SECTOR SKILLS STRATEGY IN ADDITIVE MANUFACTURING

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CU 36: Coordinating the AM Process (Pilot)

TOPIC 8: Dealing with non conformance

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FOR SAM PILOT ATTENDEES AND TRAINERS ONLY

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Topics covered include…

- Route cause analysis
- Fish bone diagram
- 5 whys
- Implementing corrective action

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Things ~~can~~ will go wrong in AM

- Build failures and defective parts are very common
- Process and part monitoring should identify problem quickly
  - Avoid defective parts being sent to customer
  - Changes the manufacturing schedule
  - Quarantine machine/materials until source of problem is understood

Then …

rapid and concerted action needs to take place to identify the nature of the problem, the **root cause** and **corrective action** taken.

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Root cause analysis

- "root cause" refers to the primary reason for the problem (build failure, defective parts etc.)

- Common examples of root cause analysis in manufacturing include methodologies such as **"Fishbone"** diagram and the **"5 Whys".**

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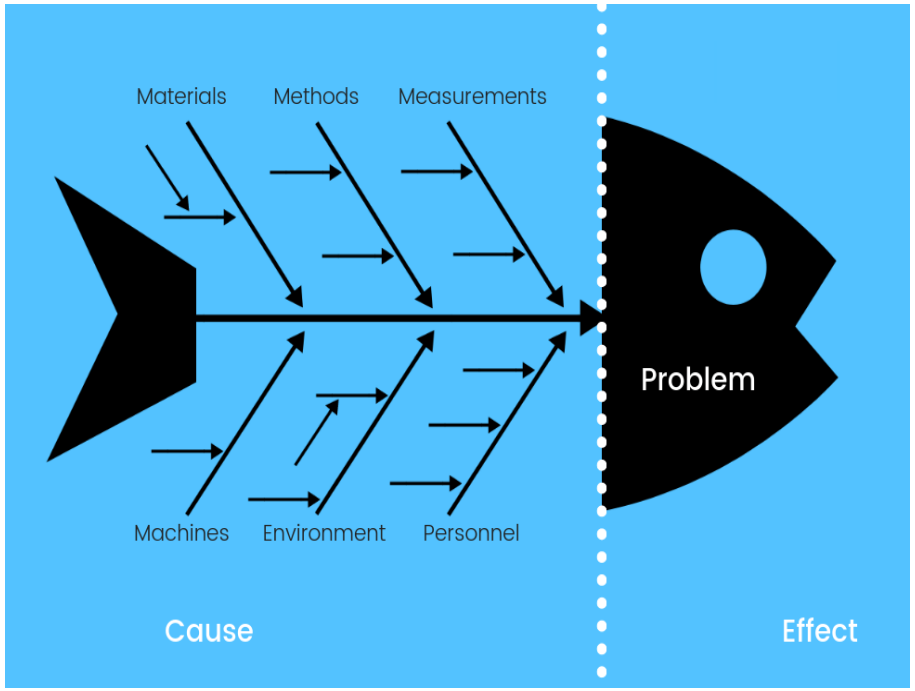
Fish Bone Diagram

- Structured approach to identify possible causes of a problem.
- Assess potential causes to identify the actual cause of the problem.



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Fish Bone Diagram

- Problem statement is the head of the fist
- Identify potential causes of the problem;
    - Methods (process)
    - Machines (equipment)
    - People (manpower)
    - Materials
    - Measurement
    - Environment
- Write the categories of causes as branches from the main arrow.
- Assess the potential causes and also write sub-causes branching off the causes.

- Continue to ask "Why?" and generate deeper levels of causes. Layers of branches indicate causal relationships.

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Examples

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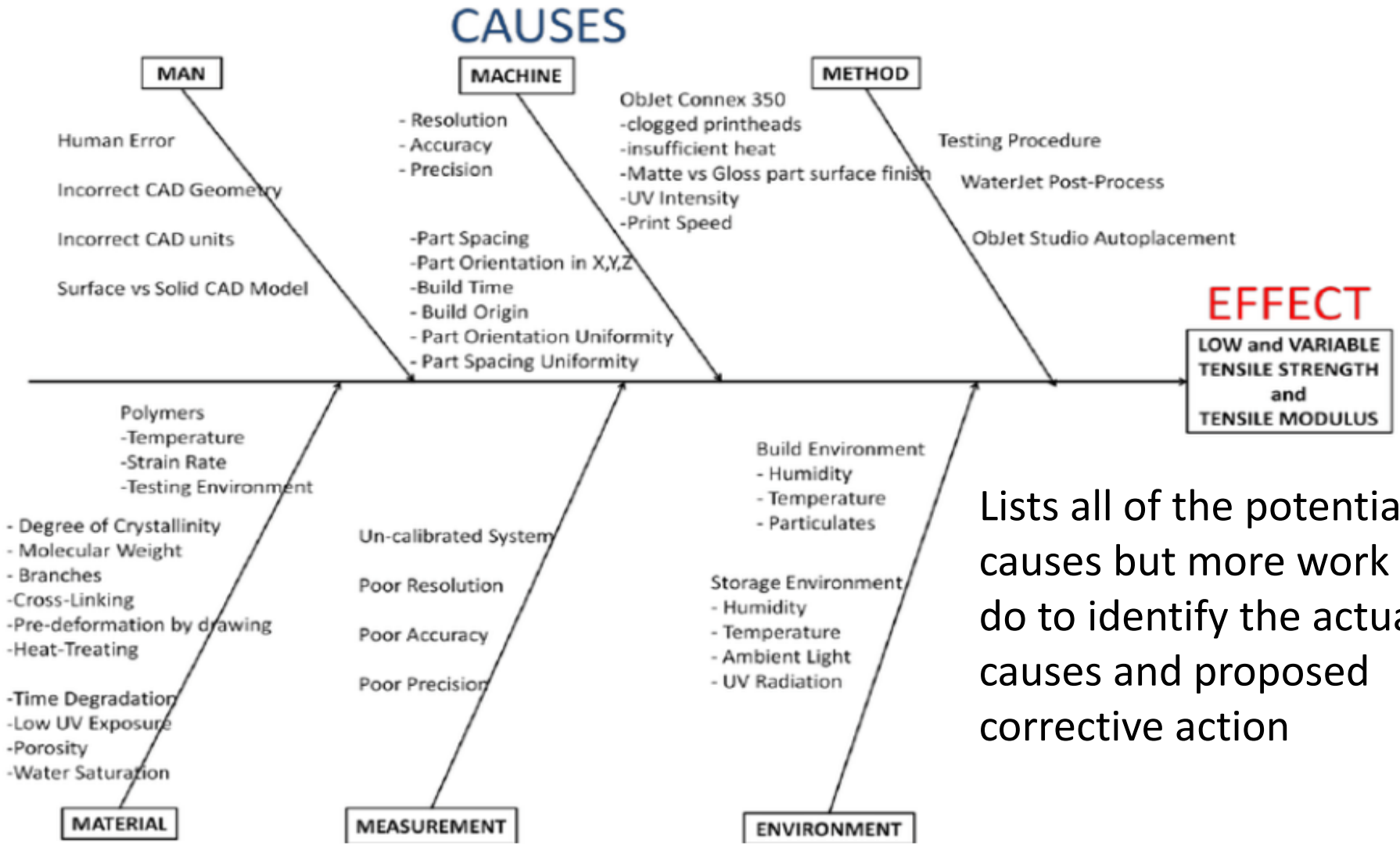

Lists all of the potential causes but more work to do to identify the actual causes and proposed corrective action

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5 Whys

- simple and effective **tool** for identifying the root cause of a problem ….by asking a sequence of "**Why**" questions. ...
- Once you have identified the root cause then corrective action to prevent reoccurrence can take place.

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Example:

Caught speeding ….

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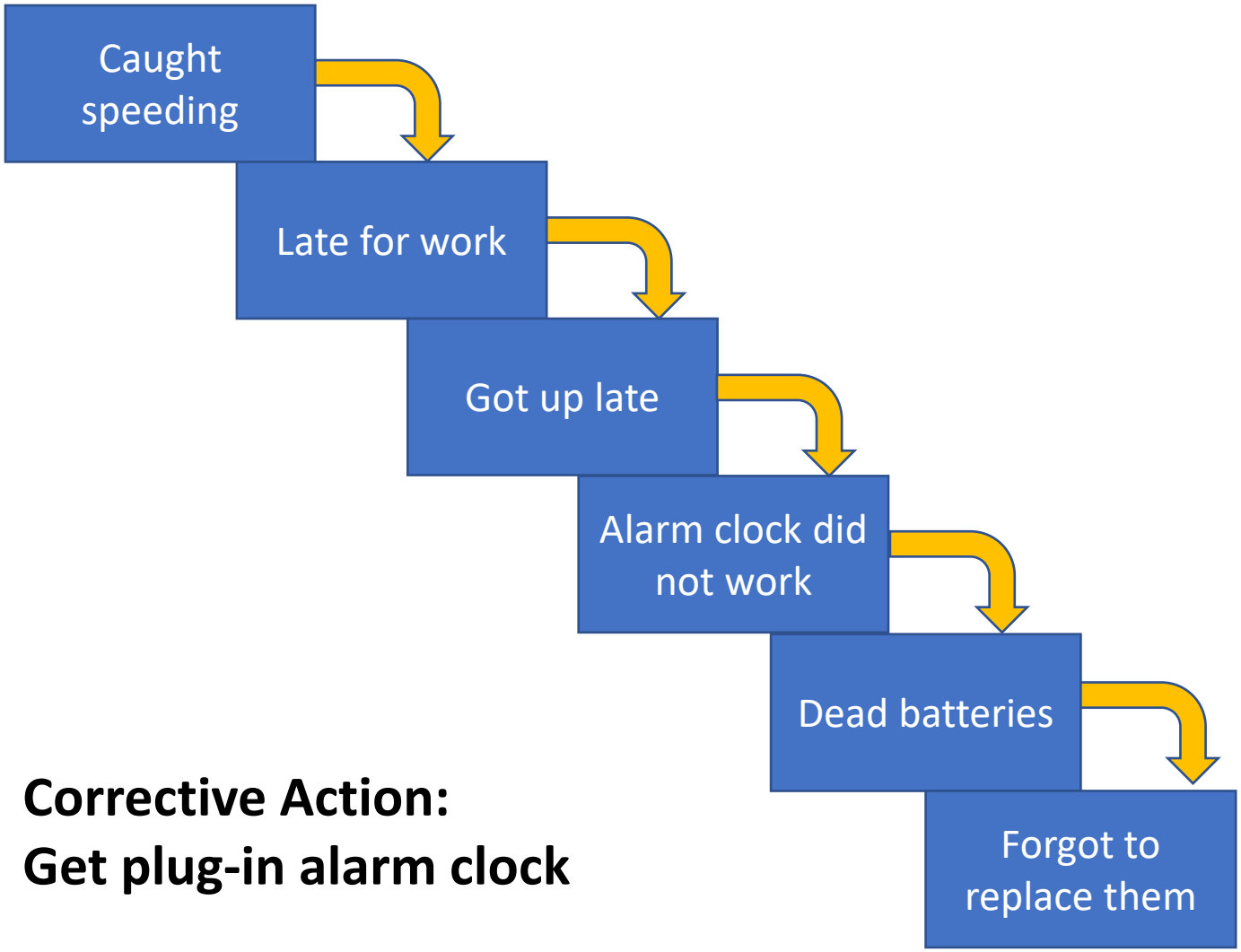

Corrective Action:
Get plug-in alarm clock

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Dealing with Recurring Problems

- One of the most time-consuming (and potentially expensive) problems is when a nonconformance continues to occur. When the same issue happens more than once, it indicates a problem in the corrective action process. When corrective action Additive Manufacturing processes fail, it's typically because of one of two reasons:

1. Investigation failed to uncover the actual root cause that led to the defect.
2. Corrective action taken was ineffective in solving the problem.

https://www.bright-am.com/corrective-action-additive-manufacturing/

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5 Steps for Effective Corrective Action Additive Manufacturing Managements

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1. Identify the problem

First - identify the problem and most likely

Some corrective actions don't require a full-blown investigation. There may be obvious solutions that can resolve the issue. Others may take an in-depth analysis to find the root cause.

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2. Identify the root cause

In any manufacturing operation, avoid treating just the symptoms. You need to treat the underlying problem. That said, you'll likely need to take a deep dive to uncover and identify the patterns. Examine each step in the process. You may find that you need to make changes in processes, training, raw materials, or suppliers.

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3. Execute the Corrective Action Additive Manufacturing Plan

- Once you've identified the root cause and created the plan to address the underlying problem, you need to put the plan in motion and document the changes. Your audit trail should capture what changes are made, and all paperwork needs to be updated so the information stays current on the production floor.
- Many Additive Manufacturers will do all of the above processes but fail to take the next crucial step: checking for effectiveness.

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4. Check for Effectiveness

- Once your corrective action plan has been put in place, it's crucial to continue to evaluate results against performance goals. If the problem hasn't been fixed, you'll need to stop again and reassess risk.

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5. Standardize and Document

- After you have confirmed that the corrective action has done its job and eliminated the nonconformance, you need to make sure to standardize your procedures, update your documentation, and communicate it to everyone involved in the production process. Changes made through corrective actions need to be part of your standard operating procedures going forward.
- These five steps will work as a framework for you to diagnose, implement, and measure your corrective action. Depending on your compliance needs, you may need to follow an even more formal process.

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