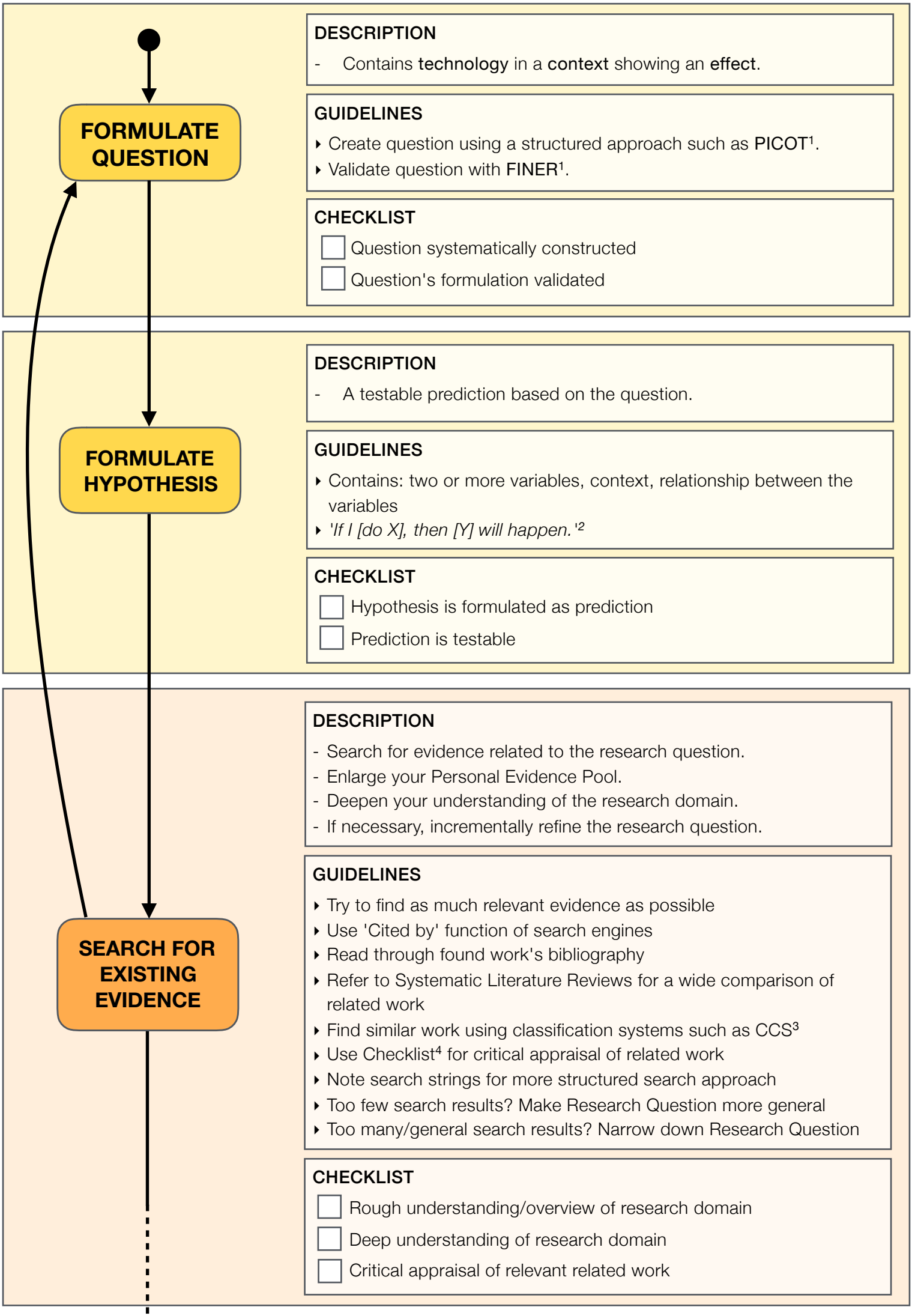
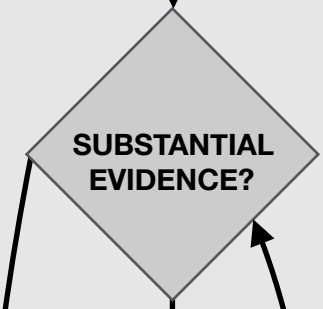

FORMULATE QUESTION
DESCRIPTION
- Contains technology in a context showing an effect.
GUIDELINES
Create question using a structured approach such as PICOT[1].
Validate question with FINER[1].
CHECKLIST
Question systematically constructed
Question's formulation validated
FORMULATE HYPOTHESIS
DESCRIPTION
- A testable prediction based on the question.
GUIDELINES
Contains: two or more variables, context, relationship between the variables
'If I [do X], then [Y] will happen.'[2]
CHECKLIST
Hypothesis is formulated as prediction
Prediction is testable
SEARCH FOR EXISTING EVIDENCE
DESCRIPTION
- Search for evidence related to the research question.
- Enlarge your Personal Evidence Pool.
- Deepen your understanding of the research domain.
- If necessary, incrementally refine the research question.
GUIDELINES
Try to find as much relevant evidence as possible
Use 'Cited by' function of search engines
Read through found work's bibliography
Refer to Systematic Literature Reviews for a wide comparison of related work
Find similar work using classification systems such as CCS[3]
Use Checklist[4] for critical appraisal of related work
Note search strings for more structured search approach
Too few search results? Make Research Question more general
Too many/general search results? Narrow down Research Question
CHECKLIST
Rough understanding/overview of research domain
Deep understanding of research domain
Critical appraisal of relevant related work



DESCRIPTION

Check if Personal Evidence Pool contains enough substantial evidence to answer the Research Question.

DESCRIPTION

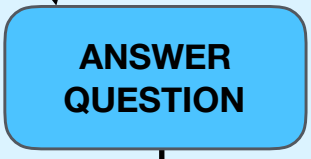
- Design, Conduct and Evaluate Experiment
- If the Research Question can not be answered in one experiment: Split up the question. Recursively start a new process instance in FORMULATE QUESTION using a sub-question.

GUIDELINES

- Use guidelines from literature like ‚*Experimenting in Software Engineering*'[5] to design and conduct experiments.
- Use Briefing Form

CHECKLIST

- [ ] Experiment Designed
- [ ] Experiment Conducted
- [ ] Experiment Evaluated
- [ ] Briefing Form filled in



DESCRIPTION

- Accept or reject Hypothesis based on evidence.
- Answer the Research Question accordingly.

GUIDELINES

- Make sure evidence is substantial enough to answer the Research Question.
- Try to avoid bias. (Confirmation Bias, Information Expectancy Bias, ...)

CHECKLIST

- [ ] Hypothesis' validity is evaluated
- [ ] Research Question is answered

DISCUSSION

DESCRIPTION

- Discuss the whole study, suggest future approaches and limits.

GUIDELINES

- Critically assess study using EBSE checklist[4]
- Put study in relation to larger context.

CHECKLIST

- [ ] Content of study critically assessed
- [ ] Study put in larger context

EVALUATE PROCESS

DESCRIPTION

- Reflect on your work in the previous steps and seek ways to improve your future performance.

GUIDELINES

- Use After Action Review and Postmortem Analysis[4]

CHECKLIST

- [ ] AAR done
- [ ] PMA done
- [ ] Conclusions drawn for future processes

QUELLEN

[1] *Farrugia, P., Petrisor, B.A., Farrokhyar, F., Bhandari, M.: Practical tips for surgical research: Research questions, hypotheses and objectives. Canadian journal of surgery. Journal canadien de chirurgie 53(4), 278–281 (2009)*

[2] *Buddies,S.: A Strong Hypothesis (2010), http://www.sciencebuddies.org/blog/ 2010/02/a-strong-hypothesis.php*

[3] *http://dl.acm.org/ccs/ccs.cfm*

[4] *Dybå, T., Kitchenham, B.A., Jorgensen, M.: Evidence-based software engineering for practitioners. IEEE Software 22(1), 58–65 (2005)*

[5] *Wohlin, C., Runeson, P., Höst, M., Ohlsson, M. C., Regnell, B., & Wesslén, A. (2012). Experimentation in software engineering. Springer Science & Business*

Population	What specific population are you interested in?
Intervention (Technology)	What is the investigational technology/ intervention?
Comparison Group	What is the main alternative/ baseline to compare with the intervention
Outcome	What do you intend to accomplish, measure, improve or affect?
Time	What is the appropriate follow-up time to assess outcome?

Feasible	▸ Adequate number of subjects ▸ Adequate technical expertise ▸ Affordable in time and money ▸ Manageable in scope
Interesting	▸ Getting the answer intrigues investigator, peers and community
Novel	▸ Confirms, refutes or extends previous findings
Ethical	▸ Amendable to a study that institutional review board will approve
Relevant	▸ To scientific knowledge ▸ To clinical and health policy ▸ To future research

Study Appraisal Checklist

1. Is there any vested interest?
   - Who sponsored the study?
   - Do the researchers have any vested interest in the results?
2. Is the evidence valid?
   - Was the study's design appropriate to answer the question?
   - How were the tasks, subjects, and setting selected?
   - What data was collected, and what were the methods for collecting the data?
   - Which methods of data analysis were used, and were they appropriate?
3. Is the evidence important?
   - What were the study's results?
   - Are the results credible, and, if so, how accurate are they?
   - What conclusions were drawn, and are they justified by the results?
   - Are the results of practical and statistical significance?
4. Can the evidence be used in practice?
   - Are the study's findings transferable to other industrial settings?
   - Did the study evaluate all the important outcome measures?
   - Does the study provide guidelines for practice based on the results?
   - Are the guidelines well described and easy to use?
   - Will the benefits of using the guidelines outweigh the costs?
5. Is the evidence in this study consistent with the evidence in other available studies?
   - Are there good reasons for any apparent inconsistencies?
   - Have the reasons for any disagreements been investigated?

After Action Review (AAR)

- What was supposed to happen?
- What actually happened?
- Why were there differences?
- What did we learn?

Postmortem Analysis (PA)

- What went so well that we want to repeat it?
- What was useful but could have gone better?
- What were the mistakes that we want to avoid for the future?
- What were the reasons for the success or mistakes?

QUELLEN

FINER, PICOT: *Farrugia, P., Petrisor, B.A., Farrokhyar, F., Bhandari, M.: Practical tips for surgical research: Research questions, hypotheses and objectives. Canadian journal of surgery. Journal canadien de chirurgie 53(4), 278–281 (2009)*

Checklist, AAR, PA: *Dybå, T., Kitchenham, B.A., Jorgensen, M.: Evidence-based software engineering for practitioners. IEEE Software 22(1), 58–65 (2005)*