

RESEARCH METHODOLOGY

Empirical studies in IS and SE

How to choose?

How to justify?

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OVERVIEW

- Primary:
 - **Survey**
 - **Controlled Experiment**
 - **Proof of concept**
 - **Case study**
 - **Action research**
 - **Interviews**
- Secondary (Literature reviews):
 - **Systematic Literature Review**
 - **Systematic Mapping Study**
 - **Multivocal Literature Review**

CHOOSING YOUR METHOD:

“The selection of methods for a given research project depends on many local contingencies, including available resources, access to subjects, opportunity to control the variables of interest, and, of course, the skills of the researcher.” (Eastbrook et al., 2008)

1. **What is studied.** Do you want to study single cases in-depth, or do you want to study statistics of samples?
2. **Where it is studied.** Whatever you are studying, you may want to study it in the laboratory or in the field.
3. **How it is studied.** Whether you are studying as an observer or you interact with the object of study, intervene in the studied phenomena.
4. **Why it is studied.** Depends on your research goals: e.g., exploration, evaluation, comparison, understanding the reasons etc.
5. **Availability of resources / possible risks**
 - Time schedule, availability of people, equipment
 - Conflicts of interests, confidentiality, possible invalidity

WHAT IS STUDIED?

- Single case:
 - Descriptive
 - Qualitative data
- Multiple cases (Samples):
 - Statistical analysis

WHERE IS IT STUDIED?

- Field study:
 - expensive,
 - population elements are heterogeneous, hard to control.
 - Rich qualitative data. In-depth analysis is possible.
 - Hard to reproduce
- “Lab” / “Desktop”:
 - can fix/control the setting (influencing parameters);
 - Reproducible.

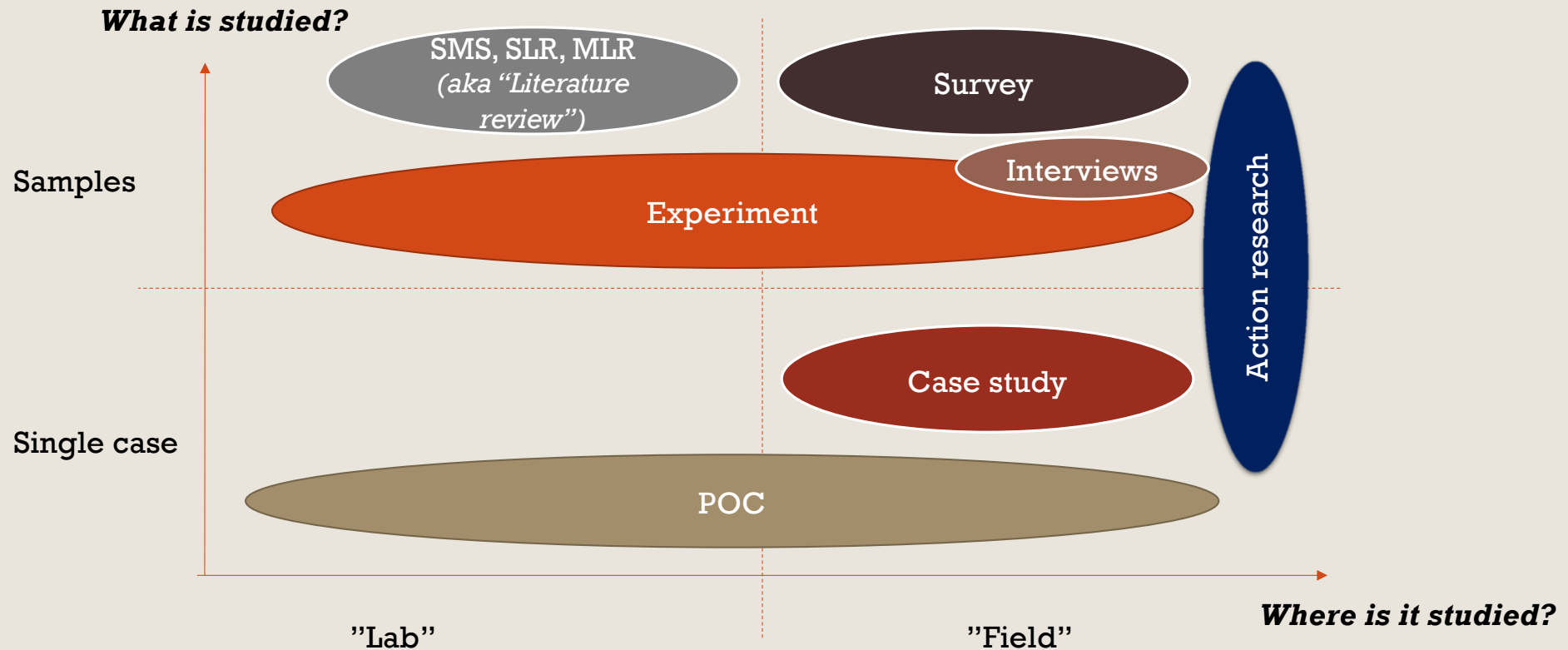
HOW IS IT STUDIED?

- You are an observer, not participating in the phenomenon – cannot influence the results.
 - Retrospective case studies,
 - Surveys
- You are active participant of the studied phenomenon and can influence the study results
 - Experiment
 - POC
 - Action research

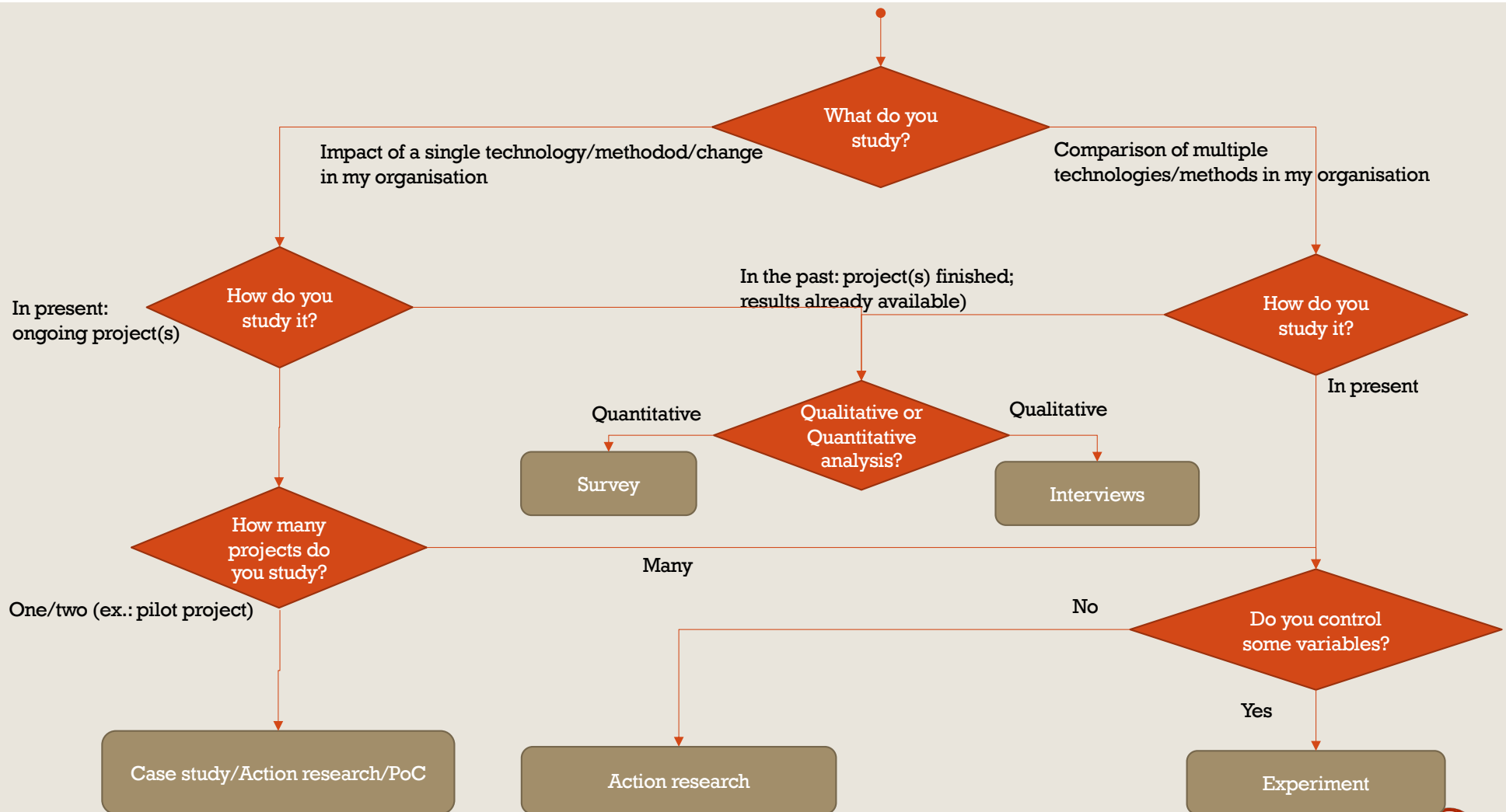
CONSTRAINTS TO FEASIBILITY

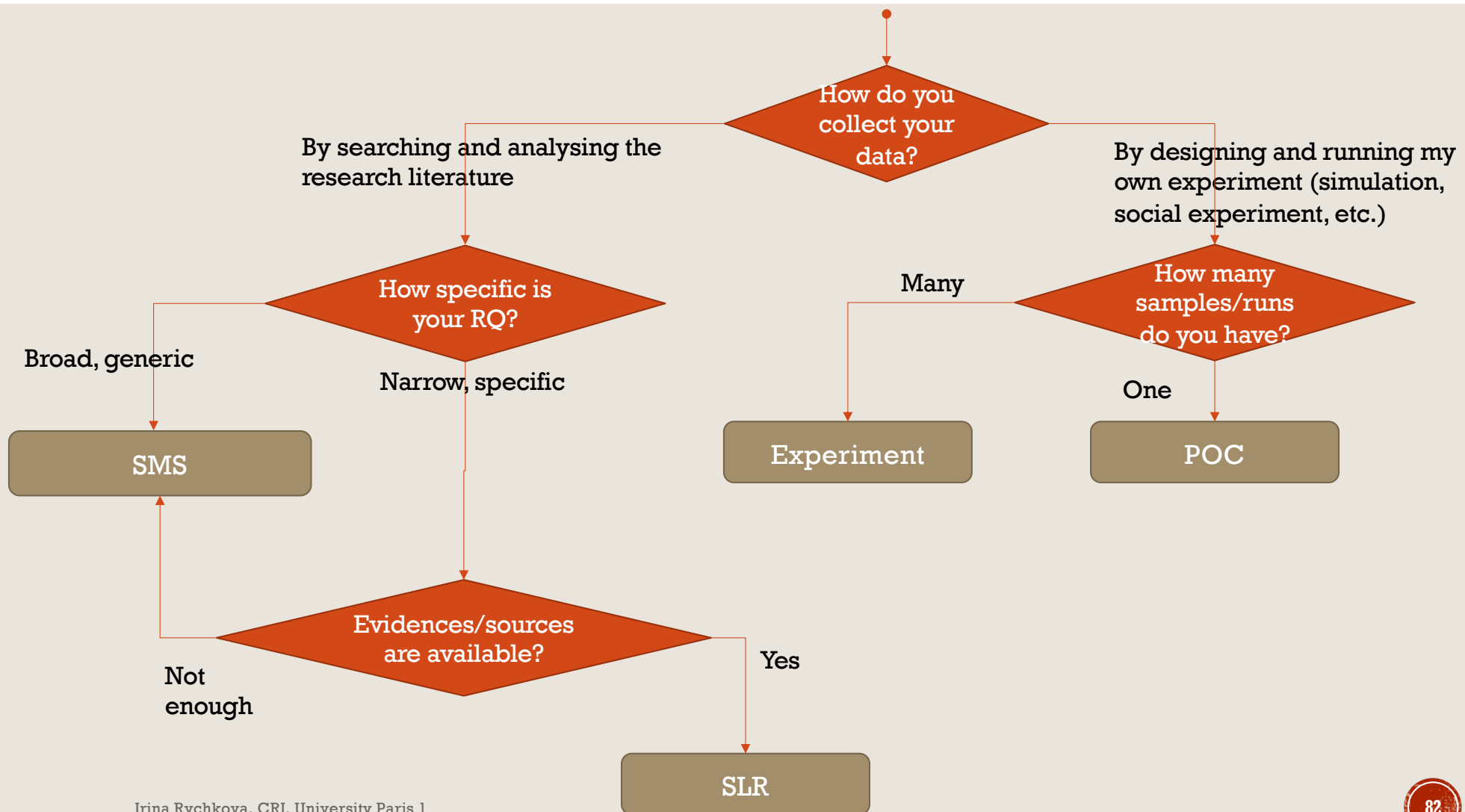
- **Data**
 - Restricted
 - Unavailable in-time
 - Incomplete
- **Sample size**
 - Too small
 - Too big (processing time!)
 - Bias (demographic, by convenience)
- **Resources**
 - Access to Specific Equipment/ Technology unavailable
 - Insufficient resources (e.g., processing power)
 - Technology / Theory Complexity: learning curve
- **Time**
 - Results will not be obtained/validated within the project timeframe

CHOOSING YOUR METHOD:



Adapted from (Wieringa, 2014)





DATA COLLECTION AND ANALYSIS METHODS

Collected data:

- Numerical (quantitative)
- Text, sound, images, video (qualitative)

Collection methods:

▪ *Primary sources:*

- Interviews
 - open-ended
 - structured
- Group discussions,
- Questionnaires, observation studies,
- Simulation
- Document study, field study

▪ *Secondary sources:*

- Literature

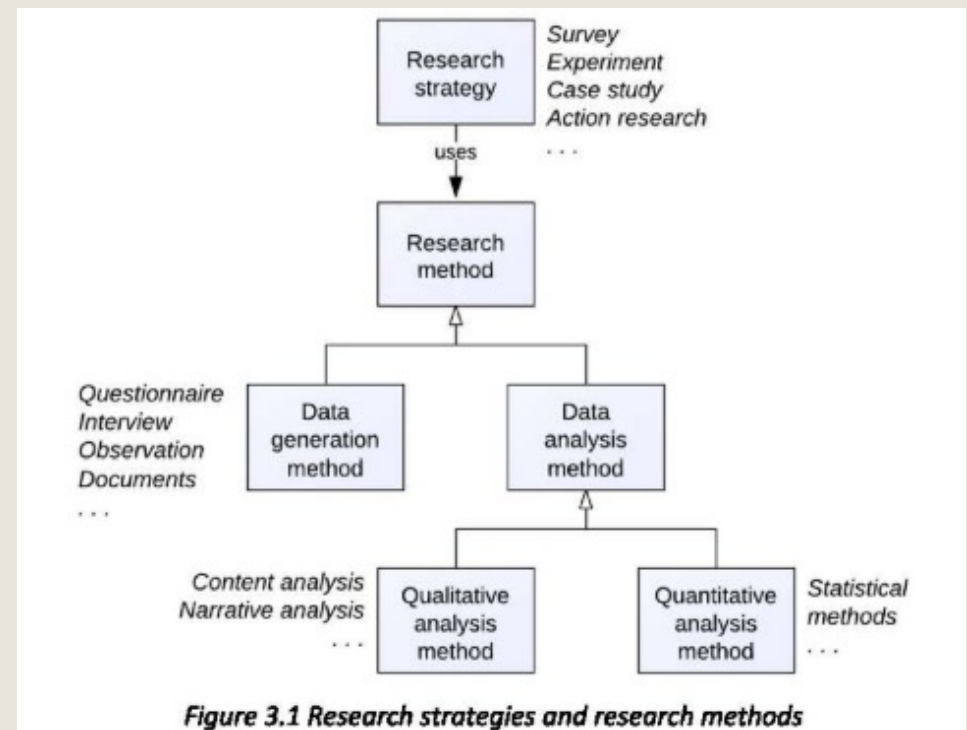
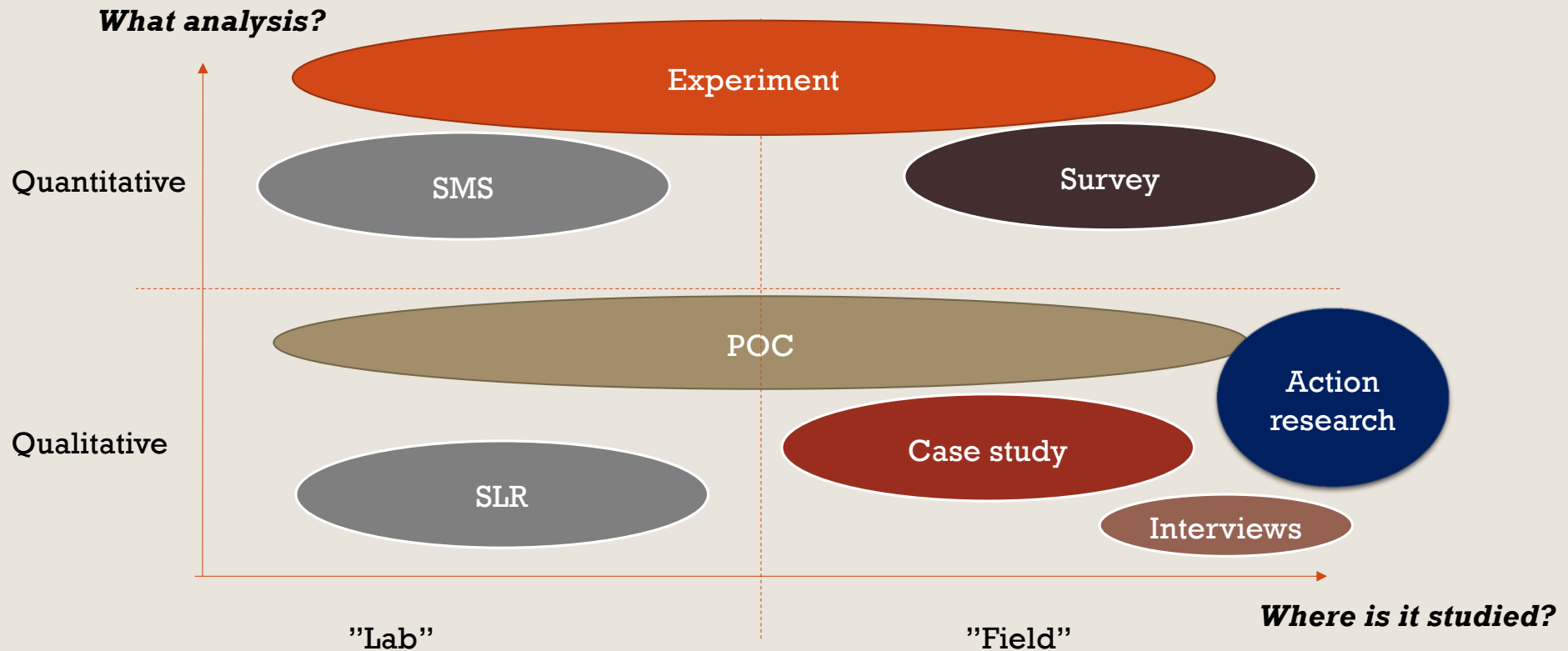


Figure 3.1 Research strategies and research methods

CHOOSING YOUR METHOD:



Adapted from (Wieringa, 2014)

EXAMPLES:

Research strategy	Data collected	Data collection methods
Survey	Quantitative	Interviews, Questionnaires
Experiment	Quantitative	Simulations
POC	Mostly Qualitative	Simulations, observations, Interviews, Group discussions, Questionnaires
Case study	Qualitative	Simulations, observations, Interviews, Group discussions, Questionnaires
Action research	Qualitative	observations, Interviews, Group discussions
SLR	Mostly Qualitative	Primary Research Literature study
SMS	Mostly Quantitative	Primary Research Literature study

EXERCISE

- Consider a RQ from the example
- Choose a research strategy and explain your choice
- For your selected strategy, what will be an appropriate data collection/analysis techniques?
- Explain your answer.

EXERCISE

- Consider a RQ from the example, define the research strategy by specifying the following:
 - “Field” or “Lab” study?
 - Qualitative or Quantitative?
 - In the present / in the past (in retrospective)?
 - Researcher’s role: Involved or Observer?
 - Method(s) of data collection:
- What is the research method implemented?
- What will be produced?
- Bonus: How your results will be validated?

- Think about several scenarios!

RESEARCH QUESTION

- Exemple 1:

Jane is a new PhD student interested in the effectiveness of a novel fisheye-view file navigator. Her research is motivated by the fact that navigation is a primary activity of software developers requiring a lot of scrolling and many clicks to find files. 'Fisheye-views' use a distortion technique that, if applied correctly, display information in a compact format that could potentially reduce the amount of scrolling required. Jane's intuition is that the fisheye-view file navigator is more efficient for file navigation, but critics argue that the more compact information is difficult to read and that developers will not adopt it over the traditional file navigator. Her research goal, therefore, is to find evidence that supports or refutes her intuition that fisheye-view file navigators are more efficient than traditional file navigators for navigation.

RQ: "Is a fisheye-view file navigator more efficient than the traditional view for file navigation?"

(Eastbrook et Al., 2008)

RESEARCH QUESTION

- Exemple 2:

Joe is a researcher in an industrial lab. His current interests are in understanding how developers in industry use (or not) UML diagrams during software design. This is because, as a student, his professors recommended UML diagrams be used during software design, but his recent exposure to industrial practices indicates that UML is rarely used. His research goal is to explore how widely UML diagrams are used in industry, and more specifically how these diagrams are used as collaborative shared artefacts during design.

RQ: “How widely are UML diagrams used as collaborative shared artifacts during design?”

(Eastbrook et Al., 2008)

FOLLOW YOUR RESEARCH PROTOCOL AND REPORT THE RESULTS

- **Implementing research protocol**
 - Data collection / extraction
 - Data Analysis
 - Validation
- **Reporting results**
 - Ethics in scientific research and publications
 - Plagiarism
 - Publication

VALIDATE YOUR FINDINGS

- Quality of research
 - Originality
 - Peer reviewing
- Validity of research
 - Reproducibility
 - Threats of validity

RESEARCH METHODS IN INFORMATION SYSTEMS AND SOFTWARE ENGINEERING



How to conduct?

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RESEARCH METHODS IN INFORMATION SYSTEMS AND SOFTWARE ENGINEERING

- Controlled Experiment
- Proof of Concept (POC)
- Case study
- Action research
- Design Science Research
- Interview
- Survey
- Literature review
 - Systematic literature review (SLR)
 - Systematic mapping study (SMS)
 - Multivocal literature review (MLR)