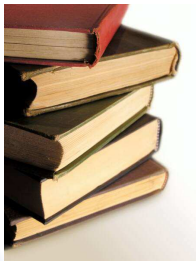



Alarcos
 Research Group

¿Cómo realizar revisiones de la literatura científica de manera sistemática y rigurosa?



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 Escuela Superior de Informática
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Bibliography

- The content of this seminar is based on:
 - Kitchenham, B. and Charters, S. (2007). **Guidelines for performing Systematic Literature Reviews in Software Engineering**. Version 2.3 EBSE-2007-01.
 - Book: **"Métodos de investigación en ingeniería del software"**.
 - Examples published in journals.



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Goals

- Present the procedure for performing systematic literature reviews / systematic mapping studies.
- Show examples published in prestigious journals.
- Provide relevant literature.

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Agenda

- Introduction
 - Systematic literature review (SLR)
 - Systematic mapping studies (SMS)
 - SMS vs. SLR
 - Tertiary studies
- Review process
 - Planning
 - Execution
 - Report
- Conclusions
- Relevant literature

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Introduction: SLR



- What a SLR is?
 - A means of **evaluating and interpreting** all available **empirical evidence** to a particular research question or phenomenon of interest.
 - SLRs aim to present a fair **evaluation of a research topic** by using a **trustworthy, rigorous, and auditable methodology**.



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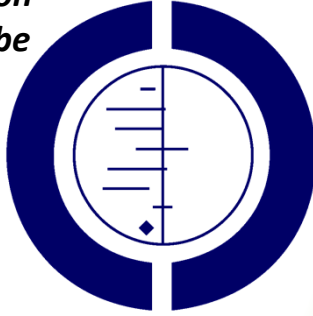


Introduction: SLR

Evidence Based Medicine

Our vision is that healthcare decision-making throughout the world will be informed by high-quality, timely research evidence

<http://www.cochrane.org>



THE COCHRANE COLLABORATION®

Working together to provide the best evidence for health care to [The Cochrane Library](http://www.cochrane.org)

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Introduction: SLR

Relevance of SLRs

Zhang, H., Ali Babar, M. (2013). Systematic reviews in software engineering: An empirical investigation. Information and Software Technology, 55(7),1341–1354.



142 (72 SLR / 72 SMS)

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Introduction: SLR



Why a SLR?

- Most **research starts**, or should start with a **literature review** of some sort.
- Unless a literature review is **thorough and fair**, it is of little scientific value.
- A systematic review **synthesizes existing work** in a manner that is fair and seem to be fair.

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Introduction: SLR



How to do a SLR?

- SLRs must be undertaken in accordance with a predefined **search strategy**, that must allow the **completeness** of the search to be assessed.
- Researchers performing a SLR must make every effort to **identify and report research** that **does not support** their **preferred research hypothesis** as well as identifying **and** reporting research that **supports it**.

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Introduction: SLR

What For?

What for a SLR?

- To summarize the existing evidence concerning a treatment or technology (e.g. to summarize the empirical evidence of the benefits and limitations of a specific agile method).
- To identify any gaps in current research in order to suggest areas for further investigation.
- To provide a framework/background in order to appropriately position new research activities.
- To examine the extent to which empirical evidence supports/contradicts theoretical hypotheses, or even to assist the generation of new hypotheses.

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Introduction: SLR



- The well-defined methodology makes it less likely that the results of the literature are biased.
- They can provide information about the effects of some phenomenon across a wide range of settings and empirical methods.
- In the case of quantitative studies, it is possible to combine data using meta-analytic techniques.



- The major disadvantage of systematic literature reviews is that they require considerably more effort than traditional literature reviews.

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Introduction: SMS

- When it is discovered that **very little evidence** is likely to exist **or** that the **topic is very broad** then a systematic mapping study may be more appropriate than a SLR.
- A systematic mapping study allows the **evidence** in a domain to be plotted at a **high level of granularity**.
- This allows for the identification of **evidence clusters** and **evidence deserts** to direct the focus of future systematic reviews and to **identify areas for more primary studies to be conducted**.
- **Not only focused on empirical evidence.**

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Introduction: SLR vs. SMS

- SLRs focuses on the **integration of empirical results**.
- SMSs may or may not collect empirical evidence. Even when they collect empirical evidence the analysis is wider, more general questions, etc.
- When you want to collect **ALL the literature available** related to a research topic → **SMS**.
- **Quality assessment** it is **not mandatory** in SMSs.

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Introduction: tertiary studies

- Individual studies contributing to a systematic review are called **primary studies**.
- A systematic review is a form of **secondary study**.
- A systematic review that analyzes the collected SLRs of SLRs is a **tertiary study**.

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Review process

A systematic mapping study



46 Journal of Database Management, 22(3), 46-70, July-September 2011

RESEARCH REVIEW

A Systematic Literature Review on the Quality of UML Models

Marcela Genero, University of Castilla-La Mancha, Spain

Ana M. Fernández-Sacá, University of Castilla-La Mancha, Spain

H. James Nelson, Southern Illinois University, USA

Geert Poels, Faculty of Economics and Business Administration, Ghent University, Belgium

Mario Piattini, University of Castilla-La Mancha, Spain

ABSTRACT

The quality of conceptual models directly affects the quality of the understanding of the application domain and the quality of the final software products that are ultimately based on them. This paper describes a systematic literature review (SLR) of peer-reviewed conference and journal articles published from 1997 through 2009 on the quality of conceptual models written in UML, undertaken to understand the state-of-the-art, and then identify any gaps in current research. Six digital libraries were searched, and 266 papers dealing specifically with the quality of UML models were identified and classified into five dimensions: type of model quality, type of evidence, type of research result, type of diagram, and research goal. The results indicate that most research focuses on semantic quality, with relatively little on semantic completeness; as such, this research examines new modeling methods vs. quality frameworks and metrics, as well as quality assurance vs. understanding quality issues. The results also indicate that more empirical research is needed to develop a theoretical understanding of conceptual model quality. The classification scheme developed in this paper can serve as a guide for both researchers and practitioners.

Keywords: Conceptual Model Quality, Conceptual Models, Software, Systematic Literature Unified Modeling Language (UML)

INTRODUCTION

Software is becoming increasingly complex. So complex, in fact, that it is widely acknowl-

the customer, of deepening the understand- how software works, and ultimately of the complexity of software, is through of models (Thomas, 2004). Over the y

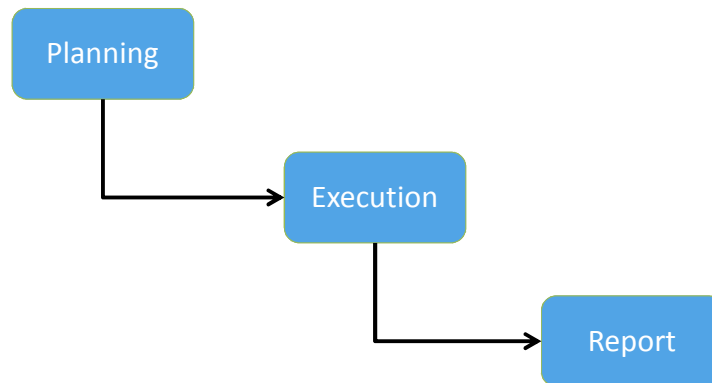


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Review process: phases



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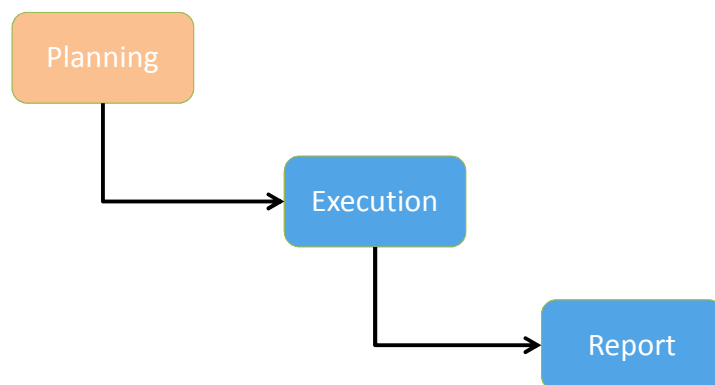
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Review process: **phases**

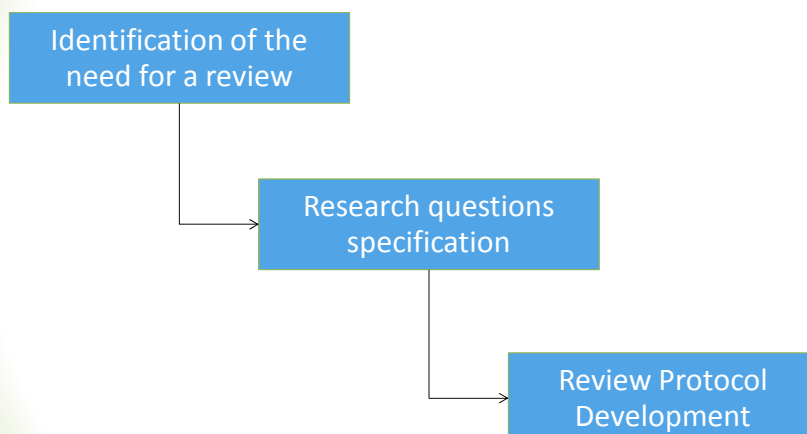


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Review process: **planning**



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Review process: **planning**

Identification of the
need for a review

Research questions
specification

Review Protocol
Development

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Review process: **planning**

- Researchers should **identify and review** any existing systematic reviews of the phenomenon of interest **against appropriate evaluation criteria**.

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Review process: **planning**

● Examples of evaluation criteria:

- What are the **review's objectives**?
- What **sources** were searched to identify primary studies? Were there any **restrictions**?
- What were the **inclusion/exclusion** criteria and how were they applied?
- What **criteria** were used to assess the **quality of primary studies** and how were they applied?
- How were the **data extracted** from the primary studies?
- How were the data **synthesized**? How were **differences** between studies investigated? How were the **data combined**? Was it reasonable to combine the studies? Do the **conclusions flow** from the **evidence**?

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Review process: **planning**

Identification of the
need for a review

Research questions
specification

Review Protocol
Development

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Review process: **planning**

- Specifying the **research questions** is the **most important part** of any systematic review.
- The **review questions drive** the entire **systematic review** methodology.
- The critical issue in any systematic review is to **ask the right question**.

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Review process: **planning**

- UML example RQs:
 - RQ1. Which **type of UML model quality** has been investigated by researchers?
 - RQ2. Which **research methods** are used in research on UML model quality?
 - RQ3. What is **the nature of the research results** on UML model quality?
 - RQ4. Which **research goals** are aimed at in research on UML model quality?
 - RQ5. Which **type of UML diagrams** is the focus of the research on UML model quality?



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Review process: **planning**



- It is desirable to define a **classification scheme**

...

	Dimensions	Categories
RQ1 →	Type of Quality	Syntactic quality: correctness Semantic quality: consistency, completeness, correctness Pragmatic quality: maintainability, analyzability, understandability, testability, functionality, executability, reusability, complexity, dependability.
RQ2 →	Type of Evidence / Research Method	Argumentation, example, experiment, case study, survey
RQ3 →	Type of Research Result	Quality model, notation, method (technique, methodology, process, approach, or strategy). or algorithm, tool, metric, confirmation of knowledge, pattern, view, checklist (guideline, rule or modeling convention)
RQ4 →	Research goal	Understanding, measuring, evaluating, assuring, improving
RQ5 →	Type of Diagram	Structure diagrams, behavior diagrams interaction diagrams

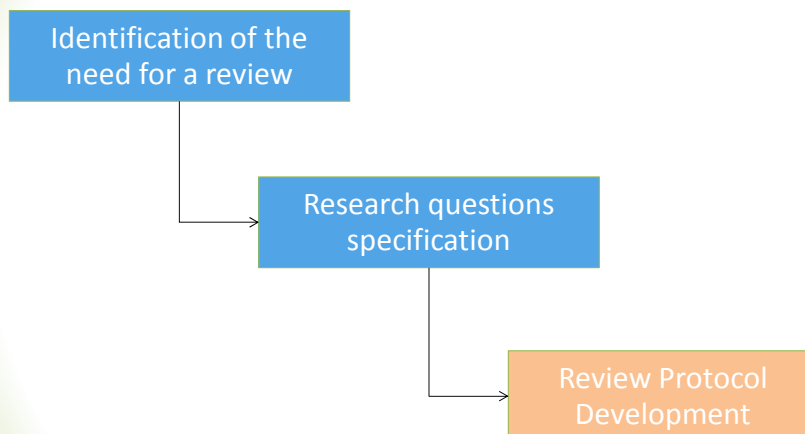
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Review process: **planning**



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Review process: **planning**

- A **review protocol** specifies the methods that will be used to undertake specific systematic review, to **reduce** the possibility of **researcher bias**.
- The components of a protocol include all the elements of the review plus some **additional planning information**.

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Review process: **planning**

- Review protocol development:
 - **Background**. The rationale for the review.
 - The **research questions** that the review is intended to answer
 - The **search strategy** that will be used to search for primary studies including **search terms** and **resources** to be searched.
 - Resources include digital libraries, specific journals, and conference proceedings.
 - **Study selection criteria**. Study selection criteria are used to determine which **studies** are **included** in, or **excluded** from, a systematic review.
 - It is usually helpful to pilot the selection criteria on a subset of primary studies.

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Review process: **planning**

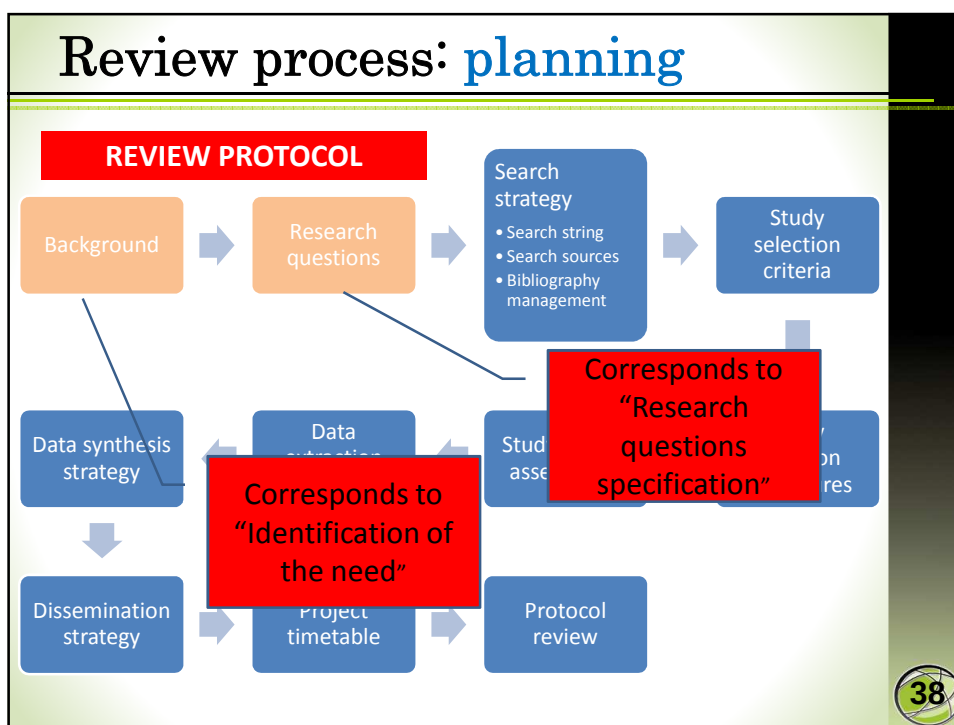
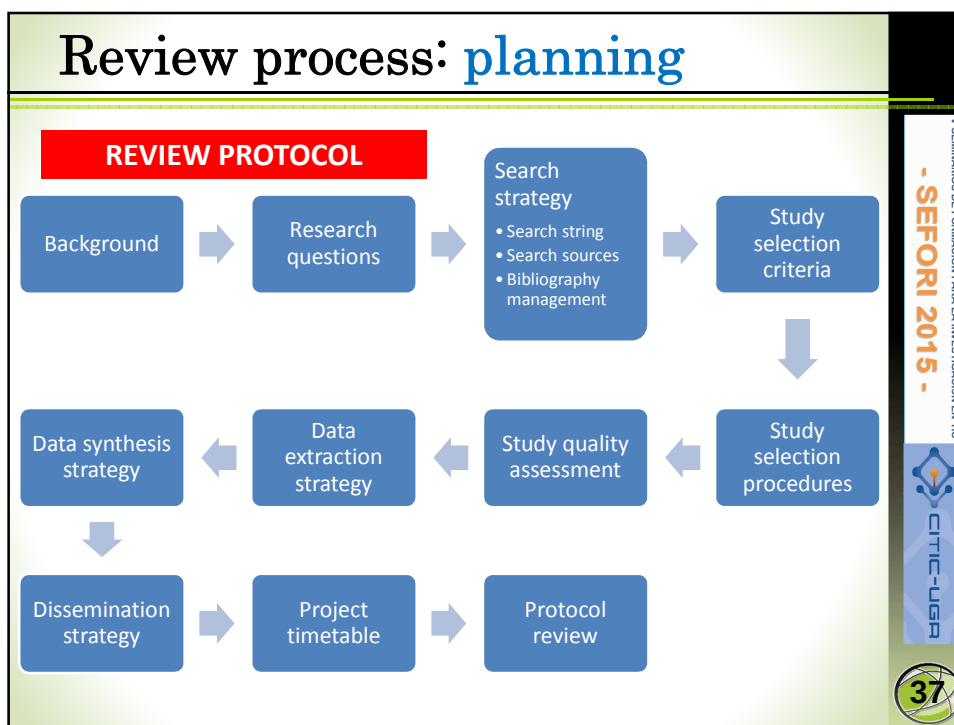
- Review protocol development (cont.):
 - **Study selection procedures.** The protocol should describe how the selection criteria will be applied:
 - How many assessors will evaluate each prospective primary study?
 - How disagreements among assessors will be resolved?.
 - **Study quality assessment checklists** and procedures. The researchers should develop quality checklists to assess the individual studies.
 - The purpose of the quality assessment will guide the development of checklists.
 - **Data extraction strategy.** This defines how the information required from each primary study will be obtained.



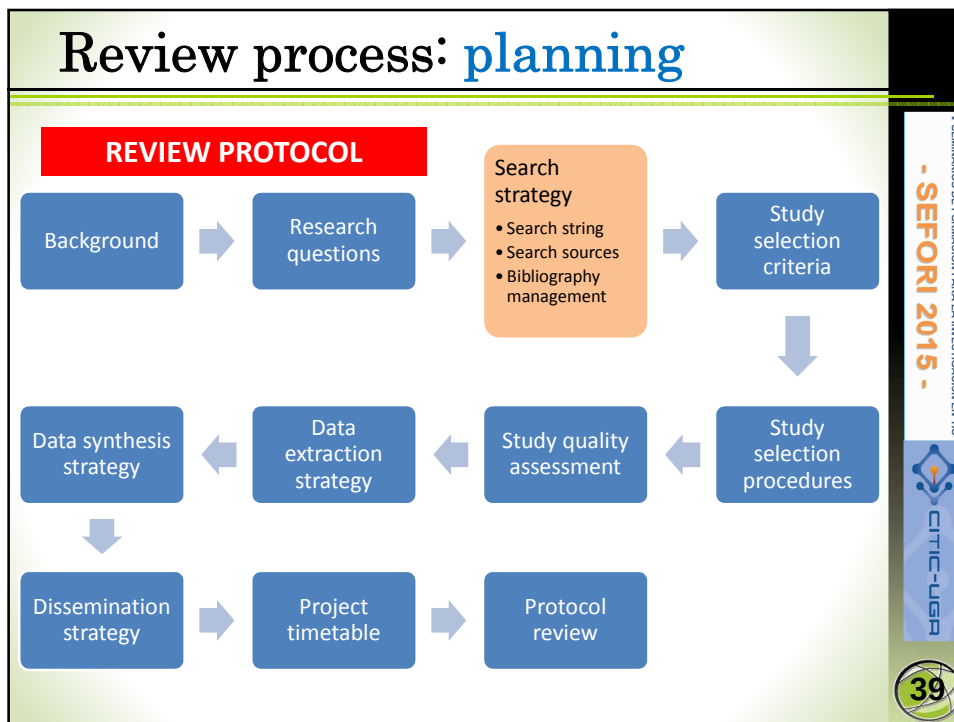
Review process: **planning**

- Review protocol development (cont.):
 - **Synthesis of the extracted data.** This defines the synthesis strategy.
 - This should clarify whether or not a formal meta-analysis is intended and if so what techniques will be used.
 - **Dissemination strategy.** How and where the results will be published or disseminated?.
 - **Project timetable.** This should define the review schedule.





Review process: **planning**



Review process: **planning**

● Review protocol-**search strategy**:

- It includes → **Search string**, **search sources** and **search period**
- Search strategies are usually iterative and benefit from:
 - Preliminary searches aimed at both identifying existing systematic reviews and assessing the volume of potentially relevant studies.
 - Trial searchers using various combinations of search terms derived from the research question
 - Reviews of research results
 - Consultations with experts in the field

Review process: **planning**

● Review protocol-**search string**:

➤ Constructed using the following steps:

- Define the **major terms**.
- Identify **alternative spellings**, **synonyms**, related terms for major terms.
- Check the keywords in any relevant papers we already had.
- Use the Boolean **OR**, to incorporate **alternative spellings**, **synonyms**, related terms.
- Use the Boolean **AND** to link the **major terms**.

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Review process: **planning**

● UML example **search string**:

Major terms	Alternative terms
Quality	quality OR consistency OR maintainability OR understandability OR completeness OR comprehension OR comprehensibility OR testability OR defect OR effectiveness OR complexity OR readability OR metric OR measure OR efficiency OR validation OR verification OR layout
UML	UML OR Unified Modeling Language
Representation	Representation OR diagram OR model

- (UML OR UNIFIED MODELING LANGUAGE) **AND** (REPRESENTATION OR DIAGRAM OR MODEL) **AND** (QUALITY OR CONSISTENCY OR MAINTAINABILITY OR UNDERSTANDABILITY OR COMPLETENESS OR COMPREHENSION OR COMPREHENSABILITY OR TESTABILITY OR DEFECT OR EFFECTIVENNES OR COMPLEXITY OR READABILITY OR EFFICIENCY OR VALIDATION OR VERIFICATION OR LAYOUT)



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Review process: **planning**

- UML example **search sources**
 - SCOPUS database,
 - Science@Direct with the subject Computer Science,
 - Wiley InterScience with the subject of Computer Science,
 - IEEE Digital Library,
 - ACM Digital Library,
 - SPRINGER database.
- **Search period** → 1997-2009
- **Type of documents** → Journals, Conferences, Workshops
- **Search in** → Title, Keywords and Abstract



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Review process: **planning**

- Review protocol - **Bibliography management** and document retrieval:
 - **Bibliographic packages** such as Reference Manager, Endnote are very useful to manage the large number of references that can be obtained from a thorough literature research.
 - Once reference lists have been finalized the **full articles** of potentially useful studies will **need to be obtained**.

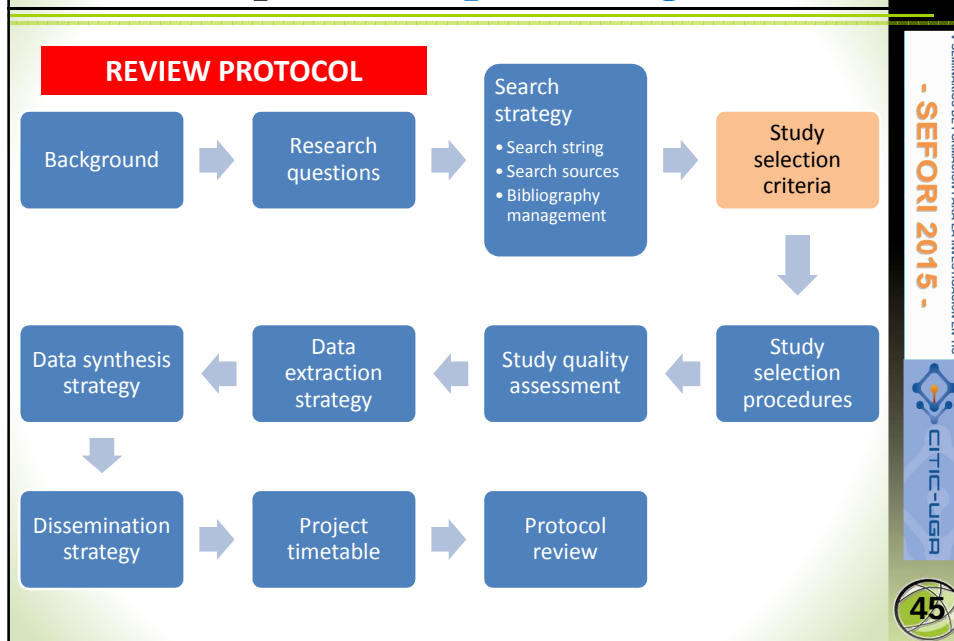
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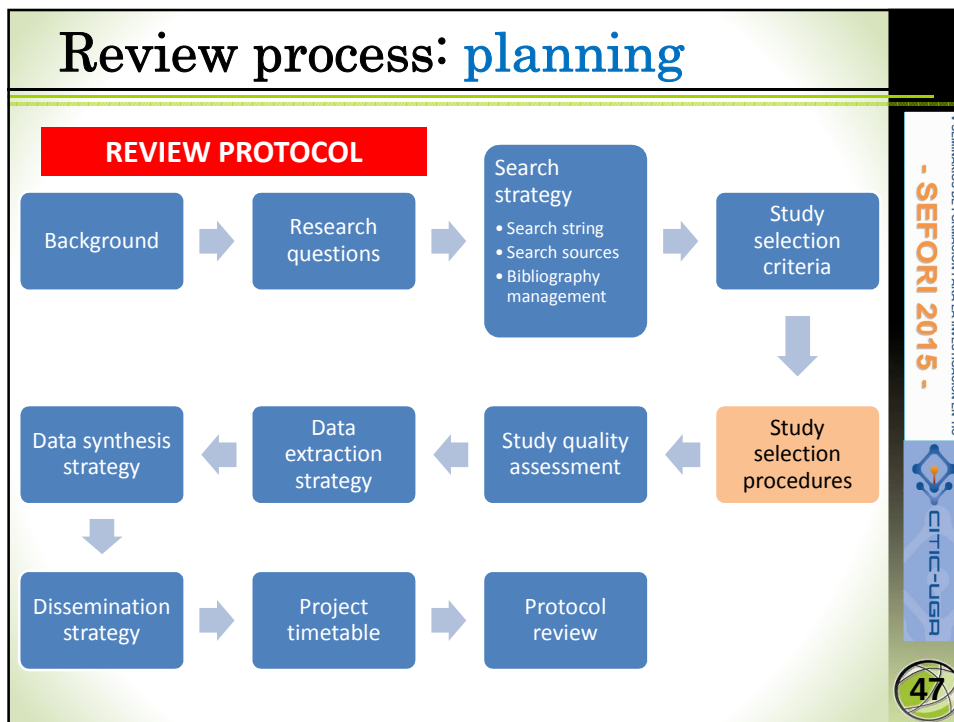
Review process: **planning**



Review process: **planning**

- Review protocol - **Study selection criteria**:
 - Selection criteria should be decided during the protocol definition.
 - **Inclusion and exclusion criteria** should be based on the research question.
 - They **should be piloted** to ensure that they can be reliably interpreted and that they classify studies correctly.

Review process: **planning**



Review process: **planning**

● Review protocol - **Primary studies selection procedures:**

➤ Study selection process

- Initially, selection criteria should be interpreted liberally, so that unless studies can be clearly excluded based on titles and abstracts, full copies should be obtained.
- Final inclusion/exclusion decisions should be made after the full texts have been retrieved.
- Maintain a list of excluded studies identifying the reason for exclusion.

➤ Reliability of inclusion decisions

- When two or more researchers assess each paper, agreement between researchers must be reached

Review process: **planning**

- UML example **inclusion criteria**
 - Papers which dealt with UML and the tangible results of the modelling process (the UML diagram),
 - were written in English,
 - and were published between 1997 and 2009.

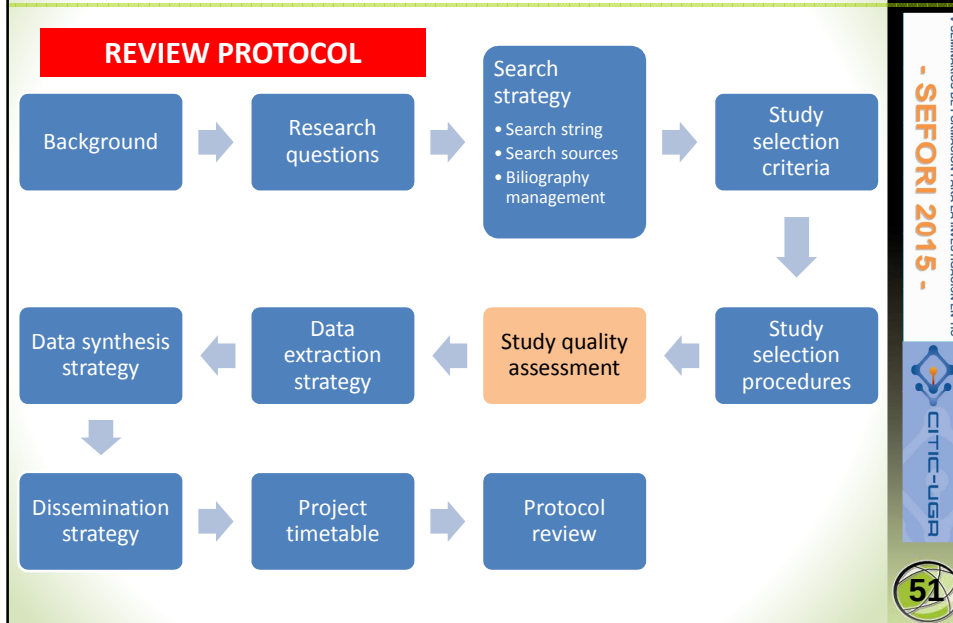


Review process: **planning**

- UML example **exclusion criteria**
 - pure discussion and opinion papers, studies available only in the form of abstracts or PowerPoint presentations,
 - duplicates (for example, the same paper included in more than one database or in more than one journal),
 - research focusing issues other than UML model quality (for example, functional size measurement), or where quality is mentioned only as a general introductory term in the paper's abstract and an approach
 - Papers were also excluded if they dealt with the quality and complexity of UML as a language (for example, how to make UML the language simpler) rather than on the complexity of the models produced by UML,
 - If the paper was a summary of a workshop.



Review process: **planning**



Review process: **planning**

● Review protocol - **Quality assessment of primary studies:**

- It is generally considered important to assess the “quality” of primary studies.
- To provide still more detailed inclusion/exclusion criteria.
- To investigate whether quality differences provide an explanation for differences in study results.
- As a means of weighting the importance of individual studies when results are being synthesized.
- To guide the interpretation of findings and determine the strength of inferences.
- To guide recommendations for further research.

Review process: **planning**

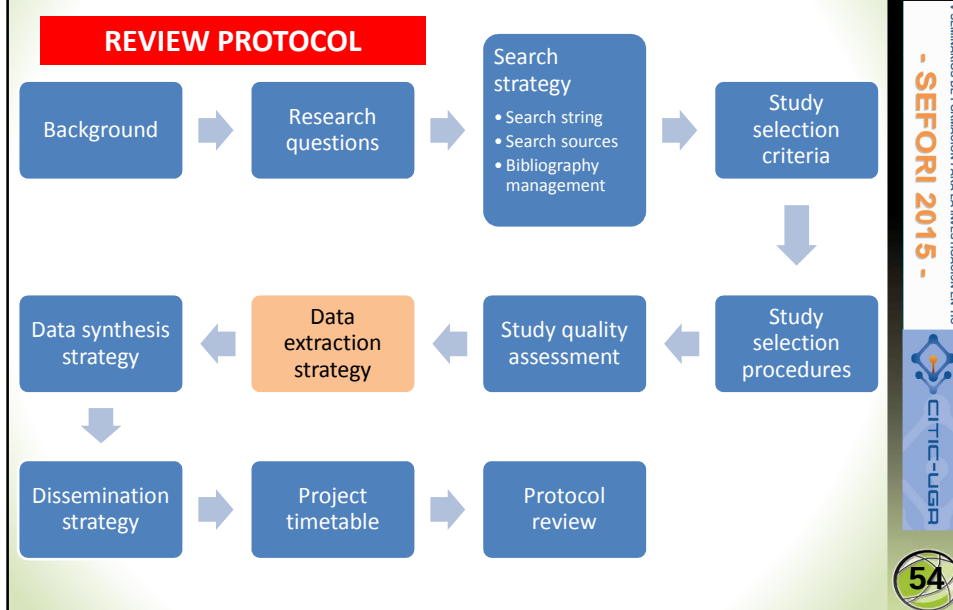
- Review protocol - **Development of quality instruments:**
 - It is advisable to :
 - build checklists
 - assign numerical scales → numerical assessments of quality can be obtained.
 - Checklists are also developed by considering bias and validity problems that can occur at the different stages in an empirical study: Design, Conduct, Analysis, and Conclusions.
 - Kitchenham and Charters (2007) in the technical report provide:
 - A quality checklist for quantitative studies
 - A quality checklist for qualitative studies

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Review process: **planning**



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Review process: **planning**

- Review- protocol - **Data extraction forms** must contain, at least:
 - Name of Review
 - Date of Data extraction
 - Title, authors, journal, publication details
 - Space for additional notes
- Data extraction procedures
 - Whenever feasible, data extraction should be performed independently by two or more researchers.
 - Data from the researchers must be compared and disagreements must be solved
- It is fundamental to avoid including multiple publications of the same data

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Review process: **planning**

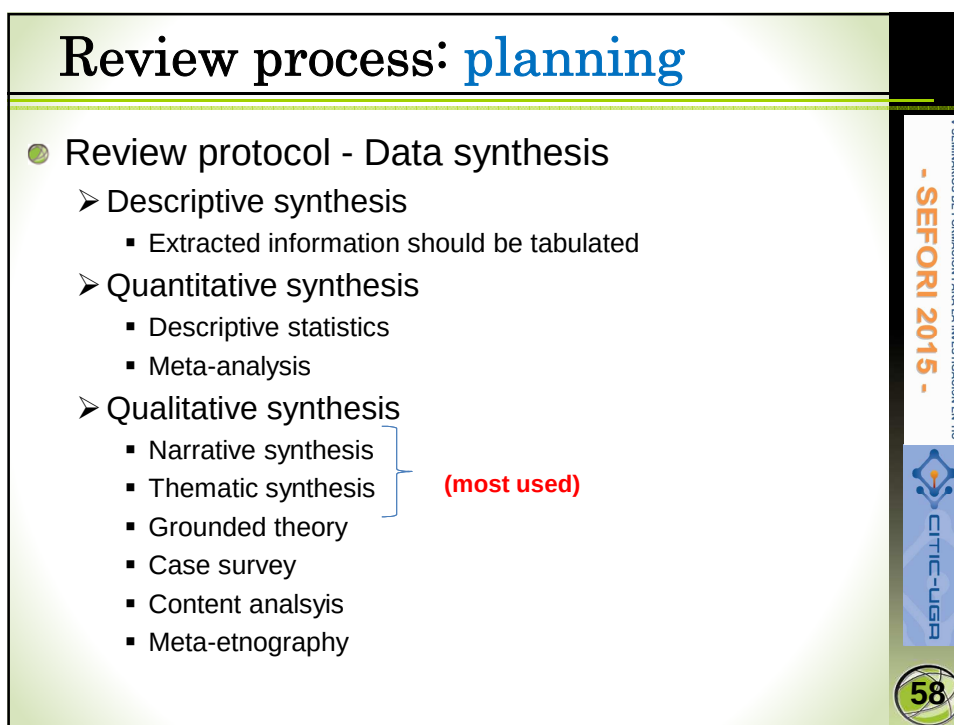
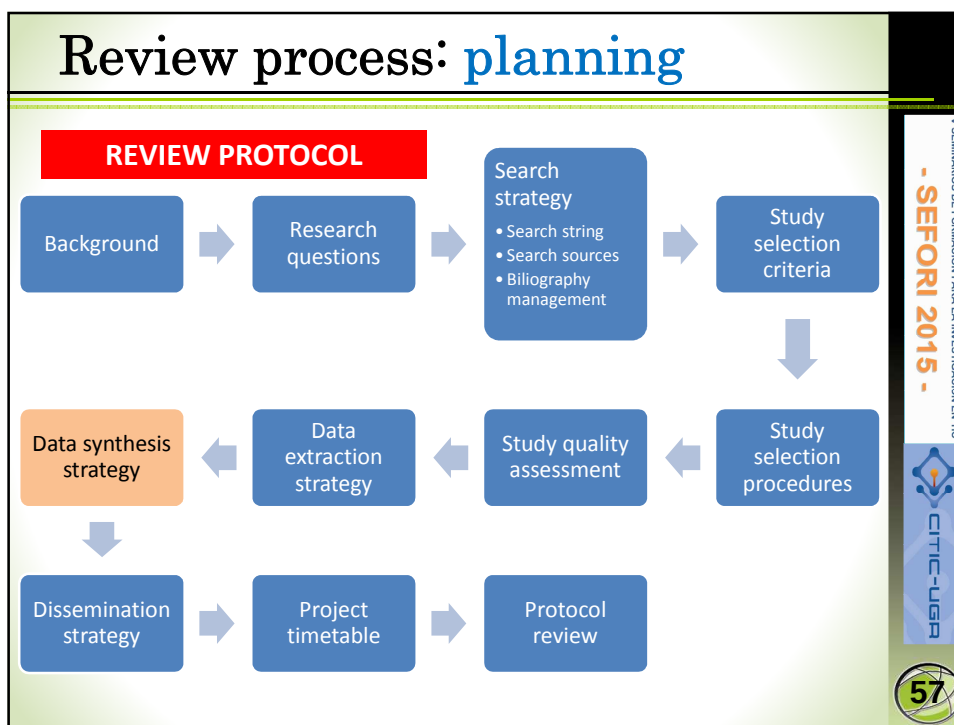
- UML example data extraction form:
 - Metadata of the primary studies
 - Columns for each research questions (RQ1-RQ5)
 - Notes



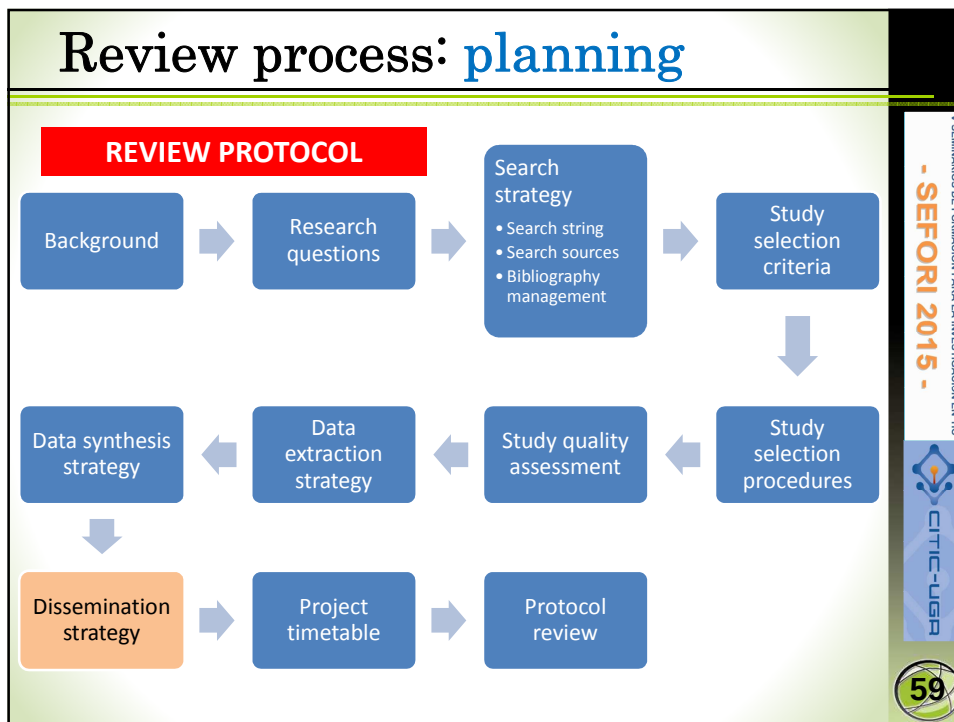
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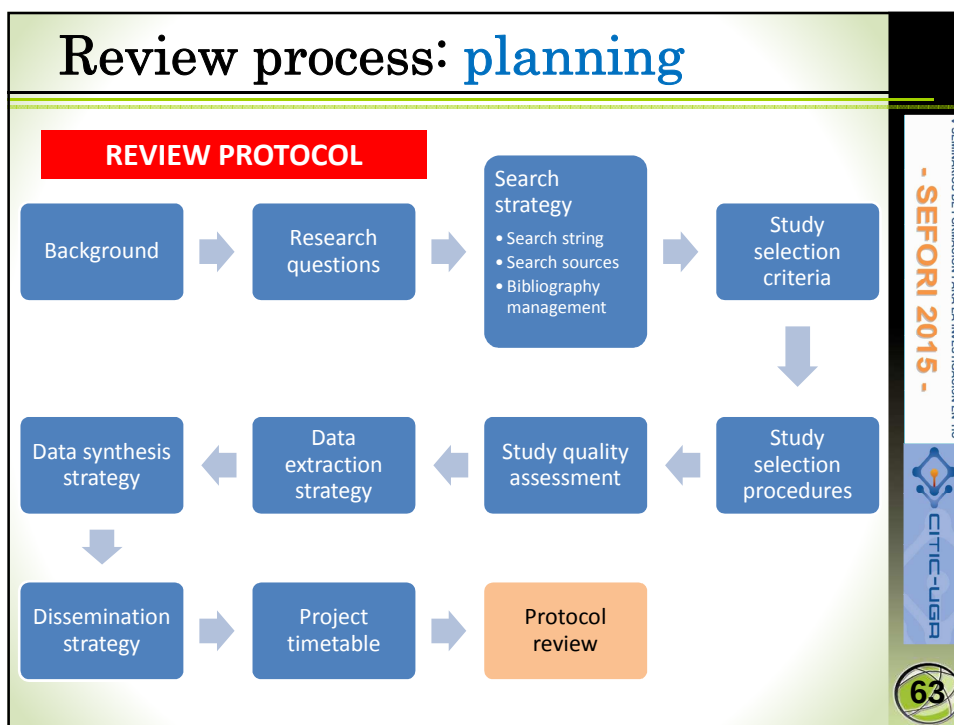
Review process: **planning**



Review process: **planning**

- Review protocol - **Dissemination strategy**:
 - It is important to communicate the results of a systematic review effectively.
 - Most guidelines recommend planning the dissemination strategy when preparing the systematic review protocol.

Review process: **planning**



Review process: **planning**

● Protocol review

- The protocol is a critical element of any systematic review.
- Researchers must agree a procedure for reviewing the protocol.
- If appropriate funding is available, a **group of independent experts** should be asked to **review the protocol**.
- The same experts can later be asked to review the final report.

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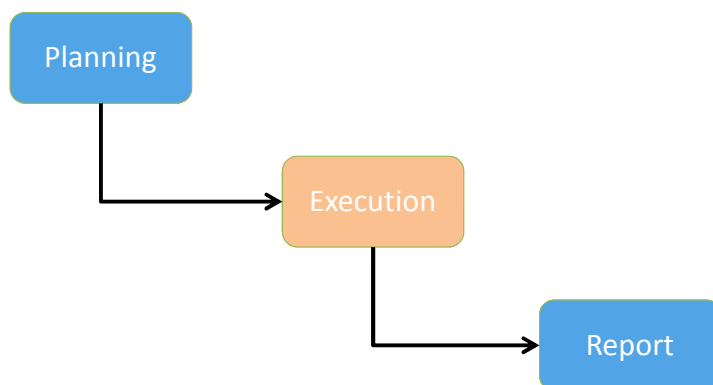
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Review process: phases

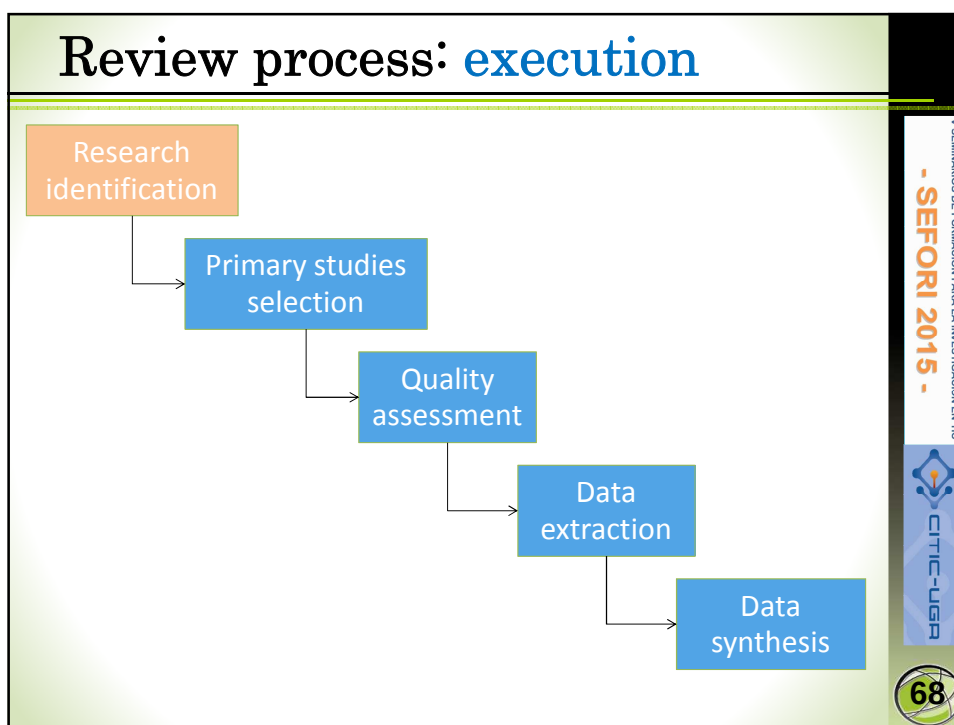
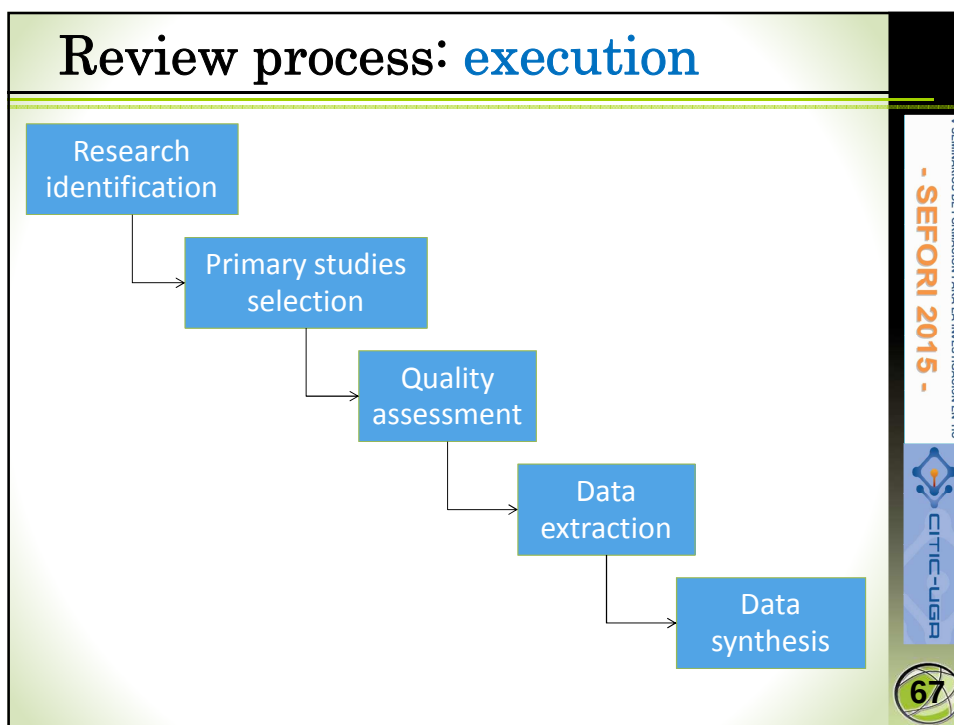


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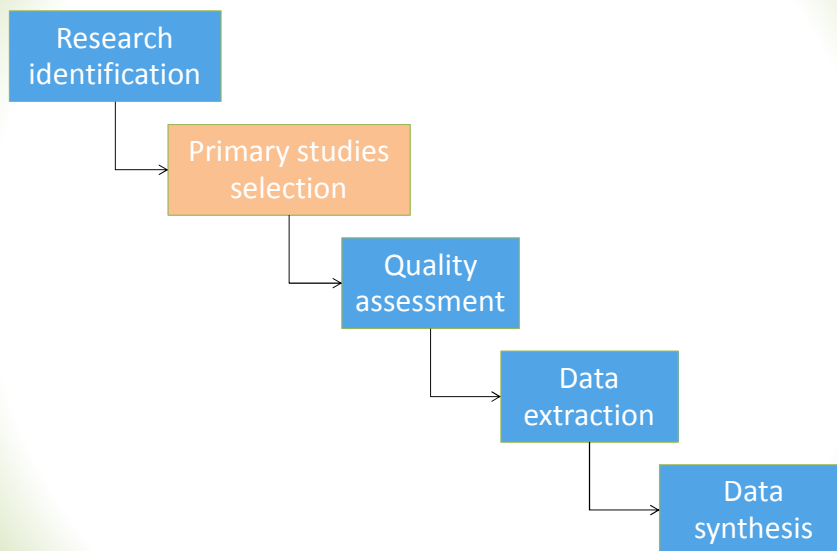
Review process: execution

- It is necessary to search the primary studies by following the search strategy
- It could be necessary:
 - To refine the search string
 - To add search sources
 - To change the search period
 - Save the searches, the meta-data, the abstract, in Bibliography management systems (EndNote, BibTex, JabRef, etc.)
 - Detect duplications (found in several search sources)

Review process: execution

- Documenting the search
 - The process of performing a systematic review must be transparent and replicable.
 - The review must be documented in sufficient detail for readers to be able to assess the thoroughness of the search.
 - The search should be documented as it occurs and changes noted and justified.

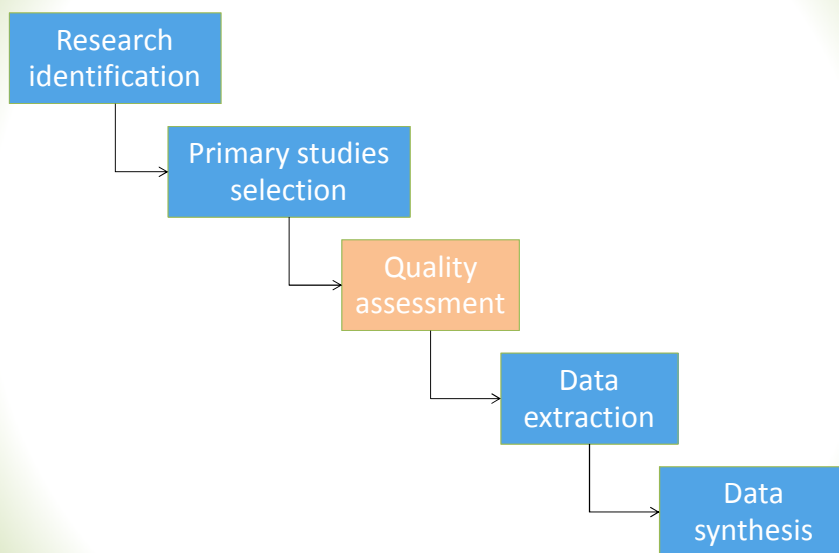
Review process: execution



Review process: execution

- The selection of primary studies must take into account the **inclusion/exclusion criteria** and the procedure defined in the protocol.
- If any primary study it is not available to be downloaded, you can contact to other researchers or the authors.
- The list of the selected primary studies is obtained.
- The primary studies must be managed by a bibliographic management tool (EndNote, BibTex, JabRef etc.).
- It is advisable to keep the list of the excluded studies and the motivation for their exclusion.

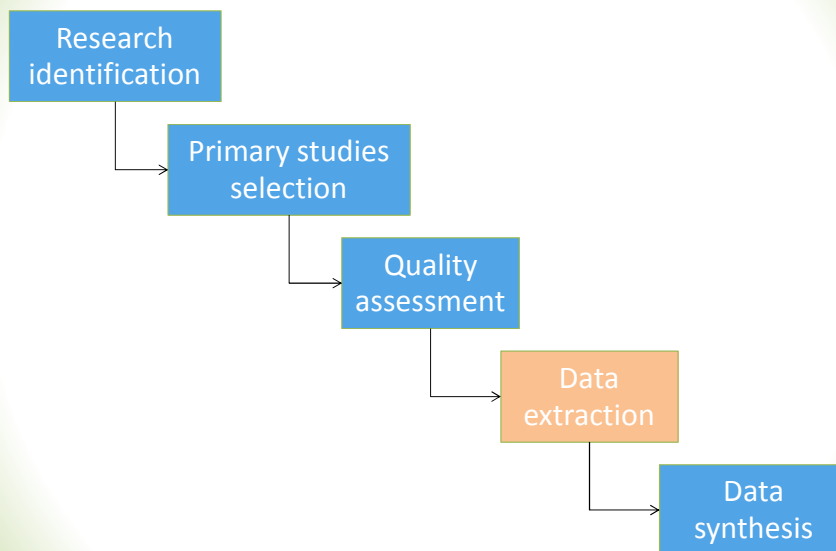
Review process: execution



Review process: execution

- Quality assessment (SMSs do not require QA)
 - Carry out the quality assessment according to the instrument defined on the protocol.
 - It could be necessary to exclude a primary study that does not reach the required level of quality.

Review process: execution



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Review process: execution

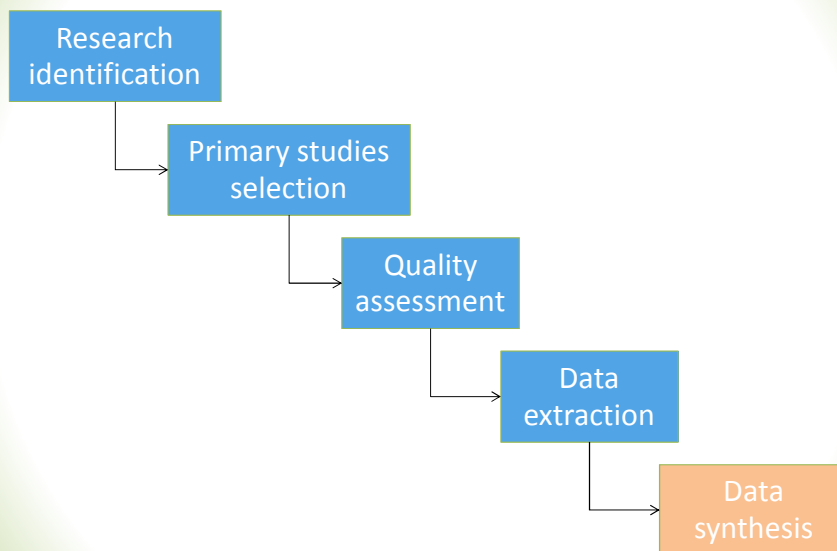
- Data extraction
 - Fill the data extraction form defined in the protocol.
 - The data extraction could be checked by other researcher.
 - Discrepancies must be solved.
 - If duplicates are found the most complete and recent study must be considered.

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Review process: execution



Review process: execution

- Data synthesis
 - The extracted data is synthesized using the techniques established in the protocol for **answering** the formulated **research questions** (RQ1-RQ5).

Agenda

- Introduction
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 - Execution
 - **Report**
- Conclusions
- Relevant literature

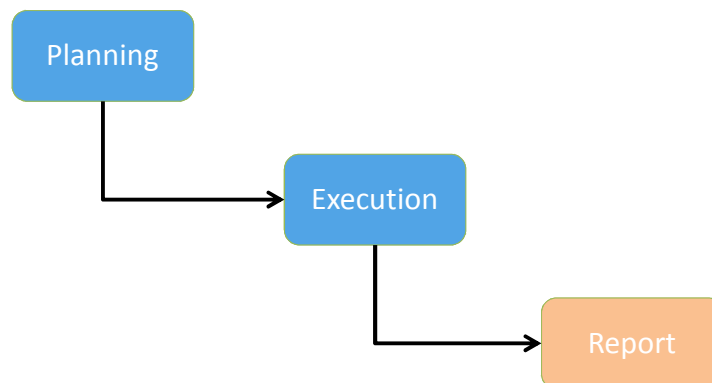
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Review process: phases



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Review process: report



Dissemination media
selection

Report formatting

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Review process: report



Dissemination media
selection

Report formatting

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Review process: report

● Dissemination venues

➤ Journals

- Information and Software Technology
- IEEE Transactions on Software Engineering
- Empirical Software Engineering
- IEEE Software – Voice of Evidence column
- ...

➤ Conferences

- ESEM (Empirical software engineering and measurement)
- EASE (Evaluation and assessment in software engineering)
- ...

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Review process: report



Dissemination media
selection

Report formatting

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Review process: report

- Usually systematic reviews will be reported in, at least, two formats:
 - In a **technical report** or in a section of a PhD thesis.
 - In a **journal or conference paper**.
- A journal or conference paper will normally have size restrictions.
- In order to ensure that readers are able to properly evaluate the rigor and validity of a systematic review, journal papers should reference the technical report or thesis that contains all the details.

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Review process: report

Section	Subsection	Scope
Title*		
Authorship*		
Executive summary or Structured Abstract*	Context	The importance of the research questions addressed by the review
	Objectives	The questions addressed by the systematic review
	Methods	Data Sources, Study selection, Quality Assessment and Data extraction
	Results	Main finding including any meta-analysis results and sensitivity analyses.
	Conclusions	Implications for practice and future research
Background		Justification of the need for the review. Summary of previous reviews
Review questions		Each review question should be specified
Review Methods	Data sources and search strategy	
	Study selection	
	Study quality assessment	
	Data extraction	
	Data synthesis	
Included and excluded studies		Inclusion and exclusion criteria List of excluded studies with rationale for exclusion

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Review process: report

Results	Findings	Description of primary studies Results of any quantitative summaries Details of any meta-analysis
	Sensitivity analysis	
Discussion	Principal findings	
	Strengths and Weaknesses	Strength and weaknesses of the evidence included in the review Relation to other reviews, particularly considering any differences in quality and results.
	Meaning of findings	Direction and magnitude of effect observed in summarised studies Applicability (generalisability) of the findings
Conclusions	Recommendations	Practical implications for software development Unanswered questions and implications for future research
Acknowledgements*		All persons who contributed to the research but did fulfil authorship criteria
Conflict of Interest		
References and Appendices		

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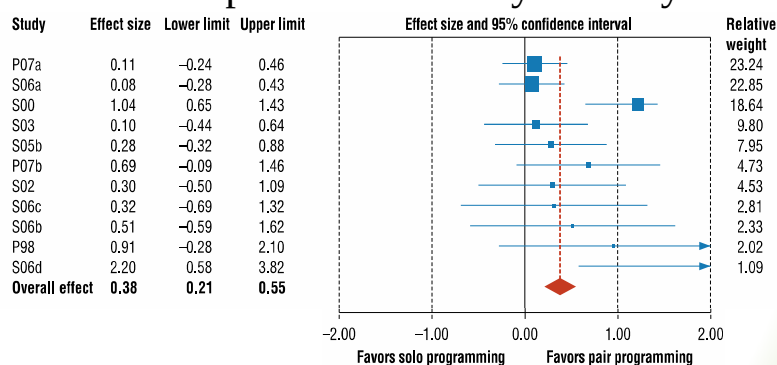


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Review process: report

Graphical representation

Forest plot: a meta-analysis study



Tore Dybå, Erik Arisholm, Dag I. K. Sjøberg, Jo Erskine Hannay, Forrest Shull. *Are Two Heads Better than One? On the Effectiveness of Pair Programming*. IEEE Software 24(6): 12-15 (2007)

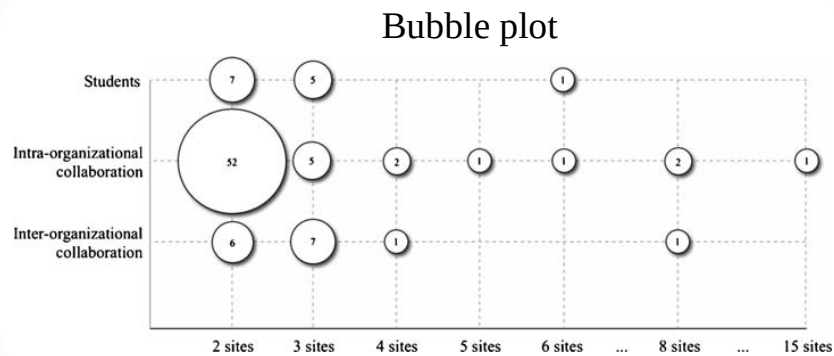
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Review process: report

Graphical representation



Number of partners from the analyzed studies

Darja Šmite, Claes Wohlin, Tony Gorschek, Robert Feldt. (2010).

Empirical evidence in global software engineering: a systematic review.

Empirical Software Engineering, 15, 91–118.

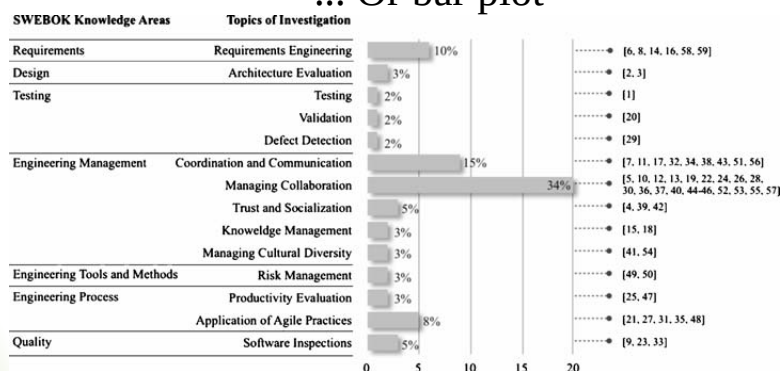
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Review process: report

Graphical representation

... Or bar plot



Detailed list of covered topics

Darja Šmite, Claes Wohlin, Tony Gorschek, Robert Feldt. (2010).

Empirical evidence in global software engineering: a systematic review.

Empirical Software Engineering, 15, 91–118.

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Review process: report

● Graphical representation

... or just a table?

Type of quality	Number	Percent
Syntactic	15	5.64%
Semantic	135	50.75%
Pragmatic	103	38.72%
Syntactic + Semantic	6	2.26%
Syntactic + Pragmatic	0	0.00%
Semantic + Pragmatic	6	2.26%
Syntactic + Semantic + Pragmatic	1	0.38%
Total	266	100.00%

Example (UML). Percentage of Papers Addressing Different QualityTypes

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Review process: report

● Evaluating systematic review reports

- If an **expert panel** were assembled to review the study protocol, the same panel would be appropriate to undertake peer review of the systematic review report.
- Otherwise several **researchers with expertise** in the topic area and/or systematic review methodology should be approached to review the report.
- The evaluation process can **use quality checklists**.

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Review process: report

Model Quality (RQ1)



Type of quality	Number	Percent
Syntactic	15	5.64%
Semantic	135	50.75%
Pragmatic	103	38.72%
Syntactic + Semantic	6	2.26%
Syntactic + Pragmatic	0	0.00%
Semantic + Pragmatic	6	2.26%
Syntactic + Semantic + Pragmatic	1	0.38%
Total	266	100.00%



20(3) 46-70

Review process: report

Model Quality (RQ1)



Type of quality	Number	Percent
Syntactic	15	5.64%
Semantic	135	50.75%
Pragmatic	103	38.72%
Syntactic + Semantic	6	2.26%
Syntactic + Pragmatic	0	0.00%
Semantic + Pragmatic	6	2.26%
Syntactic + Semantic + Pragmatic	1	0.38%
Total	266	100.00%



20(3) 46-70

Review process: report

Model Quality (RQ1)



Syntactic	Number	Percent
Correctness	21	100.0%
Total	21	

Semantic	Number	Percent
Consistency	113	62.09%
Completeness	14	7.69%
Correctness	55	30.22%
Total	182	

Pragmatic	Number	Percent
Maintainability	24	19.35%
Analyzability	1	0.81%
Understandability	78	62.90%
Testability	2	2.61%
Functionality	4	3.23%
Executability	2	1.61%
Reusability	1	0.81%
Complexity	11	8.87%
Dependability	1	0.81%
Total	124	

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Review process: report

Research Method (RQ2)

Research method	Number	Percent
Empirical	83	29.86%
Experiment	66	23.74%
Case study	15	5.40%
Survey	2	0.72%
Non empirical	195	70.14%
Speculation	26	9.35%
Example	169	60.79%
Literature Review	0	0.00%
Total	278	



96(3) 46-70



Review process: report

Research Results (RQ3)

Type of Result	Number	Percent
Formal semantics	3	1.01%
Framework	3	1.01%
Knowledge	55	18.46%
Method	119	39.93%
Metrics	28	9.40%
Notation	10	3.36%
Pattern	4	1.34%
Quality model	1	0.34%
Tool	50	16.78%
View	3	1.01%
Checklist, rules, modeling conventions, and guidelines	22	7.38%
Total	298	100.0%



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Review process: report

Research Goals (RQ4)

Research Goal	Number	Percent
Improving	15	5.64%
Assuring	122	45.49%
Measuring	38	14.29%
Evaluating	85	31.95%
Understanding	7	2.63%
Total	266	100.0%



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Review process: report

UML Type Diagram (RQ5)

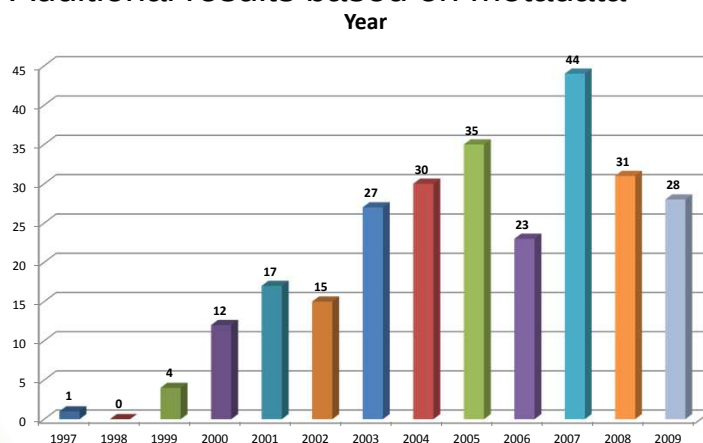
Type of diagram	Number	Percent
Class diagrams	83	25.30%
Sequence diagrams	34	10.37%
Activity diagrams	15	4.57%
Use case diagrams	21	6.40%
Statechart diagrams	55	16.77%
Collaboration diagrams	8	2.44%
Component diagrams	3	0.91%
Object diagrams	2	0.61%
Package diagrams	3	0.91%
Deployment diagrams	1	0.30%
No specific diagram	103	31.40%
UML 2.0 new diagrams	0	0.0%
Total	328	100.0%



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Review process: report

Additional results based on metadata



Number of publications per year

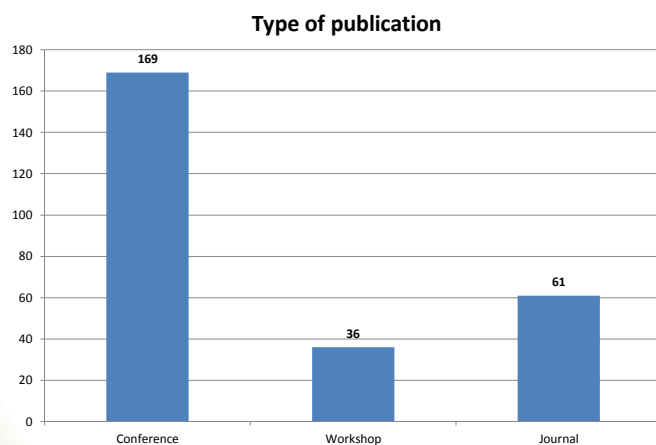


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Review process: report

Additional results based on metadata



Number of publications per type of publications



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Review process: execution

Combination of RQs

Research method	Number	Percent	Syntactic		Semantic		Pragmatic	
Empirical	83	29.86 %						
Experiment	66	23.74 %	2	9.09%	19	12.84 %	62	57.41 %
Case study	15	5.40%	2	9.09%	9	6.08%	55	50.93 %
Survey	2	0.72%	0	0.00%	9	6.08%	6	5.56%
Non empirical	195	70.14 %	0	0.00%	1	0.68%	1	0.93%
Speculation	26	9.35%	20	90.91 %	129	87.16 %	46	42.59 %
Example	169	60.79 %	2	9.09%	19	12.84 %	5	4.63%
Literature Review	0	0.00%	18	81.82 %	110	74.32 %	41	37.96 %
			0	0.00%	0	0.00%	0	0.00%
Total	278		22		148		108	

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Agenda

- Introduction
 - Systematic literature review (SLR)
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Conclusions

- The software engineering research community is starting to adopt SLRs consistently as a research method.
 - number of SLRs is increasing.
 - number of researchers and organizations performing them is increasing.
- The integration of the results of the primary studies was poorly conducted by many SLRs.

Source (da Silva et al., 2011)

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Conclusions

- There was very **little consistency** in the way the SLRs are **organized**.
- Many SLRs **omitted essential data**, including important parts of the review protocol.
- The majority of the SLRs:
 - **Do not evaluate** the **quality** of primary studies.
 - **Do not provide guidelines for practitioners**, thus decreasing their potential impact on software engineering practice.

Source (da Silva et al., 2011)



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- **Relevant literature**



Relevant literature



- Guidelines and lessons learned literature
 - Kitchenham, B. and Charters, S. (2007). **Guidelines for performing Systematic Literature Reviews in Software Engineering**. Version 2.3 EBSE-2007-01.
 - B. Kitchenham, D. Budgen and P. Brereton, **Using mapping studies as the basis for further research – A participant-observer case study**, Information and Software Technology, vol. 53 (6), pp. 638-651, 2011.
 - Kai Petersen, Sairam Vakkalanka, Ludwik Kuzniarz. **Guidelines for conducting systematic mapping studies in software engineering: An update**. Information & Software Technology 64: 1-18 (2015)

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Relevant literature



- Guidelines and lessons learned literature
 - Brereton et al., (2007). **Lessons from applying the systematic literature review process within the software engineering domain**. Journal of Systems and Software, 80, 571-583.
 - Staples, M., Niazi, M. (2007). **Experiences using systematic review guidelines**. The Journal of Systems and Software, 80(9), 1425–1437.

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Relevant literature



● Tertiary studies literature

- Kitchenham, B., Brereton, P., Budgen, D., Turner, M., Bailey, J., Linkman, S. (2009). **Systematic literature reviews in software engineering – A systematic literature review**. Information and Software Technology 51 7–15.
- Kitchenham, B. e tal.(2010). **Literature reviews in software engineering – a tertiary study**. Information and Software Technology 52 (8) 792–805.
- Fabio Q.B. da Silva, André L.M. Santos, Sérgio Soares, A. César C. França, Cleviton V.F. (2011). **Six Years of Systematic Literature Reviews in Software Engineering: An Updated Tertiary Study**. Information and Software Technology 53(9) 899-913.
- Zhang, H., Ali Babar, M. (2013). **Systematic reviews in software engineering: An empirical investigation**. Information and Software Technology, 55(7),1341–1354

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Relevant literature



● SLR literature

- Tore Dybå, Torgeir Dingsøyr. **Empirical studies of agile software development: A systematic review**. Information & Software Technology 50(9-10): 833-859 (2008).
- Darja Šmite, Claes Wohlin, Tony Gorshek, Robert Feldt. (2010). **Empirical evidence in global software engineering: a systematic review**. Empirical Software Engineering, 15, 91–118.
- Sarah Beecham, Nathan Baddoo, Tracy Hall, Hugh Robinson, Helen Sharp. **Motivation in Software Engineering: A systematic literature review**. Information & Software Technology 50(9-10): 860-878 (2008).
- Tracy Hall, Sarah Beecham, David Bowes, David Gray, Steve Counsell. **A Systematic Literature Review on Fault Prediction Performance in Software Engineering**. IEEE Trans. Software Eng. 38(6): 1276-1304 (2012)

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Relevant Literature



● SMS Literature

1. Oscar Pedreira, Félix García, Nieves Brisaboa, Mario Piattini. (2015). **Gamification in software engineering** – A systematic mapping. Information and Software Technology. Volume 57, January 2015, 157–168.
2. Adrián Fernández, Emilio Insfrán, Silvia Abrahão. **Usability evaluation methods for the web: A systematic mapping study**. Information & Software Technology 53(8): 789-817 (2011).
3. Ana M. Fernández-Sáez, Marcela Genero, Michel R. V. Chaudron. **Empirical studies concerning the maintenance of UML diagrams and their use in the maintenance of code: A systematic mapping study**. Information & Software Technology 55(7): 1119-1142 (2013).

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Relevant Literature



● SMS Literature:

4. Giuffrida, R., Dittrich, Y. (2013). **Empirical studies on the use of social software in global software development** - A systematic mapping study. Information & Software Technology 55(7): 1143-1164.
5. Maria Riaz, Travis D. Breaux, Laurie A. Williams. **How have we evaluated software pattern application? A systematic mapping study of research design practices**. Information & Software Technology 65: 14-38 (2015).
6. Nicolò Paternoster, Carmine Giardino, Michael Unterkalmsteiner, Tony Gorschek, Pekka Abrahamsson. **Software development in startup companies: A systematic mapping study**. Information & Software Technology 56(10): 1200-1218 (2014).
7. Marc Oriol, Jordi Marco, Xavier Franch. **Quality models for web services: A systematic mapping**. Information & Software Technology 56(10): 1167-1182 (2014).

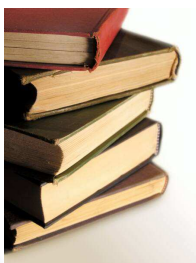
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¿Cómo realizar revisiones de la literatura científica de manera sistemática y rigurosa?



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