

# Scientific Methods in Information Systems - Intermediate Meeting -

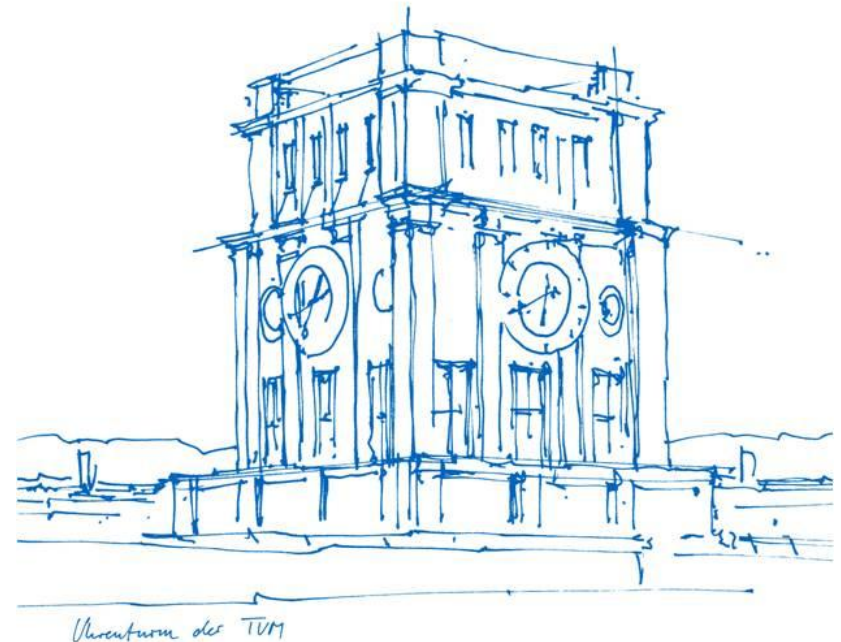
Michel Kunkler

Technische Universität München

CIT

Information Systems and Business Process  
Management

May, 24th 2023



What happened so far...

# Part I

## Design science research

## Part II

# Systematic literature review

# Systematic literature review

„A systematic literature review is a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest.“ [2]

# Systematic literature review

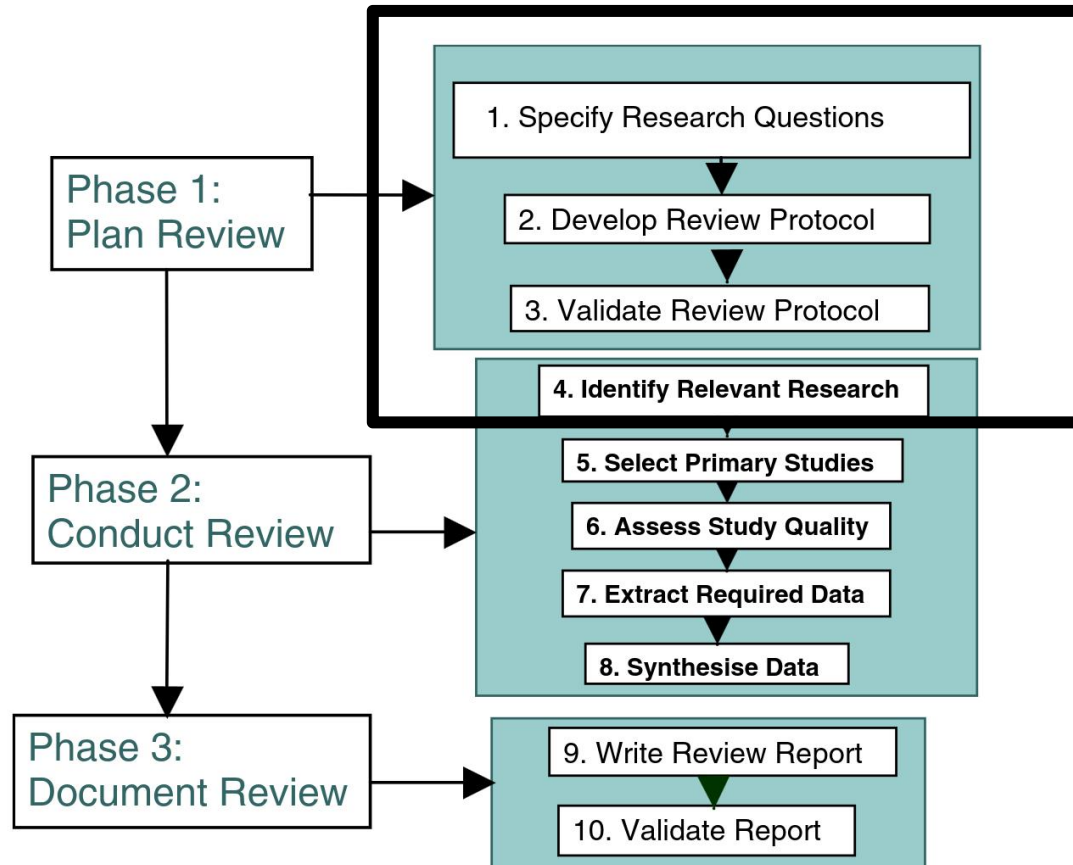


Fig. 1. Systematic literature review process.  
from [1]

Today

# Presentations



# Discussion

- Is your review protocol feasible:
  - Research questions
  - Search strategies:
    - Terms
    - Resources
    - Databases
  - Study selection criteria
  - Study quality assesment checklists
  - Data extraction strategy
  - (Data synthesis)

# Discussion

What comes next...

# Final meeting

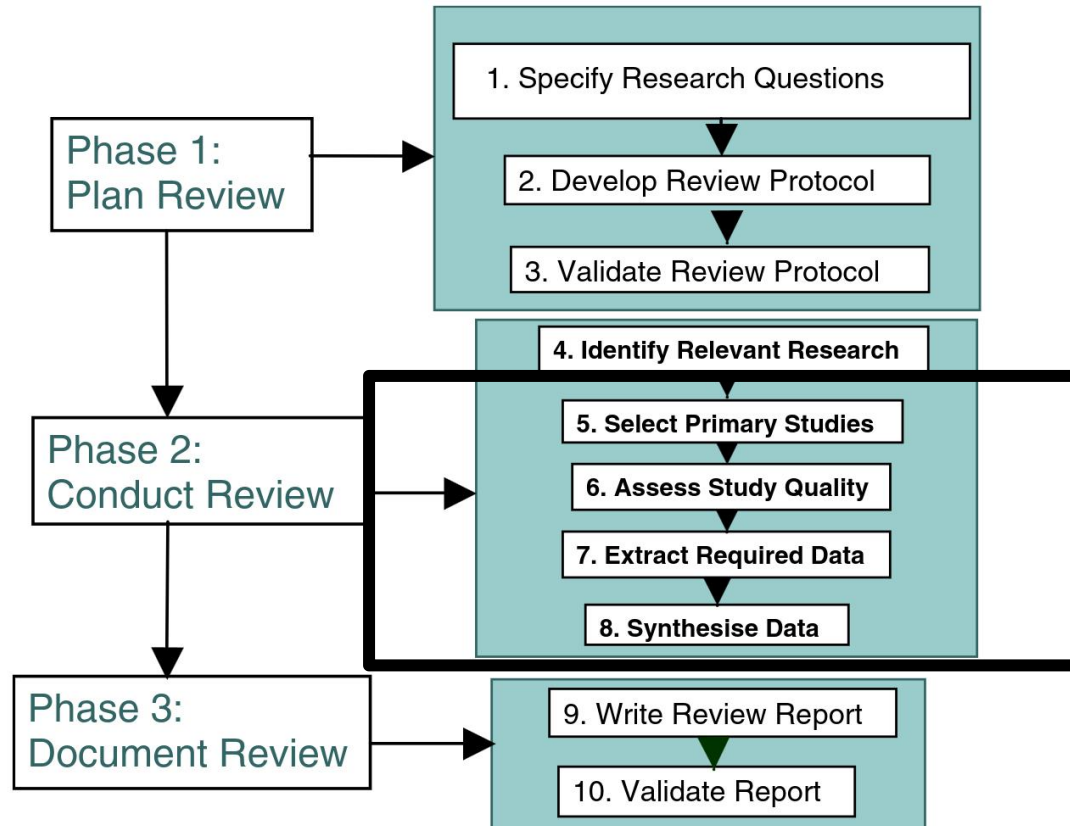


Fig. 1. Systematic literature review process.  
from [1]

## 5. Select primary studies

- Review the title and abstract of studies identified by the initial searches
- Exclude irrelevant papers
  - Selection criteria should be interpreted liberally
- Obtain full copies of the papers not previously rejected. These papers are reviewed by two or more researchers against the inclusion/exclusion criteria defined in the protocol to obtain a final list of primary studies. The two researchers should resolve any disagreements (if necessary with the help of an independent arbitrator)

# 5. Select primary studies

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TITLE-ABS-KEY ( ( {BUSINESS PROCESS MANAGEMENT} OR {WORKFLOW MANAGEMENT} ) AND ( {Operations Research} OR {Operational Research} OR {Scheduling} OR {Allocation} OR {Routing} ) )

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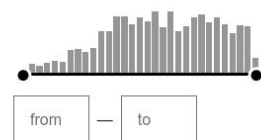
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☐ Computer Science

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auction

Pla A., López B., M...

Multi-attribute auction mechanism for supporting resource allocation in business process enactment

###

Abstract  
The resource allocation in open, distributed scenarios. The authors multi-attribute, so in addition to deal with the economic costs of inclusion of other attributes, such as feasibility on time or the quality tested our proposal in a simulated framework and the results show different attributes, in addition of providing privacy relationship. Although a wide variety of mechanisms are emerging to support process execution, these approaches do not consider performance. This paper introduces a mechanism in which the resource allocation optimization is modeled as a Markov decision process and solved using reinforcement learning. The proposed algorithm observes its environment to learn appropriate policies which optimize business process management. The experimental results indicate that the proposed algorithm outperforms known heuristic or hand-coded strategies, and agents provide a natural mechanism for modelling a system where they do not explicitly support coordination schemes. Efficient task fundamental coordination prerequisite: A competent allocation of resources to performance issues and users' quality demands. Since these fact efficient solution is hard to be identified. In this study, we suggest jointly optimizes system performance (as expressed by workload (as expressed by minimum task overlapping). A consistent model transform data of both these factors into a matrix format. The theorem and the notion of generalized eigenvalues to optimally a simple scheduling policy and an experimental setup were applied.

535

read

5

custom, start/end nodes, tasks, precedence relationship, transition probabilities

runtime

reinforcement learning / Q-learning

Huang Z., Van Der Werf W. M. P., Lu X., Du...

Reinforcement learning based resource allocation in business process management

###

Abstract  
In this paper, we present a modeling and workflow constrained by resources and nondeterministic time based previous modeling approaches, there are two kinds of places in activities and resources of a workflow, respectively. For each activity, the start and termination of the activity, the timing functions in it to define the minimum and maximum duration activity. Using the constructed Petri net model, the earliest and latest time can be calculated. With the reachability graph of the Petri net model, the implementation of the workflow can be calculated and verified conditions for the existence of the best implementation case of the method for obtaining such an implementation case is presented. The evaluation and verification of the implementation of a workflow is nondetermined time. © 2008 IEEE.

633

read

4

only tasks considered that are about to be scheduled

runtime, online

find optimal allocation between agents and tasks

discrete approximation

maximize agent utilization, while minimizing concurrent execution of tasks

Delias P., Doukakis M., Matsatsinis N.

A joint optimization algorithm for dispatching tasks in agent-based workflow management systems

###

Abstract  
In this paper, we present a modeling and workflow constrained by resources and nondeterministic time based previous modeling approaches, there are two kinds of places in activities and resources of a workflow, respectively. For each activity, the start and termination of the activity, the timing functions in it to define the minimum and maximum duration activity. Using the constructed Petri net model, the earliest and latest time can be calculated. With the reachability graph of the Petri net model, the implementation of the workflow can be calculated and verified conditions for the existence of the best implementation case of the method for obtaining such an implementation case is presented. The evaluation and verification of the implementation of a workflow is nondetermined time. © 2008 IEEE.

649

read, exclude

4

Wang H., Zeng Q.

Modeling and analysis for workflow constrained by resources and nondetermined time: An approach based on Petri nets

###

Abstract  
Staff assignment is of great importance for workflow management applications, staff assignment is still performed manually. In this automatic approach intended to reduce the number of manual staff applies a machine learning algorithm to the workflow event log that each actor undertakes. When staff assignment is needed, the machine learning technique suggest a suitable actor to undertake experiments on three enterprises, our approach achieved a fairly good performance. © 2008 Elsevier B.V. All rights reserved.

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agnostic, no and-joins

actors perform activities

runtime, online

predict next actor for process instance, based on process model and historical data

Decision support systems: Decision trees, SVM, C4.5

Liu Y., Wang J., Yang J., Sun J.

A semi-automatic approach for workflow staff assignment

###

Abstract  
Workflow concepts are well suited for scenarios where many dis collaborate together to achieve a common goal. Today, workflow management model for business processes executed in Instance Management Systems. However, there are many other applications supported cooperative work can be captured and organized by workflow management systems. Most research work in the field of workflow scheduling causalities constraints. We present an adaptive scheduling algorithm for workflow activities by additionally considering resource dynamic topology changes. Our approach utilizes a multi-stage approach to solve the real time scheduling problem of Workflow proposed approach uses an activity diagram to show the main a different routings of the Workflow Process. Based on the activity Petri net model is produced by assigning a time interval to every resource (discrete + continuous) allocation mechanisms to even discrete transitions in order to represent the different kinds of resources in a more realistic way. Time constraint propagation taken player algorithm is applied to the Petri net model in order corresponding to a specific sequence of activities which respects is illustrated through an example of "Handle Complaint Process". © 2008 Elsevier B.V. All rights reserved.

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P-timed Petri nets

Petri-net: Tokens

Julia S., de Oliveira R.

Real time scheduling of Workflow Management Systems based on a p-time Petri net model with hybrid resources

###

Abstract  
Workflow concepts are well suited for scenarios where many dis collaborate together to achieve a common goal. Today, workflow management model for business processes executed in Instance Management Systems. However, there are many other applications supported cooperative work can be captured and organized by workflow management systems. Most research work in the field of workflow scheduling causalities constraints. We present an adaptive scheduling algorithm for workflow activities by additionally considering resource dynamic topology changes. Our approach utilizes a multi-stage approach to solve the real time scheduling problem of Workflow proposed approach uses an activity diagram to show the main a different routings of the Workflow Process. Based on the activity Petri net model is produced by assigning a time interval to every resource (discrete + continuous) allocation mechanisms to even discrete transitions in order to represent the different kinds of resources in a more realistic way. Time constraint propagation taken player algorithm is applied to the Petri net model in order corresponding to a specific sequence of activities which respects is illustrated through an example of "Handle Complaint Process". © 2008 Elsevier B.V. All rights reserved.

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workflow net

agnostic

runtime

allocation of resource to activity under constraints

constraint programming

Avanes A., Freytag C.

Adaptive workflow scheduling under resource allocation constraints and network dynamics

###

Abstract  
Workflow management systems (WMS) are widely used by business administrating, automating and scheduling the business process resources. Since the control flow specifications of workflows are assumptions and errors, leading to inaccurate workflow models. a workflow graph model, determine the path chosen toward control flow. In this work, we show that positioning the decision points at their process efficiency by decreasing their uncertainties and identifying present novel techniques to discover the earliest positions by an transform the model graph. The experimental results show that efficient with respect to its average execution time and uncertainty source workflow management system. Until recently, YAWL, emj i.e., control-flow. As a result, YAWL is superior with respect to its associated with the resource perspective, i.e., the people and machines have been formally modelled. Although this concern correctness, it

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And-splits, or-splits

none

Design-phase

move decision points as early as possible by analysis of execution traces

C4.5 decision tree pruning

reduce uncertainty

Subramaniam S., Kargemaki V., Gounopoulos D., Castanos P., Castellanos H., Dagli U., Sayal M.

Improving process models by discovering decision points

###

Abstract  
Workflow management systems (WMS) are widely used by business administrating, automating and scheduling the business process resources. Since the control flow specifications of workflows are assumptions and errors, leading to inaccurate workflow models. a workflow graph model, determine the path chosen toward control flow. In this work, we show that positioning the decision points at their process efficiency by decreasing their uncertainties and identifying present novel techniques to discover the earliest positions by an transform the model graph. The experimental results show that efficient with respect to its average execution time and uncertainty source workflow management system. Until recently, YAWL, emj i.e., control-flow. As a result, YAWL is superior with respect to its associated with the resource perspective, i.e., the people and machines have been formally modelled. Although this concern correctness, it

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## 6. Assess study quality

- It might be meaningful to assess the „quality“ of primary studies:
- To provide still more detailed inclusion/exclusion criteria
- To investigate whether quality differences explain differences in results
- To weight the importance of individual studies in the „synthesise data „step
- To guide interpretation of findings and recommend further research



## 7. Extract required data

- Data extraction forms should be designed to collect all the information needed to address the research questions and quality criteria
- Make sure the extraction process remains consistent
- Avoid multiple publications of the same data
- It may be necessary to contact the authors for data / additional information



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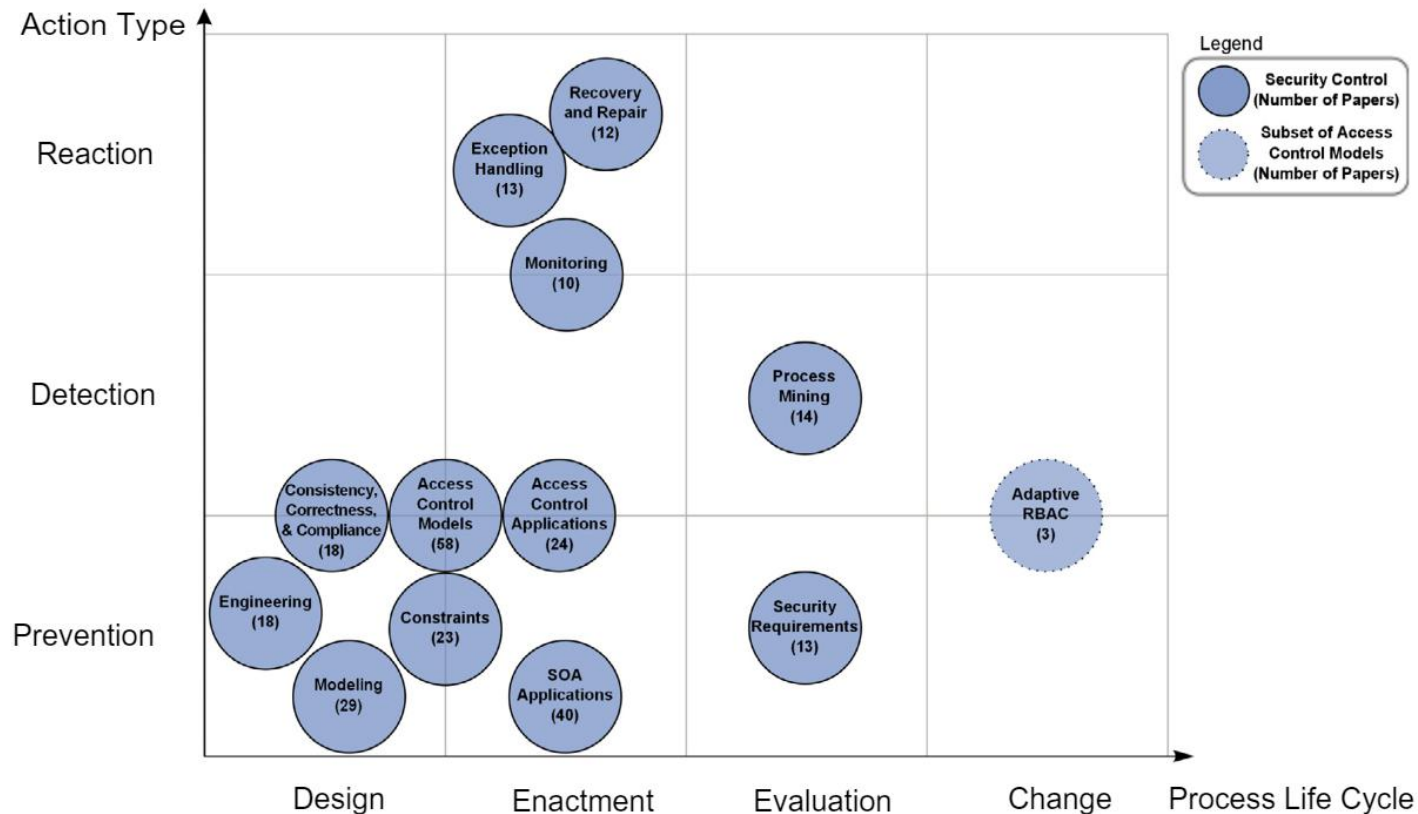
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## 8. Synthesise data

- „Data synthesis involves collating and summarising the results of the included primary studies.“ [2]
- Descriptive
  - e.g. summarizing the studies in a tabulated manner
- Quantitative
  - e.g. forest plots
- (Sensitivity analysis)

## 8. Synthesise data



**Fig. 9.** Classification of controls.

(c) Elsevier, 2014

Source: Maria Leitner, Stefanie Rinderle-Ma:

A systematic review on security in Process-Aware Information Systems - Constitution, challenges, and future directions. Inf. Softw. Technol. 56(3): 273-293 (2014)

<https://doi.org/10.1016/j.infsof.2013.12.004>

# Final meeting

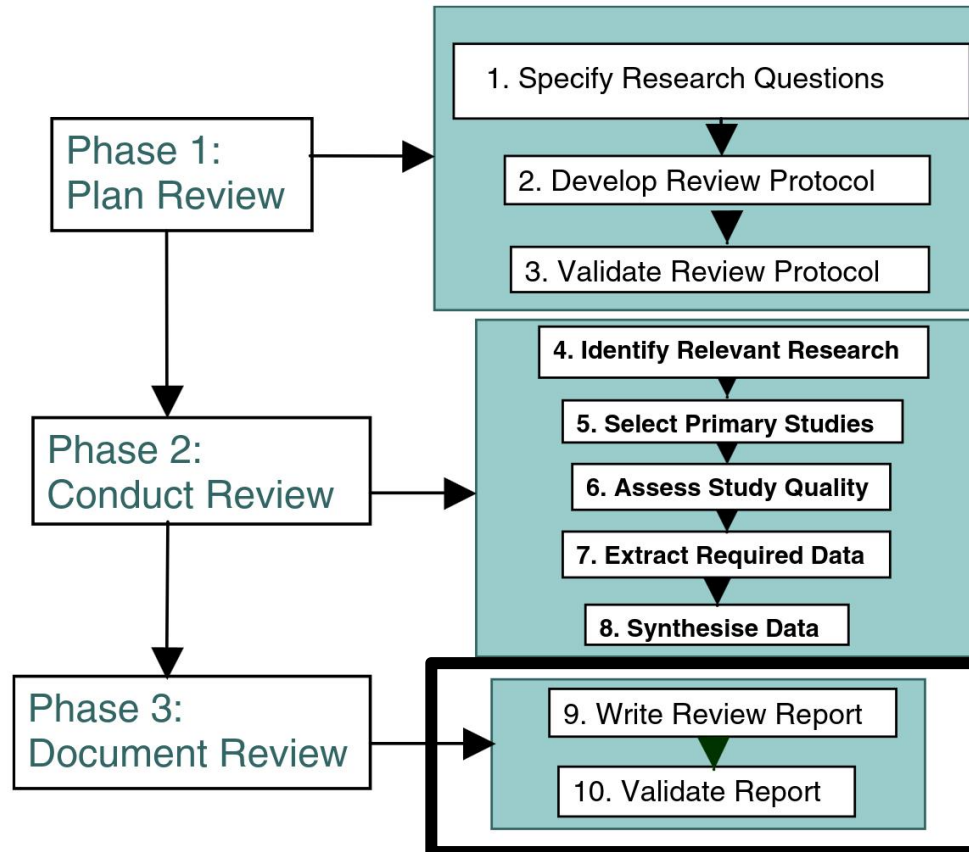


Fig. 1. Systematic literature review process.  
from [1]

# Seminar thesis structure suggestion

- Abstract
- Introduction (see kickoff slides)
- Methodology
- Results / Discussion
- Conclusion
- Bibliography

=> see also table 9 in [2]

## Part III

# Organizational

# Organizational

- Conduct the remaining steps of the SLR process
- Prepare a concise presentation about your Systematic Literature Review
  - max. 15min
- Write your seminar thesis
  - 10-15 pages, Springer LNCS template: <https://www.springer.com/gp/computer-science/lncs/conference-proceedings-guidelines>
  - Submission on Moodle, latest: July 15th, 23:59 CEST



# Questions?

# Systematic literature review

- [1] Pearl Brereton, Barbara A. Kitchenham, David Budgen, Mark Turner, Mohamed Khalil: Lessons from applying the systematic literature review process within the software engineering domain. J. Syst. Softw. 80(4): 571-583 (2007)
- [2] B. Kitchenham, Procedures for Performing Systematic Reviews, Joint Technical Report, Department of Computer Science, Keele University and Empirical Software Engineering, National ICT Australia Ltd., 2004  
([http://www.elizabete.com.br/rs/Tutorial\\_IHC\\_2012\\_files/Conceitos\\_RevisaoSistematica\\_kitchenham\\_2004.pdf](http://www.elizabete.com.br/rs/Tutorial_IHC_2012_files/Conceitos_RevisaoSistematica_kitchenham_2004.pdf))