

Evaluation in Software Engineering

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[What is Software Engineering?]

*Software Engineering means application of a systematic, disciplined, **quantifiable** approach to development, operation and maintenance of software.*

IEEE Standard Glossary

- Evaluation and measurement play a pivotal role in Software Engineering

Software Engineering is Hard

- Software Engineering was born in 1968, but it is still maturing

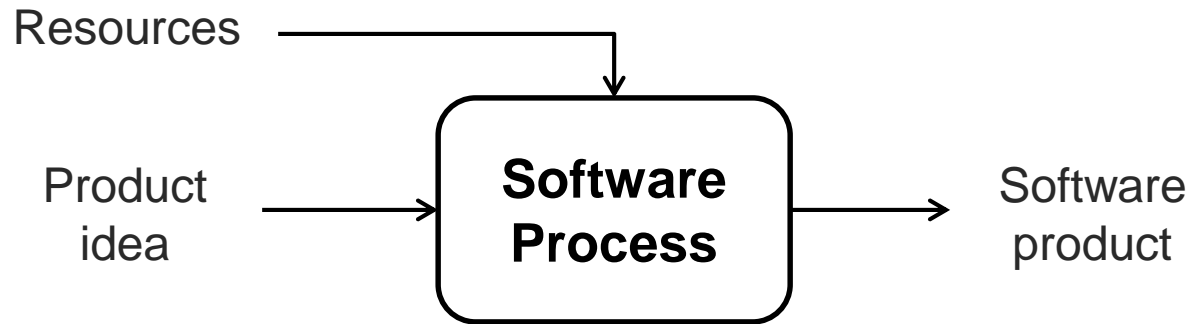
- Software development is by no means easy

- It runs over a long period of time

- It involves many people and technologies



Software Process



- The complexity of software process means that it is hard to be optimized
 - Companies need to continuous try to improve their software processes

[The Value of Evaluation]

- Software engineers need to know methods, process and techniques
 - But, they also should know how to evaluate them
- A practitioner wants to evaluate methods and techniques before introducing them into the organization
- A researcher wants to evaluate new results against something existing

Evaluation is Control

“You can't control what you can't measure”

Tom DeMarco

- Control comes from being able to evaluate new methods, techniques, languages and tools



[Process Evaluation]

- The real evaluation of a process requires people using it
 - Empirical studies are crucial to evaluate process and human-based activities
- Empirical studies are common in social and behavioral sciences

[Research Methods]

- To perform scientific research in software engineering, we have to
 - Understand the methods available
 - Understand their limitations
 - Understand when they can be applied
- There are four main research methods in software engineering
 - Analytical and Scientific
 - Engineering and Empirical

[Analytical and Scientific]



■ Analytical Method

- A formal theory is proposed and then compared with empirical observations
- It is often used in more formal areas of computer science, such as algorithms



■ Scientific Method

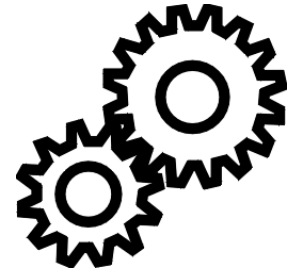
- The world is observed and a model is build based on observations
- It is usually used in applied areas, such as network (to evaluate performance)



[Engineering and Empirical]

■ Engineering Method

- The current solutions are studied and changes are proposed
- It is dominating in industry



■ Empirical Method

- A new model is proposed and evaluated through empirical studies
- Empirical studies have traditionally been used in social sciences and psychology

[The need for Scientific Approach]

- The engineering and empirical methods are variations of the scientific method
- A more scientific approach to software engineering is needed
 - Engineering method involves higher costs due to actual changes
 - The nature of software engineering is similar to social sciences (it depends on human behavior)



[Let's Use Empirical Methods]

- Empirical methods need to be further studied and used in software engineering
- The need for systematic experimentation has been emphasized since middle 80s
 - Basili raised this concern followed by Fenton, Kitchenham, Pfleeger and others
- The number of experiments in software engineering has increased since then

[Bibliography]

- C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.
 - Chapter 1 - Introduction