Dr. Norbert Cheung's Lecture Series

Level 5   Topic no: 36

Literature Search and Review

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1. Introduction to Literature Review
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Reference

Engineering Research: Design Methods and Publication, Herman Tang, Wiley, 2021.

1. Introduction to Literature Review

Research is about advancing knowledge and developing new technologies. Picture a research effort like a relay race where one researcher takes the torch from the previous runner. Doing the groundwork of reviewing relevant literature is a foundation of new research and become a value additive in a technical field.

"Literature" here refers to any collection of materials in a subject. "Review" can be the discussion, critique, synthesis, and summary of selected literature materials. From a review, we are able to have an understanding of the status quo and seek out new opportunities. Thus, a literature review is a search and evaluation of available literature to present the state-of-the-art with respect to a particular subject.

Literature review may not be new, as it is introduced in a high school curriculum. For our purposes though, a literature review goes more in-depth and becomes critical as a tool and process to qualify the status of knowledge and needs for moving forward.

Formats

- Specific section in a proposal

- Introduction section of a technical paper

- A special section/paper on literature review

Purpose of Literature Review

Figure 3.2 Purposes and benefits of literature review.

To understand status quo

We conduct a literature review to track down the latest knowledge, such as what has been studied and how the knowledge was obtained by other professionals.

To learn from other professionals

Doing a literature review is a learning process from the works of domain experts and professionals. We can learn from our peers who have conducted the same or similar research projects. For example, some papers state,

To look for opportunities

Literature reviews play as important a role in leading our research to new directions to the current research. Through a literature review, we may gain insight

research opportunities on the topics not well studied because:

- Not many people yet recognized them
- Prior advance challenges due to known reasons (technical, resources, etc.)
- Low interest (probably due to funding) etc.

Then, we may propose new research, to build our bridge to cover the knowledge need or gap on top of something that has already been worked upon. Hence, a new research proposal intends to advance by

- Applying a proven technology to a new subject or field
- Using a different method to prove an important theory
- Resolving a conflict or controversy in differing research results
- Creating a new concept or different perspective
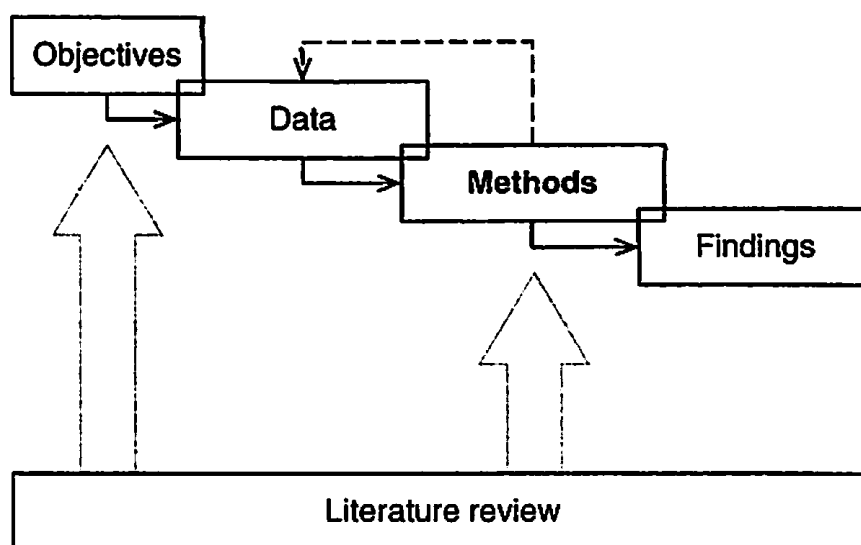
Figure 3.3   Literature review and other parts of research.

Literature review in scholarly publications
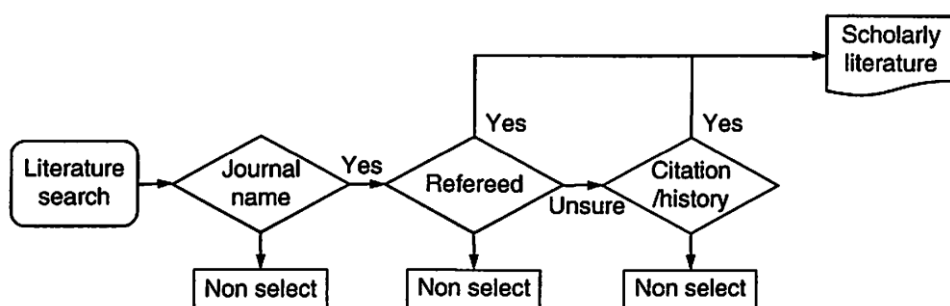
Figure 3.7 Selection considerations for scholarly journals.

2. Literature Sources and Search

To find student thesis and dissertations in universities:

Every university has a depository for its students' theses and dissertations. In addition to ProQuest, you may visit other databases through library or via public Internet for theses and dissertation:

- Networked Digital Library of Theses and Dissertations https://www.ndltd.org/
- DART-Europe E-theses Portal https://www.dart-europe.eu
- WorldCat https://www.worldcat.org/
- Open Access Theses and Dissertations https://oatd.org/

Public Domain Internet:

Using a web search engine, such as Google Scholar (https://scholar.google.com), we may find specific papers. Millions of peer-reviewed academic journals and books, conference papers, theses and dissertations, technical reports, and other scholarly literature are available, either in full-text or abstract-only to the public.

Open Access

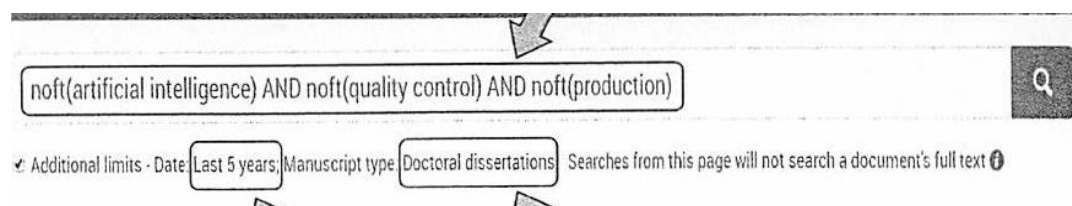| Name	Website
Elsevier's OA Journals	https://www.elsevier.com/about/open-science/open-access/open-access-journals
Springer Open	https://www.springeropen.com/journals
Taylor & Francis OA Journals	https://www.tandfonline.com/openaccess/openjournals
Wiley Open Access	https://authorservices.wiley.com/open-research/open-access/index.html
Royal Society Open Science	https://royalsociety.org/journals/authors/open-access/

Engineering Data Base

Table 3.1 Engineering databases and sources.

Database	Information
EI	EI Compendex is an interdisciplinary engineering bibliographic database published by Elsevier. The database has over 11 million of journal articles and around 7 million conference papers and proceedings of 190 engineering disciplines. For example, EI Compendex materials include about 29% in electrical engineering, 14% in civil engineering, 13% in chemical engineering, and 9% mechanical engineering. https://www.elsevier.com/solutions/engineering-village/content/compendex.
IEEE Xplore	It provides full-text journals and conference proceedings in electrical engineering, computer science, and electronics from the Institute of Electrical and Electronics Engineers (IEEE). IEEE Xplore provides over 4.5 million documents, comprising over 195 scholarly journals, over 1800 conference proceedings, more than 6200 technical standards, etc. https://ieeexplore.ieee.org/Xplore/home.jsp.
INSPEC	INSPEC, owned by The Institution of Engineering and Technology (IET), is extensive in the fields of physics and engineering, over 17 million of records. https://www.theiet.org/resources/inspec/index.cfm
Knovel	It includes engineering and science reference handbooks, databases, and conference proceedings and data. This library content includes more than 7000 reference works and databases from over 120 leading technical publishers and professional societies. Knovel has a sound content selection methodology to provide the more relevant information from the authoritative sources. https://app.knovel.com/web/index.v
NTIS	National Technical Information Service is US government-sponsored research and worldwide scientific, technical, engineering, and business-related information. Having over three million bibliographic records, including research reports, computer products, software, video cassettes, audio cassettes, etc. Its National Technical Reports Library (NTRL). (https://classic.ntis.gov/products/ntrl/) is freely available worldwide.
Scopus	It covers scholarly journal articles and conference papers on topics in science, technology, medicine, social sciences, and arts & humanities of about 35 000 peer-reviewed journals in top-level subject fields. The journals are listed on the SCImago Journal Rank website. https://www.scopus.com/
ASCE Library	It provides literature across the disciplines of civil engineering. The ASCE Research Library includes the full-text papers published in 36 journals from 1983, conference proceedings from 2000, and full-text ASCE standards and e-books. The Library offers free access to abstracts. https://ascelibrary.org/

Table 3.1   (Continued)

Database	Information
NTRS	NASA Technical Reports Server displays citation (not full-text) information from NASA's Scientific and Technical Information (STI) Program. It include research reports, journal articles, conference and meeting papers, technical videos, mission-related operational documents, and preliminary data. https://www.sti.nasa.gov/
ProQuest	ProQuest Dissertations & Theses Global is a comprehensive index to dissertations and theses from all fields of study, deposits from universities in 88 countries. The full-text version includes 2.4 million dissertation and theses with over 1 million full-text dissertations that are available to download. https://www.proquest.com/products-services/pqdtglobal.html
SAE Mobilus	SAE database covers thousands of SAE standards in three categories: Ground Vehicle Standards (J-Reports), Aerospace Standards, and Aerospace Material Specifications (AMS). The thousands of SAE technical papers covering the latest advances and research in all areas of mobility engineering including ground vehicle, aerospace, off-highway, and manufacturing technology. https://saemobilus.sae.org
SAFARI	As subscription-based, the digital library that includes technical reference books, videos, short-form content, and evolving manuscripts, etc. The topics include networking, Java, Linux/Unix, Perl, NET, desktop productivity, web development and more from O'Reilly and other publishers of IT books. https://learning.oreilly.com
SCI	Science Citation Index includes worldwide research literature in the sciences. It covers 8500 notable and significant journals across 150 scientific disciplines. The journals selected by SCI are often viewed as the world's leading journals of science and technology because of the rigorous selection process of SCI. http://mjl.clarivate.com/cgi-bin/jrnlst/jloptions.cgi?PC=K
EBSCO	EBSCO Applied Science & Technology Source database offers a diverse array of full-text and indexed contents, which cover the applied sciences and computing disciplines of over 4000 journals and magazines. https://www.ebsco.com/products/research-databases/applied-science-technology-source

Use Boolean operator in literature search: e.g. AND, OR NOT

noft(artificial intelligence) AND noft(quality control) AND noft(production)

Additional limits · Date Last 5 years, Manuscript type Doctoral dissertations   Searches from this page will not search a document's full text

Table 3.4   Boolean operator applications in literature search.

Operator	Function	Examples
AND	Containing both phrases	"Artificial intelligence" AND "quality control"
OR	Containing one phrase of two	"Artificial intelligence" OR "machine learning"
NOT (−)	Excluding the phrase	−"Expert system"

Using Keywords to search:
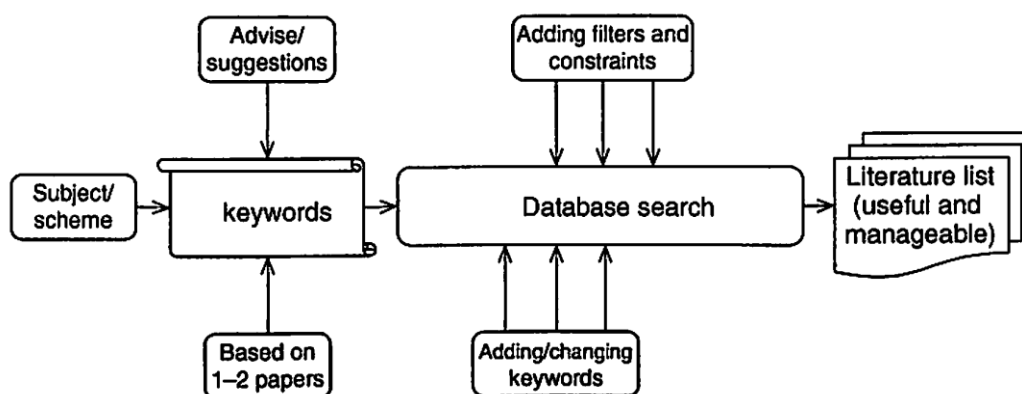
Figure 3.10   A process flow of literature search using keywords.

Currency of Literature:

Many research areas evolve quickly. It is imperative that research uses the latest information, particularly for fast advancing technologies. Therefore, the publishing date of literature is important. In general, most literature to be used should be published within several years, even within 12 months for some subjects.

A publication process takes several months between the initial submission and publication date for journal papers. Thanks to the OA scenario of many journals, the OA publication time can be significantly shortened. Note: journal papers are timelier than textbooks.

When to Stop?

We need to know when to be satisfied with our search and move forward. In theory, we should have a saturation point where we are seeing similar viewpoints repeated

What if we keep finding significantly new information? That may mean the subject is very broad or we need to adjust our focus. Preferably, such focus adjustment is in an early phase of the search.

Construct a literature tree for systematic literature search…
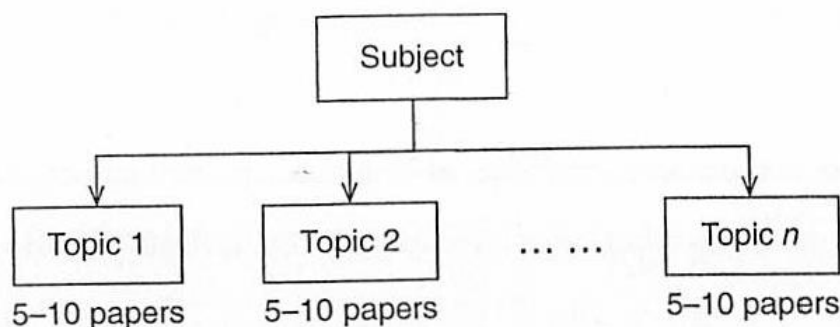
Patents

Table 3.3 Main patent databases.

Access	Database	Website
Free search (some services with fees)	Google Patents	https://patents.google.com/
	Espacenet (European Patent Organisation)	https://worldwide.espacenet.com/
	The Lens (Cambia and Queensland University of Technology)	https://www.lens.org/
	FPO (A SumoBrain Solutions Company)	http://www.freepatentsonline.com/search.html
	USPTO (US Department of Commerce)	http://patft.uspto.gov/
	WIPO (United Nations)	https://patentscope.wipo.int/search/en/search.jsf
Subscription required	Derwent Innovations Index	https://clarivate.libguides.com/webofscienceplatform/dii
	IEEE/IET Electronic Library	https://innovate.ieee.org/ieee-iet-electronic-library-iel/
	ScienceDirect	https://www.sciencedirect.com/

3.   Conducting Literature Review

Important points of literature review

Two Basic Tasks

As discussed, we have two main tasks in a literature review. One is to search for current, relevant information. The other, more importantly, is to analyze and evaluate critically the ideas, methods, and conclusions contained therein.

Essential parts of literature review

- Emphasize relative context
- Use logical transitions
- Compare one work with others in the same topic
- Use appropriate paraphrases and citations
- Summarize at the end of the review

Literature review will lead to new direction on research

Understanding other research results, assumptions, and limitations can lead to the identification of the lack of perfection and deficiency of the research. Along with identifying and presenting the research status, we analyze and evaluate the literature contents for the new research. Base such evaluation on

- Reflection on the status quo
- Logical strength of research process
- Convincing strength of results
- Different viewpoints on the particular contents
- Questions on any review impression

### *Well organize our literature research*

Table 3.5   A template of literature review summary.

Paper	Main point	Method	Research gap	Others
(1)				
(2)				
(3)				

Making good argument

Please keep in mind, when making a summary, comment, or recommendation in a literature review, we in fact make an argument. To have a good argument, it is suggested that we use the Toulmin method (Toulmin 1958), which involves the data, claim, and warrant.

A warrant is the principle and assumptions to bridge the data and the claim (see Figure 3.15). In other words, the warrant interprets the data and supports the claim. The three elements of data, claim, and warrant form a sturdy logical structure, even when the warrant or interpretation is debatable. We may have additional statements (backing) to support or prove the warrant.
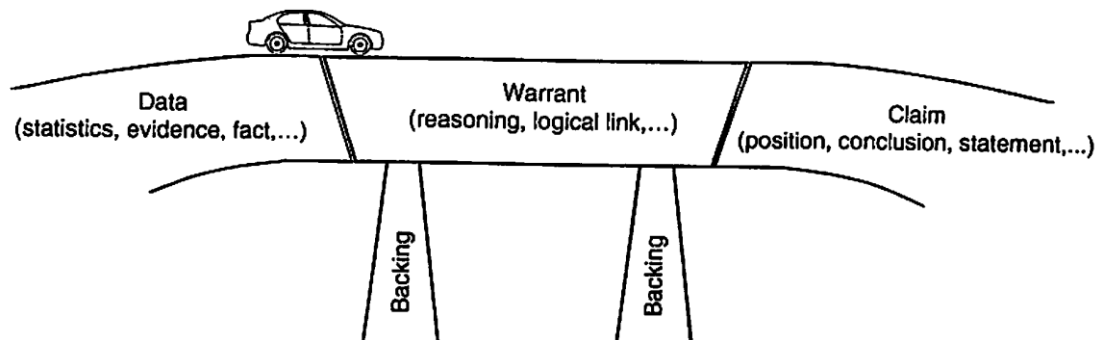
Based on our claim, we may be able to challenge existing claim and form a new research direction.

Focus Point 1 - Methods
- May focus on different methods to solve same problem
- May focus on same method to solve different problems.

Focus Point 2 – Exploring Trends
Study the latest trend of research on a particular subject

Elements of a standalone review article

- Recent advances and discoveries
- Current research focuses and gaps
- Different viewpoints and research aspects

When considering publication of a review article, we need to think a bit broadly. For example,

- Who is the audience of our review?
- What is the central thesis of the review?
- Is the review distinct from similar reviews?
- What is the additional insight beyond the collection of literature?
- What are journals that accept review articles?

Some sample publications:

- Hajihassani, M. et al. (2018). Applications of Particle Swarm Optimization in Geotechnical Engineering: A Comprehensive Review. Geotechnical and Geological Engineering, Vol. 36, Iss. 2, p. 705–722.
- Eva-Maria Schön, et al. (2017). Agile Requirements Engineering: A Systematic Literature Review, Computer Standards & Interfaces, Vol. 49, p. 79–91.
- Marttunen, M. et al. (2017), Structuring problems for Multi-Criteria Decision Analysis in practice: A literature review of method combinations, European Journal of Operational Research Vol. 263, Iss. 1, p. 1–17.
- Costabile, G. et al. (2017). Cost models of additive manufacturing: A literature review, International Journal of Industrial Engineering Computations, Vol. 8, Iss. 2, p. 263–282.

Typical structure of a literature paper
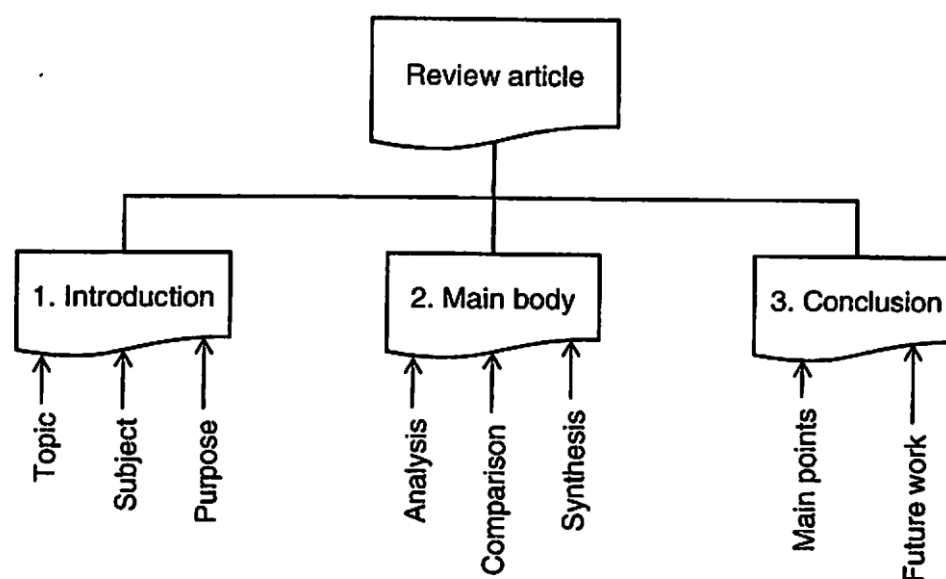
Figure 3.16 A typical structure of literature review article.

Writing Considerations

Use a professional tone

When presenting a critical or different viewpoint, we should be professional and polite to represent the original information accurately first. Then, we analyze the research information of the original authors and point out possible areas for improvement.

If the criticism of earlier work is necessary, try to be direct and mild, instead of negative manner. Instead of using judgmental words such as "no," "not," or "never," we may use "few" or "very limited." Our literature search may not be thorough. Thus, such absolute statements may be true to our knowledge but not necessarily to reality. It is possible that we do not discover some sources for various

Citation Format

In the context of literature review, the commonly used citation formats include

- "X's study [reference year] showed that..."
- "An approach in this subject was studied by X is that..." [reference year]
- "X concluded [reference year] that..."

The citation from one particular paper in a review should be considerably small, for example less than 10%, of the original paper. An excessive citation can be an issue of copyright breach.

Your Writing Grammar

The tenses can vary in the context of a review. In the introduction and conclusion sections of a review, we can use the present tense as general statements. Depending on the situations, in the main body of a review we

- Use the present tense to state other's thoughts or knowledge
- Use the past tense to refer to a specific work or result
- Use present tense for the implications of results
- May use the present perfect tense when referring to multiple researcher's work

4.   Summary

Introduction to Literature Review

1. Literature reviews may serve multiple purposes, such as situational awareness, learning from others, looking for new opportunities, assessing methods, and justifying a new proposal.
2. A literature review can be either a section of a scholarly document or a standalone systematic review article.
3. Literature review itself is a study process, consisting of searching, reading, analysis, and writing up.
4. Review may be primarily on comparison, critique, assessment, synthesis, summary, recommendation, and so on.
5. A literature review may be organized in three ways: methodological, thematic, or by technical trend.

Literature Sources and Search

6. Use keywords when searching literature normally.
7. Additional filter constraints, e.g. time limit and Boolean operators, can help search efficiency.
8. Literature sources should be scholarly journals and professional databases. Information from media and ".com" websites, including Wikipedia, are normally not allowed as a research reference.
9. Open access scholarly papers are normally of good value, but it depends on the journals.
10. In addition to relevance, the currency of literature is important as well.
11. For a systematic review, there may be a saturation point to stop a literature search.

Conducting Literature Review

12. The literature sought should be well organized for an effective review.
13. A literature review may have different focal points: methods, a latest trend, etc.
14. A literature review article normally consists of three parts: introduction, main review body, and conclusion.
15. The Toulmin method can be used to make an argument.
16. When judging others work, wording should be professional and carefully selected.
17. There are some common practices when writing up a literature review, such as tone, tense, and citation formats.

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