Defect Prevention

Dr. Mark C. Paulk

SE 4367 – Software Testing, Verification, Validation, and Quality Assurance

Defect Prevention

The activities involved in identifying defects or potential defects and preventing them from being introduced into a product. (Software CMM)

Causal analysis and resolution…
Root cause analysis…

"If you want more effective programmers, you will discover that they should not waste their time debugging, they should not introduce the bugs to start with."

- ***Edsger Dijkstra, "The Humble Programmer," 1972.***

CMMI-DEV v1.3 Support – Level 5 CAR

Causal Analysis & Resolution

Identify causes of selected outcomes and take action to improve process performance.

Specific Goals

1) **Determine causes of selected outcomes.**
2) **Address causes of selected outcomes.**

"Defects" in CMMI v1.2 became "selected outcomes."

Systemic Defects in Inspections

Causal analysis at the end of the inspection

What "systemic defects" should be prevented by process changes?

Target: 90% of systemic defects fixed within five working days.

Michael Fagan, 2002

Causal Analysis Tools

Pareto chart

- **80% of the defects are in 20% of the modules**

Cause-and-effect diagrams

5 why's

and so forth…

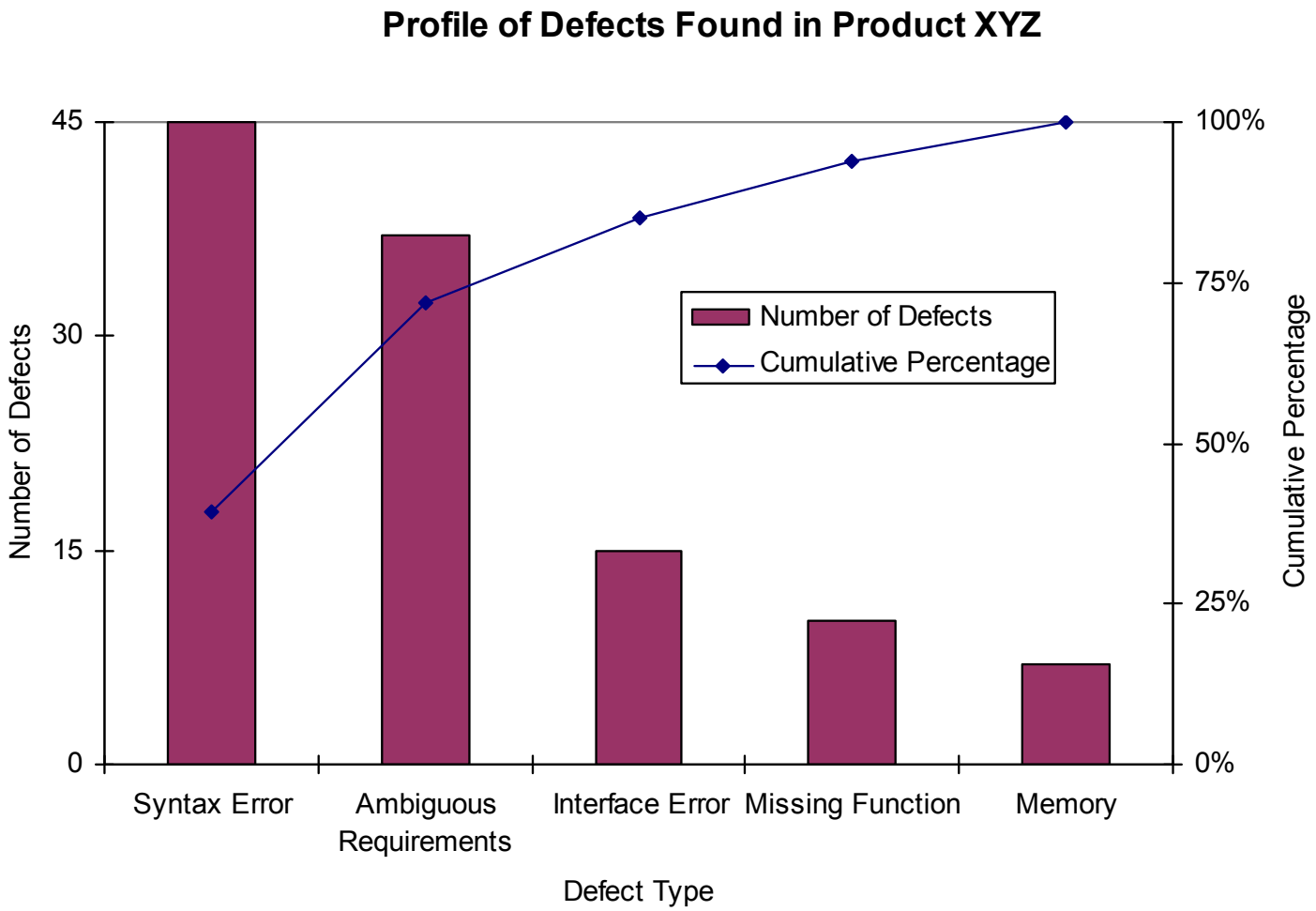
Pareto Charts

Special form of a bar chart.

Interpretation based on the "80/20 rule."

Help focus investigations by ranking problems, causes, or actions in terms of their amounts, frequency of occurrence, or economic consequences.

Pareto Chart Example



About Pareto Charts

What if the 80/20 rule does not apply?

If not, you will see a "flat Pareto."

Possible actions to consider

- **counting a different attribute, while maintaining the same stratification**
- **re-stratifying - use a different classification scheme**
- **use a different attribute of the process under study**

Cause-and-Effect Diagrams

Sometimes called "fishbone diagrams" or Ishikawa diagrams, after the person credited for their popularization.

Allow you to probe for, map, and prioritize a set of factors that are thought to affect a particular process, problem, or outcome.

They are especially helpful in eliciting and organizing information from people who work within a process and know what might be causing it to perform the way it does.

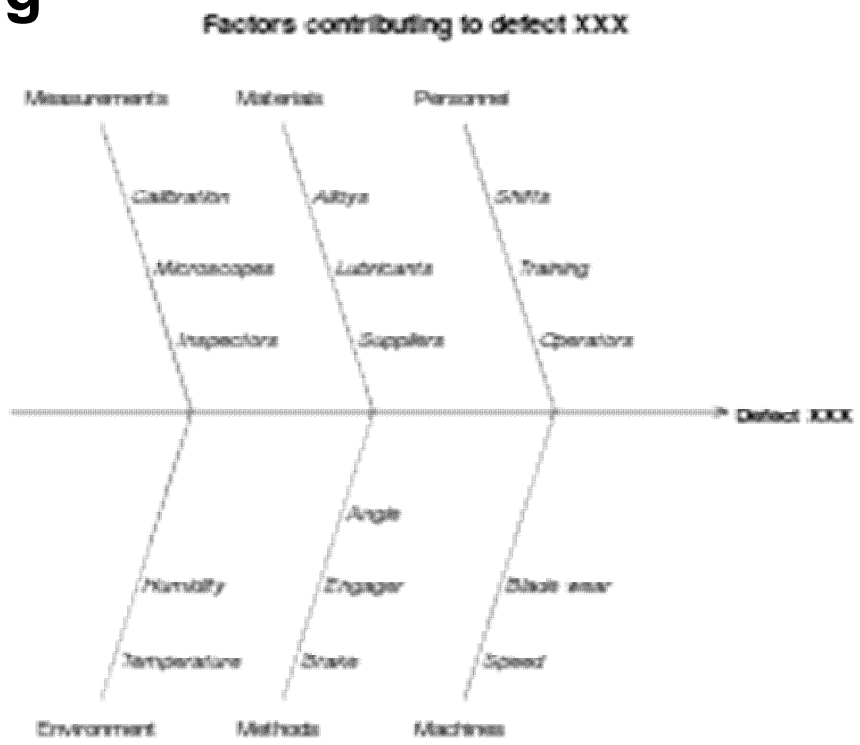
Ishikawa Diagram

6 Ms used in manufacturing

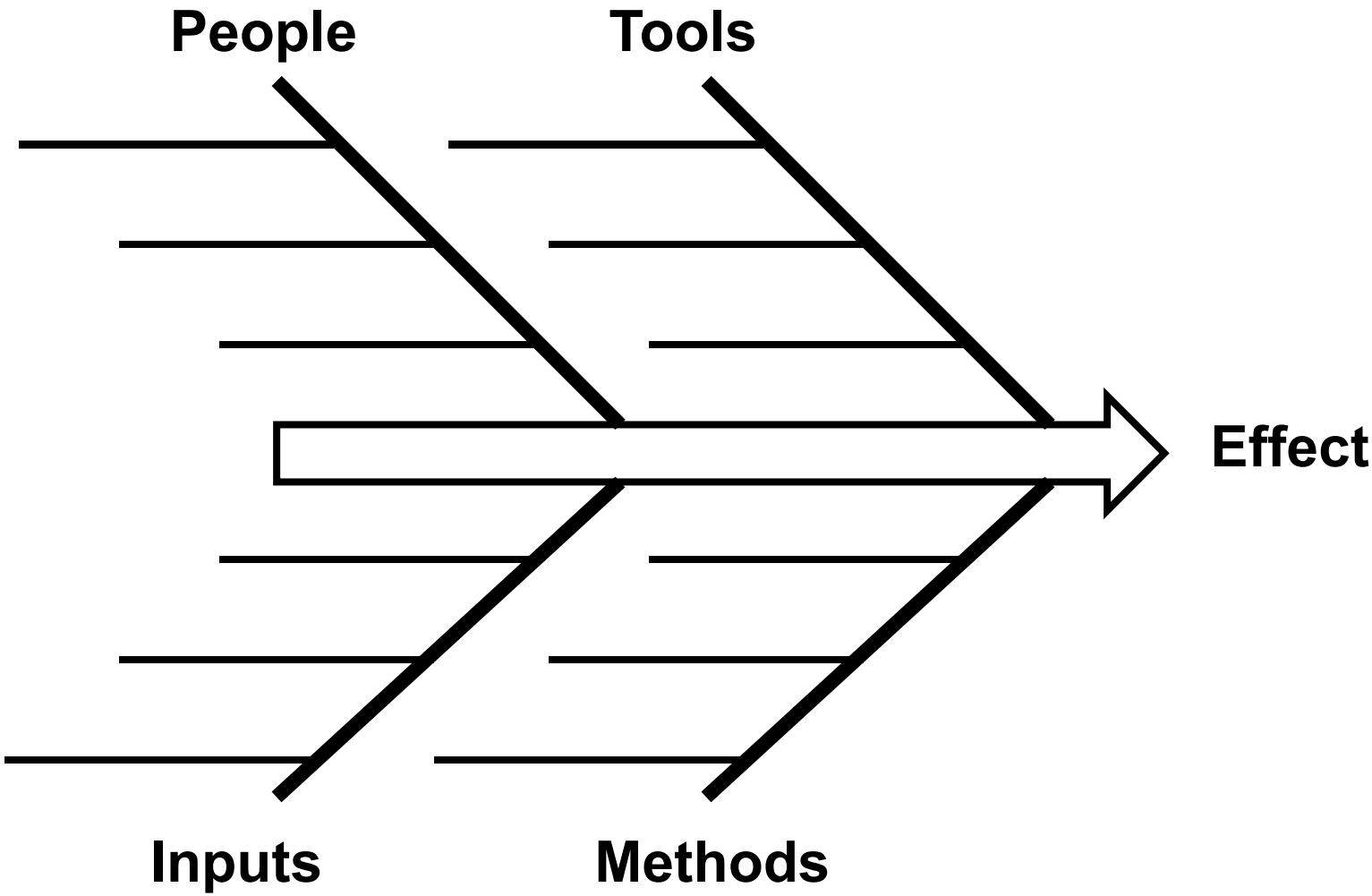
- **People**
- **Methods**
- **Machines**
- **Materials**
- **Measurements**
- **Environment**

7 Ps used in marketing…

5 Ss used in services…

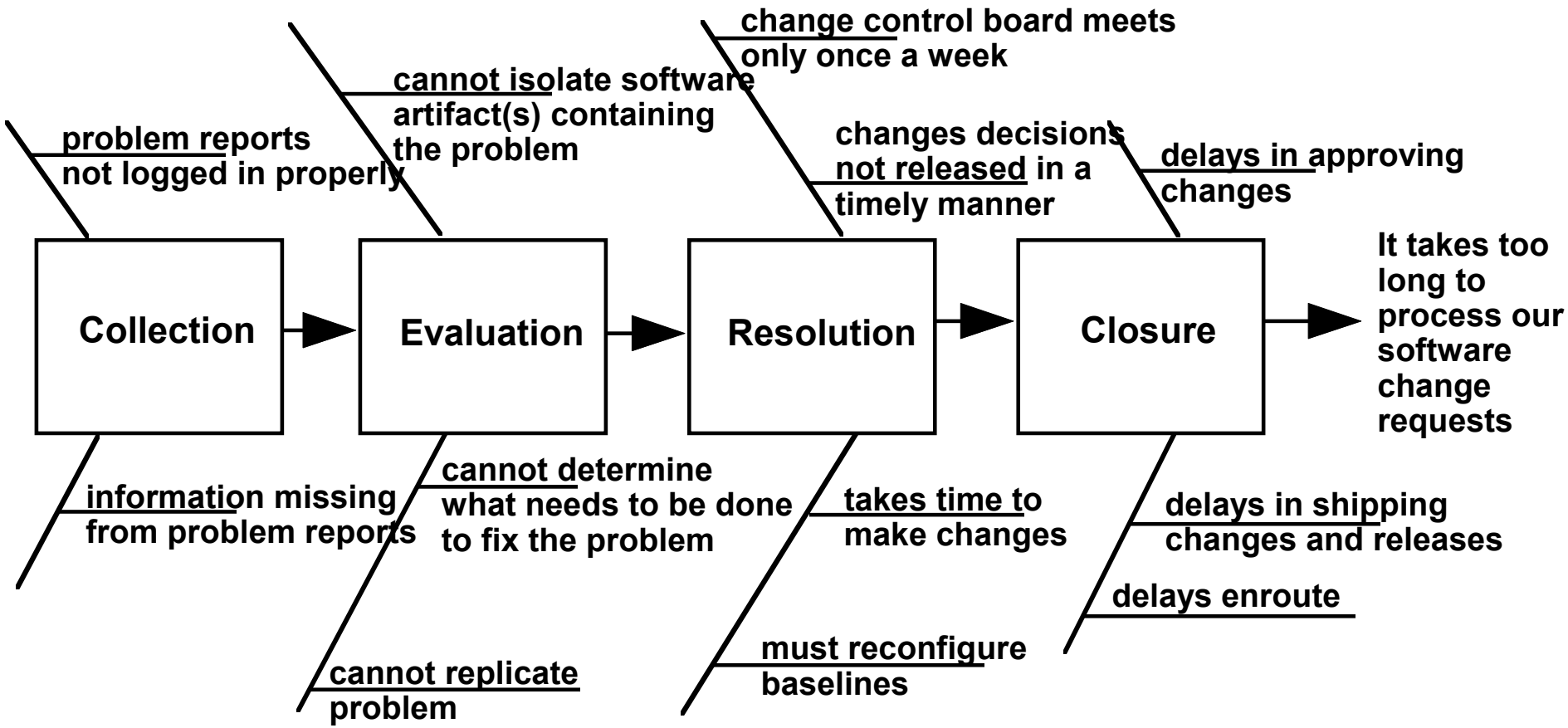


A Software Cause-and-Effect Diagram



Cause-and-Effect Diagrams

Process-Oriented Example



5 Why's

An iterative question-asking technique used to explore cause-and-effect relationships underlying a particular problem.

- **avoid assumptions and logic traps**
- **trace the chain of causality from the effect through any layers of abstraction to a root cause**

"5" is an empirical observation on the number of iterations typically required.

The *real* root cause should point toward a process that is not working well or does not exist.

- **people do not fail, processes do**

Questions and Answers