Research questions

7COM1079 – Team Research and Development Project

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Introduction

After this unit you should:

- know what a research question is;
- understand the importance of research questions;
- be able to formulate a set of research questions for a given research problem.

Definitions

Research problem

1. A general unanswered question in a research topic area.
2. An open issue that has not so far been solved.
3. A solution that could be improved upon.

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Research Question

1. A question that refines and focuses a general question or research problem.
2. A question to be answered to support a hypothesis.
3. A hypothesis rephrased as a question.

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Example: refining a general question[1]

General question

What motivates software engineers working in Global Software Development?

Research question

Do software engineers engaged in Global Software Development share similar characteristics and needs to those engineers in the general population?

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[1] From: Beecham, Sarah, and John Noll. "What motivates software engineers working in global software development?." In International conference on product-focused software process improvement, pp. 193-209. Springer, Cham, 2015.

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Example: supporting (testing) a hypothesis[2]

Hypothesis

Most software projects that often or always use agile methods, rarely or never use traditional methods.

Research questions

1. To what extent is a hybrid approach combining agile and traditional *methods* used in practice?
2. What *practices* are used by projects that employ such a hybrid approach?

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[2]From: Noll, John, and Sarah Beecham (2019 (forthcoming)) How agile is hybrid agile? An analysis of the HELENA data. In *Proceedings of the 20th international conference on product-focused software process improvement (PROFES 2019)*. Barcelona, Spain.

Example: a hypothesis rephrased as a question.

Hypothesis

The Global Teaming Model can be used to define Software Development Governance for a software development effort, by defining decision making structures, processes, and metrics.

Research question

How can the Global Teaming Model be used to define Software Development Governance for a software development effort?

Formulating Research Questions

- *General* research questions are formed either from hypotheses or insights of the researchers, motivated by problems in the research domain.
- *Specific* research questions are formulated by following a process

Write a "free format" question of interest:

- What is the effect of particular technology?
  Example: how effective is Agile development?

- How often does a factor or phenomenon occur?
  Example: how often do projects fail?

- What are the cost or risks associated with a given approach?

- What are the best practices in a particular domain?
  Caution: this is prone to survivor bias!

- What problems exist in a particular domain?
  Example: what are the barriers to collaboration in Global Software Development?[3]

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[3]From: Noll, John, Sarah Beecham, and Ita Richardson (2010) Global software development and collaboration: Barriers and solutions. *ACM Inroads* 1.

Structure the question: identify:

1. the *population*;
2. the *intervention*;
3. the *comparison*;
4. the *outcomes*;
5. the *context*.

RQ: To what extent is a hybrid approach combining agile and traditional *methods* used in practice?

1. the *population*: software projects;
2. the *intervention*: hybrid (agile+traditional) development approach;
3. the *comparison*: hybrid vs. "pure" agile;
4. the *outcomes*: fraction of total population;
5. the *context*: commercial software development in general[4].

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[4]We also looked at several specific domains, such as safety-critical software, aerospace and defense, and embedded systems.

RQ: Do software engineers engaged in Global Software Development share similar characteristics and needs to those of engineers in the general population?

1. the *population*: software engineers;
2. the *intervention*: global software development;
3. the *comparison*: global vs. co-located teams;
4. the *outcomes*: "characteristics"; in this case, what motivates developers;
5. the *context*: commercial global software development (we compared our subjects to previous studies based on co-located teams).

RQ: How can the Global Teaming Model be used to define Software Development Governance for a software development effort?

1. the *population*: software engineers;
2. the *intervention*: global software development;
3. the *comparison*: global vs. co-located teams;
4. the *outcomes*: "characteristics"; in this case, what motivates developers;
5. the *context*: commercial global software development (we compared our subjects to previous studies based on co-located teams).

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Why is this important?

Research questions:

- influence or determine the method used to answer them;
- define the (expected) results;
- focus thinking.

Influence on methods

Do software engineers engaged in Global Software Development share similar characteristics and needs to those of engineers in the general population?

Method: qualitative survey, analyzed using *content analysis*.

To what extent is a hybrid approach combining agile and traditional *methods* used in practice?

Method: quantitative survey, analyzed using descriptive statistics and Chi-square.

How can the Global Teaming Model be used to define Software Development Governance for a software development effort?

Method: artifact construction.

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Focusing Thinking

1. Start with a general idea, hypothesis, or question.
2. Review the literature to see what other people have already done to answer the question or explore the hypothesis.
3. Formulate or refine the question to focus on the gap in the literature.

Focusing Thinking: examples

> **What motivates software engineers working in Global Software Development?**

- The literature review shows we already know a lot about software engineers in general.
- The literature review also shows we know less about what motivates engineers doing GSD.

The research question focuses on the latter:

RQ: "Do software engineers engaged in Global Software Development share similar characteristics and needs to those engineers in the general population?"

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Focusing Thinking: examples

> **Most software projects that use agile methods, don't use traditional methods.**

- The literature review shows that most projects combine agile and traditional methods.

- So far no-one has examined "pure" agile projects.

- What does "pure" mean?

- What does "don't use" mean?

RQ: "Most software projects that *often or always* use agile methods, *rarely or never* use traditional methods."

Focusing Thinking: examples

> The Global Teaming Model can be used to define Software Development Governance for a software development effort, by defining decision making structures, processes, and metrics.

"... while the literature in SDG is rich in definitions and challenges, we find few recommended practices. As noted by Dubinsky et al (Dubinsky 2011), there is a need for more SDG empirical studies to be conducted within companies in which development is a core part of the business,"

HOW?

RQ: "How can the Global Teaming Model be used to define Software Development Governance for a software development effort?"

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Learning Objectives Revisited

What is a research question?

1. A question that refines and focuses a general question or research problem.
2. A question to be answered to support a hypothesis.
3. A hypothesis rephrased as a question.

Why are they important?

1. Research questions influence or determine the method used to answer them.
2. Research questions define the (expected) results;
3. Research questions focus thinking.

How do you formulate one?

1. Start with a general question or problem.
2. Examine the literature to see what has been done, and where the gaps are.
3. Use the *population*, *intervention*, *comparison*, *outcomes*, and *context* to define one or more specific research questions.

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Questions?