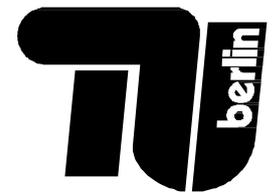


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Guide for Scientific Work

Department of

Technology and Innovation Management

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Stand 2019

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1 Introduction

Students have the opportunity to write a bachelor's, master's or diploma thesis on current research topics in the field of technology and innovation management. "The final thesis is both an examination paper and a part of the academic education and is intended to show the candidate that he or she is capable of independently working on a problem from his or her degree program using scientific methods within a specified period of time." AllStuPo §46

This guide will assist you in successfully writing a thesis in the Technology and Innovation Management field. This reading is indispensable for a successful work.

2 Process

2.1 Application

Those interested in a bachelor's or master's thesis should have already attended modules of the department. You are required to submit your written application including letter of motivation, curriculum vitae, certificates and grades from the Bachelor's or Master's studies in the subject area as described on the homepage.

The topic to be dealt with in the Bachelor's, Master's or Diploma thesis must either be taken from a list of topics published by the department or developed as a self-proposition. The topic of the thesis will be substantiated in an introductory discussion with the supervisor.

Further information on the application process can be found on the website of the department (https://www.tim.tu-berlin.de/menue/studium_und_lehre/abschlussarbeiten/parameter/en/).

2.2 Exposé

After the confirmation of the subject and a first interview within two weeks (Bachelor thesis) or four weeks (Master thesis) an outline and an Exposé will be written. Together with the supervisor of the thesis, the exposé and the outline will be discussed. The outline should include all planned chapters with an estimate of their scope in pages. In the context of the exposé, the candidate should explain the motivation on two sides, i.e. highlight the scientific and / or practical relevance of the work and what the concrete goal of the work is – i.e. which research question(s) should be answered. In addition, it must be considered with which method

(quantitative / qualitative / conceptual or literature review) the student would like to achieve the set goal.

Feedback from this session must be incorporated into the synopsis and structure immediately after this meeting.

3 Registration at the examination office

The next step is the registration at the examination office. With the registration at the examination office the official processing time starts. The specified deadline must be met. The assessment of the work is done as soon as possible. Questions regarding the organization, deadlines and dates, registration / deregistration, the content of the examination regulations, number of copies to be submitted, please contact the Examination Office or read your study and examination regulations on your own.

4 Objective of Scientific Work

A bachelor's or master's thesis should demonstrate the author's ability to work independently.

The thesis should guide the reader in a clear and clearly comprehensible manner to new knowledge, i.e. to the results of the performed scientific work.

That is, the reader must know in the end:

- what was done
- why it was done
- how it was done
- what results were achieved and
- how these results can be interpreted and used.

The task of the author is to find a way to convey to the reader complex facts as simple (but not simplistic!) and as clearly as possible. Ideally, the reader should find the answers to questions that arise while reading.

4.1 Originality of the work

An important quality criterion of a bachelor or master thesis is its originality, i.e. the intellectual contribution of the author. This intellectual achievement should usually be

provided in one of the following two forms, whereby the form to be chosen is usually already predetermined by the topic:

- The systematic collection and consolidation of all important contributions to a specific scientific issue is the most common form of this contribution. The goal here is not the elaboration of new facts, but rather the improvement, simplification and, above all, systematization of the presentation of already known facts, but so far never summarized in a single work. The first important step to such an approach is to collect as much as possible of all topic-specific publications. The system of comparison and differentiation of the different theories or investigations is crucial for a good quality work. This may be limited to the elaboration of differences and similarities, but usually requires the development of evaluation or selection criteria for the applicability of the individual works to specific problems.
- The transfer / adaptation of a theory or research methodology to a previously unobserved question or target group forms the basis for another class of bachelor or master thesis. On the one hand, the goals are the discussion of the transferability of the given theory or methodology to the chosen question or target group and, on the other hand, the new findings arising from this transfer. Apart from conveying the necessary overall overview of the current state of research, this approach does not generally aim for the completeness of the literature presentation. On the contrary, the well-founded restriction to the areas actually necessary for the transfer is usually much better. Both in the discussion of transferability and in the interpretation of the results obtained, the specific characteristics of the selected question or target group should be presented with the greatest possible precision and detail and used accordingly. Consciously limited to a very limited section, the work gains its quality through the depth of inquiry and discussion.
- Validate (i.e., check for validity) or verify a given (usually new) insight by another method or with a new sample from another context.

5 Formal criteria of a thesis

5.1 General

5.1.1 Scope

The scope of the text of a Bachelor thesis should be 15 pages and be 25 pages for a master thesis (both excluding title page, abstract, directories and appendix). The page size can also be set differently depending on the topic with the supervisor.

Adherence to these page numbers, coordinated with the supervisor, is an important part of the job. The restriction requires distinguishing important from unimportant and using precise representations rather than cumbersome paraphrases.

5.1.2 Components of the thesis

The following structure must be considered for the individual components of a Bachelor, Master or Diploma thesis:

1. Front page
2. Abstract
3. Table of contents
4. if necessary, list of abbreviations
5. If necessary, illustrations and tables
6. Text (the actual work), usually consisting of:
 - 6.1. introduction
 - 6.2. Theoretical foundation
 - 6.3. Methodology
 - 6.4. Result
 - 6.5. Discussion
 - 6.6. Conclusion
7. Bibliography
8. If necessary, appendix
9. Affidavit

5.1.3 Format

- Use sans-serif fonts (example: Calibri (11 pt), Arial (11 pt))
- Written with 1.5 line spacing and written in block format
- Footnotes in 10 pt font size and single line spacing
- Each sheet is described on one side only
- Leave a margin of 3 cm left and right; top and bottom each 2 cm edge
- The page counting with Arabic numerals starts with the first page of the text and runs to the last page of the work
- Front pages and directories before the beginning of the text are counted with Roman numerals, which are, however, only written out after the title page
- Roman or Arabic numerals should be placed prominently
- No unnecessary page breaks; Max. 1-line spacing between headings and between text breaks
- Tables and figures as large as necessary (readable) and as small as possible
- Each submitted work must have a title page containing at least the following information:
 - University and institute name
 - Type or function of the work (Bachelor's, Master's or Diploma thesis)
 - Topic of work
 - Name of the examiner or first referee with academic titles
 - Name, first name, matriculation number of the author (submitted by: ...)
 - Study address (with telephone and email address, if applicable)
 - Date of submission or submission (not of the exam day)

5.2 Details on the components of the thesis

In the following, the components of the work are presented in detail. These are to be understood as mandatory, deviations must be discussed with the supervisor.

5.2.1 Abstract

The abstract should give a precise overview of the work on one page and include the following points:

- Objective / research question
- Methodology / Procedure
- Results

It is used to quickly inform a reader who wants to find out if the contents of the work are of interest to him. The abstract is to be integrated into the work directly behind the title page.

5.2.2 Structure of the work and table of contents

In any scientific work, the central thoughts of the author should be a common thread. In order to achieve a continuous thematic focus, from the first day an attempt should be made to subordinate one's own train of thought to an outline concept. Only a few key words can be used in the first days of the collection. During the dynamic work process, the first coarse division will change. The more differentiated the (provisional) structure, the easier it is to create manuscripts. If every point has only a few individual thoughts and problems, it is easier to formulate it than for complex problem packages.

A formal outline scheme as early as possible compels an ongoing weighting of the problems dealt with.

The most common forms of structure are the numerical and the alpha-numeric order. With the numerical order it is possible to subdivide to infinity. Here, caution is advised, because a too deep subdivision illustrates the inability of the author to recognize logically connected sections and to divide only the associated special problems in the corresponding sub-points. With the

alpha-numerical order, a structure that goes beyond five levels is not possible. The choice of the structure for the work is up to the author.

Beispiel:	Numerische Gliederung	Alpha-numerische Gliederung

	3 Formalkriterien	C Formalkriterien
	3.1 Formale Richtlinien	I. Formale Richtlinien
	3.1.1 Zitate	1. Zitate

Figure 1: Example of the numeric or alpha-numeric structure.

The table of contents reflects the entire structure of the written work. It must have all the components of the work that have a page number. A table of contents without page information is useless! The structure of the text forms the core, however, all front pages/prefaces, the attachment and all directories must also be recorded in the table of content.

All headings and section titles in the table of contents and in the work must be identical. The text can not have outline points that are not listed in the table of content.

Inhaltsverzeichnis.....	III
Abkürzungsverzeichnis.....	VI
Abbildungsverzeichnis.....	VIII
Tabellenverzeichnis.....	IX
1. Problemstellung.....	1
...	
Literaturverzeichnis.....	61
Anhang.....	64

Figure 2: Example for a table of content

5.2.3 Introduction

It is the first section of a work and an integral part of the text. It is possible to make statements on the following points and to select chapter headings indicating the relevant content.

- Motivation and justification of the topic (What is the scientific and practical relevance?)

- Aim of the work or investigation (The objective should lead to 1-3 research questions.)
- Definition of the topic and possibly topic-related short definitions
- Overview of structure and sequence of arguments (possibly graph / figure)

It is essential that the objectives and research questions are determined early (in the exposé). Otherwise, the introduction can only be finalized when all the work is done. It is a taste for the reader and an invitation to further reading.

5.2.4 Methodology

In this chapter, the student must explain:

- Which methodology was used (literature review, interviews, questionnaire, experiment, case study analysis)
- Specifics of the chosen method should be described in detail (open questions, length of the interview, guides, scales of questions, specific context, ...)
- Regardless of the chosen method, a more or less detailed literature search is required and the procedure must be described: Where was literature searched for? Which keywords were used? Which kind of literature (books, articles, websites) was focused on? How did you choose the literature (title? Abstract? Key Words?)?

5.2.5 Theoretical Foundation

In this chapter, important definitions, concepts and theories should be presented clearly. It is important that this chapter does not fulfill an end in itself, but only concepts and theories should be explained, which are also necessary for the understanding of the later analyzes. If required, self-developed working definitions can also be used.

5.2.6 Results

This chapter is about the structured presentation of the results of the work. Here also graphics or tables can be designed for a clear presentation. It is important that in this chapter there is not yet a rating, interpretation and discussion of the results, but actually only to their naming.

5.2.7 Discussion

This is the most demanding chapter, in which predominantly own thoughts are to flow in and the transfer performance is greatest. It is about recognizing newly discovered relationships between the results and presenting contradictions, differences or similarities to already existing findings. Furthermore, it is about the discussion (pros and cons argumentation) of the applicability of the results. For example, are the results generally valid or dependent on a particular context? Where are the results valid? To what extent are there restrictions? Part of this chapter is the discussion of the contribution to science and practice. Important: This chapter is not a summary of the results.

5.2.8 Conclusion and Outlook

The conclusion of a thesis essentially consists of 3 elements. A discussion, a conclusion, limitations of the work and an outlook on further research. As an example, the question from the introduction can be taken up again and the developed proposals can be presented in this regard (again, no simple repetition of the results should be carried out). The limitations should critically deal with one's own work. What can the work provide, but what not? Which restrictions should be considered when interpreting the results (for example limited number of interviews, focus on particular area and thus possible problems with generalizability). The limitations are followed by an outlook on further research. Here is to be shown what is missing in the previous studies, which effects may have been neglected. From this, it should be deduced which area future research in this area can deal with.

5.2.9 References / Bibliography

The bibliography is an essential part of any scientific work. It is the complete compilation of all the literature processed in the work which have been demonstrably taken into account in the work in some form. His place is always according to the text of the work. Please design the bibliography according to the guidelines of the DBWM (The Library for Economics and Management, TU Berlin), at the following link:

<https://www.dbwm.tu-berlin.de/menue/iep/leitfaeden/parameter/en/>

We strongly encourage the use of a program to organize your literature, e.g. Citavi (for Windows, can be downloaded for free from Tubit), or Zotero (for Mac). These programs automatically create a formally correct bibliography and avoid formal mistakes when citing / referencing an article in the main text.

<https://www.ub.tu-berlin.de/literaturverwaltung/>

The website is unfortunately only in German, but once installed, the programs can be changed to English language.

5.3 Formal Guidelines

5.3.1 Abbreviations

Abbreviations should be used as sparingly as possible in the scientific text. Without limitation, only the abbreviations and acronyms cited as generally understandable in the DUDEN (short words such as USA) are permitted. Common abbreviations do not have to be included in the list of abbreviations. If abbreviations that are customary in the subject or subject area are used that are not listed in the DUDEN, they must be declared without exception and included in the list of abbreviations. It is not allowed to make your own abbreviations for convenience (for example, "Volksw." Or "Prod.mgmt."). Abbreviations that are not clearly usable in the form found are to be explained in the text when they are used for the first time (for example, DB = Deutsche Bundespost or Deutsche Bank?). The abbreviations used in representations must be explained immediately in a legend.

5.3.2 Quotes and Footnotes

It is a requirement of scientific writing to give accurate information with clear reference to the source of all facts and not independently developed ideas - if they do not represent scientific public good - as well as other suggestions! If in doubt, the author should refer to a quote. Further information and guidelines can be found in the DBWM Guide at:

<https://www.dbwm.tu-berlin.de/menue/iep/leitfaeden/parameter/en/>

5.3.3 Tables and Figures

Tables and figures are intended to illustrate, reinforce and make it easier to understand what is said. Representations must thus offer an added value compared to the pure explanations in the continuous text and may never be used for distraction, obfuscation or as placeholders. An illustration should stand alone and be accessible to the expert reader without the study of the preceding page (s). The abbreviations used in representations must be immediately explained in a legend. In the case of scientific representations, pay attention to the correct axis labeling and units used (eg: "Cost [EUR]", "Time [h]", etc.).

Each table or figure is enclosed by a frame. Below this frame is the number of the table or figure, followed by the most accurate indication of the content as a title. Tables and figures are numbered consecutively (separately). References to tables and figures are to be stated after the word "source" either after the title in brackets or in a corresponding footnote. If the table is based on its own data or a figure on its own representation, the source must be specified as follows "Source: Own representation."



Figure 3: Illustration of Nothing. (Source: Traumer, 1980, S. 5.)

Only if tables or figures take a disproportionately large amount compared to the text and their meaning for the work, it is advisable to attach them to the appendix of the work. Otherwise they should appear in the current text. The same applies to more detailed documentation, such as longer legal texts, photocopies, etc.

6 Tips

6.1 Textbooks (Methods, Scientific Work)

For the different methods of scientific work one finds different books in the TU library. The students should deal with the chosen method early and intensively with the literature. Some examples of scientific writing:

1. Saunders, M., Lewis, P., Thornhill, A. (2016). *Research methods for business students* (Seventh Edition). Harlow: Pearson.

2. Blumberg, B., Cooper, R., Schindler, P. (2014). *Business Research methods* (Fourth Edition). London: McGraw-Hill Education.

6.2 Technical search options

There are many ways to get good scientific literature. Here are some examples:

1. Libraries of the TU Berlin, FU Berlin, HU Berlin, State Library, etc.
2. KOBV, DBI link
3. Commercial online databases
 - a. <http://digibib.kobv.de>
 - b. <http://opac.tu-berlin.de/>
 - c. <http://econis.zbw.ifw-kiel.de/cgi-bin/wwwlibmenu>
 - d. <http://opac.fu-berlin.de>
 - e. <http://www.ubka.uni-karlsruhe.de/kvk.html>
 - f. <http://www.subito-doc.de> [fee required]
 - g. <http://stabikat.staatsbibliothek-berlin.de/>
 - h. <http://search.ebscohost.com>
4. Internet (e.g. Google Scholar)

6.3 Creating a manuscript

All the notes made in the course of the scientific work process are manuscript parts: first notes, sketches of ideas, excerpts with annotated excerpts of texts as well as preliminary drafts of individual sections or chapters. When creating the raw manuscript, it does not initially come down to an exact and stylistically beautiful formulation. At this stage, it is important to fix thoughts and ideas. It is extremely helpful from the beginning to write down bibliographical references in detail (formally, as they must be listed in the bibliography). Then, when creating the final manuscript and bibliography, no time is wasted searching for citation places. In addition, the different versions of the manuscript should be stored separately (with dates), so that the mental development during the work at the end is still traceable. The final manuscript

does not come in one go and not in a strict order. The only important thing is that it follows a systematic structure (see Section 4.1.2).

At each stage of creation, the manuscript should be read as often as possible! If a new piece of text has just been created, it makes sense to reread this a few times, e.g. at the beginning of a new working day, when deletions are easier and suggestions for improvement emerge spontaneously. Cuts and deletions are usually a benefit for each manuscript. Repetitions only make a manuscript longer, but not better - quite the contrary!

Texts should be read aloud to control expression and style. In addition, it is helpful to discuss the structure and important thoughts with fellow students or to get suggestions. Since you have internalized the text even after a certain time and thus it is difficult to pay attention to systematic or logical mistakes, the work should also be given to someone for proofreading.

6.4 Content

The text of a scientific paper must be read with as much interest as an exciting novel. This is only possible if the reader is led through the text. If he first needs to seek knowledge in footnotes and other additions, the essay is still incomplete. The reader loses himself and is no longer able to follow trains of thought. Accordingly, he can not appreciate them positively.

6.4.1 Logical, argumentative introduction to the result

Good scientific work is characterized by not simply postulating any result, but revealing the entire evolution of that result, i.e. made comprehensible and verifiable. The same applies, of course, to theses: all assumptions, considerations and arguments must be explicitly deduced, substantiated and discussed. What has not yet been acknowledged as a fact (for example, by publication in a scientific journal) must first be explicitly derived and thus at least made plausible to the reader.

6.4.2 Structure of comprehensible lines of reasoning

Each line of reasoning should be structured as clearly and structurally as possible, comparable to a mathematical proof: thesis, prerequisites, step-by-step completion of the proof. What is

important is a step-by-step structure that does not "leave the reader alone" through unnecessary mental leaps, incomplete and unclear arguments.

Especially within the description of the "development of new knowledge" the logic (not the timing) should determine the order! It is not important for the reader when specific knowledge has arisen or when it has come to certain findings, but how! If argument B has to be based on argument A, it is easy to understand, but unfortunately not obvious, that argument A should be found in the text before argument B.

It is important to avoid that the reader has to go back because he can belatedly understand what was written before, thanks to subsequently provided arguments. The main statements should always be placed at the beginning of a section, as all subsequent statements can then be immediately related and arranged by the reader.

The fine-graining of the individual sections should have approximately the following structure:

- Identify main message(s)
- Explain, discuss and supplement main statements with side statements
- Draw conclusions from the argument (which will lead to the next step).

6.5 Style

Although scientific texts primarily serve to present and critically discuss a problem in the subject, some effort should be spent in the elaboration of the language. Because when trains of thought are presented unclear, the assumption comes close, the author had thought just as unclear.

Common stylistic problems:

- **Technical terms**

They are used in every science, but in each case their use must be carefully tuned to the purpose and the readership of the work. Subject-specific abbreviations should be applied sparingly, if at all, and must be explained in a corresponding list of abbreviations.

- **Foreign words and buzzwords**

They can - used sparingly and correctly - add flavor to a text. But misused, they can easily make him incomprehensible. Technical terms and special vocabulary are often suitable for clarifying very specific facts in precise form. When introducing a new term, it should be explicitly described what is hidden behind this term from its own point of view (definition).

- **Symbols, comparisons, pictures**

They must be generally understandable and comprehensible, otherwise an involuntary comedy may arise or incorrect information may be transmitted.

- **Slang**

Colloquialisms are not a means of stylistic simplification. They seem unobjective and miss the scientific seriousness.

- **Paraphrases and platitudes**

They are as compelling as the author's attempt to encourage himself by using reinforcing adverbs or superlatives instead of convincing arguments: "only right model," "unbelievably wrong approach," or "most optimal alternative."

Adverbs such as "natural" or "self-evident" are forbidden in any scientific work, "well", "almost", "somehow", "to a certain extent" are anxiety words that are intended to cover only contentual uncertainties of the author. A thought gap should not be filled with famous glue words ("so", ...), a sentence transition should not be worsened with "by the way".

- **Spelling, grammar, punctuation**

They must each correspond to the current edition of the DUDEN. For English translations we recommend www.dict.cc, for English synonyms www.oxforddictionaries.com/thesaurus/.

- **Complicated sentences / subordinate clauses**

This can be avoided by making complex facts clear on the basis of a sketch and subdividing them into individual aspects. Then one should be careful when formulating not to mix several of these aspects in one sentence.

6.6 Time Management

- There should always be enough corrective time scheduled
- Allow enough time to create the layout and settings
- Observe holidays (during the planning of interviews, when printing the work, etc.)
- If possible, save work as a PDF before printing, in order to avoid possible shifts and missing documents etc.