



**Carnegie Mellon  
Software Engineering Institute**

Pittsburgh, PA 15213-3890

# Conducting Effective Pilot Studies

**Mark Kasunic**

Software Engineering Measurement and Analysis [SEMA]  
Software Engineering Institute  
mkasunic@sei.cmu.edu

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## The Problem

Quite often, software/system improvements are made without measurement either before or after the change was introduced.

Therefore, how do we know if the outcome was better or worse than the original situation?

In these cases, interpretation is based on opinion and impressions – but there is a lack of data to back it up!

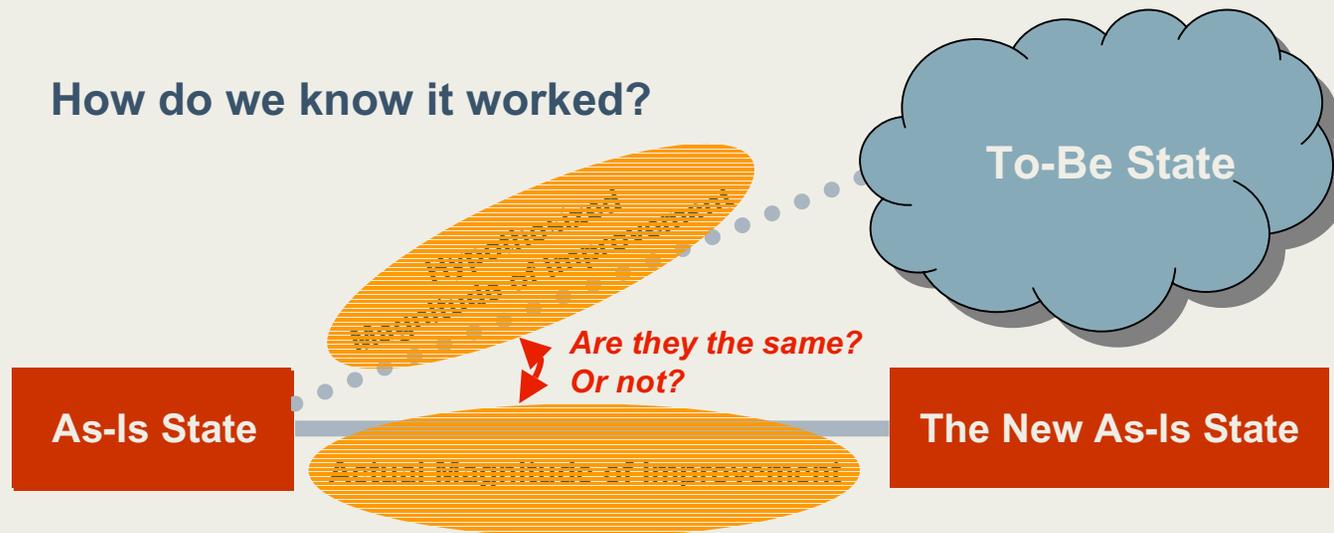
Therefore, there is less confidence in the results of the innovation – interpretation is problematic and there's a risk that consensus about the results are not achieved.

**How do we know if the change worked?**



# Need to Validate That Changes Are Effective

How do we know it worked?





# Typical Approaches to Evaluating Improvement

## Typical approaches that fail

	Before the change	Change introduced	After the Change
Approach #1		X	
Approach #2		X	O
Approach #3	O	X	

X represents the introduction of a change  
O represents a measurable observation



# How Do You Know It Really Worked?

## Typical approaches that fail

	Before the change	Change introduced	After the Change
Approach #1		X	
Approach #2		X	O
Approach #3	O	X	

In all three approaches, there is no way to tell if the outcome from the change was better or worse than the original situation.

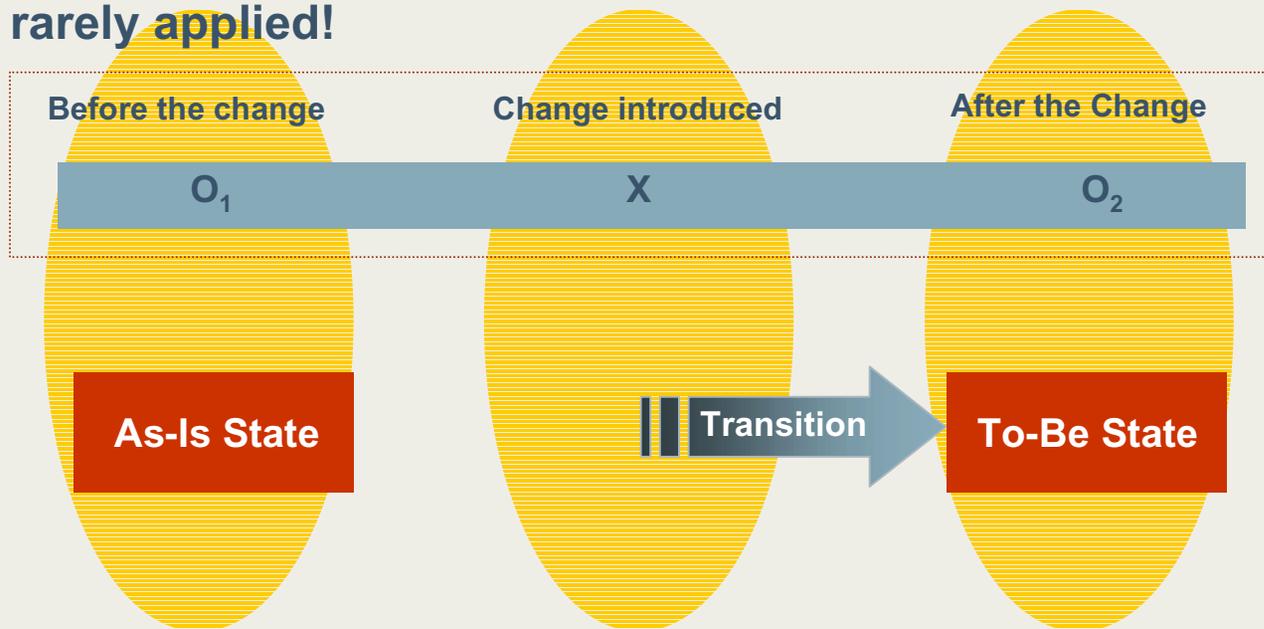
How do you know  
the change worked?





# Scientific Methods Do Exist

Research designs do exist for proper interpretation of results after innovations are introduced ... but they are rarely applied!





## A Structured Approach to a Pilot Study

- 1 Plan and design the pilot study
- 2 Train personnel to accomplish change
- 3 Support and monitor pilot study
- 4 Evaluate pilot results
- 5 Make recommendations & improve



# A Structured Approach to a Pilot Study

## 1 Plan and design the pilot study

### • Define the problem

- How will you measure success?
- Where will you conduct the pilot study?
- Designing your approach using scientific principles
- Writing down your plan

## 2 Train personnel to accomplish change

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## Define the Problem

A problem that is clearly defined is half-solved.

Defining the problem means identifying a gap between some desired situation and the current situation.

An important challenge is for the improvement team to collect and use **valid information** to define the current situation instead of assuming that it already has the necessary valid information.

A problem statement implies no particular solutions and no potential causes.

A good problem statement states only the current and desired situation.



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## Subtopics

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## Develop Pilot Study Success Criteria

### You will want to know:

Did the solution component generate the outcome that it was intended to achieve?

- What are you hoping for in terms of performance change when using the solution component?
- Try to define performance standards that will help you determine this explicitly. Are there any historical data that can be used to baseline the status quo?

Did the users experience difficulty in its use?

- What are your expectations in terms of the solution component's impact on changing people's attitudes and behaviors?
- Try to define qualitative measures that will provide objective assessment of job improvement for the users of the



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## Will we be Able to Generalize Our Findings?

Is there anything we can do to increase the probability that we can generalize the pilot study results to the larger population?

- Is this a *typical* program/project within the organization?
- Is the experience and skill level of the pilot study personnel typical of what one would find in other programs/projects in the organization?
- Are there factors beyond our control that can confound or influence the cause-and-effect relationship of the change we are trying to implement?

Making smart decisions about *where* (in your organization) to conduct a pilot study improves confidence with generalizing the solution to other parts of the organization.



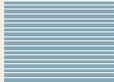
## Understanding the Pilot Environment

During pilot study planning, you can mitigate the risk of misinterpreting or over-interpreting your eventual results if you can identify and characterize the impact of potential influences.

- How similar is the project/program environment of the candidate pilot project to other projects in the organization (size, domain, etc.)?
- Will participants in the pilot study embrace the proposed change (that is being considered) or resist adopting it?
- What are the adoption characteristics of the pilot project manager and the project staff in general?
- Given the adoption characteristics of the pilot participants, how much refinement (of the solution component) and support will be necessary to test the potential effectiveness of change?
- How supportive is the project/program manager to the change that will be piloted? Are they enthusiastic about the idea of serving as a pilot?
- What kinds of pressure is the project/program already under?
  - Difficult schedule constraints?
  - New product or domain area?
  - Inexperienced staff?

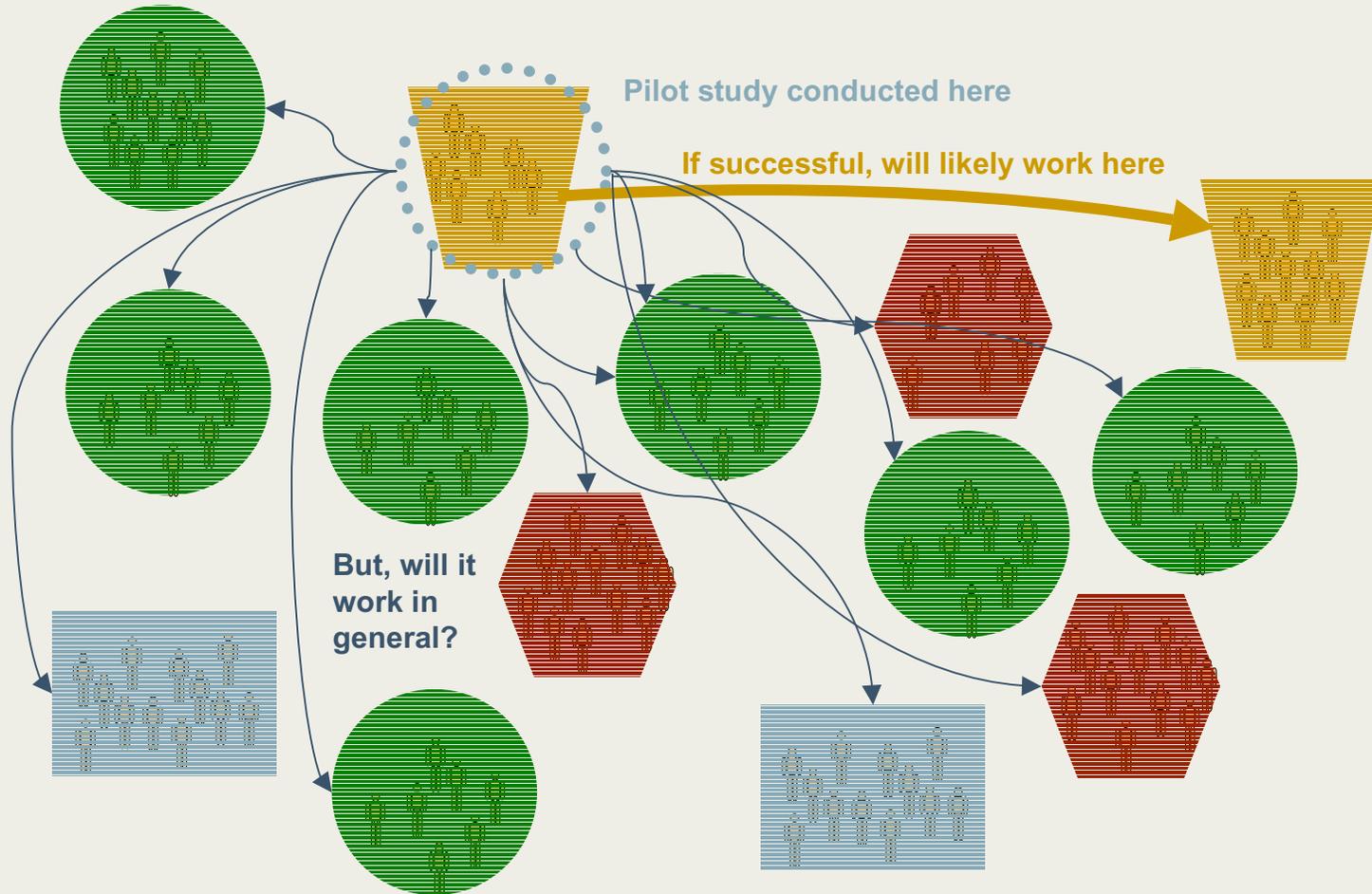


## Project Categories Example

Project Type	Description	
Critical	<ul style="list-style-type: none"><li>on-time release is imperative</li><li>20-30 individuals on project staff</li><li>using new object-oriented technology</li></ul>	
Product enhancement	<ul style="list-style-type: none"><li>5-10 individuals on project staff</li><li>improvements to baseline products</li></ul>	
Maintenance	<ul style="list-style-type: none"><li>&lt; 5 individuals on project staff</li><li>correction of bugs reported by users</li></ul>	
Emergency	<ul style="list-style-type: none"><li>5-20 individuals on project staff (dependent on need)</li><li>project formed to address unanticipated government mandated order</li></ul>	



# Can We Generalize the Pilot Results?





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# Approaches to Validation

In the scientific and manufacturing world, improvements or innovations are validated using a rigorous statistical approach known as design of experiments (DOE)

- Extraneous variables that might impact the result you're looking at can be held steady or controlled
- The experimental design can employ techniques such as randomization and replication to add clarity and confidence to the assertions that are made about the change

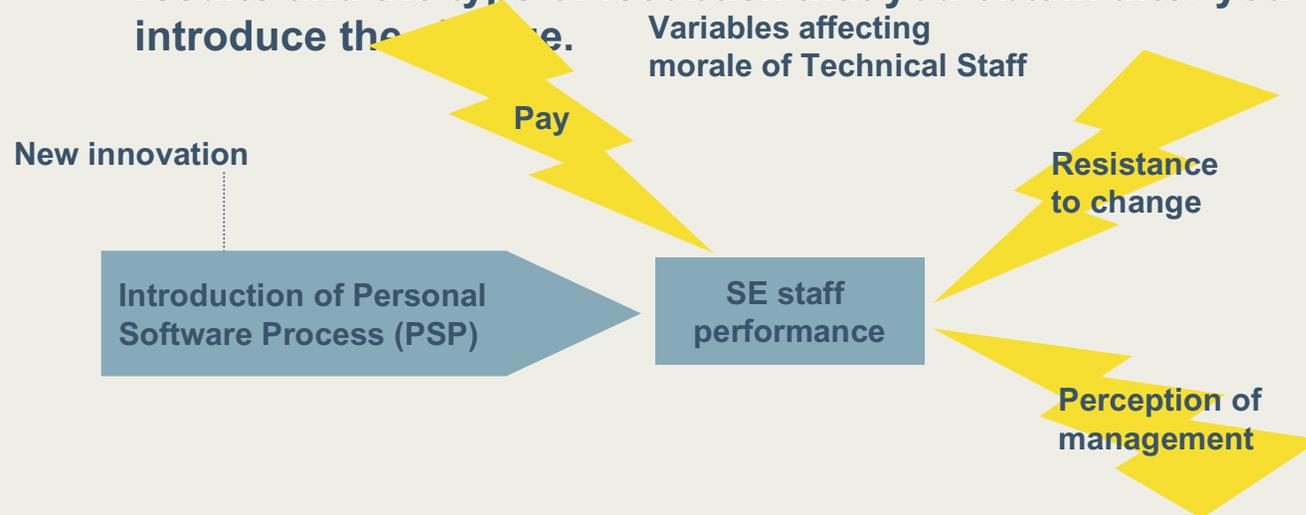
Run Number	Variable A	Variable B	Variable C	Result
1	-	-	-	7
2	+	-	+	15
3	-	+	-	21
4	+	+	+	11



## The Human Side of Change

In a human-related, real-time program/project environment, pilot studies are not conducted in a laboratory under ideal controlled conditions.

- It is difficult—if not impossible—to control variables involving people.
- The characteristics of the experimental medium (i.e., the *people* using the solution component) may influence the results and the type of feedback that you obtain after you introduce the change.

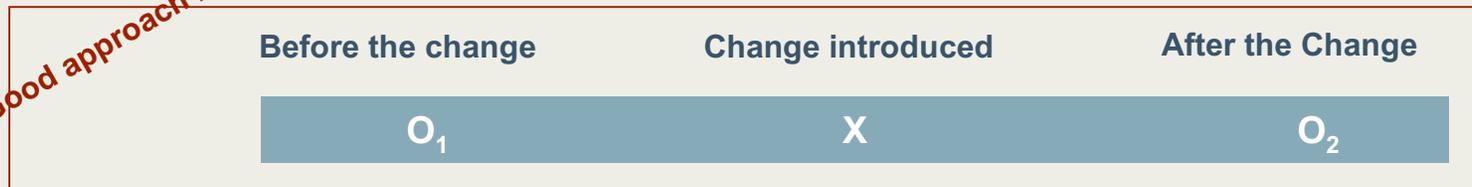




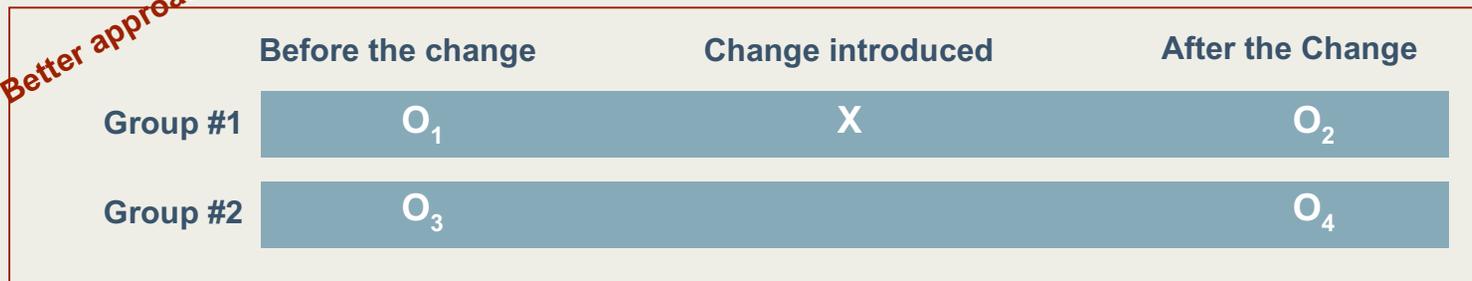
# Scientific Methods Do Exist

Research designs called quasi-experimentation do exist for proper interpretation of results from pilot studies ... but they are rarely applied!

*Good approach #1*



*Better approach #2*



A *t* test and the analysis of covariance method are statistical methods that provide a scientific basis for making assertions about the results of change effort.



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# Pilot Implementation Plan

The pilot implementation plan is developed collaboratively with the people who will participate in the pilot study.

Pilot studies involve altering the environment (e.g., how they work) of the participants.

Therefore, changes must be introduced carefully so that they don't become overwhelming.

Introducing too many variables at one time will make the results difficult to interpret.

A plan is developed that describes how solution component(s) will be introduced over time into a program/project for pilot testing.

The plan provides a mechanism for setting the appropriate expectations with the project partner.



## What's in the Plan?

The plan includes

- objectives of the pilot study
- success indicators and how they are measured
- approach
- responsibilities of participants
- training activities
- description of support mechanisms (e.g., mentoring, hot-line support, trouble-shooting)
- a description of pilot study retrospective activity
- a schedule
- risks and mitigation strategies



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## Don't Overlook the Need for Training

The type, style and extent of training will depend on the complexity of the proposed change.

The pilot implementation plan describes the training activities.

The training should cover

- how the new process, procedure, and/or associated technology is performed or used
- how to use the documentation that describes the new feature
- how to obtain additional help if there are problems

**Ensure that feedback mechanisms are included as part of the training approach.**



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## Supporting and Monitoring the Pilot Effort

Any change, however well-planned, can cause unanticipated results. That's why we conduct a pilot test – we're not *sure* what to expect.

Pilot personnel will need help when problems are exposed.

Support must be provided during pilot testing so that program/project personnel can obtain quick solutions to glitches or bugs in the new process component(s).

A member of the pilot project support team

- is assigned as the primary point of contact to provide guidance or help when problems arise
- is responsible for ensuring that performance indicators are tracked throughout the pilot effort.

Document problems or issues as they occur.



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## Evaluate Pilot Results

Compile performance measurements and indicators. Evaluate how the new process component performed with respect to the objectives and success criteria.

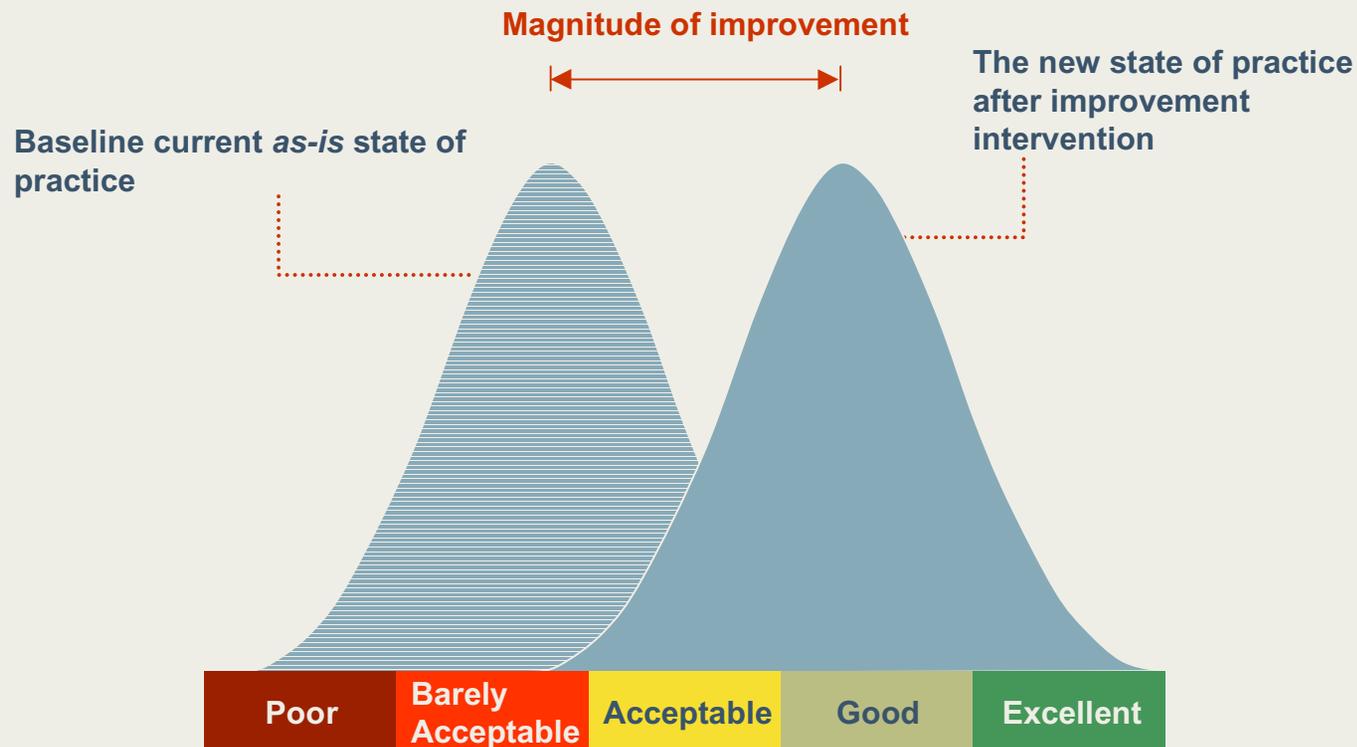
Conduct a lessons-learned meeting with pilot study personnel to obtain

- feedback on the new solution component; what worked well and what didn't work well
- ideas for improving the solution component
- suggestions for improving how new solution components are piloted

In addition, consider using an instrument for obtaining anonymous feedback.



# Statistical Analyses to Validate that the Change Worked





## Are You New to Measurement Analysis?

For an easy-to-understand example of the T-test and Analysis of Covariance, see:

Kelley, D. Lynn and Morath P. *How Do You Know The Change Worked?*. Quality Progress. American Society for Quality. pp. 68-74. July 2001.

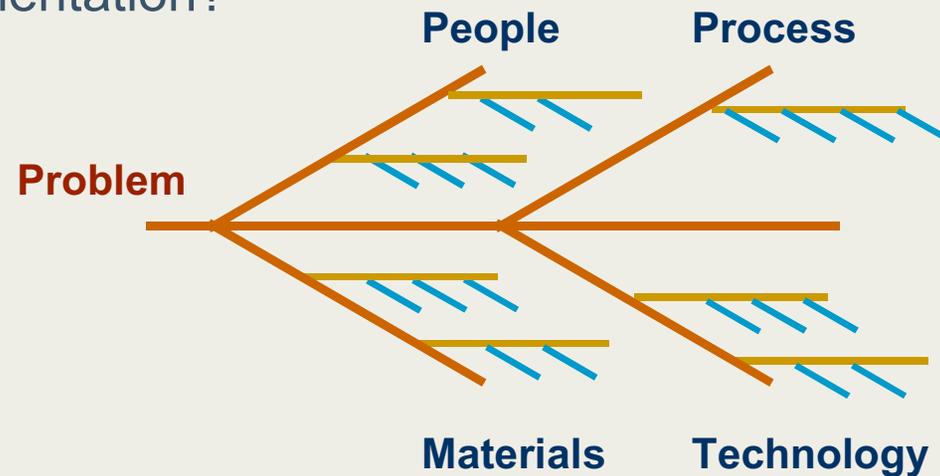
You can also refer to a statistical textbook or reference book. Statistical software packages (e.g., SPSS, JMP/SAS) are also capable of performing these analyses.



## Analyzing the Results

Since many variables may contribute to the pilot results, it's important not to draw immediate conclusions without exploring root causes.

What factors contributed to success or partial success?  
What factors led to the less-than-successful implementation?





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# After the Pilot Study

## Outcome

## Follow-on steps

### Major revision required

- Plan the revision
- Review the plan with pilot project personnel and get their feedback—will changes address concerns?
- Revise the solution component
- Review with project personnel—do the changes address concerns?
- Conduct another pilot study

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### Minor revision suggested

- Revise the solution component
- Review with project personnel—do the changes address concerns?

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### Additional support required to use solution component

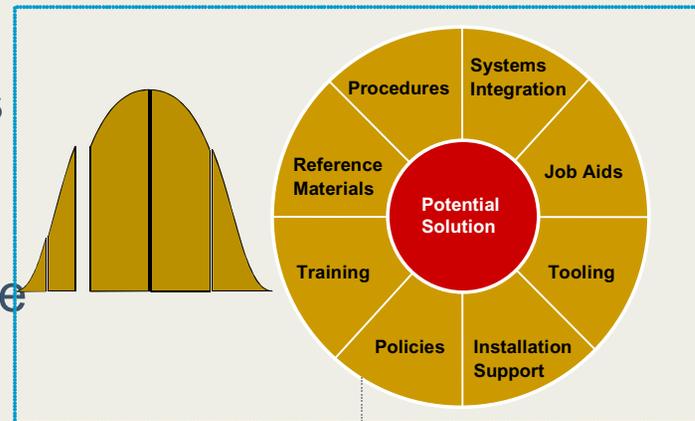
- Plan the development of whole product support components that address the need
- Review plan with pilot project personnel—will additional support address concerns?
- Develop additional support components
- Review with project personnel—do the support components address concerns?



# The Value of Pilot Feedback

Feedback from the pilot can help you

- remove *bugs* from the solution component (i.e., the process, procedure or technology)
- identify ways for enhancing the solution component
- identify additional whole product components that will make it easier for users (in the actual implementation) to embrace the process, procedure or technology



The Whole Product Wheel



## Bringing Closure to the Pilot Effort

### Communicate

Meet with the management and other stakeholders to

- review pilot results
- make recommendations
- identify next steps

Post the performance results of the pilot effort in a public area for review from the organization.





## The Value of Conducting Multiple Pilot Studies

Conducting multiple pilot studies leads to more reliable information for decision-making.

When “testing” a new technology, investigators understand that replications are required to understand the extent of experimental error.

Experimental error is caused by the variation in the test results caused by environmental influences that are beyond the control of the experimenter.

To mitigate the risk of experimental error, the investigator repeats the experiment multiple times to better characterize the influence of the technology that is being tested.



## Why Did We Conduct a Pilot Study?

Piloting reduces the risk of rolling out a flawed process, procedure or other solution component to a broad multi-project environments.

The idea behind a pilot is to *test* the solution component within a bounded and controlled environment before the component is sanctioned for broader use.

During a pilot study, the usability of the solution component is evaluated in a near real-world project setting.

Experience demonstrates that such a test *always* exposes improvement opportunities that can be exploited to hone and refine the solution component before broader dissemination.



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Software Engineering Institute**

## **Contact Information**

**Telephone**                      **412 / 268-5800**

**FAX**                                **412 / 268-5758**

**Email**                              **customer-relations@sei.cmu.edu**

**World Wide Web**            **<http://www.sei.cmu.edu>**

**U.S. Mail**                        **Customer Relations  
Software Engineering Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213-3890**