Data Analytics: How to Improve Your Process

Dr. Brian McGinley, Jr. CAPM, CTCM, CTPM

Learning Objectives

What are the desired outcomes?

- Understanding existing processes
- Introduce process changes to 1) improve quality, 2) reduce costs, or 3) accelerate schedules
- Most process improvement work focuses on defect reduction and prevention
- Process improvement always hinges on knowing the *point* of the process, who is (or ought) to be *involved*, and *who* the “customer” is

Process Improvement Goals

What questions should be asked along the way?

- “Why?” is the most important question to ask throughout the process.
- **Why** does our department exist?
- **Why** does this process exist?
- **Why** do we do it in this order?
- **Why** does this person need to approve this?
- **Why** are there so many steps?

Process Improvement Goals

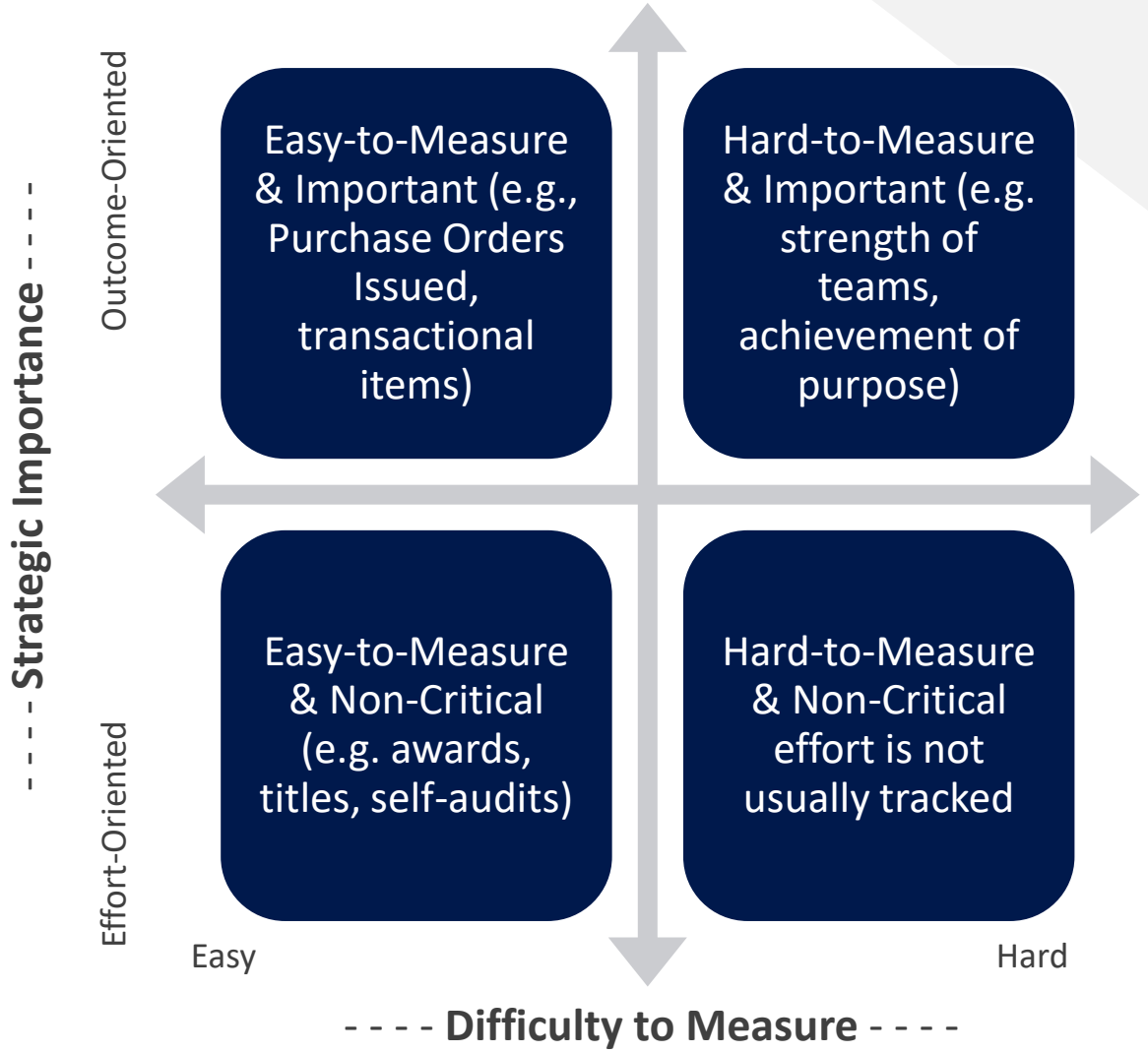
Verifiable Mission Success

- Departments exist to achieve their *few, uniquely vital* mission outcomes.
- Scorekeeping on those few outcomes is essential:
  - Data points
  - Transaction numbers
    - Dollar value
    - Number of Units
    - Complexity Factors

What We Measure: Important vs. Easy

Measuring Success

If the *easy-to-count* overshadows the *important-to-count*, then we will get too many easy things and not enough of the important ones



Process Improvement Goals

”We want to go electronic!” - Clarification

- **Digitization** - merely transfers bad processes and forms to computers, and humans still have to do the same work
- **Automation** - workflow is re-conceptualized, and then computers help do the work
  - Workflow tools
  - Docusign
  - Laserfiche
  - Macros, etc.

Process Improvement Stages

A continuing process of improvement

1. **Process Analysis** – modelling and quantitative analysis of existing processes
2. **Improvement Identification** – Quality, Cost, and Scheduling Bottlenecks
3. **Process Change Introduction** – modify process to remove bottlenecks
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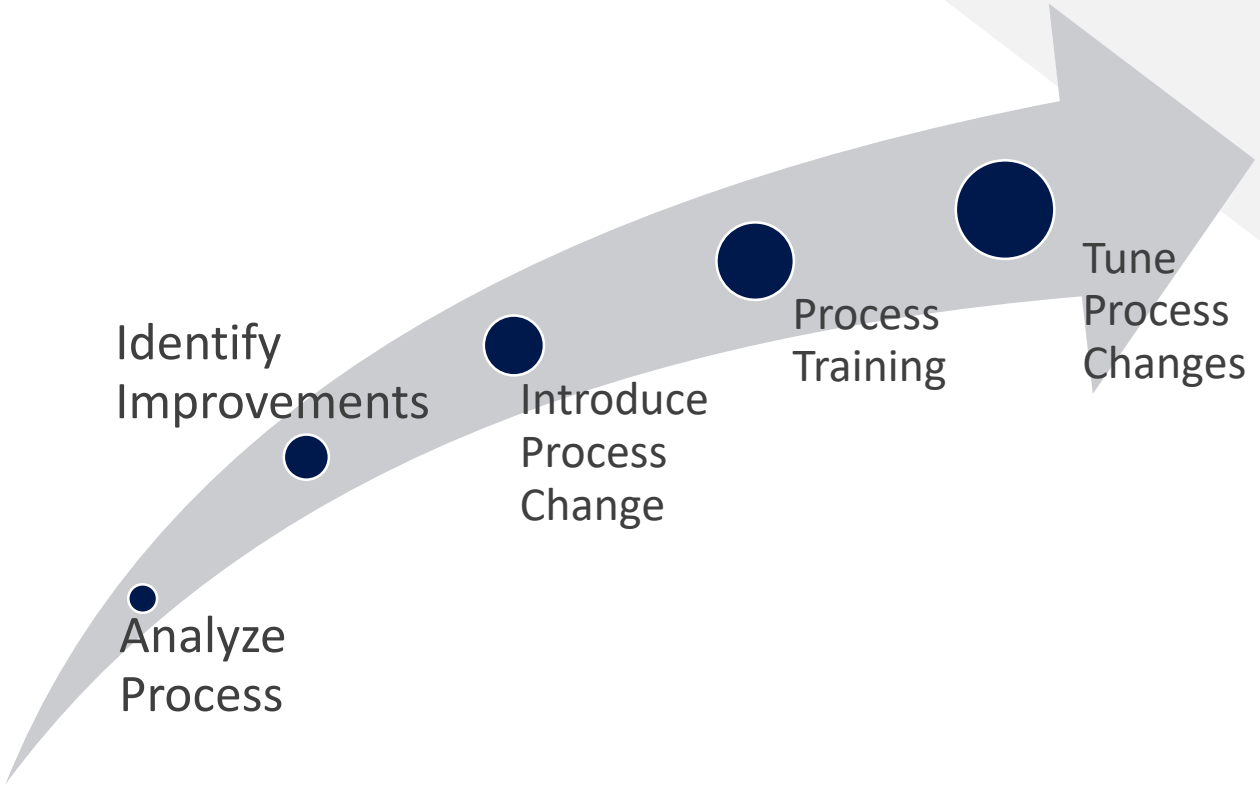


Process Improvement Outcomes

Process Measurement Goals

- Time taken to complete process activities (*calendar time to complete a milestone*)
- Resources required to complete processes or activities (*Labor Hours, raw materials, other inputs, etc.*)
- Number of event occurrences (*Number of defects*)

Process Improvement Terms

Process Measurement

- **Productivity** – Ratio of Output to Input
- **Efficiency** – Ratio of Actual Output to Standard
- **Cycle Time** – Measurement from Beginning to End
- **Run Time** – Product of Cycle Time and Batch Size
- **Throughput Rate** – Output Rate Over Time

Process Improvement Terms

Process Measurement

- **Buffering** – Storage Area Between Steps
- **Starving** – Activities Stop Because of No Work
- **Bottleneck** – Stage that Limits Productivity
- **Value-Added Time** – Useful Work Being Done

Process Improvement Tools

Process Measurement

- **First pass yield (throughput yield) =**

$$\frac{Number\ of\ Defect\ Free\ Units}{Number\ of\ Units\ Entering\ Process}$$

- This shows how many units pass through the steps and process without any errors *on the first pass*
- ***Note:*** cannot be computed until process is up and running for a period of time

Process Improvement Stages

Process Measurement

Step A: $\frac{90}{100} = .9000$ (90%)

Step B: $\frac{80}{90} = .8889$ (89%)

Step C: $\frac{75}{80} = .9375$ (94%)

Step D: $\frac{70}{75} = .9333$ (93%)

TOTAL: $.9000\ x\ .8889\ x\ .9375\ x\ .9333 = .7000$ (70%)

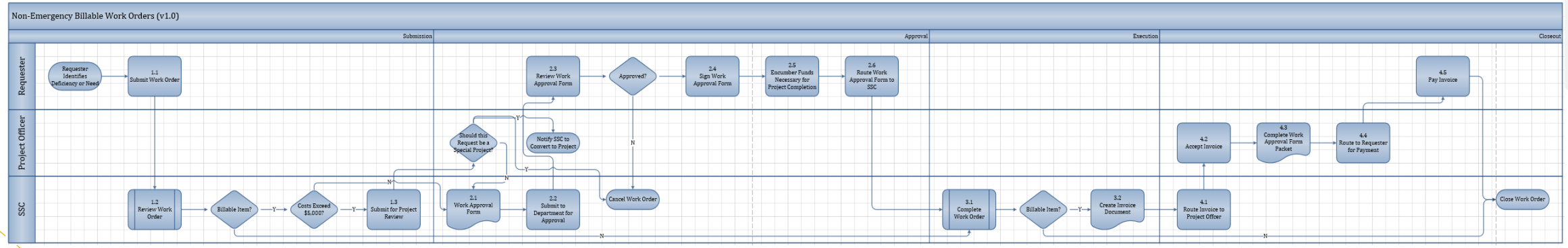
This means that only 70% of the inputs made it through the process without any errors

Process Improvement Tools

Flowchart

- Pictorial representation of a process
- Breaks down process into constituent steps
- Can be useful in identifying where errors are likely to be found in the system
- Easily see the number of handoffs, which can be one of the greatest contributors to inefficiency

Flowchart



- Swim lanes indicate responsibility
- Decision Points (Diamonds) show where a process can be split
- Documents and deliverables can be used to show what users produce

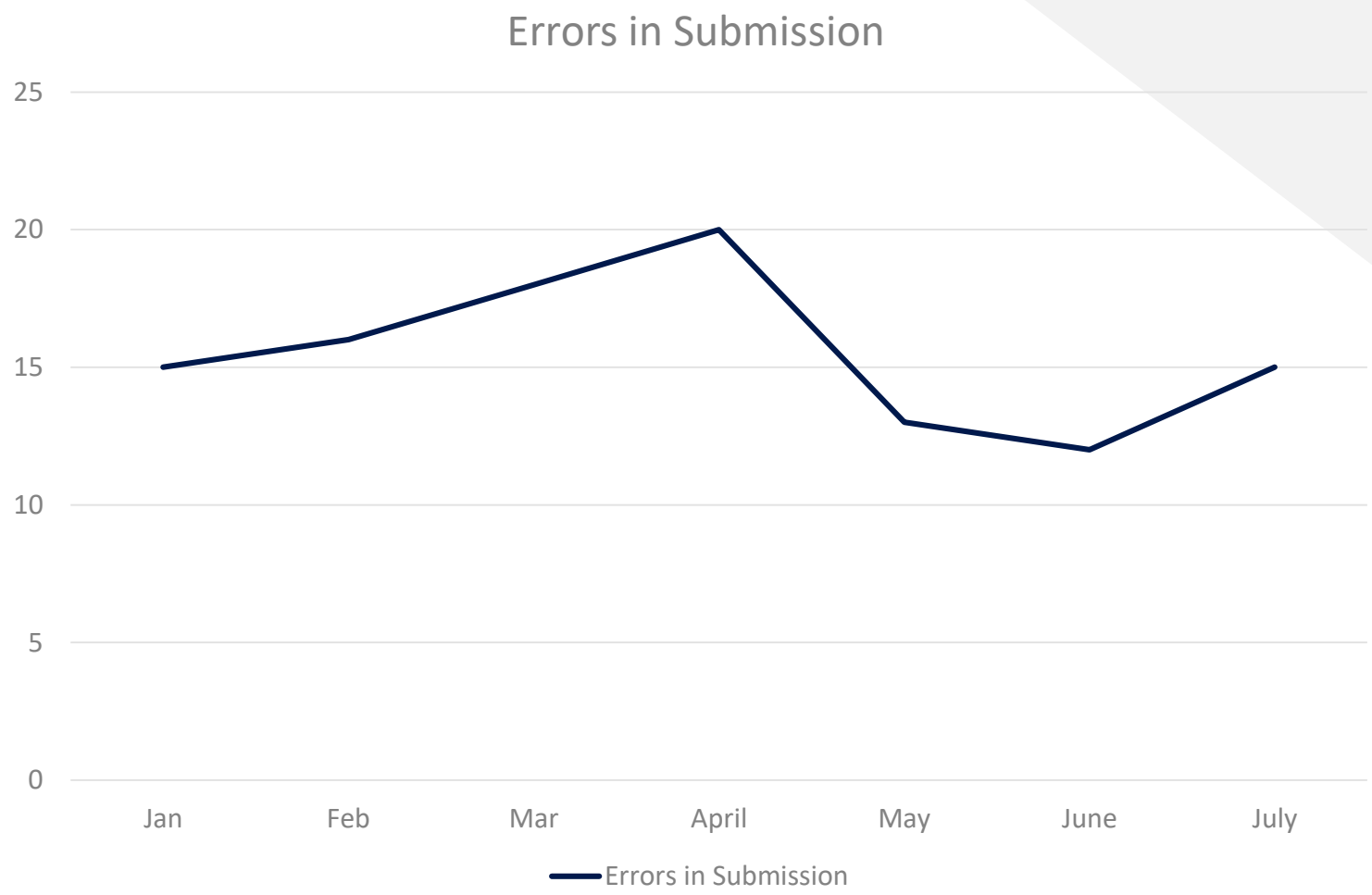
Process Improvement Tools

Run Chart

- Line graph showing performance of dependent variable (y) over time (x)
- Best used for trend analysis (*arrival of defects during each step*)
- Can plot cumulative dependent variables (S curves)

Run Chart

- How many documents were submitted with errors during a given month?
- A percentage of errors *vs* submitted documents will give an error rate
- What happened in May that errors decreased?
  - Training Event
  - Staff member leaving
  - Errors weren't caught



Process Improvement Tools

Check Sheet

- A check sheet is a structured, prepared form for collecting and analyzing data. Graphical representation of the inputs and control variables for a single problem
- When to use:
  - When data can be observed and collected repeatedly by the same person or at the same location.
  - When collecting data on the frequency or patterns of events, problems, defects, defect location, defect causes, etc.

Check Sheet

Check Sheet Procedure:

- Decide what event or problem will be observed. Develop operational definitions.
- Decide when data will be collected and for how long.
- Design the form. Set it up so that data can be recorded simply by making check marks or X's or similar symbols and so that data do not have to be recopied for analysis.
- Label all spaces on the form.
- Test the check sheet for a short trial period to be sure it collects the appropriate data and is easy to use.
- Each time the targeted event or problem occurs, record data on the check sheet.

Telephone Interruptions

Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number	𝍸	||	|	𝍸	𝍸 ||	20
Info request	||	||	||	||	||	10
Boss	𝍸	||	𝍸 ||	|	||||	19
Total	12	6	10	8	13	49

Process Improvement Tools

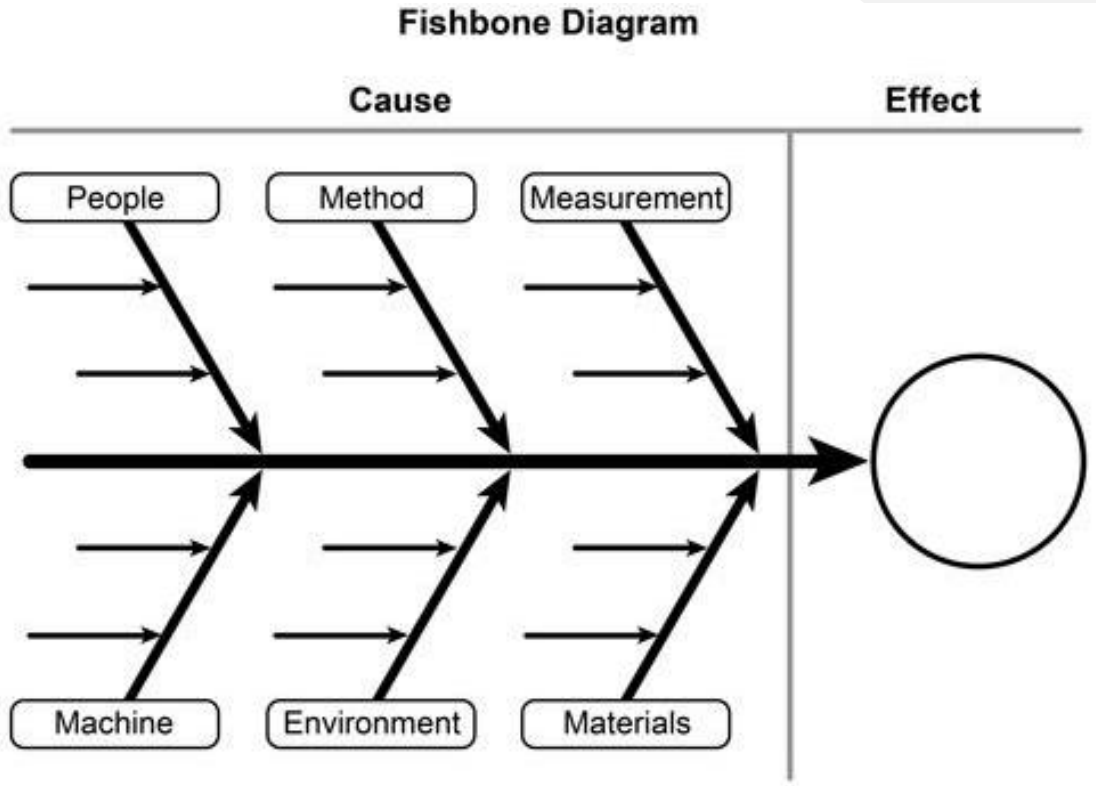
Cause and effect (fish bone) diagram

- Shows effect between quality variable and the factors affecting it
- Graphical representation of the inputs and control variables for a single problem
- When to use:
  - When identifying possible causes for a problem.
  - Especially when a team's thinking tends to fall into ruts

Cause and Effect/Fishbone/Ishakawa

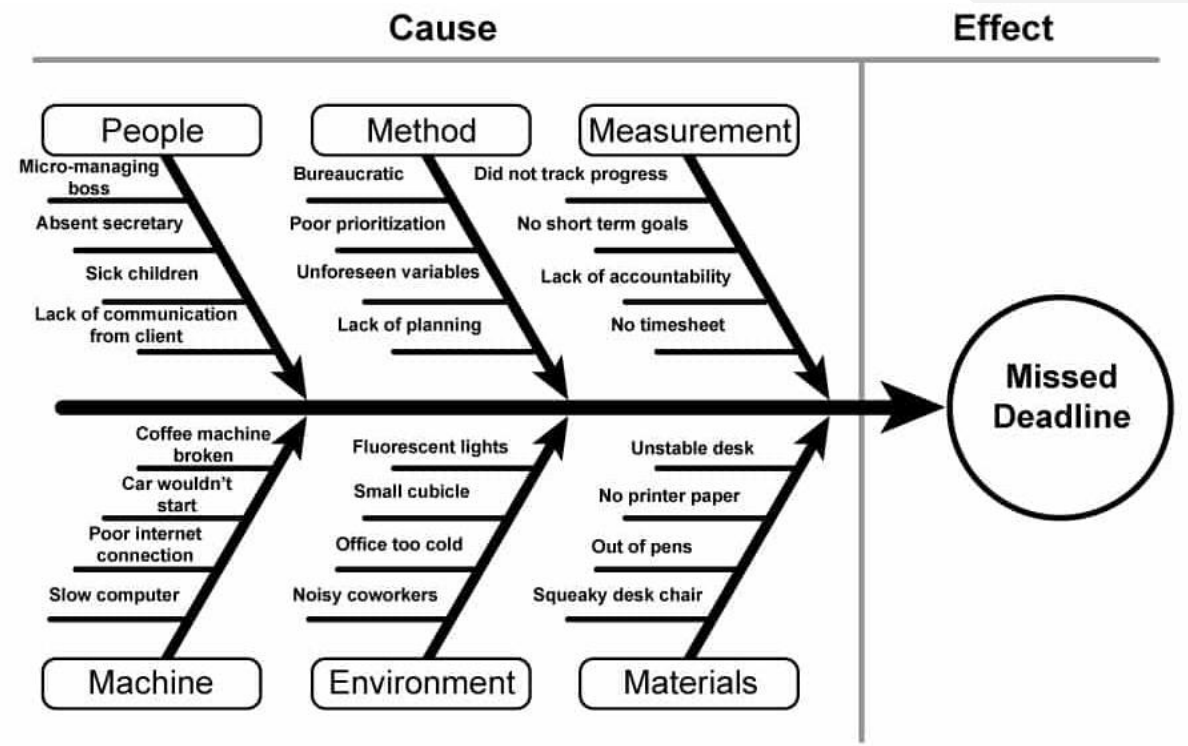
Materials needed: flipchart or whiteboard, marking pens.

1. Agree on a problem statement (effect). Write it at the center right of the flipchart or whiteboard. Draw a box around it and draw a horizontal arrow running to it.
2. Brainstorm the major categories of causes of the problem. If this is difficult use generic headings:
    1. Methods
    2. Machines (equipment)
    3. People (manpower)
    4. Materials
    5. Measurement
    6. Environment



Cause and Effect Exercise

3. Write the categories of causes as branches from the main arrow.
4. Brainstorm all the possible causes of the problem. Again ask “why does this happen?” about each cause. Write sub–causes branching off the causes. Continue to ask “Why?” and generate deeper levels of causes. Layers of branches indicate causal relationships.
5. When the group runs out of ideas, focus attention to places on the chart where ideas are few



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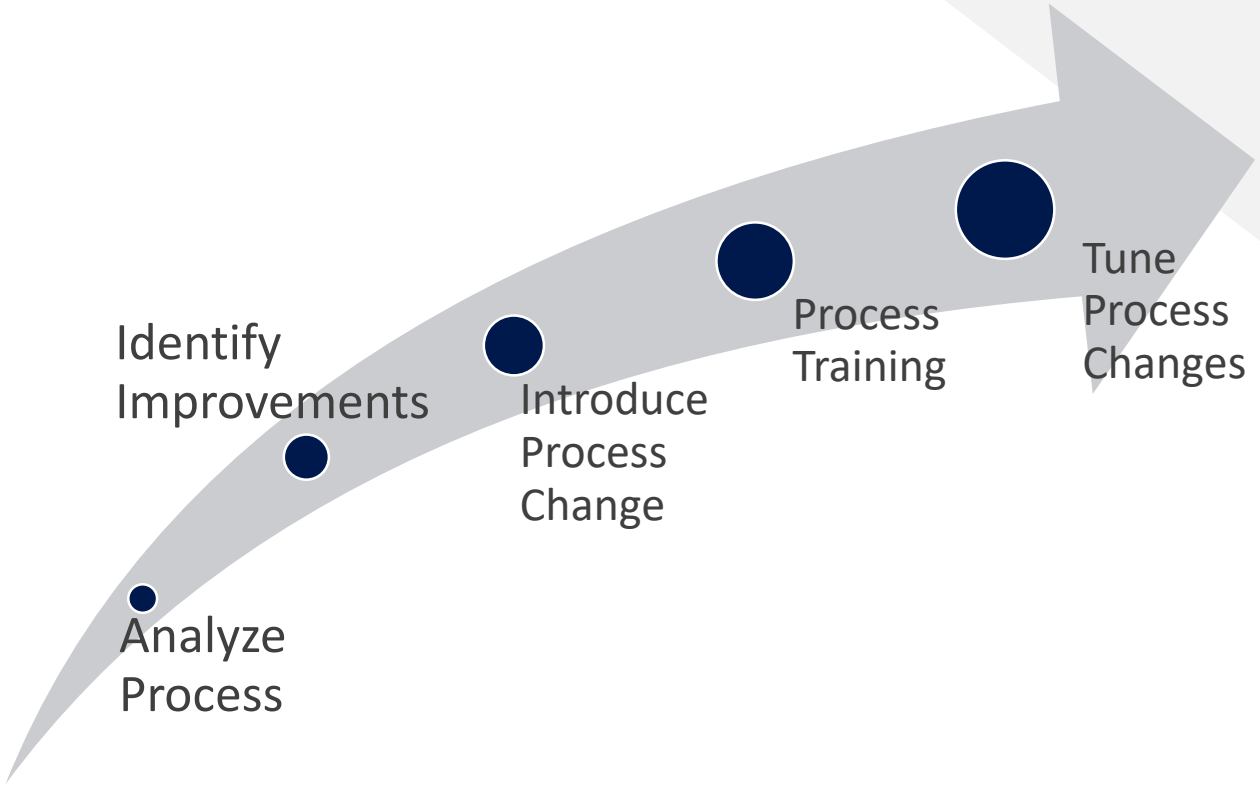

Process Improvement References

Additional Resources/References

- American Society for Quality (ASQ) (2018) – Process Improvement Tools: http://asq.org/learn-about-quality/process-analysis-tools/overview/overview.html
- Department of Defense (2018) – *Improving Air Force Squadrons: Recommendations for Vitality*

Thank *You*.

Brian McGinley

903 886 3000

Brian.mcginley@tamuc.edu

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