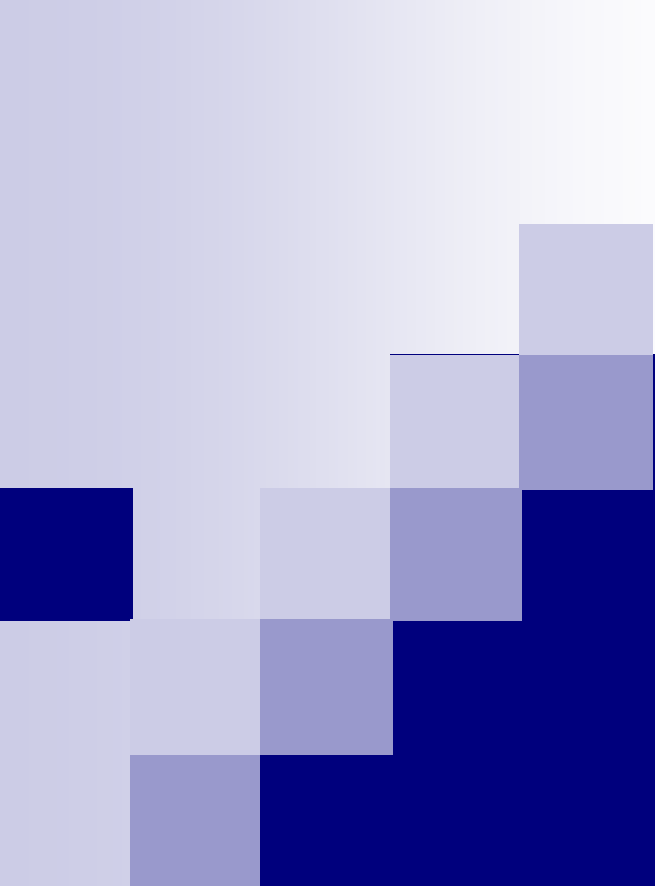# Engenharia de Software Experimental

Prof. Dr. Manoel Mendonça/Mário André
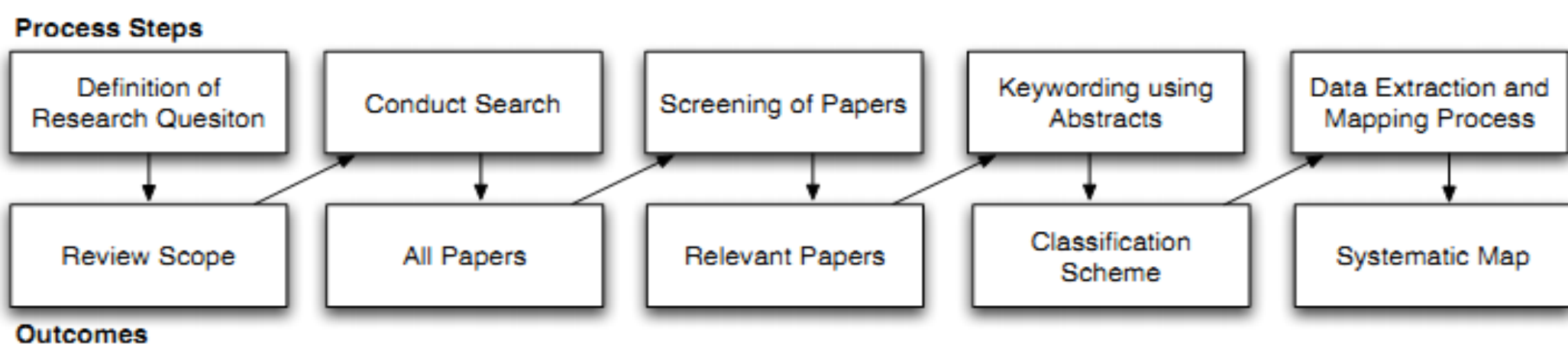**2014**

The systematic mapping process
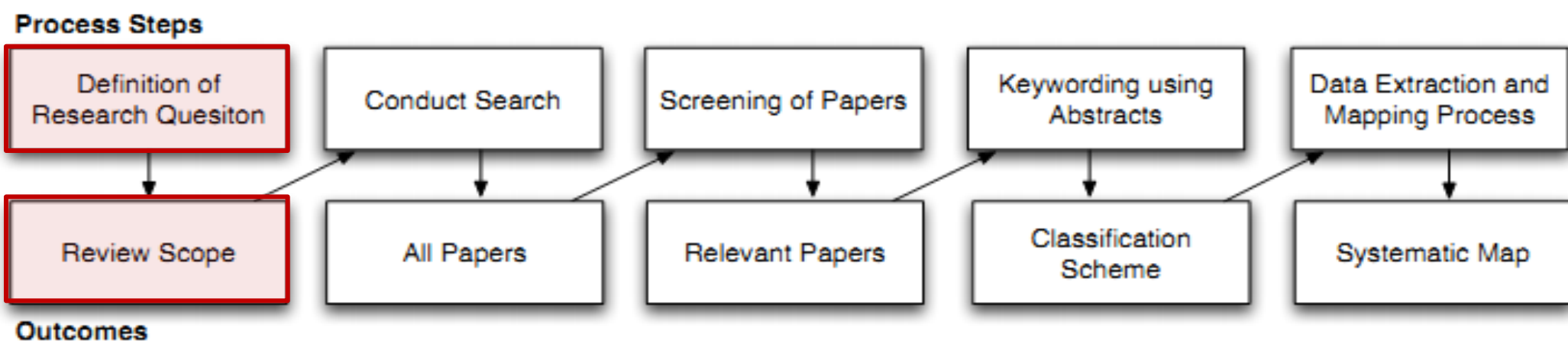
The systematic mapping process

Three stages by Budgen et al. (2008):

1. identification of primary studies that may contain relevant research results (searching);

2. selecting the appropriate primary studies from these after further examination (inclusion/exclusion);

3. where appropriate, performing a quality assessment of the selected studies (bias/validity)

Mapping process by Petersen et al. (2008):

Process Steps

Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts	Data Extraction and Mapping Process
Review Scope	All Papers	Relevant Papers	Classification Scheme	Systematic Map

Outcomes

The systematic mapping process

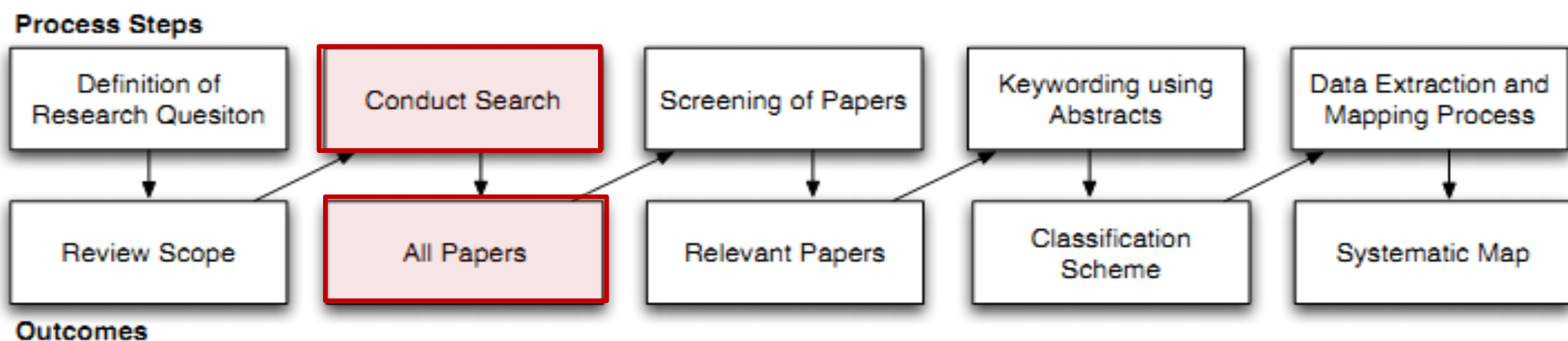| Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts	Data Extraction and Mapping Process
Review Scope	All Papers	Relevant Papers	Classification Scheme	Systematic Map

Outcomes

Examples:

Object Oriented Design Map (Bailey et al. 2007)	Software Product Line Variability Map (Mujtaba et al. 2008)
RQ1: Which journals include papers on software design? **RQ2:** What are the most investigated object oriented design topics and how have these changed over time? **RQ3:** What are the most frequently applied research methods, and in what study context?	**RQ1:** What areas in software product line variability are addressed and how many articles cover the different areas? **RQ2:** What types of papers are published in the area and in particular what type of evaluation and novelty do they constitute?

The systematic mapping process

| Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts	Data Extraction and Mapping Process
Review Scope	All Papers	Relevant Papers	Classification Scheme	Systematic Map

Outcomes

- The primary studies are identified by using search strings on scientific databases or browsing manually through relevant conference proceedings or journal publications.

- The choice of databases maybe different among mapping studies

Examples of search querires:

- *Object Oriented Design Map:* ("object oriented" AND "design" AND "empirical evidence") OR ("OO" AND "empirical" AND "design") OR ("software design" AND "OO" AND "experimental")
- *Software Product Line Variability Map:* "software" AND ("product line" OR "product family" OR "system family") AND ("variability" OR "variation")

5

The systematic mapping process

Process Steps

Outcomes
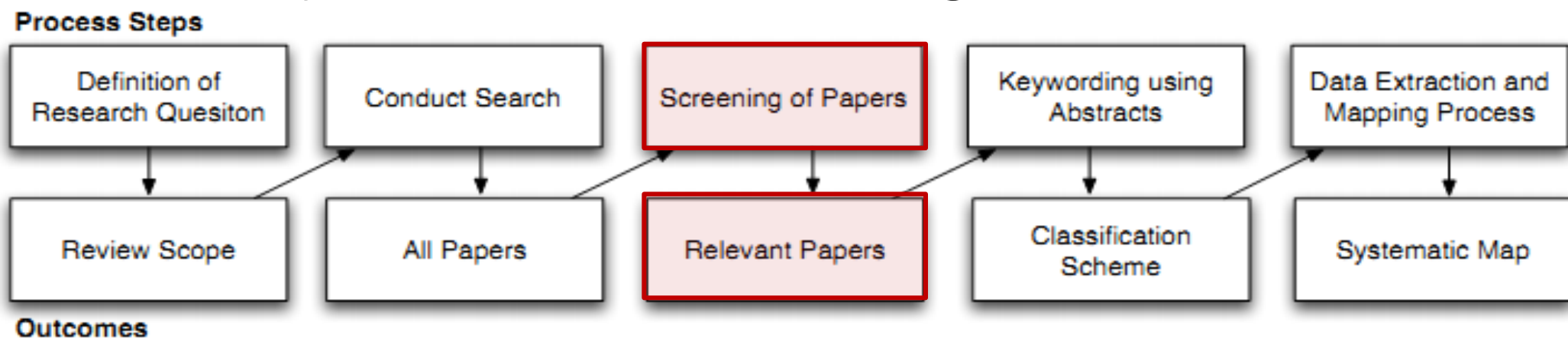
Apply inclusion and exclusion criteria to filter out studies that are not relevant to answer the research questions.

Examples of inclusion/exclusion criteria:

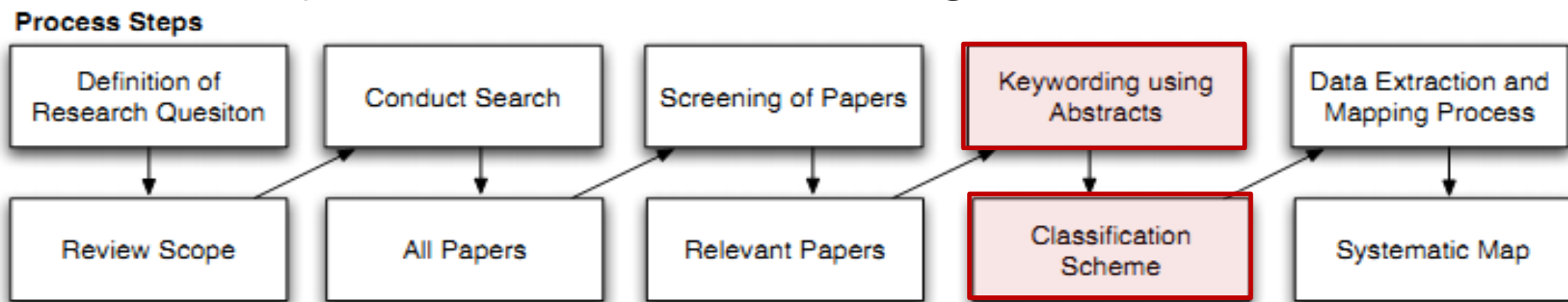| Object Oriented Design Map (Bailey et al. 2007)	Software Product Line Variability Map (Mujtaba et al. 2008)
Inclusion: books, papers, technical reports and grey literature describing empirical studies regarding object oriented software design. Where several papers reported the same study, only the most recent was included. Where several studies were reported in the same paper, each relevant study was treated separately. **Exclusion:** Studies that did not report empirical findings or literature that was only available in the form of abstracts or Powerpoint presentations.	**Inclusion:** The abstract explicitly mentions variability or variation in the context of software product line engineering. From the abstract, the researcher is able to deduce that the focus of the paper contributes to product line variability research. **Exclusion:** The paper lies outside the software engineering domain. Variability and variation are not part of the contributions of the paper, the terms are only mentioned in the general introductory sentences of the abstract.

The systematic mapping process

Process Steps

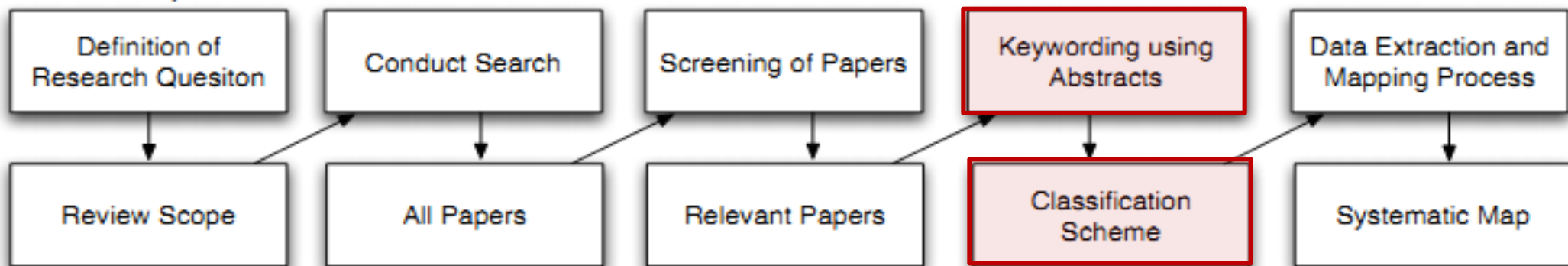| Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts	Data Extraction and Mapping Process
Review Scope	All Papers	Relevant Papers	Classification Scheme	Systematic Map

Outcomes

Keywording is a way to reduce the time needed in developing the classification scheme and ensuring that the scheme takes the existing studies into account.
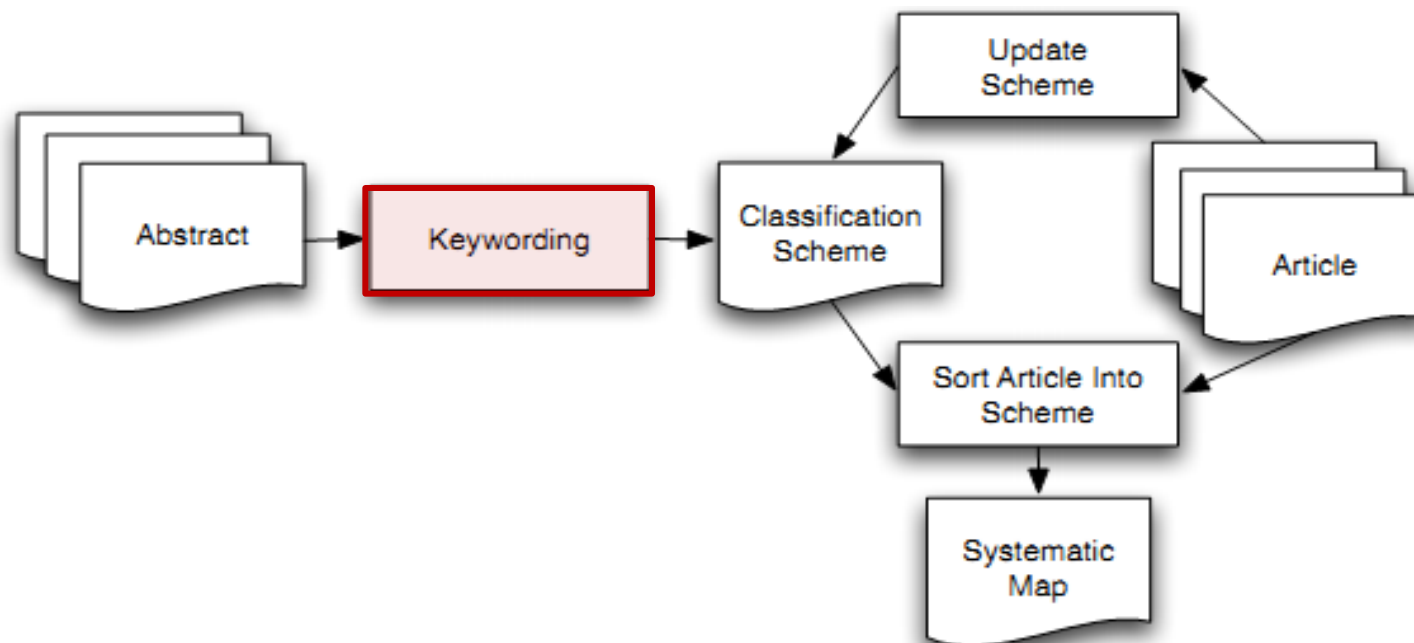
Keywording is done in two steps:

- First, the reviewers read abstracts and look for keywords and concepts that reflect the contribution of the paper. While doing so the reviewer also identifies the context of the research.
- When this is done, the set of keywords from different papers are combined together to develop a high level understanding about the nature and contribution of the research.
- This helps the reviewers defining a set of categories which is representative of the underlying population.
- When abstracts are of too poor quality, reviewers can choose to study also the introduction or conclusion sections.
- When a final set of keywords has been chosen, they can be clustered and used to form the categories for the map.
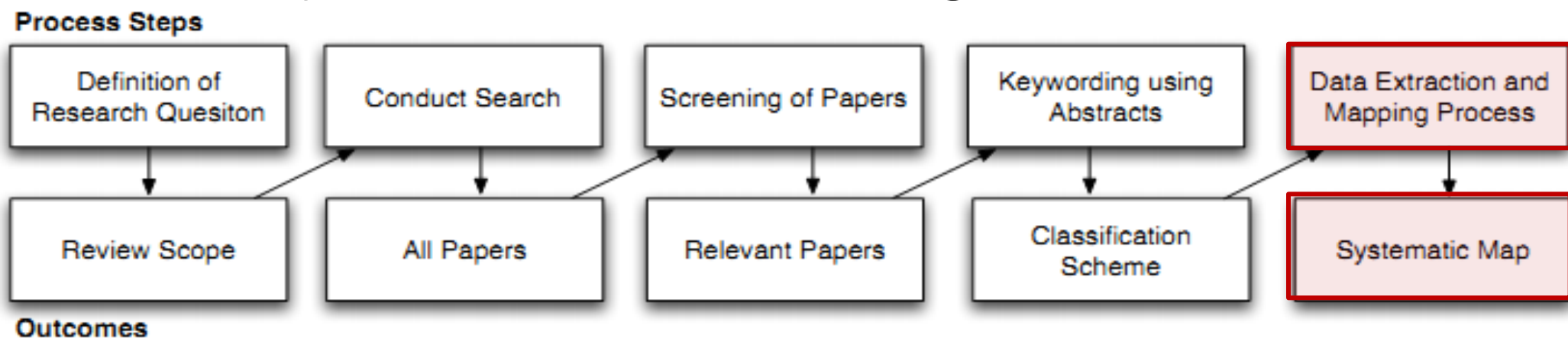
7

The systematic mapping process

8

The systematic mapping process

Process Steps

| Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts	Data Extraction and Mapping Process
Review Scope	All Papers	Relevant Papers	Classification Scheme	Systematic Map

Outcomes

- In this step, use a spreadsheet to document the data extraction process. The table may contain each category of the classification scheme.

- **Every time reviewers enter the data of a paper into the scheme, they must provide a short rationale why the paper should be in a certain category**

- From the final table, the frequencies of publications in each category can be calculated.

- The analysis of the results focuses on presenting the frequencies of publications for each category. This makes it possible to see which categories have been emphasized in past research and thus to identify gaps and possibilities for future research.

9

Visualization of a systematic map in the form of a bubble plot
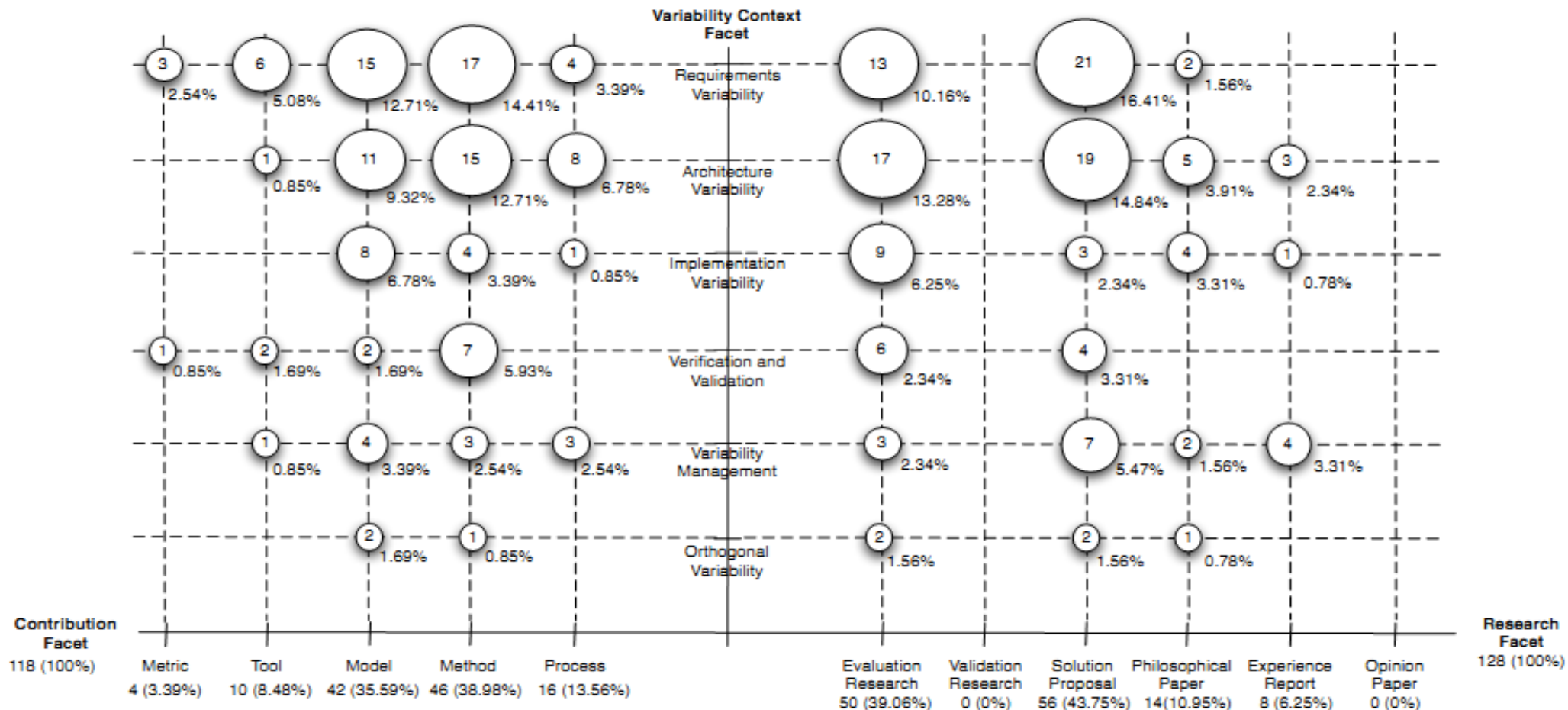
References

P. A. Silveira Neto et al. 2011. A systematic mapping study of software product lines testing. *Inf. Softw. Technol.* 53, 5, 407-423.

D. Budgen, M. Turner, P. Brereton, B. Kitchenham, Using Mapping Studies in Software Engineering, in: Proceedings of PPIG Psychology of Programming Interest Group 2008, Lancaster University, UK, 2008, pp. 195–204.

Barbara Kitchenham. 2010. What's up with software metrics? - A preliminary mapping study. *J. Syst. Softw.* 83, 1, 37-51.

Emelie Engström and Per Runeson. 2011. Software product line testing - A systematic mapping study. *Inf. Softw. Technol.* 53, 1, 2-13.

Barreiros, Emanoel. "A Systematic Mapping Study on Software Engineering Testbeds". Dissertação de Mestrado, Universidade Federal de Pernambuco, 2011.

Kai Petersen et al. "Systematic mapping studies in software engineering". 12th International Conference on Eval-uation and Assessment in Software Engineering, pages 71–80, 2008

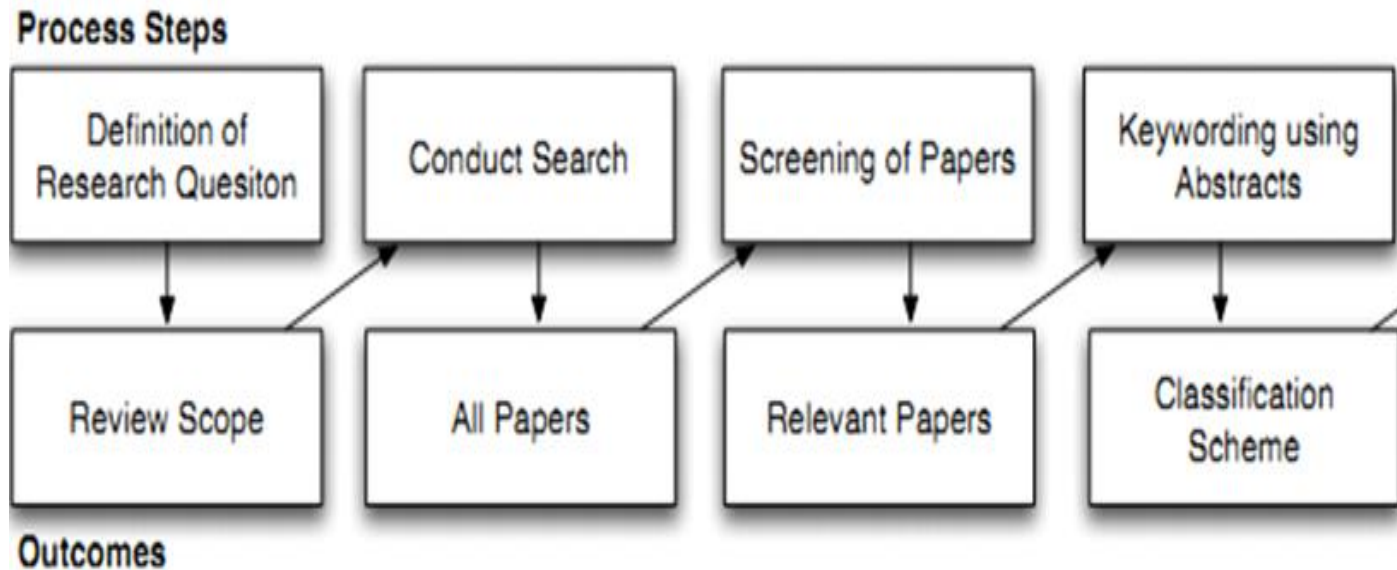# Trabalho do Curso
em Revisões Sistemáticas
(2014)

Goals

- We will use systematic mapping to explorer the Mining Software Repositories area.

- The Mining Software Repositories (MSR) field analyzes the rich data available in software repositories to uncover interesting and actionable information about software systems and projects.

Design - Teams and Evaluations

- Total of reviewer: 22

- Each reviewer will analyse 12 ou 13 papers;

- Some papers will be analysed by two developers;

- If there is some disagreement even after this step a third researcher will be involvement;

- You must follow all review processes;

- The reviewer will be rewarded for this task through of your qualitative analysis.

Design – Data Source

Process Steps

Definition of Research Quesiton	Conduct Search	Screening of Papers	Keywording using Abstracts

Review Scope	All Papers	Relevant Papers	Classification Scheme

Outcomes

Reviewer	22
Paper by reviewer	12/13

Design - Exclusion criteria

- We will exclude studies from MSR conference that do not:
  - Cover mining software repository;
  - Summaries of tutorials;
  - Survey and secondary experimental study;
  - Short paper.

Design - Data extraction

Table 2: Data extraction model for each paper

Data	Descrition
Paper code	Unique identity for the paper
Authors	Paper's authors
Institutions	Authors' institution (one institution or more)
Country	Country of institution
Goal (approaches) **Type – Focus - Object**	Main objective of study. The purpose of MSR: why mine or what to mine for?
Data Source	Type of data source mined
Measurement - attribute - metrics – granularity - Methodology	The metrics used in data collection for analysis. A method must be adopted or devised to answer MSR questions.

Design - Data extraction

Table 2: Data extraction model for each paper

Data	Descrition
Constraints and Limitations	Identified constraints and limitations in each study
Mining techniques	Mining techniques used to achieve the goals.
Tools	Tools used to support the mining.
Methodology	A method must be adopted or devised to answer MSR questions.
Research method used for Evaluation	The evaluation of the undertaken approach: how to assess quality? Included technique for the design of the study, e.g. case study, experiment, interview to obtain data, observation.

Data extraction form

What documents must I give and what is the deadline?

- 11/06
  - **Data extraction form filled out**
    - Paper 1: p23-callau – How Developers Use the Dynamic Features of Programming Languages: The Case of Smalltalk;
    - Paper 2: p33-eshkevari - An Exploratory Study of Identifier Renamings.
  - **Files of papers with notes and marks.**

- Xx/yy
  - **Data extraction form filled out**
    - **List of paper per reviewer;**

  - **Files of papers with notes and marks.**