

Process Mistakes (McConnell)

- Overly optimistic schedules
- Insufficient risk management
- Contractor failure
- Insufficient planning
- Abandonment of planning under pressure
- Wasted time during fuzzy front end
- Short-changed upstream activities

More Process Mistakes

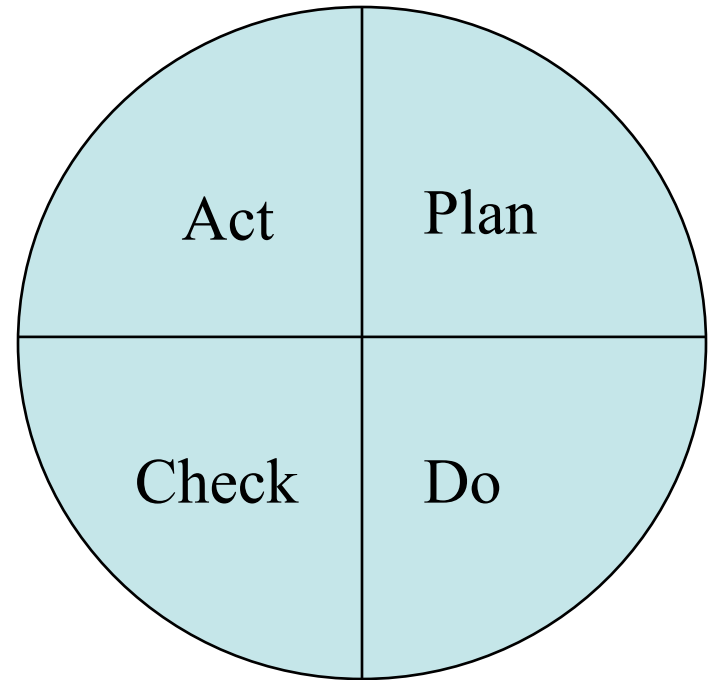
- Inadequate design
- Short changes quality assurance
- Insufficient management controls
- Premature or overly frequent convergence
- Omitting necessary tasks from estimates
- Planning to catch up later
- "Code-like-hell" programming

McConnell Fixes

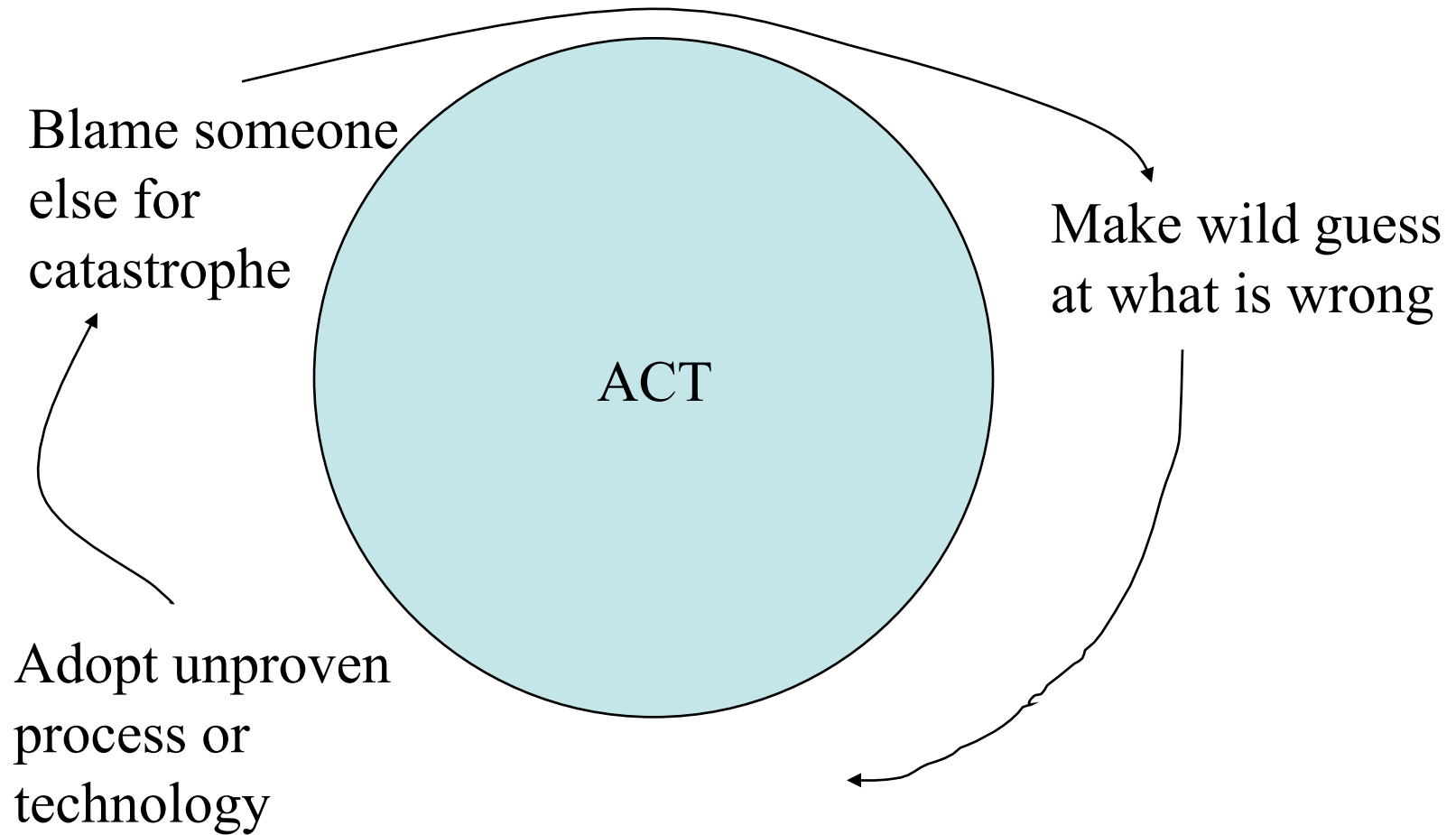
- Identify and fix classical mistakes
- Miniature milestones
- Milestone-based schedule
- Track schedule meticulously
- Record reasons for missed milestones
- Recalibrate early and often
- Don't commit to a new schedule until you can do so meaningfully
- Manage risks painstakingly

Process Improvement (Shewart Cycle)

- **Plan**
 - What and why?
- **Do**
 - How, when, and how much?
- **Check**
 - How will you know it worked?
- **Act**
 - How do you plan to fully adopt?



The Dilbert Cycle



Plan

- Identify problem or opportunity
- Vision
 - Where do you want to be?
- Describe the current process
- Is the process in control? Is it repeatable?
- Identify possible weaknesses
- Strategic impact
 - Cost / benefit analysis, how effort supports core-competence, risk of not doing

Do

- Determine what changes might help
- Develop or purchase an evolution plan
- Implementation tactics
 - Major deliverables, organization maturity considerations, key role of infrastructure, coordination with other groups, timing to match user projects, hand-off criteria
- Select and implement a change on a pilot project
- People and resources
 - Sponsor and champion roles, user partners, people and expertise needed, hardware, software, space
- Schedule risks, contingency plans

Check

- Measure effect of change
 - Baseline measurement, prechange environmental characteristics, expected effect
- Postproject review, degree of adoption
 - Percentage of engineers using improvement, range of uses, maturity of usage

Act

- Adopt across organization
- Support strategy
 - Infrastructure changes, documentation, training, consulting, packaging, maintenance, feedback
- Continue cycle

Metrics and Measurement

Get the data first,
then distort it with your judgment.

--Mark Twain

You can't control what you can't measure.

--Tom Demarco

If you don't know where you are going any map will do,
If you don't know where you are, a map won't help.

--Watts Humphrey

Getting the data

How do we decide what data to collect?

- **Goal, Question Metric (GQM) (Basili)**
 - Goal, e.g. reduce defects to 6/KLOC in code
 - Question, e.g. what is the defect rate now?
 - Metric, e.g. defect count per KLOC

Key Metrics

- Lines of code
- Staff months
- Calendar months
- Defects

Defect Analysis

- Origin (where)
 - Requirements / specification, design, code, environment support, documentation
- Type (what)
 - Next slide
- Mode (why)
 - Missing, unclear, wrong, changed, better way

Defect Types

- **Requirement / analysis:** functionality
- **Specification / design:** HW / SW / User interfaces, functional description
- **Design:** Communication, data definition, module design, logic description, error checking, standards
- **Code:** Logic, computation, data handling, module interface implementation, standards
- **Environment:** Test SW, Test HW, development tools, integration SW

Root Cause Analysis

- Determination of the underlying process deficiency that causes a class of product defects
 - Collect defect data
 - Determine causes
 - Organizational buy-in (tie to business goals)
 - Assign responsibility
- Variations
 - One-shot, postproject, continuous

One-Shot Root Cause Analysis

(Requires prior defect data collection but no prior causal analysis)

- Train on defect analysis; indicate goals
- Select 50-75 defects randomly
- Classify; pie chart
- Pick top two defect types; fishbone diagram
- Improvement recommendations
- Present results; assign responsibility; implement change

Postproject Root Cause Analysis

(Prior understanding of defect patterns)

- Premeeting
 - Identify primary business goal
 - Data analysis (*champion* and *facilitator*)
 - Select two defect types for brainstorming
 - Invitations to engineers
 - Bring examples of their faults (in selected categories)
 - Guess at root cause
 - Suggested prevention mechanism

Meeting

- State meeting goal and rules
- Select issues
- Review defects/causes/solutions brought to meetings
- Analyze defects (fishbone diagram)
- Brainstorm solutions
- Assure organizational commitment
- Plan for change (responsibilities and dates)

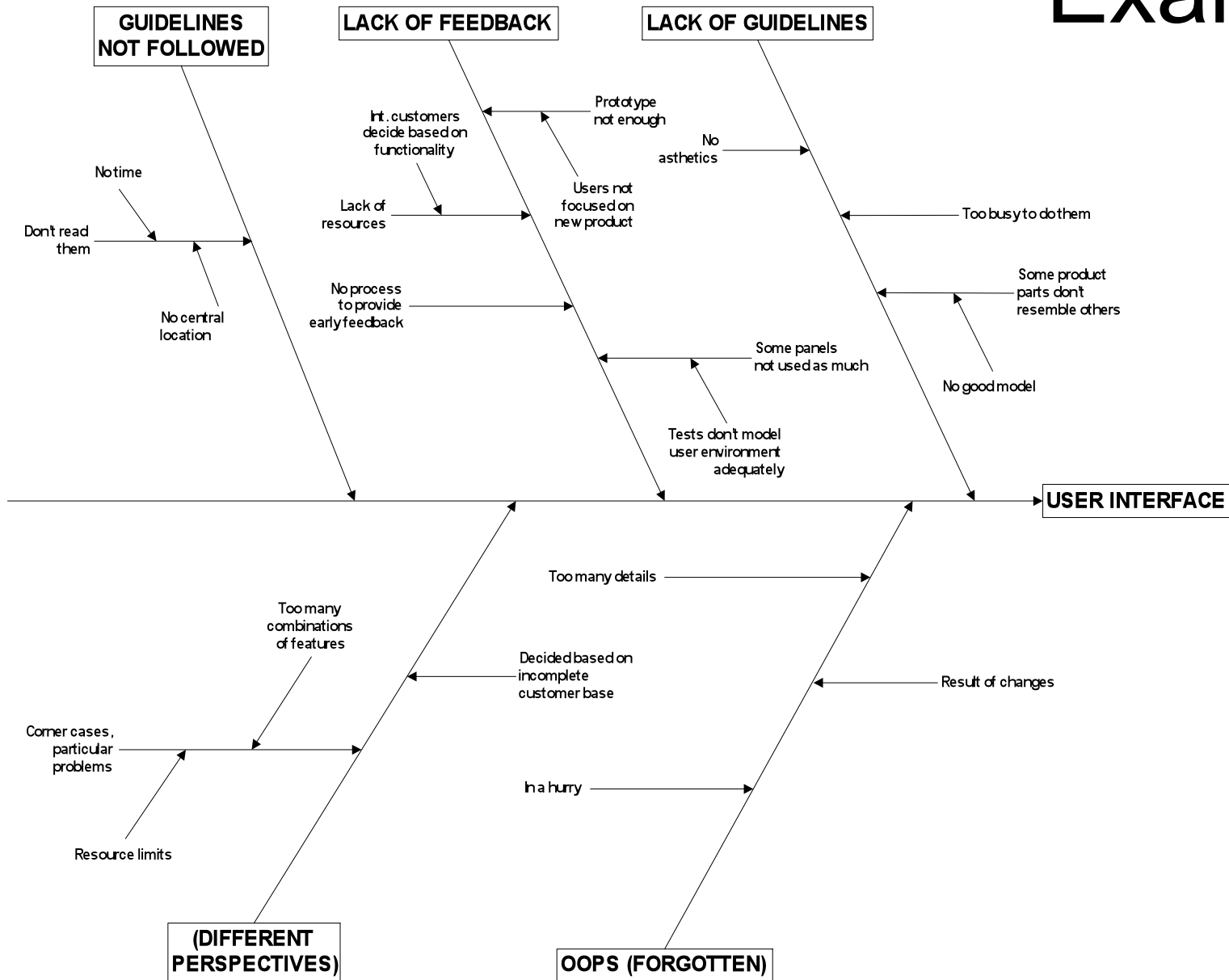
Postmeeting

- Champion and facilitator review meeting
 - Prepare meeting summary
- Champion captures process baseline data
 - Before and after process description and data

Fishbone Diagram (Cause and Effect Diagram)

- Write suggested causes of a class of defects on note cards
- Organize into *affinity groups*
- Use lines to indicate "is a cause of" or "is a prerequisite of"
- Spine is major defect class
- Major branches are affinity groups

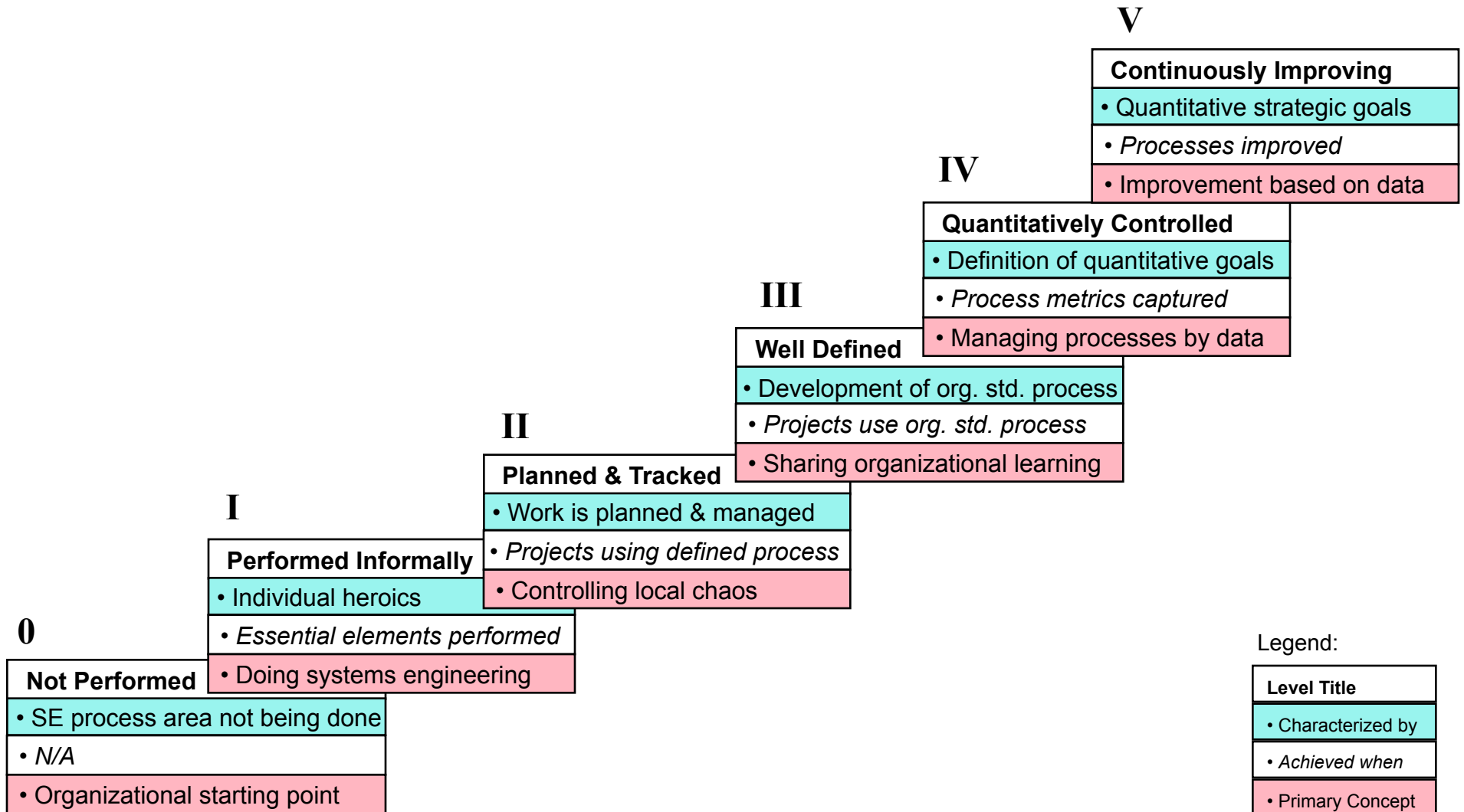
Example



Third Party Audits / Assessments

- CMM: maturity model
- ISO9001: international standard
- SQPA: business practices; functional model
- QMS: business model
- Baldrige: Department of commerce; weighted criteria

CMM



ISO 9000 Series

- Actually a series of specifications that allow companies to be “certified”
- Doesn’t focus on improvement—just current state
- Addresses minimum criteria for a quality system
- Strongly paper-trail oriented
- Checklist assessment
- Generic—not software specific
- Principle: Every important process should be documented

Guidelines for Process Improvement

- Incremental rather than big-bang implementation
 - Contrast with “Paradigm Shift”, “BPR”
- Use data
- Treat root causes not symptoms
- Workers know best how to do a process
 - Avoid consultants

More Guidelines

- Today's problems come from yesterday's solutions
- The harder you push, the harder the system pushes back
- The easy way out usually leads back in
- The cure can be worse than the disease

Still More Guidelines

- Faster is slower
- *Cause* and *Effect* are not closely related in time and space
- Small changes can produce big results, but the areas of highest leverage are the least obvious
- You can have your cake and eat it too, but not at the same time
- Dividing an elephant in half does not produce two small elephants
- "Fix the problem, not the blame"