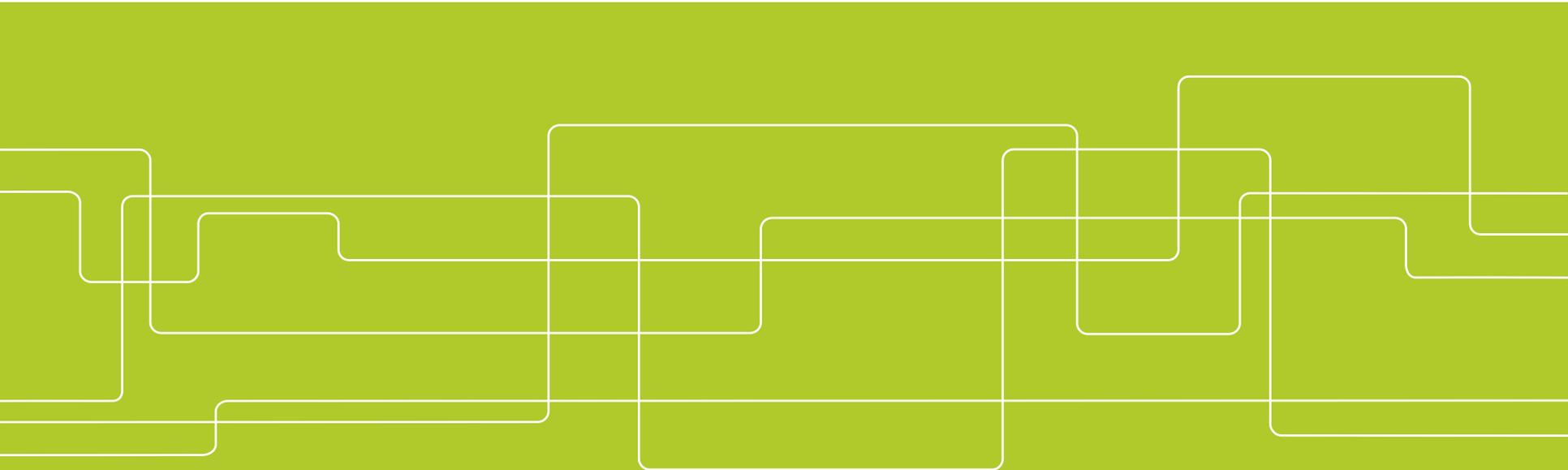




Research Methods

Emrah Karakaya, 18-2-2022





Emrah Karakaya

Associate professor of industrial dynamics and sustainable business models

PhD in Industrial Management (2015, Spain & Sweden)

Master in Computational Mechanics (2011, Germany & Spain)

Bachelor in Mechanical Engineering (2009, Turkey)

Case study research in collaboration with several companies, such as Hartmann Energietechnik, SSAB, LKAB, Peltarion, Boliden, Vattenfall etc.

Published several papers ...

Examiner and course responsible of research methods in industrial engineering and management; guest lectures on diffusion of innovations, sustainability transitions, business models etc.

Co-investigator in two major projects: (i) Sustainable Energy Transformations in Aviation (FoES) & (ii) Artificial Intelligence and Industrial Transformations (WASP HS)

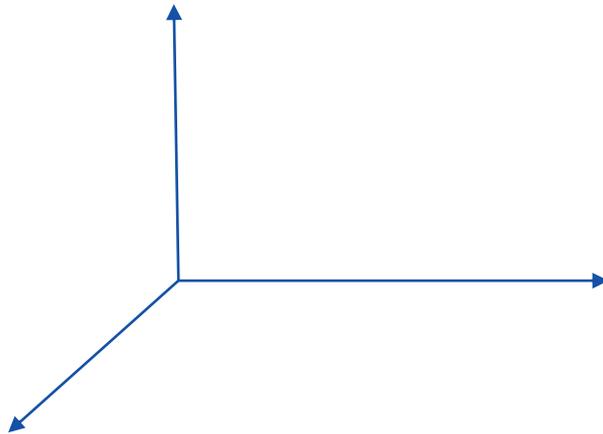


My research (some examples)

Theory/Concepts

Multi-level perspective on industrial transitions

Diffusion of Innovations



Method:

Qualitative case study

Quantitative modelling

Context:

Diffusion of solar photovoltaic systems in Germany

Industrial transformation of steelmaking industry in Sweden



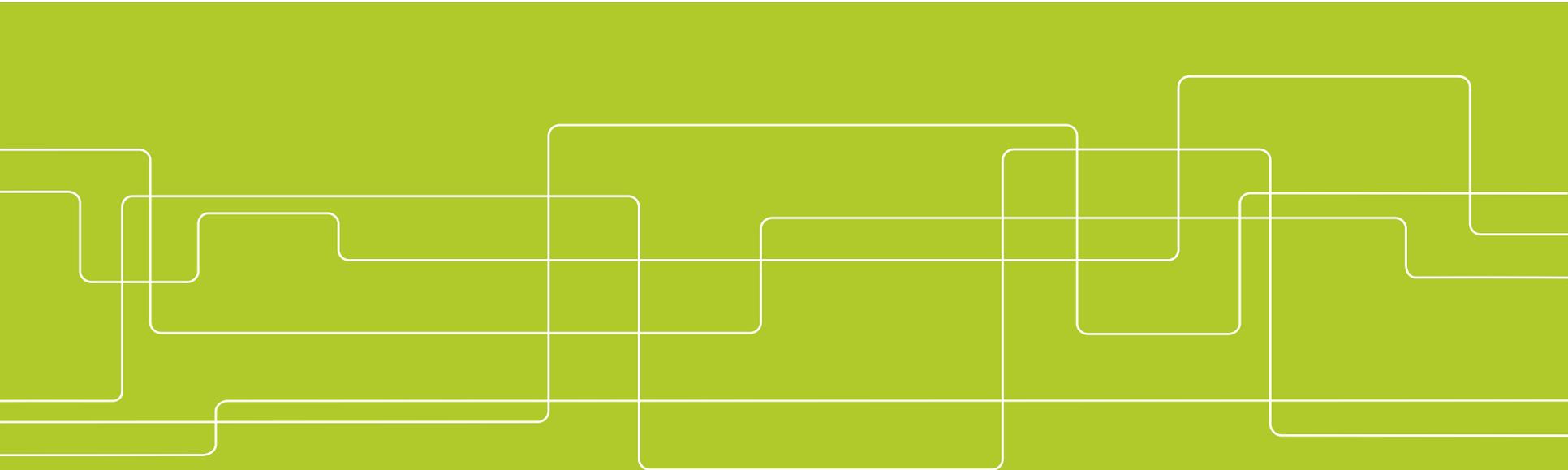
**Which method(s) do you plan to use
in your bachelor thesis?**

Go to www.menti.com and use the code 6999 6174



Research Methods

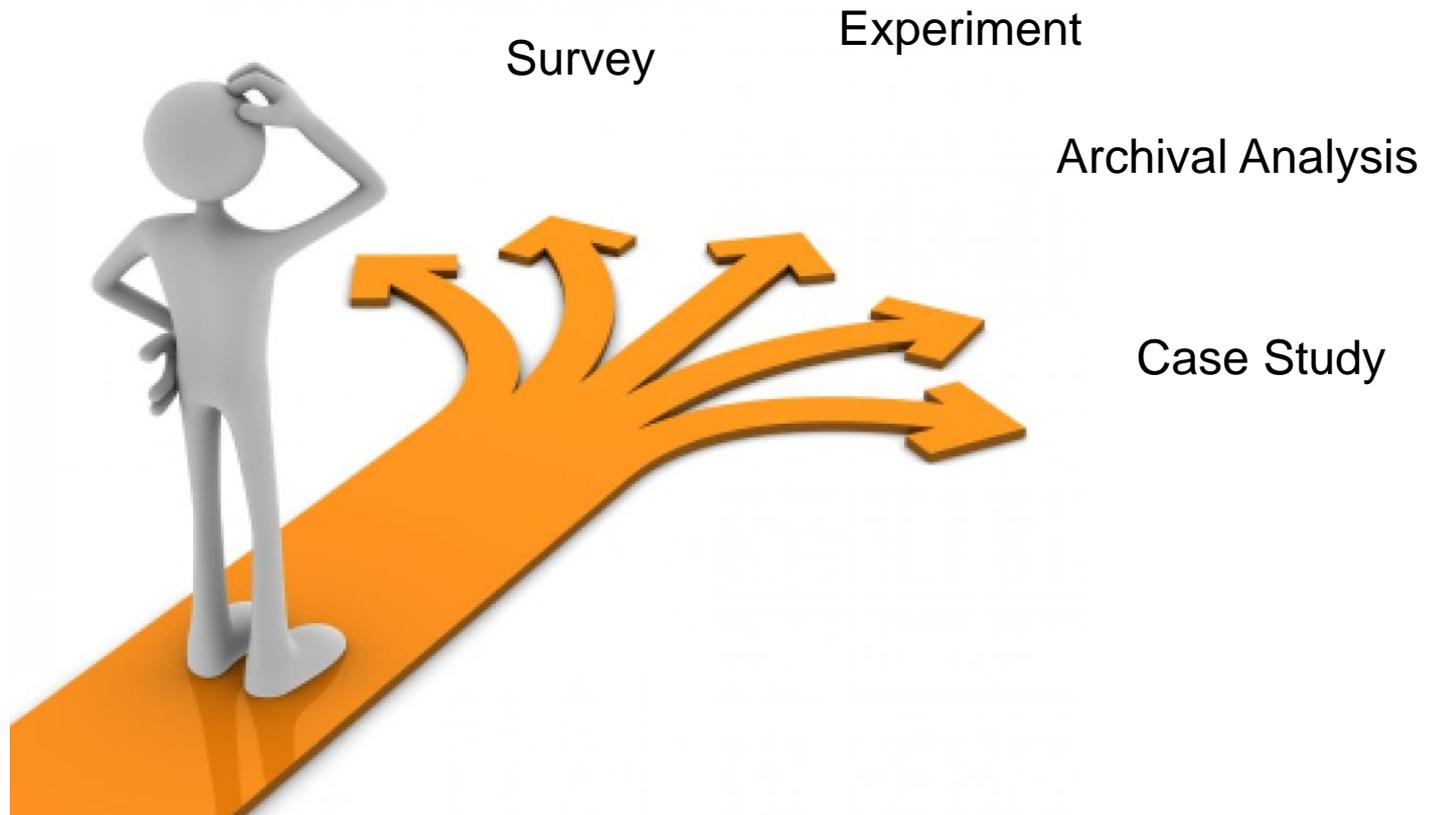
Emrah Karakaya, 18-2-2022



Decisions in life



Decision in research methods





Aim high ...



KTH Industrial Engineering
and Management

Energy Provision and Informality in South African Informal Urban Settlements

A Multi-Criteria Sustainability Assessment of
Energy Access Alternatives

Simon Runsten



Minor Field Study

Bachelor of Science Thesis
KTH School of Industrial Engineering and Management
Energy Technology EGI-2015
SE-100 44 STOCKHOLM



Energy provision in South African informal urban Settlements - A multi-criteria sustainability analysis

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ABSTRACT

In South Africa, as in much of sub-Saharan Africa, strong urbanization trends lead to people settling in ever less suitable informal locations, which are often considered ineligible for basic service provision. This study explores how access to basic energy services can be provided to informal urban households in South Africa that are ineligible for grid electrification. This is done through a multi-criteria sustainability analysis of current and alternative ways of accessing energy services. The case of the Western Cape Province is explored, showing that barriers for electrification can be overcome in some cases, given that there is political will at the local level to do so. When electrification is unviable, off-grid electricity alternatives combined with support for access to modern cooking fuels may provide short or medium-term solutions. This study further suggests that governmental efforts of meeting basic energy needs must be persistently oriented and structured towards access to energy services, as opposed to supply of electricity.



Index

1. Research purpose & research path
2. Research space & methodological field
3. Reviewing the literature
4. Research designs
5. Methods
6. Data collection and analysis



Research Purpose

What is the purpose of research?

| | Exploratory | Descriptive | Explanatory | Evaluative |
|--------------------------|-------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|
| Means to | Ask open questions Discover what is happening Gain insights | Gain accurate profile of events, persons or situations | Establish causal relationships between variables | Find out how well something works |
| Useful if you are | Unsure of an issue, problem or phenomenon | Willing to have a clear picture of the phenomenon | Aiming at explaining the relationships between variables | Concerned with assessing the effectiveness of something |

Saunders et al 2016 (p.174-176)

A typical path (for a case study)

1. Problem/topic

- Is it interesting to anyone?

2. Objective

- What do I want to find?

3. Literature review

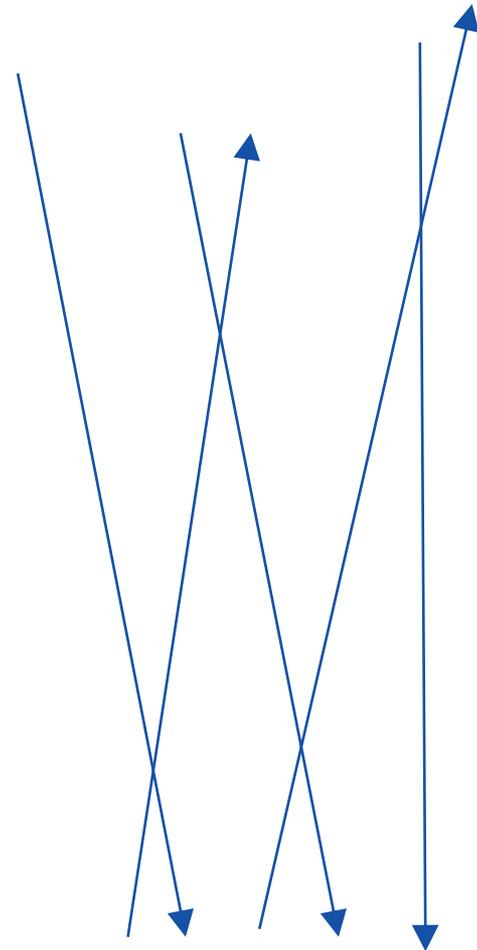
- What is the state of the art?
- Theoretical/conceptual Framework

4. Empirical design/analysis

- Deciding the unit of analysis
- Selecting cases
- Collecting and analyzing the data
- Interpreting the findings

5. Writing and reporting

- Theoretical implications
- Practical implications





*Can you change the research objectives
during/after data collection?*



Closed, adaptive or open designs?

*“You should not think that a case study’s design cannot be modified by new information or discovery during data collection. Such revelations can be enormously important leading to your **altering or modifying your original research design** (Yin, 2017, p.63)”*

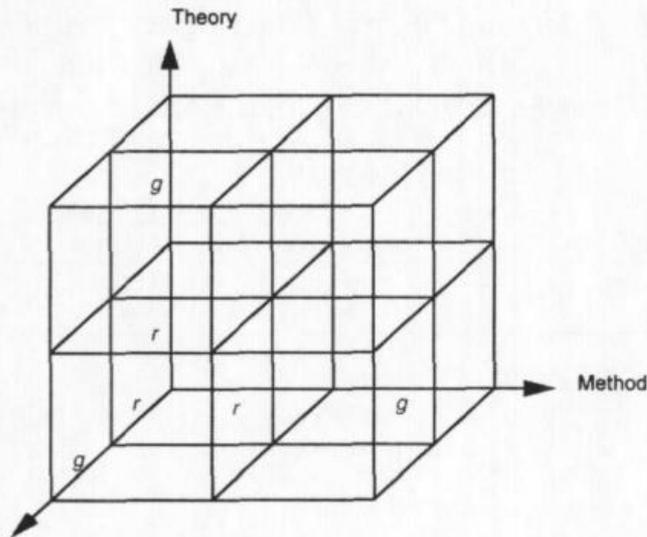
*“if you are conducting **exploratory research**, you must be willing to **change your direction** as a result of **new data** that appear and **new insights** that occur to you (Saunders et al, 2016, p. 175)”*



Research Space

Dimensions of Research

Figure 1 Potential Research Space



Context

Where r = parameter level replication, and g = parameter level generation.
The problem dimension is held constant.

Table 1 Research Space and Levels

| Level 1 | |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Problem | <i>General problem</i> General managerial and research question(s) |
| Theory | <i>Philosophical lens</i> Meta theory, including ontological, epistemological, and methodological axioms |
| Method | <i>Data generation</i> Methods of data production, including measurement issues, survey processes, interviews techniques, observational protocols, etc. |
| Context | <i>Investigative context</i> The when, where, and from whom/what data is collected (i.e., population specification and variable delineation (e.g., country, culture, industry, etc), sample issues, etc.) |

(Berthon et al, 2002)



Theory ...

‘Theory’ is a ***formulation regarding the cause and effect relationships between two or more variables***, which may or many not tested. (Saunders, 2019, p.729)

‘Theory’ is ***simply a way of of imposing conceptual order*** on the empirical complexity of the phenomenal world (Suddaby 2014, p. 407).



Which 'theory' or 'theoretical concepts' do you plan to use in your bachelor thesis?

Go to www.menti.com and use the code 81 91 68 7



When you read a paper:
*Can you identify its **theory, method and context?***



Methodological Field



Positivism / Interpretivism

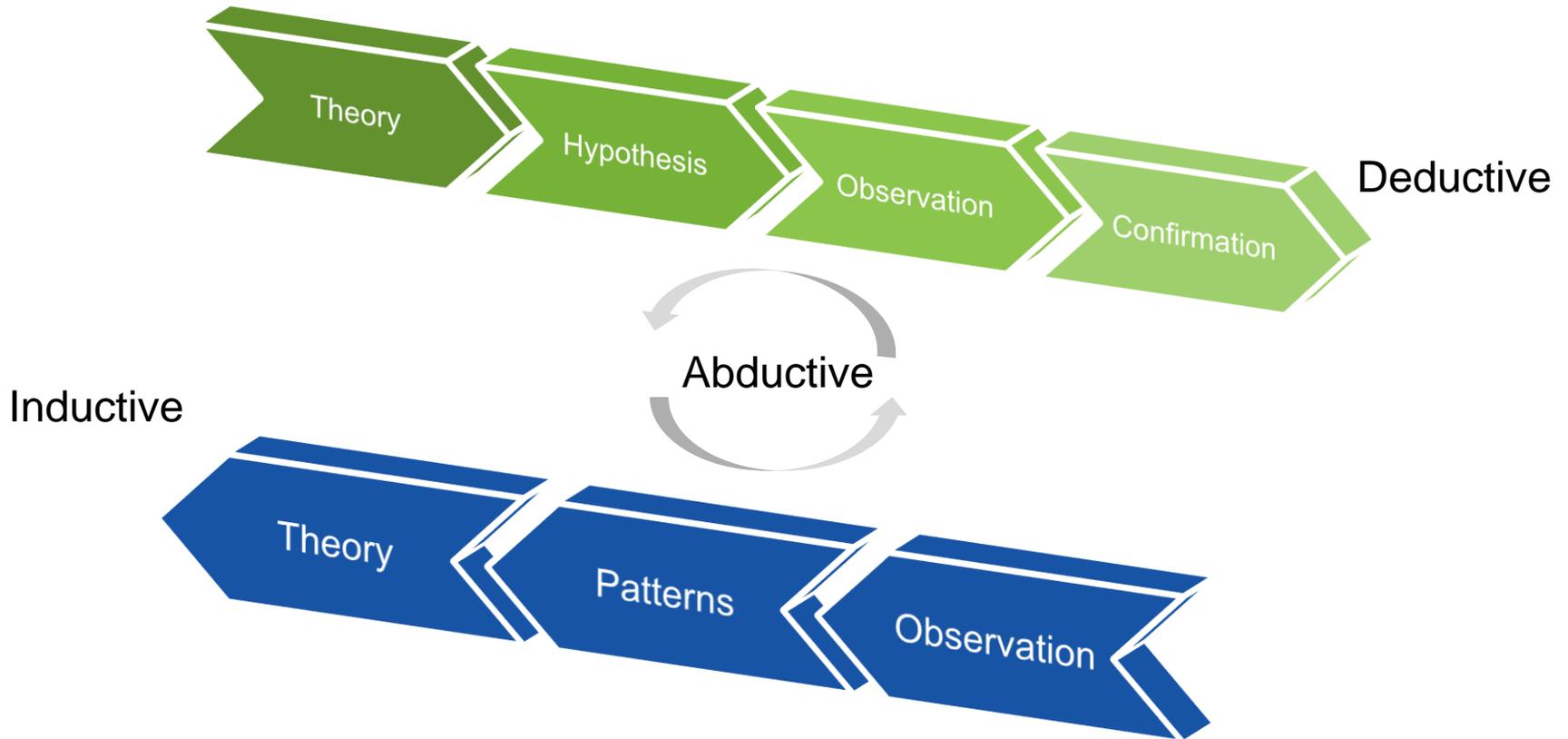
Positivism approach

- “ [...] surrounding precise empirical observations of individual behavior in order to discover and confirm a set of probabilistic causal laws that can be used **to predict general patterns of human activity**”

Interpretive approach

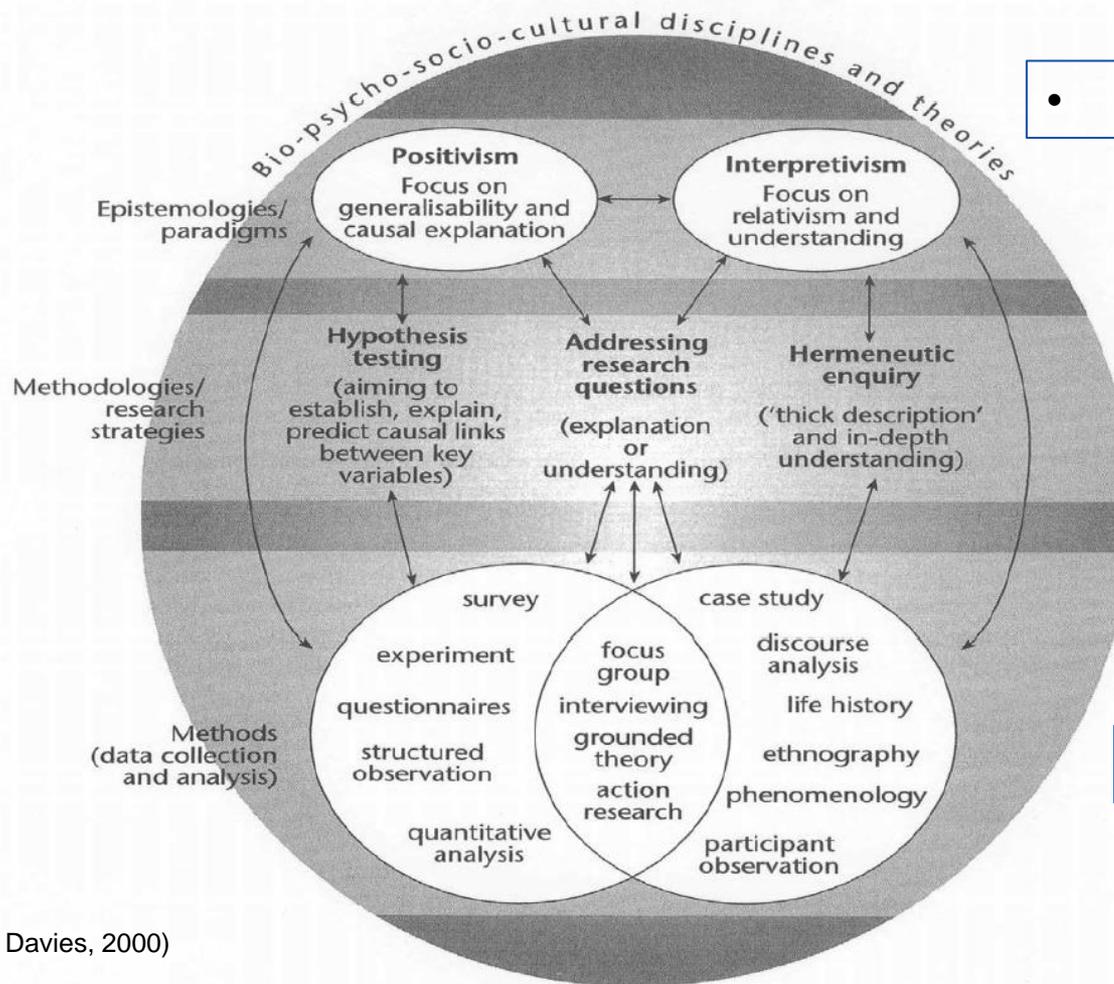
- “[...] socially meaningful action through the direct detailed observation of people in natural settings in order **to arrive at understandings and interpretations** of how people create and maintain their social worlds” (Neuman, 1997:as cited in Arnaboldi 2012).

Abductive?



*“... an **abductive** approach moves back and forth, in effect combining deduction and induction (Suddaby 2006). This matches what many business and management scholars actually do (Saunders 2017, p. 148)”*

The methodological field



- Philosophical Worldview

- Research Design / Strategy of inquiry

- Methods

(Gomm and Davies, 2000)

Creswell (2009)



Reviewing the literature



literature

/ˈlɪt(ə)rətʃə/ 

noun

written works, especially those considered of superior or lasting artistic merit.

"a great work of literature"

synonyms: written works, writings, (creative) writing, literary texts, compositions, letters, [belles-lettres](#); [More](#)

- books and writings published on a particular subject.

"the **literature on** environmental epidemiology"

synonyms: publications, published writings, texts, reports, studies, relevant works

"the literature on prototype theory"

*Google Dictionary



Search vs. Review

Which ones are the definitions of “Review”?

A. try to find something by looking or otherwise seeking carefully and thoroughly.

Search

B. an act of searching for someone or something.

C. a formal assessment of something with the intention of instituting change if necessary

Review

D. a critical appraisal of a book, play, film, etc. published in a newspaper or magazine.

*Google Dictionary

Growing literature

The number of science publications is growing exponentially, doubling every 9–10 years (Bornmann and Mutz, 2015)

For instance, web of Science Core Collection (WoS, 2018)

- More than 20,300 journals + books and conference proceedings
- Over 71 million records
- More than a 1 billion cited references (1900 to present)





Why should one review the literature?

Literature review let you

- determine whether the topic is **worth studying**
- provide a brief overview of **key ideas and themes** (general to narrow)
- summarise, **compare and contrast the research of the key** research streams
- **narrow down to highlight previous research** work most relevant to your own research and **compare/contrast**
- highlight those aspects **where your own research provide fresh insights**

Saunders et al (2009)



Also ...

They help you to

- Generate and refine your research questions
- Avoid repeating research that has been conducted already [which is very unlikely anyway]
- Learn from different research designs



The databases: **Any differences?**

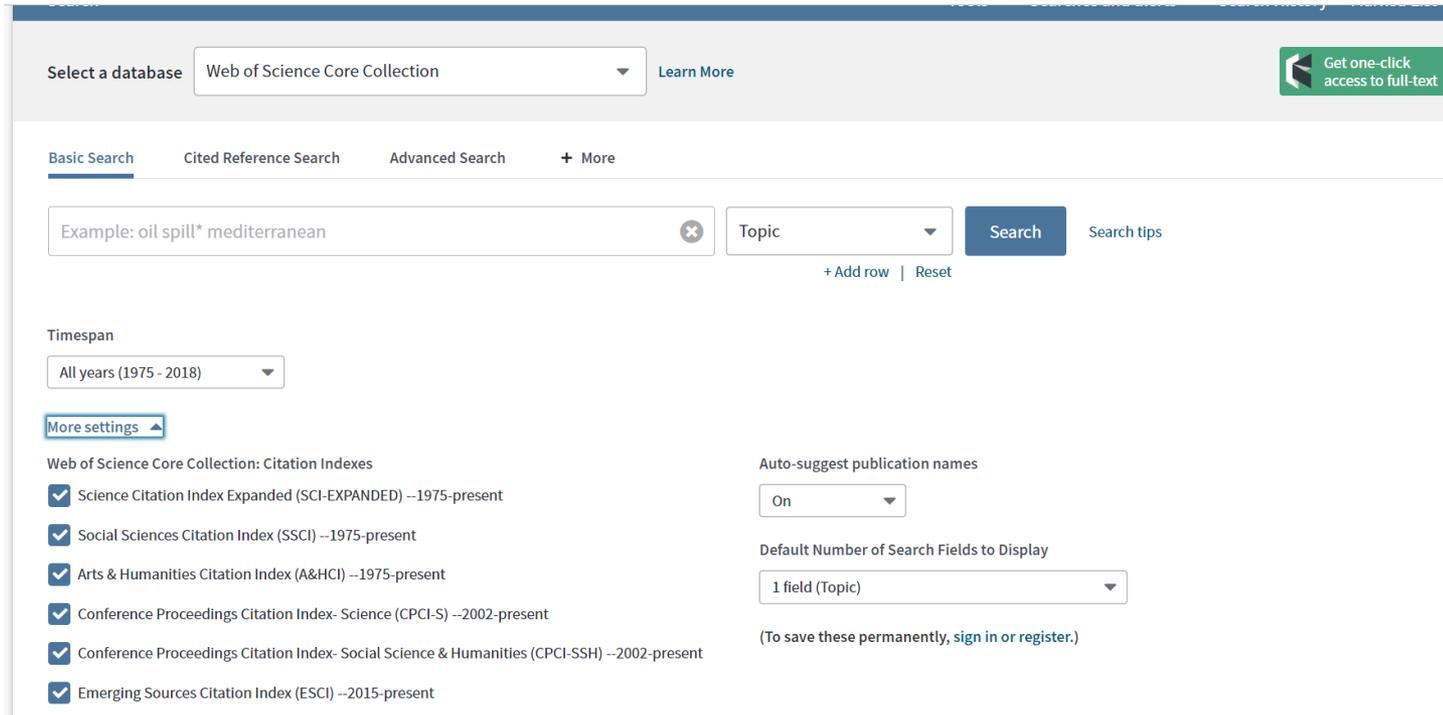
Google
Scholar



WEB OF SCIENCE™

Scopus®

An example on web of science



The screenshot shows the Web of Science search interface. At the top, there is a dropdown menu for "Select a database" set to "Web of Science Core Collection" with a "Learn More" link. A green button on the right says "Get one-click access to full-text". Below this are search options: "Basic Search" (selected), "Cited Reference Search", "Advanced Search", and "+ More". The search input field contains "Example: oil spill* mediterranean" and has a "Search" button. A dropdown menu next to the input is set to "Topic". Below the search bar are options for "Timespan" (set to "All years (1975 - 2018)") and "More settings". Under "More settings", there are two sections: "Web of Science Core Collection: Citation Indexes" with five checked checkboxes for "Science Citation Index Expanded (SCI-EXPANDED) --1975-present", "Social Sciences Citation Index (SSCI) --1975-present", "Arts & Humanities Citation Index (A&HCI) --1975-present", "Conference Proceedings Citation Index- Science (CPCI-S) --2002-present", and "Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH) --2002-present"; and "Emerging Sources Citation Index (ESCI) --2015-present". The second section, "Auto-suggest publication names", has a dropdown set to "On". The "Default Number of Search Fields to Display" is set to "1 field (Topic)". A note at the bottom says "(To save these permanently, sign in or register.)".

<http://apps.webofknowledge.com/>

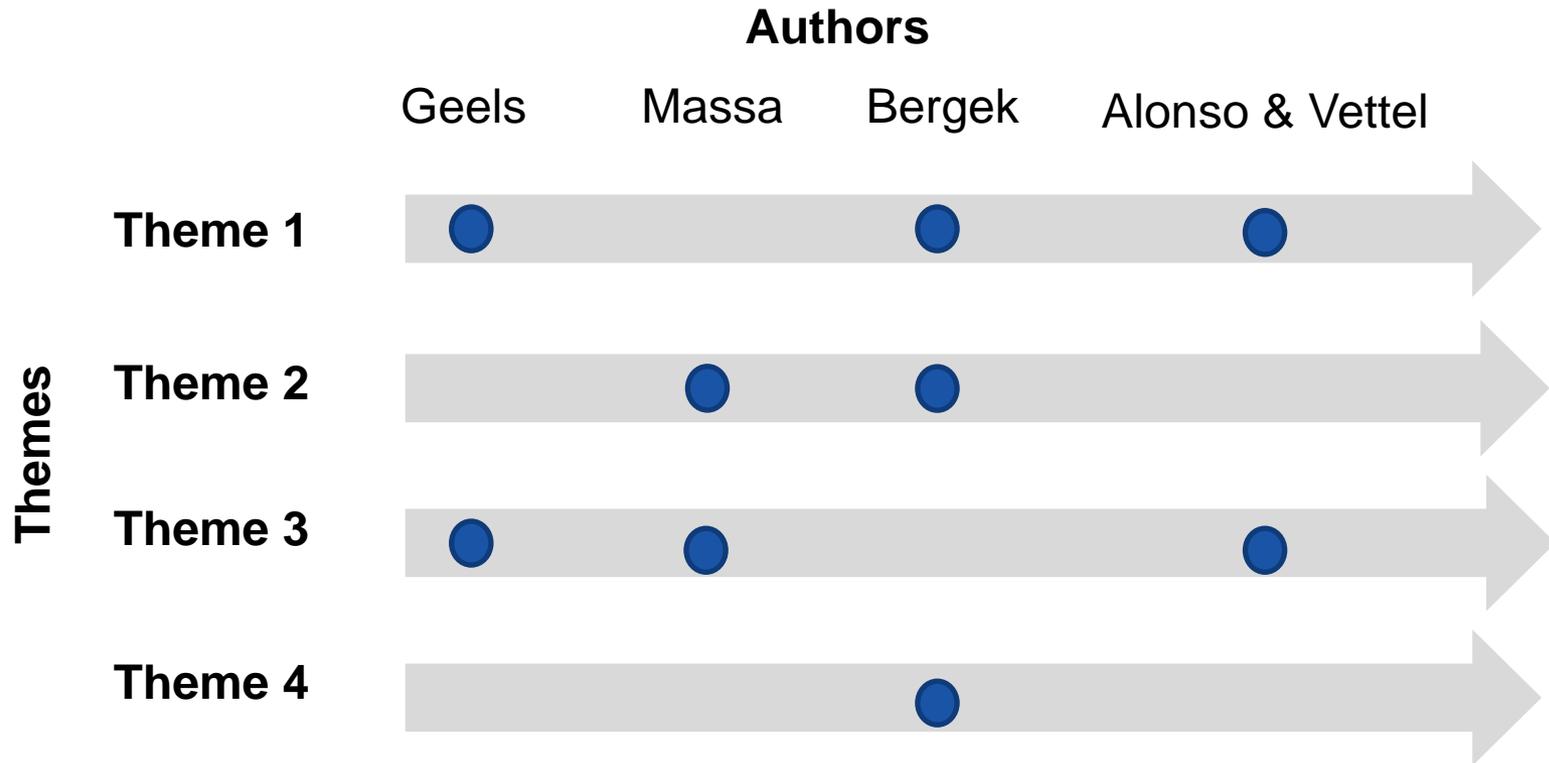


How to write and structure a literature review chapter?

One example: Funnel approach

1. Start at a more general level before narrowing down to your topic
2. Provide a brief overview of key ideas and themes
3. summarise, compare and contrast the research of the key research streams
4. narrow down to highlight previous research work most relevant to your own research
5. highlight those aspects where your own research will provide fresh insights

How to structure



My advice: Do not list/summarize papers one by one. Instead, you can come up with themes and synthesize the knowledge!



Research designs



Research Designs

It can be called “strategies of inquiry” as well

Two main type of designs

- Qualitative (i.e., non-numerical)
- Quantitative (i.e., numerical)

They should not be viewed as polar opposites or dichotomies

Mixed approaches are possible



Qualitative vs Quantitative

Some examples (not dichotomies):

| | Qualitative | Quantitative |
|------------|-----------------------------------|---------------------------------------------|
| Data | E.g., using words or observations | E.g., using numbers |
| Purpose | Exploring and understanding | Examining the relationships among variables |
| Questions | Open-ended | Close-ended |
| Strategies | Case study etc. | Experiment etc. |



Quantitative Designs

Some examples:

- **Survey research**
 - a quantitative or numeric description of
 - trends,
 - attitudes,
 - or opinions
 - Studies a sample of a population.
- **Experimental research**
 - seeks to determine if a specific treatment influences an outcome
 - true experiments, natural experiments, quasi-experiments



Qualitative Designs

Some Examples:

- **Narrative research**
 - researcher studies the lives of individuals
 - provide stories about individual lives
 - involve a narrative chronology

- **Phenomenological research**
 - Grounded theory approach
 - Ethnography
 - Case studies

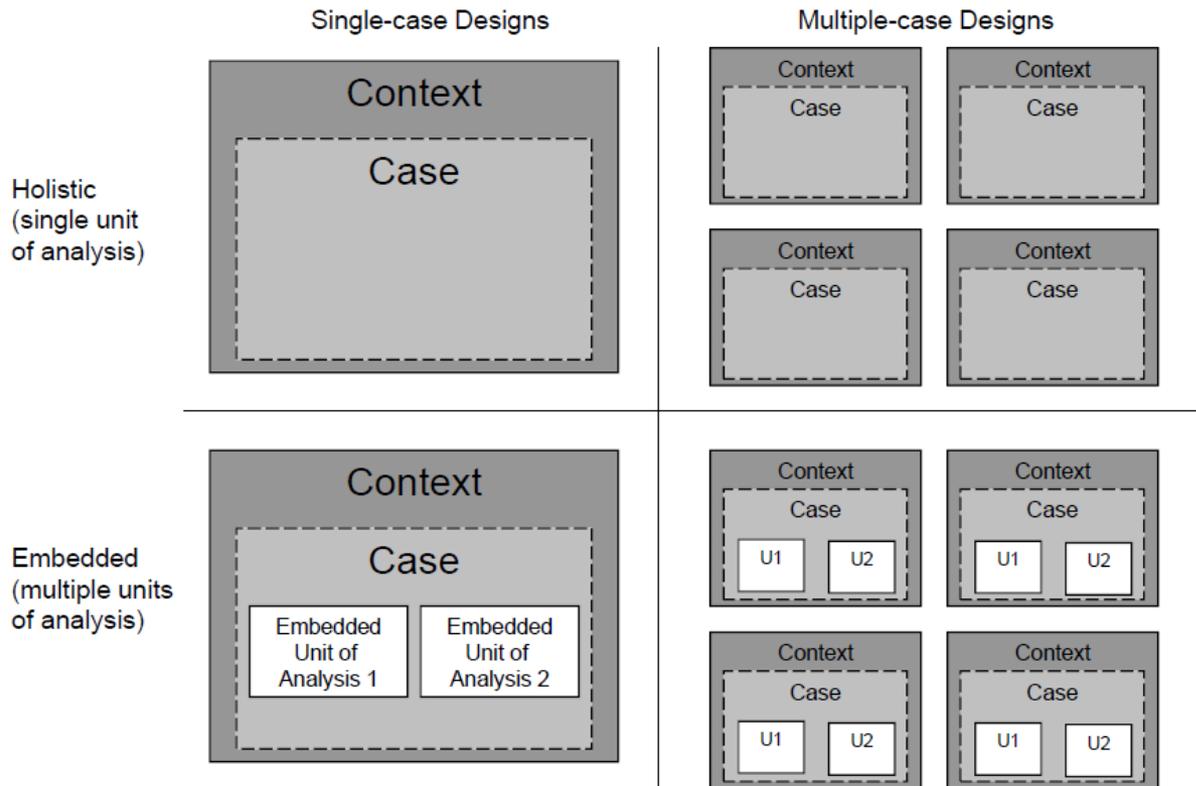


For instance ...

A **case study** is an empirical inquiry that

- investigates a contemporary phenomenon **in depth and within its real-life context**,
- copes with a distinctive situation in which there are **many variables**
- relies on **multiple sources of evidence**
- may benefit from the prior development of **theory to guide data collection and analysis** (Yin, 2009; p.18)

Single vs. Multiple Units of Analysis



(Yin, 2009:32)

Methodological Differences

| | Survey | Case Study | Econometrics | |
|-----------------------------------|------------------------------------------|-------------------------------------------------|------------------------------------------|------|
| Source of Data | Responses to questionnaires | Human words, observation, documents etc. | Large databases | |
| Position of the researcher | Outside the field | Entering and observing the field | Outside the field | |
| Data Analysis | Mathematical | Non Mathematical | Mathematical | |
| Software/tool | Yes | Sometimes | Yes | |
| Type of research questions | Hypothesis and relations among variables | Open ended questions | Hypothesis and relations among variables | |
| Phenomenon | Reducible into a model | Complex | Reducible into a model | |

(Arnaboldi, 2012)

Research Questions

| | Research question | Control of behavioural events | Focus on contemporary events |
|-------------------|---------------------------------------------------|-------------------------------|------------------------------|
| Experiment | How? Why? | yes | yes |
| Survey | Who? What? Where? How many? How much? | no | yes |
| Case Study | How? Why? | no | yes |

(Yin, 2016)



Research Methods



Research Methods

But



What is difference between
method and methodology?

“The most common definitions suggest that

- methodology is the overall approach to research linked to the paradigm or theoretical framework*
- the method refers to systematic modes, procedures or tools used for collection and analysis of data.”*

(Mackenzie and Knipe, 2006)



Research Methods

Research methods

- involve the forms of data collection, analysis, and interpretation that researchers propose for their studies

Some examples

- Big data analysis
- Questionnaires
- Experiments
- Observations
- Focus groups
- Interviews etc.



For instance: Interviews



Interviews

Interviewing is a method to know about phenomenon by asking open-ended questions to informants

- **Who to interview?**
- **Which questions?**
 - It depends on research question
 - Let them talk
- **Structured semi-structured?**
- **Recording**
 - Always ask in advance
 - Ask additional questions after turning off the recorder

Different types of interviews vs. research purpose

| | Exploratory | Descriptive | Explanatory | Evaluative |
|-----------------|-------------|-------------|-------------|------------|
| Structured | | ++ | + | + |
| Semi-structured | + | | ++ | ++ |
| Unstructured | ++ | | | + |

++: more frequent
+: less frequent

Saunders et al 2016 (p. 393)



Different types of interviews

- **Structured interviews**
 - Based on predetermined and standardized questions
 - More often in quantitative research
- **Semi-structured interviews**
 - Non-standardized
 - More often in qualitative research
 - Researcher has some themes and some key questions to cover (although their use may vary from interview to interview)
 - Some questions can be dropped and some others can be added
 - Room for open discussion
- **Unstructured interviews**
 - Ideas on what aspects to explore
 - No predetermined questions
 - Informal and non-directive



Data Analysis

Quantitative vs. Qualitative data

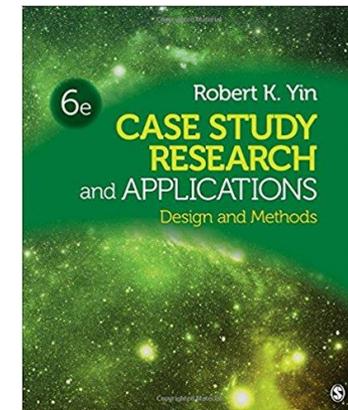
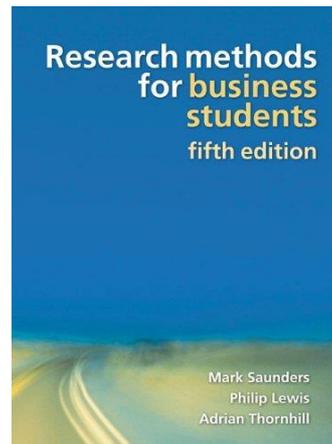
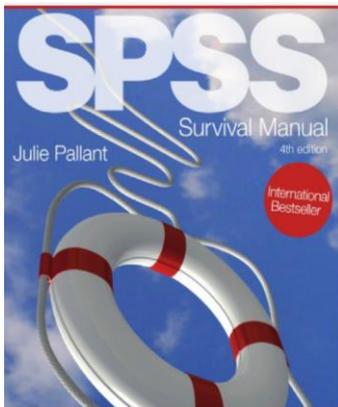
| | Quantitative data | Qualitative data |
|-----------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Data type | Based on meanings derived from numbers | Based on meanings expressed through words |
| Data structure | Collection results in numerical and standardized data | Collection results in non-standardized data requiring classification into categories |
| Data analysis | Analysis conducted through the use of diagrams and statistics | Analysis conducted through the use of conceptualisation |

Saunders et al 2016 (p. 482)

Some suggestions

Quantitative
analysis

Qualitative
analysis





For instance: interview analysis

Have you analyzed any interviews so far?



For instance: interview analysis

The primary source for case study are interviews

- Once transcribed you start analyze the text
- Which steps:
 - Deciding on your approach to analysis
 - Coding text
 - If you are in group: make the first coding separately and then cross-check results
 - Identify variables/dimensions
 - Identify:
 - Patterns
 - Relations



Approach to analysis

Using a **deductive** approach

- Existing theoretical framework help you organize and direct your data analysis

Using an **inductive** approach

- You do not use a predetermined theoretical framework
- You start to collect data and then explore them

Remember:

- It is an interactive and iterative process
- Abductive approaches are common
- You can change your approach along the way

Saunders et al 2016 (p. 569-571)



Coding the text

- A code is a concept, a word that signifies “what is going on in this piece of data.”
- Coding, on the other hand, is the analytic process of examining data line by line or paragraph by paragraph (whatever is your style) for significant events, experiences, feelings, and so on, that are then denoted as concepts (Strauss & Corbin, 1998)
- Codes can be based on
 - Themes, Topics
 - Ideas, Concepts
 - Terms, Phrases
 - Keywords



An example

Interviewer: Tell me about teens and drug use.

Respondent: I think teens use drugs as a release from their parents Well, I don't know. I can only talk for myself. For me, it was an experience. You hear a lot about drugs You hear they are bad for you.

AFTER CODING

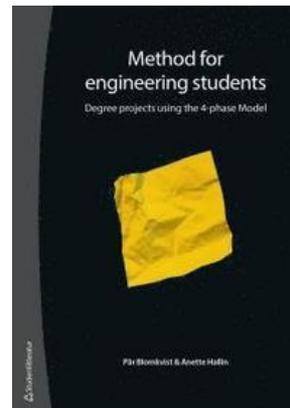
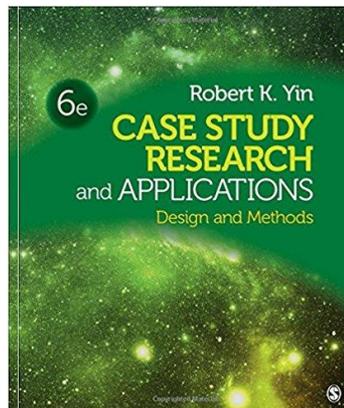
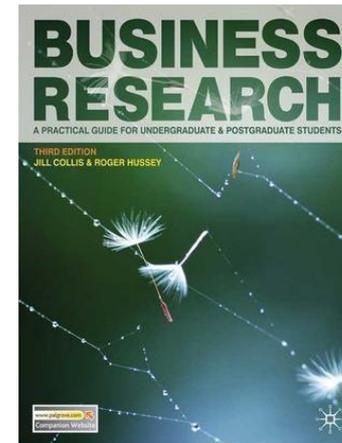
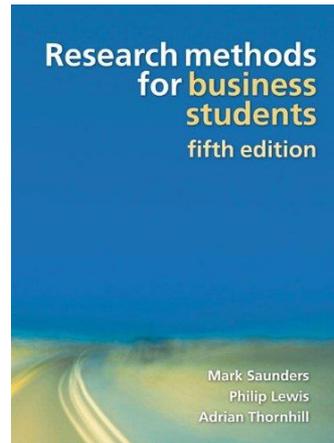
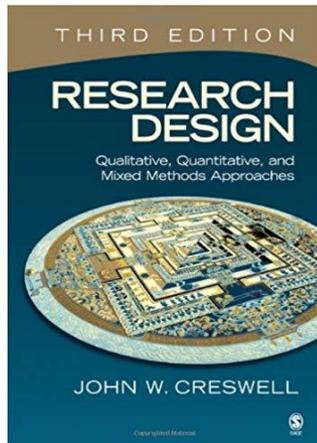
Interviewer: Tell me about teens and druguse.

Respondent: I think teens use drugs as a release from their parents [**“rebellious act”**]. Well, I don't know. I can only talk for myself. For me, it was an experience [**“experience”**] You hear a lot about drugs [**“drug talk”**]. You hear they are bad for you [**“negative connotation”** to the **“drugtalk”**].

Source: *Basics of Qualitative Research*, (Strauss & Corbin,1998).



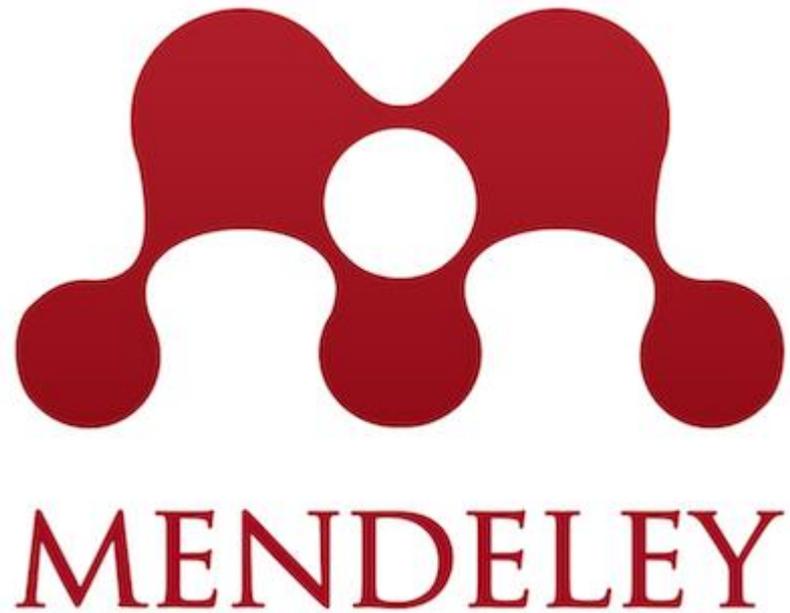
Some key books ...





Btw, how do you manage your references?

One example ...





Any questions or comments?



Thanks!

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Profile page: <https://www.kth.se/profile/emrahka>



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