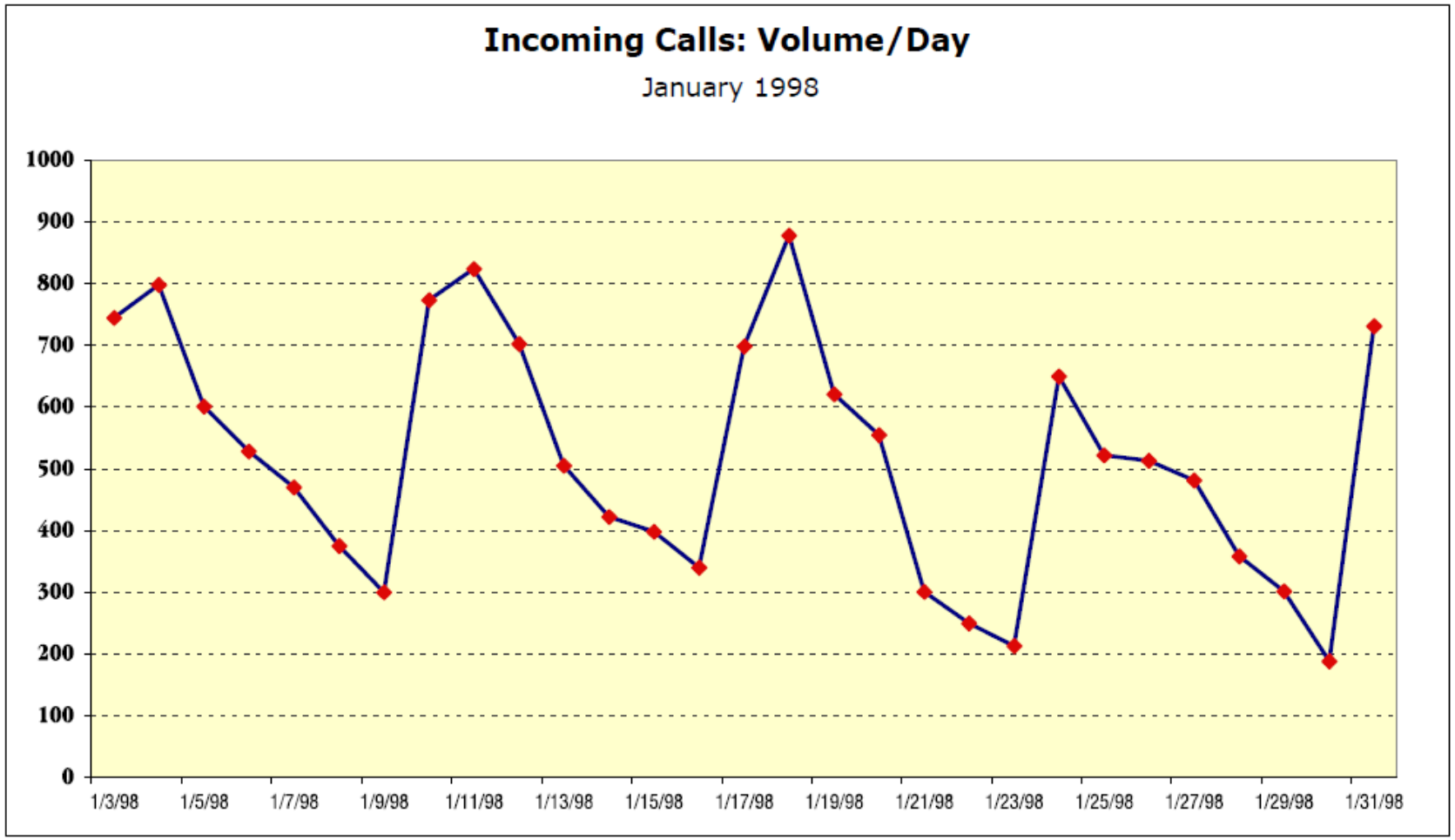


Evenly distributed data values
(This seldom occurs naturally)

# Run or Trend chart

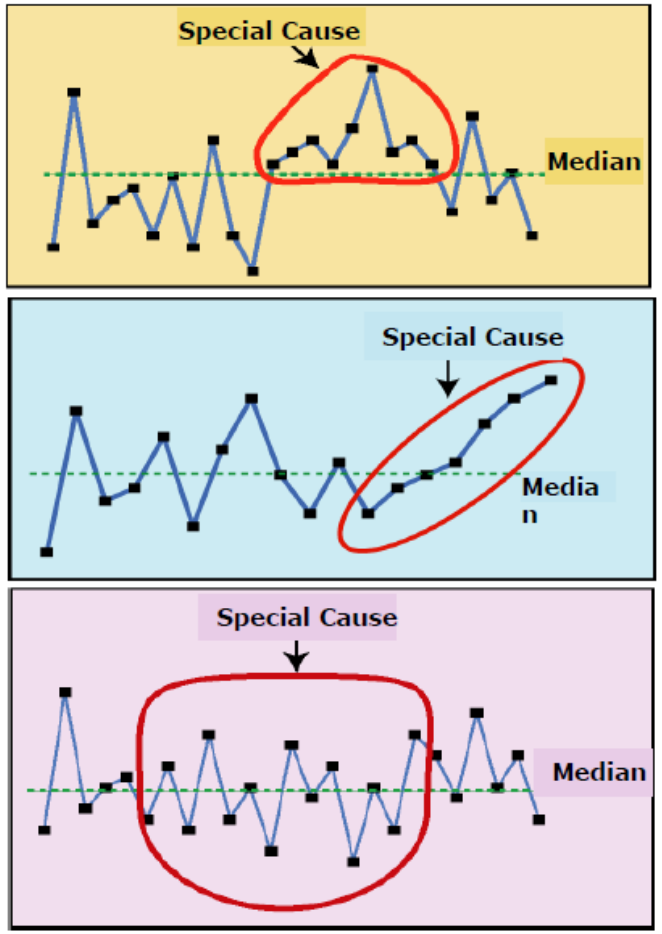
- Uses time-ordered data to see patterns
- Another way to see amount of “variation” in a process
- Helps differentiate between “common” and “special” causes of variation
  - Focuses on times of special interest/concern
- Valuable in ongoing monitoring of process

# Run Chart Sample

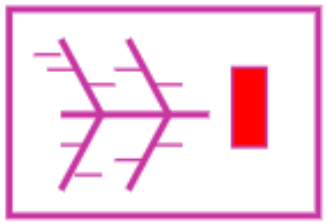


# Patterns

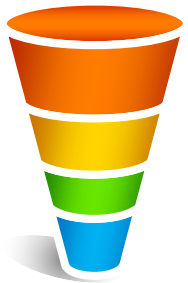
- **Shifts: Eight or more consecutive points on same side of median**
- **Trends: Seven or more points continuously increasing or decreasing**
- **Alternating Points: Fourteen or more consecutive points “up-and-down”**



# Tools



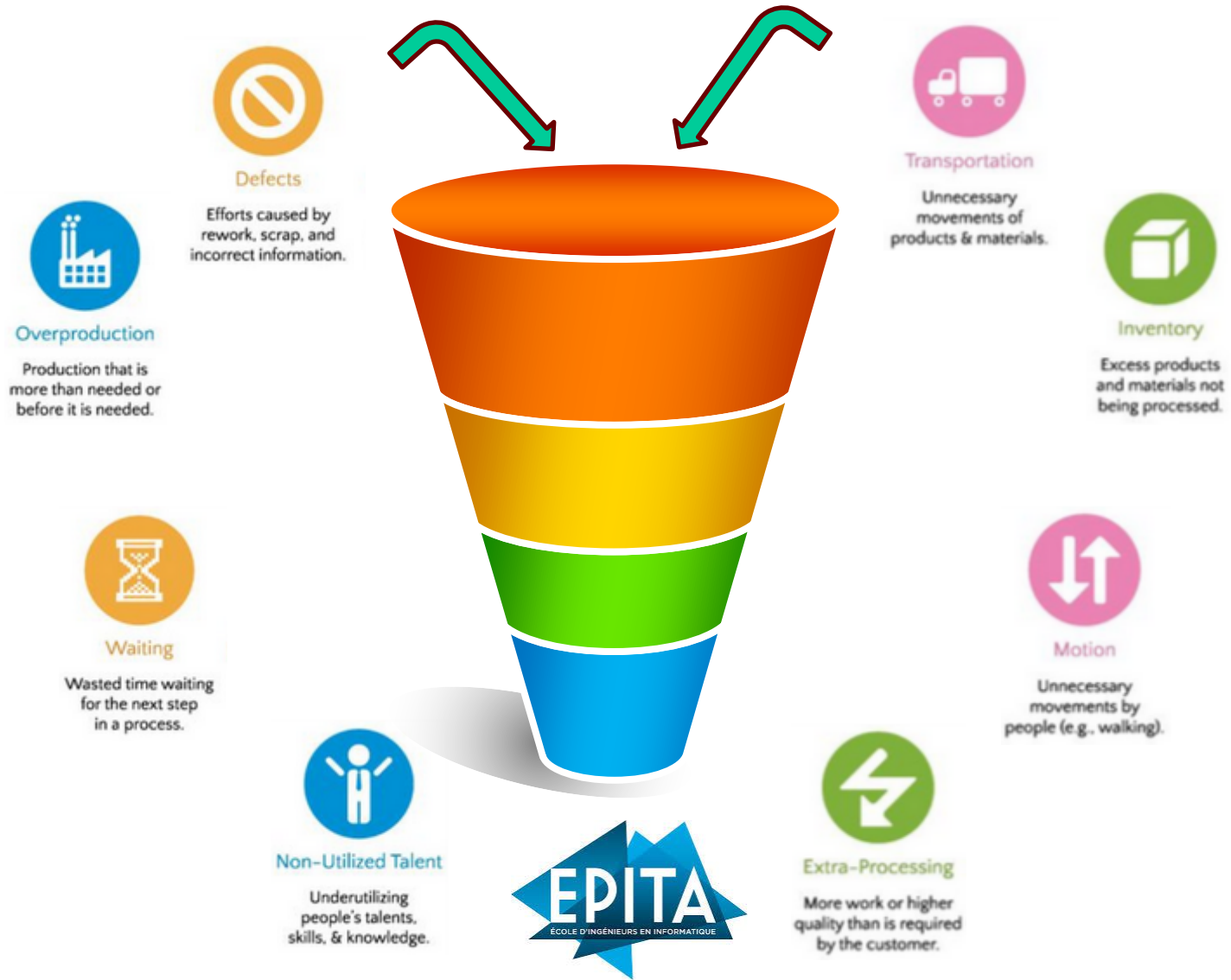

Fishbone of potential root causes



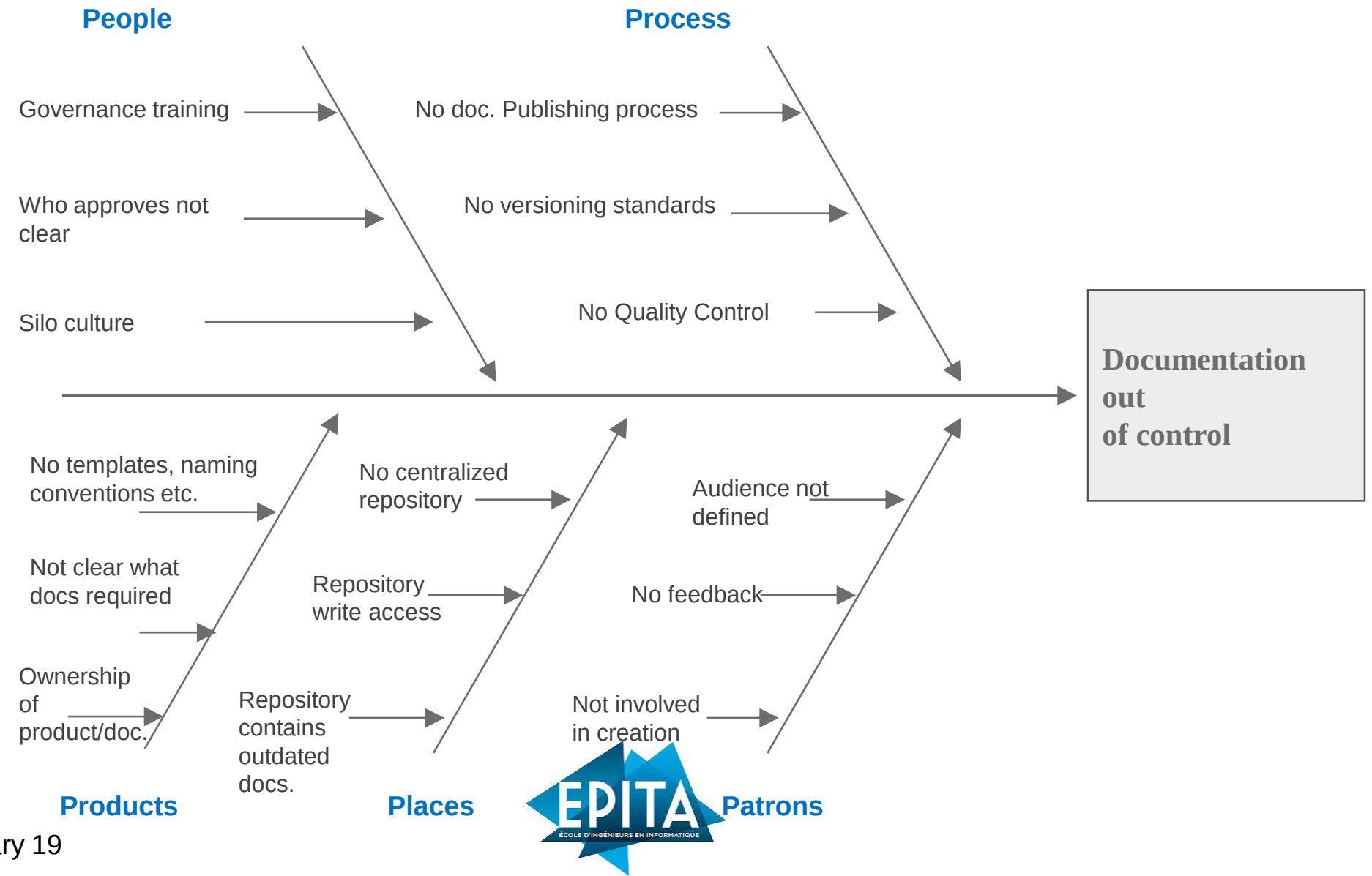
Identification of wastes

Most impactful root cause
(to deliver value if fixed)

# The 8 wastes


Defects
Efforts caused by rework, scrap, and incorrect information.
Transportation
Unnecessary movements of products & materials.
Overproduction
Production that is more than needed or before it is needed.
Inventory
Excess products and materials not being processed.
Waiting
Wasted time waiting for the next step in a process.
Motion
Unnecessary movements by people (e.g., walking).
Non-Utilized Talent
Underutilizing people's talents, skills, & knowledge.
Extra-Processing
More work or higher quality than is required by the customer.
EPITA
ÉCOLE D'INGÉNIEURS EN INFORMATIQUE

# Fishbone or Cause-And-Effect Diagram



# The 5 WHY's


https://www.youtube.com/watch?v=WZ32BZT9pnk

## Exercice


**My car runs out of gas on the highway**

# My car runs out of gas on the highway

- I run out of gas because I did not go to the last gas station
- Because I did not have my credit card with me
- Because it was in the cupboard at home
- Because the cupboard was locked
- Because I had not the second key
- Because the second key was in my wife’s car and I was going to my wife’s office to get the key