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LUND UNIVERSITY
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Master Thesis in Informatics

Guidelines

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Abstract:
A master-thesis means that students must demonstrate that they can formulate a research question. Furthermore they must design and conduct an investigation. The investigation and the findings from it must be reported according to standards and guidelines for academic and/or scholarly reports. There must be a chain of evidence starting with the research question and ending with the conclusions.

In a master-thesis (as any other academic report) there must be a research question. Literature, theories and previous investigations, which are appropriate and relevant for the research question, must be presented and reviewed. Based on literature and theories the relevant ones must be chosen, based on an assessment of the theories, which must result in a research (investigation) model. Methods to be used in conducting the investigation should be based on a motivated selection, which must be presented and argued in the master thesis.

It is important to present the literature and theories that have been used. There must be a connection with previous research and literature. So a master-thesis must have references, and references must be written according to the applicable guidelines.

The contents and layout of a master-thesis are essential to present and mediate the investigation and findings of the thesis in a solid and readable way. The chain of evidence must be clear through the whole master-thesis.

Teaching consists of a series of lectures, supervision and seminars. The seminars are intended to provide support during the process of conducting an investigation and writing a master-thesis. The process is concluded with pre-seminars and final seminars, where the master-thesis is presented and discussed, as well as assessed. During these seminars student-teams must review the master-theses of other student-teams.

Contents

1 Introduction

The master-thesis is an important part of an academic degree. It provides opportunities to integrate different types of knowledge and to carry out an independent work of one's own. It is quite simply the crown to academic studies.

Students often consider the work with the master-thesis as rewarding, stimulating and challenging, but also demanding. It provides opportunities to select a topic and explore a problem within an area of interest students may select themselves, which simultaneously poses requirements on working independently and having analytical abilities. The methods of work are very different from those of literature courses, since the students must themselves learn how to design and carry out a task within a limited and set period of time.

It is therefore crucial that courses from previous semesters have been completed, so that there is no need to do any examinations, which may risk taking time from the work with the master-thesis. In addition the knowledge acquired from earlier courses provides a foundation for the master-thesis.

1.1 Goals

The master-thesis – independent/degree project – concludes the studies towards the degree of Master of Science (1 year). The goals (learning outcomes) for a master degree (Higher Education Ordinance, Qualifications ordinance) stress that students must demonstrate, a.o.:

- knowledge and understanding in the main field of study, including both an overview of the field and specialized knowledge in certain areas of the field as well as insight into current research and development work; and demonstrate specialized methodological knowledge in the main field of study.
- the ability to integrate knowledge and analyses, assess and deal with complex phenomena, issues and situations even with limited information.
- the ability to identify and formulate issues autonomously as well as to plan and undertake advanced tasks within predetermined time frames, making informed selections of appropriate methods.
- the ability in speech and writing to report clearly and discuss the conclusions of study and the knowledge and arguments on which they are based in dialogue with different audiences.

- the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate the awareness of ethical aspects of research and development work.

The master-thesis is crucial in order to achieve these goals. It provides students with opportunities themselves to select a problem to study, design a plan or approach for solving the problem, and finally to present a written scholarly report. The work with the master-thesis must be carried out *independently,* i.e. it is *the students who have the responsibility.* The work is carried out in *teams of two (2) students* (according to a decision by the board of LUSEM, cf course syllabus). The thesis-team selects a problem of study, plans and carries out the study. This must not be done by the teachers or supervisors. It also means that the work is not scheduled as previous courses, since there is a need to take into consideration the study the team will do. There are only some predetermined time-frames (with regard to pre-final and final seminars) to take into account for planning the work with the master-thesis.

The master-thesis comprises 15 hec (higher education credits) or 10 weeks (i.e. half a term). This thesis is a scholarly or scientific minor *study of some problem area within informatics* (e.g. IT-supported information systems) but no computer science problem (like algorithmics, compiler technology, coding, programming or anything such like), which *contributes towards developing knowledge in the discipline of informatics,* which belongs to the social and economic sciences. It may involve three different types of studies: theoretical-empirical, theoretical and design-theoretical. The most common is the one which addresses a problem through a review of literature and an empirical field study of some kind, where the findings from these are contrasted in order to answer the research question. It is, however, becoming increasingly common with design-theoretical studies, where the scientific problem is a design-problem and the contribution to knowledge of the study has the character of design-research.

The work with the master-thesis is carried out independently, thus it is not scheduled. The thesis must be begun and concluded during the same semester. Otherwise the work on a thesis must start again, the next time the degree-project-course is offered. In order to pass the course-module it is required that the study is carried out, reported (as an academic or scholarly report) and defended at final seminar; furthermore that written and oral reviews of other master theses discussed at the same final seminar are presented. The course language is *English.* All master theses must be written and presented in English.

1.2 Teaching

Lectures present how to organize the work with the master-thesis, how it is planned and designed as well as basic research approaches. However research methods are taught more thoroughly in the course-modules on research methods. In addition teaching encompasses

- discussion-seminars, including the TP1,

- supervision, including TP2,
- pre-final and final seminars.

1.2.1 Discussion-seminars and TP1

Discussion-seminars are organized for groups of students, and they are led by two teachers/supervisors. The purpose is to discuss various ideas or suggestions for thesis-topics and how these may be approached, in order for TP1 (thesis proposal 1) to provide a good foundation for carrying out the project-work involved in the master-thesis. During the discussion-seminars teams of two students will be formed. After the discussion-seminars a proposal for topic for the master-thesis (TP1) must be submitted.

It must be possible to decide whether the proposed topic falls within informatics. It is also important that it is feasible, which involves whether there are previous studies and relevant theory. Furthermore whether it is possible to find empirical data, either through collecting new data or by using data from the Internet. This means that TP1 (appendix 1) must include:

- presenting the problem area and selecting a research question,
- which theories will be used,
- what empirical data will be used, how will they be collected.

Based on the TP1 a supervisor will be assigned. It is not possible to guarantee that students wish with regard to supervisor can be satisfied or that the students will be assigned the supervisor who has led the discussion-seminar in question. When allocating and assigning supervisors there is a need to take into consideration not only the students' selection of research question but also the supervisors' orientation and specialist knowledge. Not least must the scopes given by the teaching-plan and the course-budget be taken into account.

1.2.2 Supervision and supervisors

Each thesis-team is assigned a supervisor, who supports the students in their work to accomplish a report that will at least have a pass-grade. The role of the supervisor is to be a discussion-partner who poses (critical) questions, points at problems and provides feedback on the text produced by the team of students in order to support their work. However, it is not the task of the supervisor to tell the students exactly how to improve their draft, overall as well as in detail, since the master-thesis is an independent work. The supervisor attempts to coach the thesis-team to be realistic and focus their ambitions so that the thesis-work will realistic and it will be possible to accomplish it within the time-frames given. The supervisor will provide advice but at the same time make sure that the team works independently. Above all the supervisor is a sounding-board and may assist with regard to the scope, orientation, design and carrying out of the thesis-work, as well as assist in issues of theory and methodology. However, it is *the students who must plan and carry out the work,* and it is *the students who have the responsibility for the thesis-work.* The supervisor may provide

suggestions and advice, but the thesis-team must themselves search for literature and suitable or adequate theories.

With regard to *grades* the supervisor does not have any responsibility to guide the thesis-team towards a grade of PD (pass with distinction), instead this grade is achieved through the thesis-team independent work and their ability to take good care of and develop the comments and advice from the supervisor. Furthermore, the tasks of the supervisor do not include language-clearing and proof-reading, instead this must be done by the team themselves, e.g. using the facilities available in MS-Word, and possibly asking somebody else to read their draft.

Supervision takes place based on agreements between the team and their supervisor. The time the supervisors have for supervision is limited, in total it is possible to have *no more than 4-5 meetings* (incl. TP2-seminar and pre-final seminar) with the supervisor. In order for supervision to be profitable it must be prepared. This means that the thesis-team must in advance (a couple of days) before the agreed meeting with the supervisor submit a written draft to the supervisor, who then will have possibility to read it; alternatively the thesis-team may when they submit the draft ask for a time for supervision.

It is a good idea to *prepare for the meeting with the supervisor*, i.e. that the thesis-team in advance thinks about what you would like to discuss and which questions you would like to have an answer to. This may be about how to organize the literature survey and the theoretical review, how to design an interview-guide or a questionnaire, or something else. Supervision gives most if the thesis-team can give an account of how they plan to select e.g. interviewees (as a draft of the methodology-chapter) and then discuss this with the supervisor. It is less profitable if the thesis-team poses the question “what should our problem or research-question look like” or “how should we make our selection” without offering any suggestions for discussion.

Please note, that no interviews made be conducted or questionnaires distributed before the *supervisor has examined interview-guides or questionnaires and said OK.* Protocols (or transcripts) from the interviews must be made and confirmed by the interviewee (informant). These protocols must be added to the thesis as appendices.

A few weeks after the TP1 has been accepted and the work on the thesis has started, TP2 (thesis proposal 2, planning report) must be submitted to the supervisor, who will organize *TP2-seminars* (possibly together with another supervisor), where the TP2s will be discussed. TP2 must provide a more detailed and elaborate description of the problem, the theoretical starting-points and how the problem will be approached. The description needs to be sufficiently rich to provide a foundation for conducting the investigation.

TP2 must follow the layout for the final thesis (chap 2), in particular the TP2 must include:

- introduction,
- survey of relevant literature,

- object of study,
- methodology, with appendices in terms of drafts of interview-guide(s), questionnaire(s) and other study-instruments,
- in addition TP2 must include a plan and schedule of the work with the thesis.

These parts are preliminary. They will need to be revised and re-written a few times, before the final thesis is submitted and discussed at a final seminar.

1.2.3 Pre-final and final seminars

In order to prepare for the final seminar, it is mandatory to present a complete draft of the final thesis in a *pre-final seminar* (chap 6). In the pre-final seminar an assessment of the thesis is made in order to decide whether the thesis has sufficient quality to be discussed and examined in a final seminar. In a pre-final seminar the participants are master-theses, which have been supervised by the two supervisors organizing the pre-final seminar. If the draft presented at the pre-final seminar is considered to be lacking, then a new revised draft must be presented at a new pre-final seminar. Pre-final seminars are scheduled a few weeks in advance of final seminars. If the pre-final draft is considered to have sufficient quality, then an application can be made for final seminar (the supervisor provides the form).

A couple of weeks after pre-final seminars *final seminars* (chap 6) take place, at the end of the semester. Before the final seminar it is necessary to do the changes, corrections and amendments identified by the pre-final seminar. Students attend and participate in pre-final and final seminars during the same term. Regular pre-final and final seminars take place during May, and extra-ordinary in August.

A final seminar is led by two examiners, who have not supervised any of the master theses to be discussed and assessed in the final seminar. Each student-team will be asked to make reviews of the other master-theses presented in final seminar (chap 6). After the final seminars the examiners will assess the theses (chap 5), they will also have a meeting to discuss the grading of the master-theses, not until after this meeting will grades be decided definitely and assessment protocols distributed to each thesis-team.

1.2.4 Miscellaneous

Supervision for a master-thesis is only offered during one semester (cf syllabus), i.e. the semester when the TP1 has been accepted. Thus supervision is only offered during the semester the thesis-module is scheduled. After the final seminars at the end of this semester no supervision will be available during the next semester.

A final thesis must be presented at a pre-final and a final seminar the same semester as the TP1 was accepted or at the extra-ordinary seminars in August. In the event that the thesis-team does not present their thesis at a final seminar or if they fail at the final seminar, they

will have to submit a new TP1 and be assigned a supervisor, the next semester the thesis-module is offered, which means that the students will have to re-register for the module the. A new TP1 may address the same research question or a new research question may be selected, furthermore it may be the same thesis-team or a different composition of the team.

1.3 Academic text

In an academic thesis, report or paper – e.g. a master-thesis – the contents are essential. It is the contents that must be given prominence, the contents of a mater-thesis must therefore be reflected in the language used. The requirements with regard to the contents of a master-thesis mean that there are high demands with regard to exactness, objectivity, verifiability and relevance. In other words the style or language must be academic or scholarly. This is a polished professional language. The writers are expected to aim for a language which is timeless, i.e. a language with is not characterized by a too narrow and time-dependent language-use (e.g. various words and expressions in fashion).

The text and the language used must be exact, i.e. it must be simple, adequate and correct. It must not be journalistic or colloquial, neither must it be pure fiction or fictional. Furthermore it must not be obscure, excessively abstract or bureaucratic. The advantages of academic language are that it is neutral, matter-of-fact and maintains a distance. In an academic, scholarly or scientific report the authors must maintain a distance to the topic they are investigating (Jacobsen 2002), they must not become too involved in the topic. A certain amount of engagement may, however, make the report more worth reading.

It is difficult to give general advice about the academic style, therefore it is a good idea to listen to supervisors and other readers of drafts. There are handbooks and guides, which are useful to consult: electronic guides (AWELU 2011, Språkrådet 2012) as well as printed ones (Creme & Lea 2008, Hicks 2009, TNC 2004)

The audience for an academic text is not everybody, instead the authors write for colleagues (or fellow students) who are not specialists within the problem-area the paper or master-thesis deals with. It is reasonable to assume that the readers have approximately the level of academic knowledge as the thesis-authors, but that they lack some detailed knowledge within the topic of the thesis. Therefore it is mostly unnecessary to explain the obvious, even though brief explanations sometime may be necessary in order for the text to have flow with no gaps. Such explanations must, however, not be long repetitions or reproductions, since the thesis then will resemble a textbook. Focus must be on the research question and the investigation which will be made to answer the research question.

Formulations like “in order to make it easier for the reader” are not acceptable in a master-thesis or in any other academic text. It suggests that the authors don’t believe that the readers have sufficient knowledge. Furthermore this is something the authors always have to do. It is

always necessary to explain what one writes and does in order that there will be no misunderstandings of the text.

Avoid expressions as "many believe/think" or "researchers/scientists think/consider". It is not at all certain that everybody believes the same or even that they agree. It is not self-evident that it is negative, that researchers are not unanimous, on the contrary disagreement suggests that there are problems to approach or potential research questions to answer. It is necessary to demonstrate that the thesis-authors are aware that there may be variations in what researchers consider. Therefore it is necessary to make references to the publications of researchers expressing a specific view-point, and preferably also include references to publications of researchers/authors taking different view-points. Also it is not only interesting which view-points they have, but much more why they express these opinions.

Writing academically means that one must present own *well-founded* standpoints, findings and interpretations – not beliefs and opinions, even though the distinction sometimes can be minimal. That standpoints and statements must be founded means that they must build on current theories, previous investigations and analysis of collected empirical data. It is only acceptable to present own opinions *if* they are motivated and argued for. Thus, it is not permitted to write "I/we think/believe", instead what is interesting is why you think so, what you base it on, how you have arrived at what you write.

Neither are formulations like "according to me/us" permissible. They are also expressions of opinions and thus they don't provide an acceptable foundation. They need to be replaced with an explanation, why is it applicable.

The same is relevant for formulations like "author A (year) means/thinks/believes". An academic text does not primarily put forward opinions, the concepts used are not opinions, and neither are the findings. The text becomes boring when there are many means/thinks/believes following each other. There are other more adequate and suitable expressions, as assert, maintain, state, suggest, indicate, found etc. The text becomes more interesting if these expressions are varied.

Many master-theses discuss a professional group, like system developers, system designers, programmers etc. When the text is about a specific representative, who is known, then he or she is used depending on gender. Sometimes the expression "the system designer … he/she …" is used. Then the authors obviously don't know the gender, which suggests that the text refers to the group or category of system designers. Then it is preferable to use plural, i.e. "system designers … they …", in that way the problem of he or she or the poor compromise of he/she is avoided.

Using too many you/one or too many passive formulations makes the text bureaucratic and too impersonal. Furthermore who is you/one? Is it the authors, or just anybody? It is therefore appropriate to avoid a too frequent use you/one. Nowadays it is much more acceptable to use I/we in academic text, however the text must not become too self-centered. But when the text

concerns the choices the thesis-authors have with regard to method, then it is quite all right to write “I/we decided/chose/selected”. With regard to we, then this may be used if it refers to what the authors have carried out. However, the variety of we attempting to include readers is not acceptable, since readers have actually not taken part in the investigation. Such a we can also easily slip into the majestic (where we means I), which simply is only pretentious.

Try to use an academic style from the beginning. True, it is difficult and hard, when the writer has not previously written much academic text. But it will gradually become easier, and eventually you will learn to use the academic language. It is good to be able to use an academic style also in other contexts, since it is a neutral style which does not become emotional or excited. There is no need to be perfect from the beginning when using an academic style. It is, however, good to try from the beginning, otherwise there will be too much work at the end, if it then would be necessary to rewrite completely. Polishing and refining formulations may however be saved until the end, but it needs to be done before – not after – the final seminar.

1.4 Handbooks

It is hard work to do a master-thesis, since most students have limited experience in doing research on their own and writing a research reports. However, there are many handbooks (unfortunately of varying quality) that can be consulted (e.g. Booth et al 2008, Creme & Lea 2008, Deane 2010). Also the Internet is increasing in importance as an extremely rich source of empirical material. However, this requires the ability to navigate with a critical attitude on the Internet. Furthermore material found on the Internet varies considerably with regard to quality, so it must be critically evaluated and assured with regard to its quality and reliability i.e. source criticism must be applied (Ford 2012).

2 Design and contents

The Master-Thesis (Degree project essay Master level) involves designing, planning, conducting and reporting an independent scientific task, which is concluded by presenting a master-thesis at a final seminar. It provides opportunities for exploring an area of potential interest in more detail, it may be something which has not been considered previously during your university studies but it may also be something else of interest. The master-thesis is not just about exploring an area in the sense of reading up on the literature within a knowledge field. The challenge is above all in the opportunities it provides for conducting an investigation of one's own and thereby making *a small but novel contribution of knowledge* to the already existing body of knowledge within informatics.

The master-thesis provides opportunities and possibilities for integrating and developing knowledge which has been acquired during previous studies. It provides training in conducting analyses, evaluations, inquiries and investigations. The tasks of the professional systems analysts or informaticians usually involve planning, conducting and reporting investigations and evaluations of various kinds; for different clients or customers and other stakeholders. It requires the abilities to be able to report, present the design and the findings, which in addition must be communicated to a number of interested parties, which requires the presentation to be clear and comprehensible. The master-thesis provides opportunities for training skills, methods and techniques useful for collecting, processing, analyzing and presenting materials, which is very useful in actual professional work and which companies are looking for.

A master-thesis must be based on *scientific foundations,* which means that

- The thesis investigates a *scientific problem* and it provides a small but new *contribution* of knowledge. It must be clear from the thesis that there has been an endeavour to describe, critically problematize and improve knowledge about the phenomenon or problem that has been investigated.
- The thesis must demonstrate that the authors have *worked according to the guidelines which apply to a scientific task.* The thesis must have a clear structure, i.e. the various components must be connected and coherent as well as supporting each other. The literature and the theories that have been used – or questioned – must be relevant for the investigation (the research question).
- The thesis must *document* information, research approach, empirical data, reasoning and argumentation; in order to make the approach and the report clear and understandable.

- The thesis must be correct with regard to *scientific accuracy* and *formal requirements.* This means that there must be *references* in the text and a list of references. The thesis must also use *adequate and appropriate language and terminology;* furthermore it must have *linguistic and conceptual clarity.* Conceptual clarity means that the concepts and terms must be used consistently and logically, and that concepts which are unclear must be clarified and explained.

2.1 The building blocks of a scientific report

A scientific report, an academic or scholarly paper reports on some scientific research study. Mostly this involves an empirical study and the findings from it. A theoretical study involves reviewing and assessing a number of scientific theories and models, however this requires that the researcher is thoroughly acquainted with the area of interest.

An empirical study can be carried out by using interviews, questionnaires and/or observations in order to collect data, e. g. in one or a few companies. An empirical study may also be carried out by using material from the Internet (Ford 2012), e.g. company home-pages, newspapers, computer press, blogs etc. But it may also be a review and critical examination of previous empirical studies (e.g. previous bachelor or master theses which have approached similar research questions). A scientific report must include references to relevant previous work and to suitable theoretical models.

Scientific reports and academic papers may be published in academic or scientific report-series (working-papers series) published by departments at universities, by institutions of higher education, or by research institutes. Most importantly they are published as articles in scientific journals or presented at scientific conferences. A paper presented at a scientific conference may later be revised and rewritten and then published in a scientific journal. Publishing in a scientific journal or in scientific conference proceedings requires the paper to be subject to a peer-review process, involving examination by other researchers (peers) knowledgeable in the field. This review-process is double-blind, i.e. the authors don't know who the reviewers are and the reviewers don't know who the authors are. If an article or paper has not been examined in such a scientific review-process, it cannot be considered a scientific article or report. Research studies can also be published as dissertations (e.g. PhD-theses) or books. Finally scientific reports also include bachelor and master theses presented at university departments, but not various course-assignments.

Academic publications are oriented towards the scientific community, thus they don't provide easy reading for the general public. So it is often required that the researcher alone or in collaboration with research-journalists make a presentation suitable for the general public, these are then published as popular science in journals or as books. Some high quality popular science publications can be considered as scientific publication; but not all.

In general journalistic articles (daily press, business press, computer press etc.) don't constitute scientific publications, since they have not been examined in a scientific review-procedure. This also includes much material on the Internet, popular science and much other material. However, this material may be very useful as empirical data.

A research study must be designed based on the research question which will be approached and answered. This also means that each master-thesis partly constitutes a unique piece of work which must be designed with regard to the problem purpose and expected findings. However, this does not mean that it may look in whatever way you like. Since a master-thesis must be based on a scientific foundation, then every master-thesis is required to have a set of building-stones, which in principle are the same in all scientific reports. However, how these building-blocks are treated, i.e. how they are used and represented in the master-thesis, varies with the character or type of the investigation.

Scientific work can be described from at least two different perspectives that normally are integrated:

- The tasks actually involved in a practical research investigation:
    - Reading literature on the subject, and thinking about formulating one's own problem,
    - Using appropriate and concrete methods for collecting and processing data,
    - Looking for a theoretical perspective or theoretical starting-points in order to analyze and interpret the empirical material,
- The investigation carried out and the findings arrived at must be presented in a written report.

In a scientific report the reader must be able to follow how the findings have emerged, i.e. there must be a *chain of evidence.* This concerns simply the quality and reliability of the findings. How have the data been analyzed? What data have been collected, why has it been collected? How has the collection of data been organized and carried out, what methods and instruments for collection have been used? Which are the theoretical starting-points? These questions must be answered, i.e. there must be an account of the research tasks carried out, as well as how the tasks are related to and based on each other.

This means that the scientific work includes a number of *primary building-stones:*

- problem-formulation,
- previous research and theory,
- approach and method,
- analysis and interpretation,
- concluding discussions.

These are the primary or main building-blocks in the main text in a master-thesis. In addition there will be a number of smaller building-blocks supporting the primary building-blocks. A scientific report commonly has a very uniform outline, where the building-stones are dealt

with in a very specific order. Following this outline also makes it easier to satisfy the requirement of establishing a chain of evidence. This clarifies how the findings have come about from the empirical material used and the theoretical starting-points, thus establishing the chain of evidence.

Every academic or scientific publication must have a *chain of evidence,* which ensures that the conclusions are founded in the empirical material and based on selected theories, thus the chain of evidence connects:

- research-question,
- theories used and the research-model developed,
- data required,
- methods used in collecting and analyzing data,
- findings and conclusions.

Title page
Abstract, required, maximum 1 page
(Preface, if absolutely required)
Table of contents
Table of figures, table of tables (if necessary)
Abbreviations and acronyms used (or as an appendix)

- *1. Introduction.* Background, formulating the problem, research question, purpose and delimitations. If necessary an outline may be provided of research approach or method, but no presentation of the layout of the thesis
- *2. Reviewing literature and theoretical starting-points.* Reviewing literature, designing a theoretical frame of reference and research-model. Concluded with presenting the research-model and how the factors of interest will be measured.
- *3. Object of study* (if relevant)
- *4. Approach for collecting empirical material.* Describing and motivating the method used in empirical studies. What data will be collected, how will the collection of data be carried out, how will the material collected be processed and analyzed.
- *5. Empirical studies.* A presentation and first or basic analysis of the empirical material.
- *6. Further analysis and interpretation.* Referring to theory presented previously. Summarizing the findings.
- *7. Conclusions.* Which are the main findings? Referring to the research question. Assessing the findings.

Appendices
A1. Abbreviations and acronyms used (instead of after the table of contents)
A2. Interview-guide(s)
A3. Interview-protocols (transcripts)
A4. Survey-questionnaires
A5. Compilation of survey-data
A6. System descriptions
Literature (references)

Figure 2.1. Outline of a master-thesis, involving an empirical research-question.

Thus a master-thesis must include firstly a *main text,* which provides an account for problem, theories, methods and findings, and secondly *supplementary texts,* as abstract, table of contents, appendices (figure 2.1). In the actual thesis it is necessary to change the titles of the

various building-stones into headings which appropriately reflect the research issue and the investigation that has been performed in order to answer the research question.

2.2 Title-page, abstract and table of contents

A master-thesis, just like any other scientific report, must have a title. This should be short and catch the contents of the thesis; it may be supplemented with a sub-title. The *title-page* must be designed in a uniform way.

The title-page (front-page) of the master-thesis must include

- the logotype of the department,
- title of the master-thesis,
- the text “Master-thesis 15 HEC, INFM02 in informatics”,
- month and year for the final seminar, the text “Presented in <month year>”,
- authors,
- supervisor,
- examiners.

It is required that a master-thesis has an *abstract*, which must contain sufficient information to identify the thesis and briefly present it, i.e. it must be possible to remove the abstract-page from the thesis and still know which thesis it is.

The *abstract-page* is the page immediately after the title-page and it must not take more space than a single page. The abstract-page must include

- title of master-thesis,
- authors,
- publisher (department and university),
- supervisor,
- examiners,
- final seminar (year and month),
- type of thesis, i.e. master
- keywords or search-words (5-6 keywords)
- the abstract proper.

The emphasis must be on providing a good presentation of the contents, thus attracting readers. After the final seminar and grading of the master-thesis, the thesis must be uploaded into the Lund university publications database, LUP. So it is essential that the abstract includes the information required for the thesis to be searchable, further information about the abstract can be found in LUP Student papers.

There may be a *preface,* which then is placed after the abstract but before the table of contents. A preface is usually quite unnecessary, since there is no need to thank the supervisors for doing their job.

Also a *table of contents* is required. A list (table) of figures and tables – in particular of figures and tables presenting empirical data collected in the study – if there are many. If there are only a few figures or tables presenting empirical data, there is no need to have lists of these.

2.3 The main text

The main text in the thesis is the important part of the master-thesis. This is where the research question is presented, which will be answered in the investigation, how the investigation has been performed, what the theoretical starting-points for the investigation are, and not least which findings have been arrived at. Thus it deals with submitting the evidence for the findings the thesis presents.

It is essential to provide a suitable theoretical foundation for the empirical part of the investigation, but this does not mean that the theoretical chapter is the most important one. Instead the empirical chapters are the most important, since they provide the basis for any contribution of knowledge. Therefore more space should be devoted to presenting, discussing and analyzing empirical findings than to developing and elaborating on a theoretical framework or research-model.

2.3.1 Introduction

The introductory chapter encompasses some sections presenting the starting-points for the investigation. The *background* must be briefly described in order to motivate the selection of problem. It is not necessary to make neither a long historical background nor an extensive description of the situation. Instead the background should be short and identify the problem area, within which a more precise problem then is selected. This problem is formulated in terms of a research question.

A scientific problem must not be confused with phenomena we refer to in everyday speech as problems (e.g. an unsatisfactory state of things) which should be attended to. A *scientific problem* takes its point of departure in something which puzzles us – something we consider needs to be explained or made more comprehensible. Problems in terms of unsatisfactory affairs (e.g. that something is not working) may of course be investigated scientifically, but this requires reformulating them as scientific problems. A scientific problem is not about solving a problem (i.e. an unsatisfactory state of things) instead it involves making a contribution of knowledge about solving or avoiding the type of problem concerned in future, the research problem need to be formulated in a more general way.

A problem formulation, which is feasible and practicable, is of great importance for the success with the work on the thesis, since it provides the foundation for selecting theoretical starting-points and for selecting methods and not least with regard to analysis and interpretation of the material. Problematizing involves a discussion of the problem area and various aspects of it, which then leads towards identifying and formulating a problem. This is next made concrete by formulating a *research-question,* which may have a couple of sub-research-questions, which contributes towards answering the research-question. There must be a discussion and argumentation demonstrating how the sub-questions are related to the research-question. There should be no more than one research-question with at the most three sub-questions; otherwise the investigation will be too large for the time-limits applicable to a master-thesis. It is not a research-question (nor a sub-question) to review relevant literature; instead this is a means for conducting an investigation, and identifying theoretical starting-points. It is always necessary to review literature when carrying out a research-study. It is neither a research-question (nor a sub-question) to compare the findings with previous research-outcomes. The results from the study performed must always be considered in relation to previous research-findings.

A good problem-formulation and research-question is characterized by

- a concise and concrete description of the *research-task* to be performed,
- adequate and relevant *scientific literature and theory,*
- possibility of access to relevant *empirical material,*
- the investigation can be carried out and reported within the *available time.*

While the research-question should indicate what the subject of investigation is, then the *purpose* must indicate which findings one wants to achieve, what is the *goal for the investigation.* It is not a purpose that one may want to make an investigation, instead the purpose is what one wants to achieve by the investigation. Also the purpose may be divided into a couple of sub-purposes, which are related to the sub-questions.

Furthermore, it is usually necessary to make *delimitations* of the research-question. There may be aspects of the research-question which are not relevant or not possible to investigate (due to lack of access to material). Delimitations are selected by the researcher(s) and need to be argued for. Lack of time is, however, not an acceptable reason; instead it is necessary to consider the lack of time in terms of selecting a problem and formulating the research question. Delimitations must not be confused with selecting the object of study, which refers to what type of company and/or what type of computer-supported systems will be investigated. Neither should delimitations be confused with *limitations,* which are factors, the researcher(s) cannot control, but which may influence the possibilities for conducting a study or for analyzing the data and drawing conclusions. It is necessary to try to be aware of such limitations.

It is essential to discuss, and conduct a line of reasoning and argumentation, of how the problem-area has been identified, how the research-question is identified and developed, how

the research-question is made more specific through the purpose, and how the delimitations are related to this.

In the introduction it is also possible to provide a comprehensive presentation of how the investigation will be approached. This encompasses a discussion of how the search for literature and theory has been conducted. The crucial aspect here is which type of literature or theory has been looked for, why this literature is of interest. Also which criteria or search-terms have been used may be relevant; however, it is of little interest what databases have been used. In the literature on research methods, a distinction is often made between primary data (the empirical data collected in an investigation) and secondary data (empirical data collected in other investigations), but it is perfectly unnecessary to use these terms in an academic report or master-thesis instead one must account for how and where data have been collected. In addition literature used for the theoretical starting-points is not secondary data.

In most cases it is completely unnecessary to give an account of the outline of a master-thesis. Mostly, it does not add anything which is not clear from the table of contents. Furthermore the outline of scientific reports follows a common format.

Problem area, research question, purpose and delimitations must be formulated at the start of an investigation, since they influence the process of investigation. Still it is normal for the researcher to return to the research question and purpose at the end, since it may be necessary to clarify and revise.

2.3.2 Reviewing literature and theoretical starting-points

In the introduction to the chapter it may be relevant to present – starting from the research-question – which types of literature have been considered, within which research-areas or disciplines. Such an introduction a chapter should not be a list of the contents. Instead it should present what will be discussed, e.g. by motivating which theories have been selected and why they have been selected.

In general it is very hard to find literature within precisely the area identified by the research-question, instead there is a need to search a broader area, possibly even within several disciplines (or subsets of disciplines). If the research-question e.g. touches on organizational issues, then one may search in business administration, psychology, sociology, work sciences etc. It is similar with regard to work-organization (including job-design), human communication using computers/IT. In addition one must look for specific literature (books or articles) presenting research findings with regard to relationships between computers/IT and organizations or work-organization.

Reviewing literature when conducting an investigation or research study includes three types of literature

- finding a problem area and *identify a problem*, which next is formulated as a research question; this belongs to the introductory chapter,

- literature about the *object of study*, e.g. cloud computing, ERP-systems, enterprise systems, system development methodologies,
- selecting *theoretical starting-points,* including relevant theories, models and previous empirical research.

The search for and survey of scientific publications must include

- a review of *theories and theoretical literature* relevant for the research question
- a review of *previous empirical studies* dealing with similar research questions (to the extent such empirical studies exist and are available),

The emphasis in a master-thesis must be on scientific literature, scientific journals and conferences (with review-procedures). Neither the daily press, popular press (e.g. computer journals) nor Internet-material may be part of the theoretical basis in a master-thesis, though it may be very useful as empirical material. A careful and critical examination must be made of material from the Internet, in order to be used as theoretical foundation it must be scientific material, i.e. published in an electronic scientific journal with a review-procedure, or in a report-series (working paper series) published by a department at a university or by a research institute.

Encyclopedias and reference books, whether electronic (as Wikipedia) or non-electronic, are very useful to consult. However, they may not be used as references in the literature-review. Wikipedia provides reviews with extensive references to other literature, which are valuable. It is these references that one consults and uses, not Wikipedia.

There is a need to critically examine and assess the theories regarding their relevance and usefulness for answering the research-question. Scientific publications need to be assessed (Deane 2010) with regard to the following criteria

- *Contents, relevance and interest.* The contents of a scientific publication need to be relevant and interesting with regard to your research question.
- *Thesis* is the main argument or message of the published study.
- What *evidence* is presented to support the thesis of the study and the findings.
- *Reliability.* Peer-reviewed publications are the most reliable for academic use
- *Ingenious,* i.e. does the theory or model stimulate your thinking with regard to your study?
- It is worth considering the background of the *author(s).* Journal articles usually have brief presentations of authors. It may also be useful to Google the authors.

This is not a source-criticism, which primarily involves the sources included in the empirical material (Berggren 2008, Thurén 2005, section 2.3.4).

The review of literature must not dominate the master-thesis (i.e. it must not take up more space than presenting and analyzing the empirical material), instead it provides background and foundation for the empirical data that will be collected, and how they are processed and

interpreted. Only the literature which has been used to approach and answer the research-question should be presented. Furthermore literature which only provides a background or background-knowledge should not be included; instead the thesis assumes that the readers are reasonably knowledgeable and that they can assess what additional knowledge they may need. A master-thesis is not a text-book but a report from a scientific investigation.

Reviewing literature involves conducting a critical examination and assessment of relevant theories, theoretical models and previous studies. It is also important that the critique is motivated and well-founded. It is not acceptable if it is own beliefs or opinions, instead it is necessary to have a critical attitude to previous studies and theories.

The review of literature should be concluded with an identification of the components, factors, variables, aspects or characteristics which the investigation will study, i.e. a research-model or theoretical framework. This means that some theories or models (from different books or articles) must be presented and examined. It does not mean that concepts or terms can be taken from different theories and brought together; this does not constitute a theory. Instead terms or concepts which belong to and constitute a theory or theoretical model, but both concepts and the theory may need to be elaborated and conceptualized in order to be useful.

The review of literature must *not* be carried out in such a way that first one model is described, then the next, and possibly next a third one, since this does not provide any support for identifying relevant factors. This type of presentation is known to most readers, and they may read it themselves in relevant literature. In addition this method of presentation increases the risk for plagiarism. Since a selection of factors and/or characteristics must be made, then a comparison and examination must be made of how these factors or characteristics have been described by different authors or in different models. If one wants to investigate the acceptance of an interface, then the HCI-literature provides a number of models. If these models are presented in sequence – first one, then the second, and then the third etc. – it is very difficult for the readers to understand why the authors of the thesis have finally selected these factors with precisely that definition. Instead the models need to be compared and examined: does model 1 include the same factors as models 2 and 3, do the factors have the same meaning? Such an examination requires that the models are presented in a way that makes comparisons possible, which most easily is accomplished by using one or a couple of tables (table 2.1).

Table 2.1. Example on comparing models from different authors.

Aspects (components, factors, characteristics)	*Author1 (year)*	*Author2 (year)*	*Author3 (year)*
Aspect 1	Keyword	Keyword	
Aspect 2	Keyword		Keyword
Aspect 3		Keyword	keyword
Aspect 4	Keyword	Keyword	Keyword
Etc.			

For each model (author year) it is briefly presented how the aspect of interest is characterized in the model, but leaving an empty cell if the aspect is not included in the model. Then it is possible to discover similarities and differences between the models, and then identify which factors or aspects are relevant, and furthermore how they should be defined with regard to the research-question addressed in the thesis. Accordingly the choice and definition of selected factors can be motivated, which is crucial for the chain of evidence and a fundamental requirement in all scientific reports.

A critical examination of theories does not mean just listing a number of definitions; instead a much more thorough examination must be made. Furthermore many definitions are so comprehensive and general that they don't really explain anything.

In the review focus must be on factors and characteristics which are central for the research-question addressed in the thesis. Factors which are peripheral are not considered to the same extent as the central aspects, irrespective of how much has been written about them in the literature. The selection of factors must be made from the perspective of the research-question by those conducting the investigation, i.e. by the authors of the master-thesis. It is they who have selected and read the literature, so it can never be a completely objective and exhaustive account of what can be found in the literature, but the account must be impartial and based on facts.

The review and examination of literature is concluded with motivated theoretical conclusions in terms of the selection and definition of factors, components or characteristics relevant with regard to the research-question. This may be formulated as a simple framework or research-model (preferably presented using a simple figure), which should only consist of just a few components and some simple relationships between these, and a couple of characteristics for each component. Next, this research-model is used for selecting methods for the investigation and providing the foundation for analysis and interpretation of the empirical material. It is crucial that the model is simple and clear, since it then provides a more useful foundation for further work.

2.3.3 Object of study

The problem and research-question normally concerns some question or issue with regard to some object of study. This object of study may be some information system (e.g. an ERP-system), some methodology for information system development (e.g. agile methods), some type of software, some type of intranet, some type of groupware, or some technical phenomenon (e.g. software as a service, cloud computing).

It is necessary to review the relevant technical literature about the object of study in focus. Based on this literature it is then possible to present the object of study and relevant features and characteristics that are of interest for the empirical study. However, it is important to recognize, that this is not theoretical literature and does not provide any theory relevant for the research question.

2.3.4 Approach for collecting and analyzing empirical material

The review and discussion of theoretical starting-points is thus concluded with an identification of the aspects and their sub-aspects (characteristics) that will constitute the foundation for the investigation, i.e. a simple research-model or framework. This is the starting-point for what empirical data are required, how they should be collected and how they should be processed.

Empirical material (sources for the investigation) may consist of

- empirical data collected by investigators/authors (interviews, surveys, observations, diaries),
- documents (decision-protocols, system-descriptions, company descriptions),
- empirical data collected in other investigations (compilations of surveys, interview-transcripts from similar studies),
- previous bachelor or master theses, articles in popular or technical journals,
- web-pages (e.g. company home-pages), blogs and other material from the Internet.

Please note, that it is not data collection to search for and acquire literature and previous studies. An account of what theories and literature have been searched for belongs in chapter 1 of the thesis or in the introduction to chapter 2, but not in the methodology chapter of the thesis.

Discussing which method to use in a study should not take its starting-point in what is considered appropriate choices according to the literature on research methods. It must be founded in the research-question and the research-model, which point to which empirical material is required. The literature on research method is of secondary importance. Hence, it is not acceptable to assert “we have chosen qualitative methods, because <method-book> says it is suitable, when one wants to understand something”. Firstly, there are a large number of qualitative methods, so one must identify precisely which one will be used, and secondly the choice has not been supported in the current investigation. One may briefly describe the different alternatives the methodology literature presents, but *the selection of a particular method must be founded in the current research-question and investigation.*

Based on the research-question and research-model the authors must argue for the methodological choices and decisions they make in order to conduct the investigation, which also constitutes a link in the chain of evidence. Before deciding on how to collect data, it is necessary to identify the data required. Next the population must be identified and how to select informants or make a sample of respondents. Discuss and motivate if interviews and surveys are used, based on the research question. Not least it is essential to discuss the design of interview-guides and questionnaires, where again the starting-point is the research-model. It is always a good idea to use interview-guides and questionnaires, which have been tested. However, they may need to be modified, so it is necessary to carefully account for any amendments, additions or changes made for the current study (table 2.2).

Table 2.2. Example for designing interview-guide or questionnaires

Author1 (year)	*Author2 (year)*	*This interview-guide (questionnaire)*
Question-group 1	Question-group 1	Question-group 1
Question-group 2	Question-group 2	Question-group 2
	Question-group 3	Question-group 3
Question-group 4		Question-group 4
		Question-group 5
Etc.		

For each question-group there may be a number of questions, show in the column "this interview-guide (questionnaires)" which questions you will use, which questions you will exclude, any reformulations you make, and which questions you add. In the text, in connection to the table, the changes and additions made are motivated and argued for. The final interview-guide or questionnaires must be included as an appendix.

How the collection of data has been performed is a crucial point. It is necessary to motivate and argue why interviews have been conducted as visits, via telephone or using e-mail. Unfortunately interviews using phone or e-mail tend to give a poorer outcome than visiting interviews. It is therefore often necessary to prepare phone and e-mail interviews much more carefully than visiting interviews, using more detailed and follow-up questions. When using questionnaires it is required to motivate and argue for the selection of method for collection (visit, post, phone, web etc.).

Interviews must be documented in terms of interview-protocols, which are transcripts if a tape-recorder has been used or notes. Interview-protocols must be approved by the informants (interviewees), and they must be included as appendices in the master-thesis. Often it is not relevant to give the names of the informants, many times it is completely unsuitable. In other cases it is simply of no interest, since they normally don't speak in their private capacity but as representatives for a company or some other organization. However, what may be of interest is the position or role of the informant in the company. The major rule is therefore that the *names and ages of informants are treated as confidential and not disclosed.* An exception is provided by expert-interviews, since they are often conducted to have access to expert-information, which is not available in the literature.

If the master-thesis involves a quantitative study, then statistical methods must be used, which are accounted for in the methodology chapter. This does not mean that a master-thesis in informatics may become a thesis in statistics. Questionnaires are compiled and the complete compilation must be included as an appendix. It is the task of the authors of the master-thesis to present findings and conclusions supported by statistical analysis and compilation. This should not be left to the readers. Only a selection of tables or diagrams is used to present the findings (in a later empirical chapter in the master-thesis). If a detailed discussion of statistical aspects is required, this too should be an appendix.

The master-thesis must present what efforts have been made in order to accomplish the various aspects of quality, discuss and argue for them. However, the thesis should make no statements to the effect that the quality is good, that the reliability and validity is high etc. –

that is for the reader to decide. The thesis only provides the evidence and support for quality, as part of the chain of evidence.

It is an integral part of a scientific investigation to discuss aspects of quality of the research-work, including:

- *source criticism,* which involves an assessment of credibility and trustworthiness with regard empirical sources (i.e. empirical or observational data).
- *generalizability.* It is rarely possible to claim that the findings from a study are general, however, it is always possible to discuss which are the possibilities for generalizing, and what are the limitations with regard to generalizations. How applicable are the findings in other settings?
- *reliability.* How reliable are the findings.
- *validity.* How valid are the findings.
- *ethical aspects.* There are a number of ethical aspects which must be considered in an investigation (Swedish Research Council 2011). These concern which data, which population. Furthermore, they concern the collection of data. But they also include actions in the interview-situation.

In everyday speech we commonly use a fairly broad definition of sources, including anything which provides some basis for something we say. Then sources may include scientific publications, theory, empirical experiences as well as observations. In scientific contexts, however, a distinction is normally made between *scientific publications* (theories, previous studies) and *sources,* where the latter include empirical material (interviews, observations, archives etc.), collected in the current study or in some other study.

The empirical material or sources, in particular the material which has not been collected in the study performed, must be critically examined and evaluated (Leth & Thurén 2000, Thurén 2005, Thurén & Strachal 2011). There is a brief discussion of sources and source criticism on the Lund University Library web-pages (Berggren 2008). Wikipedia provides an introduction. An easy to read account of source criticism as a crime-novel is provided by Tey (2009). Source criticism is basic in historical research (Howell & Prevenier 2001).

Such a *critical evaluation of empirical sources* (primary as well as secondary) involves first assessing – based on *external criteria* – whether the source (e.g. document) is genuine and not a fake or forgery. Furthermore data collected in another study are often collected with another purpose, therefore it is necessary to assess whether the data from the previous study can be used in the current study.

Secondly there are four *internal criteria* (Berggren 2008, Thurén 2005):

- *Contemporary,* which involves whether the source (e.g. document) for an event originated at the same time as the event occurred. In particular, whether it is a firsthand written account made at the time of the event by someone who was present at the event.

- *Tendency* referring to whether the source has been influenced by the author's values.
- *Dependency*. If there is more than one source, it is crucial to assess whether they are independent.
- *Reality*, which involves whether the event is really possible, based on other facts.

These criteria are not applicable to scientific theories or previous studies.

2.3.5 Empirical studies

The empirical material must be presented, at the same time a first preliminary analysis can be made. It is not necessary to present every detail in the main text of the thesis, since interview-protocols and compilations of questionnaires must be included as appendices. It is of very little interest to retell interviews in detail, or to reproduce and comment on every informant answers. It is also of very little interest to comment on every question and answer in a questionnaires. Instead the presentation must be on higher level, providing an overall view, which connecting various informants and companies, or contrasting them with each other.

The presentation must do justice to the material as well as attract the interest of the readers. Thus it is not a very good idea to present the material one informant after another or one company after the other one, or interviews and questionnaires separately. The level of the presentation of empirical data is too low if the focus is on the informants, e.g. with formulations such as "Informant A said …, furthermore informant B claimed ….". In order to raise the level it is necessary to identify patterns (by focusing attention on similarities and dissimilarities). Therefore, a systematic presentation is more fruitful, e.g. according to the questions or groups of questions which have been posed. If the same or similar questions have been made in both interviews and questionnaires, then they should be presented together. In order to present the empirical data separate from the analysis, then simple text-tables can be used, one for each theme or question-group (table 2.3). A small number of well-chosen quotations can be used to illustrate, but too many quotations break down the argumentation and the text.

Table 2.3. Example of presenting empirical data

Question-group	*Company A*	*Company B*	*Company C*
Question a	Keywords (ref)	Keywords (ref)	Keywords (ref)
Question b	Keywords (ref)	Keywords (ref)	Keywords (ref)

The text in the cells needs to be brief, so only keywords are used in the tables, and references must be made to the statement in the interview-protocol. Each statement in an interview-protocol must have an identification-code, e.g. IP1-Sx means interview-protocol 1, statement x. The interviewees (informants) have not spoken in their private capacities, but as representatives of a company, so it is the company name or alias, not the informant, who should be in the column-head.

Based on the table it is possible to carry out a discussion on a slightly higher level than just retelling the empirical data. This is much more worthwhile and offers more interesting

reading. Very importantly, it provides a much better foundation for doing a deeper analysis and interpretation.

2.3.6 Further analysis and interpretation

The presentation and elementary or basic analysis which has been made in the chapter "Empirical studies" (in the thesis suitably renamed) must be elaborated; furthermore it must be connected to the theory that provided the foundation for collecting empirical material. The references, which are then made to the theory, should be made directly to the theory or theories concerned or literature, not to the theoretical chapter.

It is not a question of comparing the findings from the empirical studies with theory and other studies. Instead, e.g. "we have in our study found that … which is similar to … (ref)" and then discuss what the agreement may depend on, in other words one must try to discuss and explain it. Or e.g. "we have in our study found that … which is different from the findings in other studies …. (ref)" and then discuss what the differences may be due to, i.e. try and explain them.

This is the most important part of the master-thesis, and it needs to be thoroughly elaborated and worked-through, which normally requires several revisions of the text. It must also be rich, which means that the *empirical material must be analyzed and interpreted,* and not least that explanations and interpretations must be supported in empirics and theories.

2.3.7 Conclusions

The master-thesis must be concluded by presenting the major conclusions. Furthermore, the conclusions must be assessed with regard to the research-question and purpose. Thus, it is necessary to discuss to what extent the purpose has been achieved and the research-question has been answered. If the success is not complete, then it is important to try to explain why – but not to make excuses.

Ideas or suggestions for future research may be presented if it is *direct result or a conclusion of the investigation* that has been performed. Attempting to improvise and invent various ideas is only irrelevant and ill-placed, and it does not improve the master-thesis.

2.4 Appendices and references

In the main-text there are no possibilities of treating all empirical material, since it may be much too detailed, which may conceal the major features. Therefore all material of importance for the master-thesis, but which might burden the presentation through too many details or the like, is placed after the main-text in appendices. It can be material presenting the object of study (e.g. interface, parts of some ERP-system, some software). Most importantly,

it is the detailed empirical material. There must be some logical structure to the appendices, thus interview-guides are placed before interview-protocols. There must be interview-protocols or transcriptions of every interview that has been carried out, in order to ensure the quality of the material and analysis. Questionnaires are placed before a complete compilation of the questionnaires.

The appendices are placed after the main-text but before the list of references. Placing the list of references at the end makes it much easier to find the references without a lot of turning over pages, in particular if the appendices are extensive.

All academic publications must have a list of literature or references, which is not an appendix, nor is it a chapter, so no chapter-number. It is unnecessary to make a subdivision of references into books, articles, reports and Internet-material, since that only makes it harder to find the reference looked for. It must be a single list in alphabetical order according to author-surname (chapter 3).

3 The art of writing references – guidelines

In every academic, scholarly or scientific report and publication there must be references to the publications – previous investigations, theories and models – which have been used in the current study. This must be made in a standardized way, according to common guidelines for the academic field.

The references used in academic publications must be *scientific.* These include reports from scientific studies or surveys of scientific material. It may be books or doctoral dissertations reporting scientific investigations. It may be articles, published in scientific or scholarly journals or presented at scientific conferences (and then published in proceedings from these conferences). These articles have undergone peer reviewing, i.e. they have been critically examined by other researchers (peers) in the same field, which is presented by the journal (in particular on the journal homepage). This examination by peers represents quality control. Usually the process takes around two years before a journal-article is published, but it is quicker for conferences.

The references are often an important source of information for readers of scientific publications. Many readers start by browsing the list of references, since it often says more than the headings in the table of contents. The list of references says more about how recent and representative the publications used are, which theories have been used and how they reflect the position within the field. Thus references are important.

There are several reasons why there must be references and that they must have a common and consistent format, making clear

- which previous studies, theories and models that the current study builds upon,
- what findings and conclusions the current study has arrived at,
- what are the foundations for interpretations and statements,
- and easy to find the source for a statement, if a reader wants to read more or check a statement in the current report.

Thus it is not acceptable with statements such as “there is general agreement”, “it is commonly acknowledged”, “researchers agree”, or statements to that effect. It is very unusual that there is general agreement; there are always those who disagree. Also it is hard to know about “everybody”. Therefore one must always specify what references have been used, and if possible try to find those who disagree, this demonstrates familiarity with the specific research area.

If there are no references of if they don't have the correct layout, then suspicions may arise of plagiarism or theft, which is not acceptable in academia. Checking publications with regard to plagiarism has increased; in scientific journals, in university education and elsewhere.

There are two aspects when making references:

- references in the body of the text, in the thesis proper,
- the list of references.

3.1 System for references

There are various styles or systems for references:

- author-year or parentheses, e.g. the Harvard-system, the APA-system,
- footnotes or endnotes,
- numerical with serial numbers,
- alphanumerical codes based on author surname and publication-year.

When references are written according to *author-year,* then the references are found in the text, sometimes within brackets. In addition there is a list of references (organized alphabetically), which is placed at the end of the publication (after appendices if any), which makes it easier to find the references.

References may be written as *footnotes,* at the bottom of each page, or endnotes, at the end (in a book after each chapter or collected at the end of the book). In this case full bibliographical references is given the first time a publication is mentioned, next time only the authors and the year. There is rarely a list including all references, which makes it hard to get an overview of the references.

When references are given a *serial number*, then each reference has a serial number. They are given numbers in the order they are introduced in the text. Next time the same reference is used, then it has the same serial number. The list of references is in serial number sequence (not in alphabetical order).

When *alpha-numerical codes* are used then a few letters from the author-surname(s) are used plus the year of publication, e g LAN73 means Langefors (1973). The list of references is organized based on the codes.

The system which is most common in social and economic sciences is author-year. *At informatics at Lund University the Harvard-system must be used.* There are detailed guidelines for the Harvard-system (Anglia Ruskin University, Swedish School for Library and Information Science at Borås), further guidelines may be found in handbooks on the art of making references (Backman 2008, Eriksson 2009). The present guidelines will only provide

the basic outlines. If you need more detailed information you must consult the more detailed guidelines available.

3.2 References in the text

The aim of making references in the body of the text is to provide sufficient information, in order for the reader to be able to find the complete reference in the list of references, without burdening the text with long references. This means that the information provided needs to be sufficient to identify the reference in the list, but there should not be more information than that. Therefore the basic rule is to provide only author surname(s) and year of publication, but it is not enough with just author surname(s), year must be included. Further information, like first name or initials, is not required, and neither are titles or positions.

In scientific publications references are made to the text and publication one has used oneself, and only to this publication. All publications referred to in the body of the text in the report must be included in the list of references (at the end of the report). Furthermore the list of references may only include references which have been used and are explicitly referred to in the body of the text.

3.2.1 Making references

In the Harvard-system there are two ways of making references in the body of the text (table 3.1):

- Author surname and year of publication (year within brackets), when there is more than one author "and" is used, but never the &-sign.
- The whole reference within brackets when there is more than one author "and" is not used instead the &-sign.

Table 3.1. References in the body of the text

	Year within brackets	*Whole reference within brackets*
One author	Surname (year)	(Surname, year)
Two authors	Surname1 and Surname2 (year)	(Surname1 & Surname2, year)
Three or more authors, first time	Surname1, Surname2 and Surname3 (year)	(Surname 1, Surname2 & Surname3, year)
Three or more authors, successive times	Surname1 et al (year)	(Surname1 et al, year)

These two methods must be used judiciously and with some discrimination but also with some variation. They provide slightly different signals. If the author name is outside the parentheses then there is more focus on the statements of the author quoted or referred to. On the other hand if the author name is within parentheses, then the focus is instead on the theoretical discussion and the main function of the reference is to give the statement more weight.

References as “according to author surname (year)” must only be used infrequently. Frequent usage is boring but it also signals that the one making the references don’t really trust the reference, in that case it is necessary to provide the reasons why and how one is critical.

3.2.2 Primary and secondary references

The references used in a scientific report or study may be

- *Primary references* (original reference), this is material which is close to the event, the person or the idea studied,
- *Secondary references,* which report what others have described about an event, a person or an idea.

When one reads a report, article or book, which reports a scientific investigation the authors themselves have conducted, then this is a primary reference for the study. However if one reads a publication, e.g. A, which describes an investigation, which was originally reported in publication B, then B is the original or primary reference about the investigation, while A is the secondary reference, since it builds on a previous description. This may be the case when a publication reports a study comparing several investigations, then the comparison is a primary reference, but the accounts of each study, compared, is a secondary reference.

If one wants to use an investigation – the findings from it, or theories – one has read about in a publication, which is not the original reference, one must try to find the original (primary) reference for the investigation or the theoretical model. It may sometimes be difficult, the sought-after publication may not be available at the nearest library, nor is it available in electronic form. In that case one must in the reference provide both the original (primary) reference B and the secondary reference A (the reference that has been used):

- primary reference B (year, according to secondary reference A year)
- (primary reference B, according to secondary reference A, year).

Note that the secondary reference A is always more recent (younger) than the primary reference B.

The rationale is that the secondary reference may have misunderstood or misrepresented the original. There may also be the possibility that the original reference encompasses something essential which should, and would, have been included – if one had read the original. It is therefore well-advised to make clear that one only has knowledge about the study at second-hand, if one has not succeeded in obtaining it.

In particular with regard to student-thesis (bachelor or master) presented at Swedish universities, the literature they refer to is available from Swedish libraries. It is therefore fairly simple to find the original (primary) reference, which is much more reliable than a bachelor or master-thesis. So when the reference is a bachelor or master-thesis, the primary reference must always be consulted.

3.2.3 When and how often

It must be clear what are the personal thoughts and arguments (by the authors of the current paper or report) and what has been taken from other publications. This raises the issue of how often one should write references. Should they be in every sentence? It is not possible to provide any definitive rules; instead this is a matter of judgment. On one hand the text must not be interrupted by too many references, since that makes it hard to read, on the other hand there must not be any doubts about the source of a statement or sentence.

If a whole paragraph contains references to just one reference/source, then it is sufficient to have it once, e.g. at the beginning. If the paragraph is a long one, then there may be a need to repeat the reference, so that the reader does not have to look for the reference. However, it is not necessary to repeat the reference for every sentence, which is simply boring and tedious.

When references are written as a whole within brackets, then the reference-parentheses may be placed before or after the full-stop of the sentence. If the reference-parentheses are placed *before* the full-stop, then the reference refers to the current sentence. But if the reference-parentheses are placed *after* the full-stop, then the references refers to all sentences, since the previous reference; or in the full paragraph. However, writing references after the full stop must be used carefully and with considerable discernment.

When the reference is written ”author-surname (year)”, it is announced that the focus is on the work of just those authors. If one wants to emphasize the argument and the reasoning, and not the authors referred to, then it is often more appropriate to have the reference within brackets at the end of the paragraph. In particular it is useful to collect references within brackets at the end of paragraph, when one is summarizing what several publications are saying about an area, without particularly giving prominence to any of the authors.

Sometimes the expressions “ibid.” or “ibidem” are used, which are Latin and means “previous”, in this instance one refers to the previous reference. This method should be avoided, since it may easily be misrepresenting, as ibid. does not mean any previous reference but only the immediately previous. Several ibid. in sequence may also create uncertainty about which publication the reference refers to.

3.2.4 Direct or indirect quotation

When one gives an account for what others have written, there are a few alternatives

- direct quotation, always within quotes,
- indirect quotation or paraphrasing (rewriting) in own words,
- review or summary.

In direct quotation the original text is reproduced with the exact original wording, which means that nothing may be changed, added or omitted. Quotations must be clearly distinguished from the own text. When *quotations are short* (less than 40 words) then they

can stand in the body of the text, but within quotes. There must also be a reference (with page-reference) in immediate connection with the quote.

In the case of *long direct quotations* they must have their own paragraph with indentations, with a line-spacing before and another after, as well as slightly smaller font-size. The quotation must be written exactly as it is in the original text, including any misprints. If one wants to make an addendum in order to clarify, then this is put within square brackets. The quotations must have references (with page-reference), which may be put in your own text just before the quotation, or within parentheses immediately after the quote, not on a new line.

In *indirect quotations* the text is not represented verbatim, but instead it involves rewriting, reformulating or paraphrasing the original portion of text. In other words one represents the text using own words and phrasing, as the same time as it is summarized. Even if one uses own words and phrasing, there must be a reference making clear that what is written is based on another publication.

When one wants to provide an account of a larger investigation and reproduce a more extensive reasoning from another text, it is best to make a *review or summary*. Long quotations or a large number of short quotations makes difficult reading. In addition there is a risk that several short quotations break down the original argument making it hard to understand. When making a review the factual contents of the original text is summarized without details. In the review direct quotations may be used, which then must be identified with quotations-marks and reference (with page-numbers).

3.3 The list of references

At the end (after appendices) in a scientific or academic report there must be a list of the references that have been used in the report. It must contain all information required to be able to find the publication and borrow it from or reserve it at a library, or find it in some electronic library-system for scientific journal articles. This means that the basic format is

- Author (year): Title. Publisher or journal.

The list of references must be in *alphabetical order* according to the authors' surnames. If the same author has several publications then they should be ordered chronologically with the oldest first and the most recent last. If the same author has several publications with the same publishing-year, then the letters a, b, c etc is added to the year.

There must be *no subdivision* of the list according to whether it is a book, an article, a conference paper or something else – instead it should be one single list. Subdividing the list makes it only harder for the reader to find the reference. There should be a line-spacing between each reference, but no indentations. The references must be written according to a logical and consistent format.

The only formatting of text that may be used in the list of references is italicization, definitely not neither bold nor underlined. The main rule is that what is italicized is what one looks for in a manual library card-index, when one wants to find the publication in question. That is why *book-titles* must be in italics and *titles/names on journals*, but not titles on articles (in scientific journals).

3.3.1 Books

Books may be *monographs,* which are coherent reports of one or several studies written jointly by the researchers-authors, and the authors of each chapter is not specified. On the other hand books may be *anthologies* with contributions (articles) by different authors, for each article the authors are specified. It may be contributions, which have been written specifically, e.g. conference proceedings. On the other hand it may also be collections of articles which have been published previously, e.g. in different scientific journals or conference proceedings; the original publication-data must always be provided in the anthology (due to copyright regulations).

In both cases the same or similar information needs to be provided (table 3.2). In an anthology the names of the editors (not the authors) are provided. If there are any doubts about what is the surname and what is the first-name, then check – if possible – how the authors (editors) refer to themselves.

Table 3.2. References to books

Monographs and doctoral dissertations published by a publishing company	*Anthologies*	*Doctoral dissertation, published by a university department*
Author surnames and first name initials	Editor surnames and first name initials	Author surnames and first name initials
Publication year within brackets	Publication year within brackets	Publication year within brackets
Title with initial capital letter, the whole title in italics	Title with initial capital letter, the whole title in italics	Title with initial capital letter, the whole title in italics
	Name and time of conference	
If relevant the edition	If relevant the edition	Dissertation-series
Publication place (one)	Publication place (one)	Publication place
Publisher	Publisher	Department, school and university

In monographs and anthologies only the book-title is italicized, nothing else. If the anthology is a conference proceeding, it is common to provide also the name and time of the conference. If there are several publication-places on the title-page, only one is included in the reference, namely the first one. Large publishers often give several places on the title page, among these the most significant is the first one, since this is where the book has been published, so this is the place that is included in the reference.

A doctoral dissertation (PhD-thesis) which has been published by a publishing company is treated just like a monograph. However, when the dissertation has been published by a university department (by far the most usual case) then it normally belongs to a dissertation-series, which needs to be included (table 3.2).

3.3.2 Articles

Scientific articles may have been published in scientific journals, in anthologies or they may have been presented at scientific conferences and then included in proceedings from these conferences. The common factor is that they have been scientifically reviewed by other researchers, in a review-procedure. In the case of journals this can be found on the journal home-page (with the publisher), sometimes as a footnote on the first page of the article. In the case of conference proceedings there is normally a list of the names of all who have been involved as reviewers. Most of the articles which can be found using Lund University Library databases and search systems have been subject to a scientific review-procedure. This is not the case with regard to publications which have been found using Google-Scholar. Often, however, Google-Scholar indicates whether the article is available through the Lund University Library search-system. In other cases it is necessary to critically examine and assess the scientific quality of the article, if one wants to use it.

Publications which are found by using Google are, however, seldom scientific or scholarly, instead they may have been published by consultancy companies, technology suppliers, private individuals and others. In these instances, it is necessary to be very critical and make a very thorough examination. This material can rarely be used in the review of literature and theories of the thesis. However, it may be very useful to describe the object of study and not least as empirical data.

Table 3.3. References to scientific articles

Journal article	*Article in an anthology*	*Article from conference proceedings*
Author surnames and first name initials	Author surnames and first name initials	Author surnames and first name initials
Publication year in parentheses	Publication year in parentheses	Publication year in parentheses
Article title with initial capital letter, no italics	Article title with initial capital letter, no italics	Article title with initial capital letter, no italics
Journal name, in italics	If same publication year - In: see reference of anthology If different publication year - Reprinted in: see reference of anthology	In: see reference of anthology
Information about volume, issue (number) and pages, i.e. Vol x, No y, Pages pp-pp		

In all cases similar information needs to be provided (table 3.3), which is the same as that provided for books. However in the case of articles, the article-title is not italicized. Scientific

journals normally have consecutive pagination (page-numbers) through the volume, including all issues of a volume.

Sometimes the expression "in publication" is added and the journal reference is incomplete. This means that it is not the final publication, but the article has been made available in advance. The journal may then also provide information what the reference must look like. However, it is absolutely necessary to check whether the article has been finally published before finalizing the list of references to one's own essay or report.

For articles in scientific or academic journals it is not required to provide publisher or publishing place. If the journal is available both on paper and in electronic format, it is not required to provide the web-address nor the address in the search-system.

Sometimes it may be difficult to find the name of the journal or conference. The journal-name may be found on the first page or in top- or foot-margins of the article. It can, however, not be found in connection with the author-name(s), instead the affiliation(s) of the author(s) is provided, i.e. the departments, universities or research organizations where the author(s) work.

3.3.3 Scientific reports and student essays

Departments at universities, independent research institutes or organizations and government offices and agencies (as the Swedish National Agency for Higher Education) often have publication-series, where their working-papers and reports are published. University-departments also publish student essays (bachelor theses, master theses). These must provide the same publication information as books and journals (table 3.4)

Table 3.4. References to scientific papers and student essays

Scientific paper	*Student essay*
Author surname and first name initials	Author surname and first name initials
Publication year within brackets	Publication year within brackets
Title of paper with initial capital letter, in italics	Title of essay with initial capital letter, in italics
Report series, and report number	Bachelor- or master-thesis
- Research organization - Government office of agency - Department and university	Department and university
Place	Place

3.3.4 Reports form Internet

The material available on Internet has a broad range

- scientific reports and electronic scientific journals,
- reports from IBM, Microsoft and similar companies and organizations,
- sundry more or less dubious publications.

This means that the scientific quality is extremely varying. Also electronic journals must have a review-procedure to be considered scientific (table 3.3). Reports and working-papers from a university department, an independent research institute or a government office or agency are normally considered as scientific reports (table 3.4). The publication must then have information on the working-paper series, and the report-number in the series. If this information is missing, it is not a scientific publication.

Unfortunately it is also possible to find papers based on course-assignments, student PMs, which have been uploaded onto the Internet in such a way that they appear to belong to a university or a university-department. However, these are not scientific reports and should not be used as foundation for or as references in master-theses or other scientific reports.

Reports from IBM, Microsoft and other suppliers may be relevant, since they may provide factual information about the object of the study or the field of study, which the essay is concerned with. This is, however, not theory and should not be treated as such. References are written according to the same format as books, articles and reports, but with the addition of web-address and date of visit.

Many scientific journals are today available both on paper and in electronic form, but the reference is written the same way in both cases, i.e. according to the paper-version (table 3). Articles in purely electronic journals follow the same format as paper-journals, there is no need to provide web-address or date of visit.

3.3.5 Empirical material

Internet is a gigantic archive, where it is possible to find all kinds material, including

- articles from newspapers, broadsheets, tabloids, periodical journals etc.
- technical journals, including computer journals
- material from company web-pages.

In these instances the publications may be used but not as scientific publications or references, i.e. not when reviewing and examining theories, and neither with regard to the methodology to be used in the investigation. On the other hand they may be quite useful as empirical material. But then a critical examination of the sources is fundamental (section 2.4, Berggren 2008, Thurén 2005). With regard to Internet-material it is often a problem to find author and year, which is an indication the there is a need to assess the quality.

When the empirical material is presented and analyzed it is necessary to make references to it, in particular this is required when those interviewed (interviewees, informants) are quoted. When the investigators or researchers have conducted their own interviews, then the transcripts or interview protocols must be included as appendices. If the interviews are short, then it is often sufficient to make references to protocol or appendix. If the interviews are

long, then it is also necessary to indicate where in the transcript the quotation is. This can be made by introducing reference-codes (e.g. an identifier-column in the protocol). Reference-codes may be constructed based on appendix-number and statement-number, e.g. IPx-Q/Ay means interview protocol x, question/answer y. These reference-codes are always included at the end of the quote, within parentheses.

When the empirical material consists of documents from archives, journals or magazines, or from the Internet (magazine-articles, web-pages, blogs etc), then there needs to be references, but they should be designed differently from scientific publications. These materials may also include material from a number of companies or organizations. Instead of making interviews, articles or web-pages from the Internet have been collected, such articles can then be considered as protocols from interviews. However, it would be too much to includes them as appendices to a master-thesis or report.

The best alternative to do is to make an appendix listing all these articles or web-pages. The appendix can be divided into several, if a number of companies are involved (figure 3.1). In the text (chapters 4 and 5 in the mater thesis), the codes Alfa-1 etc are used as references. I many cases in newspapers and technical press the names are given of both the journalist who has written the text and the photographer, both names should be included when they are provided. If there are no names, e.g. a news-item, then it is of course omitted. List all articles from newspapers or magazines (alphabetically) separately, and for each newspaper or magazine according to date. Next all web-documents are listed.

Appendix x. Company Alpha

Alfa-1 <article-heading>, <text XX, photo YY>, <newspaper/magazine> yyyymmdd
Alfa-2 <article-heading>, <text XY photo YZ>, <newspaper/magazine> yyyymmdd
.
.
Alfa-n <web-page>, <name>, web-adress, visited yyyymmdd

Appendix y. Company Beta

Beta-1 <article-heading>, <text XX, photo YY>, <newspaper/magazine> yyyymmdd
Beta-2 <article-heading>, <text XY photo YZ>, <newspaper/magazine> yyyymmdd
.
.
Beta-n <web-page>, <name>, web-adress, visited yyyymmdd

Figure 3.1. Appendices of Internet-material regarding companies

3.4 In conclusion

It makes it easier if you from the beginning write references correctly according to the Harvard-format and in an alphabetical order. Then you avoid having to find references again, which may prove difficult e.g. with regard to books.

There are many special cases, which have not been dealt with in these guidelines. If you need to make references to any such sources, consult some of the more detailed manuals (e.g. Anglia Ruskin Univ, Swedish School for Library and Information Science), or ask your supervisor.

It may also be useful to use the system for EndNotes that Lund University Libraries provide.

4 Layout of academic papers and reports

It is very important that a master-thesis or any other academic report has an attractive, uniform and consistent layout, which is easy to read. All master theses must follow the same guidelines and format.

It facilitates the work of writing and designing the theses, if already in the first drafts it is designed according to the guidelines which are applicable.

4.1 Margins and line-spacing

A page where the text is compact, with narrow margins, is very hard to read. So having proper margins and line-spacing makes the text more attractive and easy to read, which is positive for the contents as well.

Note, that

- Margins and the top and bottom of page must be 1,5 cm,
- The left margin must be at least 2,5 cm and straight,
- The right margin must be at least 2,5 cm, but it don't have to be straight. Today many working with graphical design maintain that the right margin may well be uneven,
- Single line spacing, with a distance of 1,15,
- A blank (empty) line between text paragraphs and no indentation of the text in the first line.

Long paragraphs make hard reading, since the text becomes compact with no breaks. So you should not write long paragraphs of text, i.e. before there is an empty line prior to the next paragraph. Instead try to divide the text into shorter paragraphs.

On the other hand short paragraphs with only one or two sentences also make hard reading. The text includes, unnecessarily, too many breaks, which breaks up the argument thus making it hard to follow the line of reasoning.

4.2 Fonts

It is advisable to use different fonts in the main text and other parts of the thesis or report:

- Main text: use a font with serifs (e.g. Times New Roman),
- Headings: use a font without serifs (e.g. Arial),
- Figures, tables: use a different font than in the main text, e.g. without serifs (or sans serif).

Using a different font in the figures and tables than in the main text makes figures and tables stand out more from the main text. There is less risk that figures and tables will blur into the main text. A serif font makes the text flow. In these guidelines a serif font has been used in the main text, in particular Times New Roman (other examples are Times, Garamond). In the headings a sans serif font has been used, in particular Arial (another example is Frutiger).

In the main text it is not advisable to use a too small font-size, or a too big font-size, they will both make the text hard to read. A smaller font-size can be used in appendices, to save paper-space.

Recommended fonts and font-sizes are

- Main-text, abstract and contents: Times New Roman 11 or 12,
- Headings: Arial (different sizes)
- Appendices, references, notes: Times New Roman 10,
- Figures and tables as well as figure-headings and table-headings: Arial 9 or10,
- Page header and footer: Arial 9 or 10.

In the main text **bold font** and *italicized font* must be used infrequently. In particular bold font should be avoided, since it makes the text in bold too conspicuous, it seems to be jumping towards the reader. Sometimes it may be necessary to emphasize a key-word, term or key-phrase, and then it is appropriate to italicize. However, it should only be occasional words or phrases which are emphasized. Italicizing whole or major parts of a paragraph makes difficult reading.

4.3 Headings

Headings signal the significance or importance, the order or structure and relationships between various text-sections. They are therefore organized hierarchically. There are various systems, from left-adjusted to centered headings, with or without numbering. The hierarchical structure is indicated through font and size (Backman 2008), but using a numbering system makes the hierarchy much more clear. Depending on the headings position in the heading-hierarchy different guidelines apply for font and size (figure 4.1).

In a master-thesis in informatics

- a hierarchical numbering-system must be used (figure 4.1),
- headings must be adjusted to the left (not centered),
- a sans serif font must be used for headings
- a heading must include both lower- and upper-case letters, not just upper-case letters,
- only three levels of headings should be used (figure 4.1).

The hierarchical design with decimal-numbering of headings makes it easier to have a check on the levels of headings and where a particular section of text belongs. It also makes references between sections of text easier. Otherwise, there is considerable risk that the hierarchy becomes unclear and confusing, making it difficult for the reader – but also for the author(s).

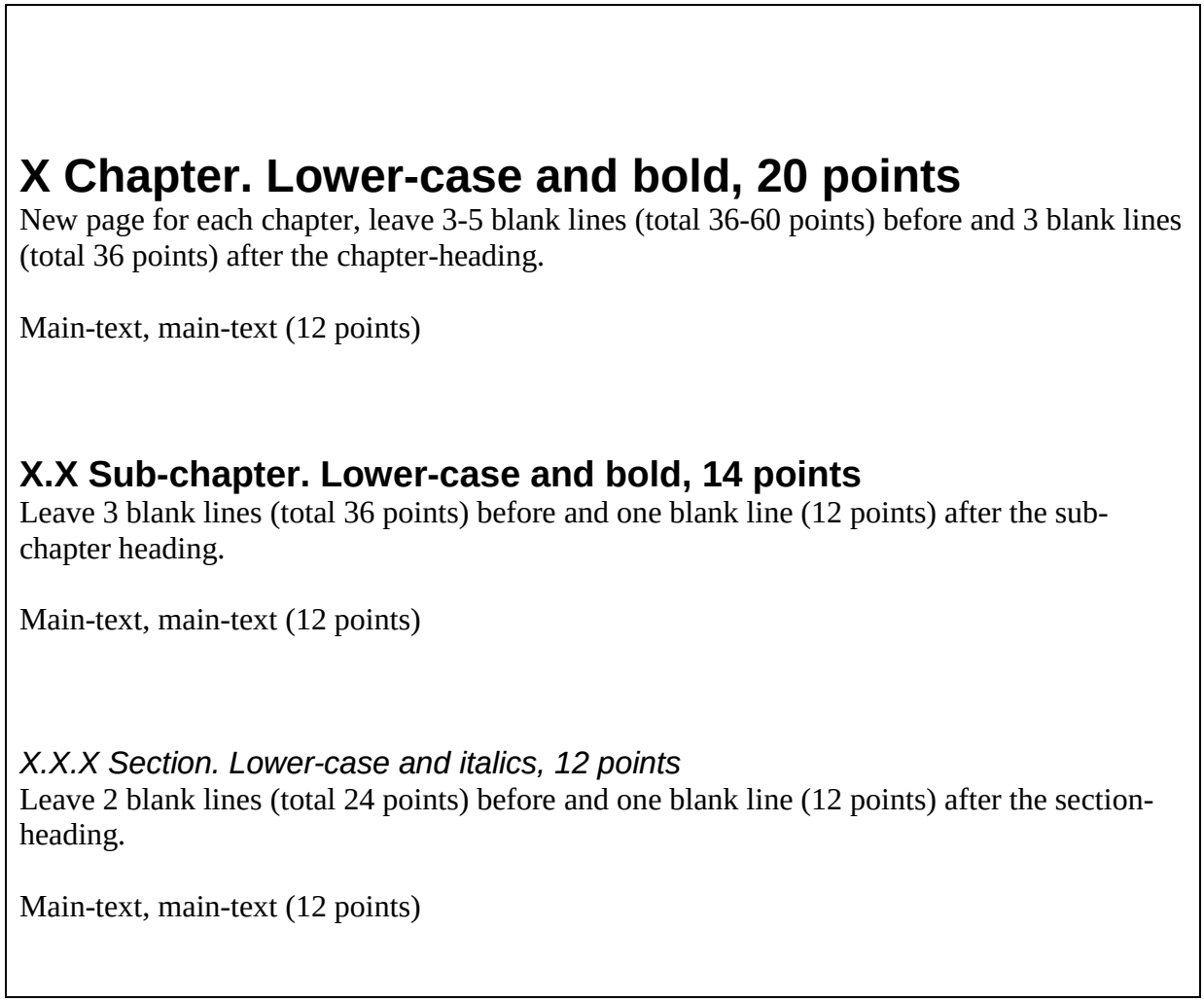

Figure 4.1. The hierarchy of headings

A chapter-heading should not be followed directly by a sub-chapter-heading, nor should a sub-chapter-heading be followed directly by a section-heading. Instead there needs to be some text between headings, e.g. briefly presenting the subchapters or sections to follow. A sub-chapter or a section-heading must not be alone at the bottom of a page, instead they should

always be followed by two or rather three lines of text, alternatively blank lines are added to the page and the heading is moved to the top of the next page (Hellmark 1998).

Furthermore a figure, diagram or table should not be placed immediately after a chapter-heading, a sub-chapter-heading or a section-heading. There must be some text introducing the figure, diagram or table. A sub-chapter or a section must not consist of only a table or a figure. There must be some text presenting and discussing the table or figure.
Sometimes it is necessary to present various factors and characteristics of a component. Then it is inappropriate to use headings (e.g. one heading for each factor or characteristics), since that will fragmentize the text. Instead use the possibility of creating various types of points (using bullets, squares etc.). It is also possible to use italics (but not bold) for the key-word or key-term that will be described more exhaustively.

4.4 Figures

Figures often provide good ways of illustrating and clarifying the text and making it more comprehensible, e.g. presenting research models or demonstrating findings from the investigation. Great pains need to be devoted to the design of figures, so that they don't become complicated but are simple and easy to understand.

Note, that

- figures are consecutively numbered within a chapter (but not for each sub-chapter), i.e. "Figure x.y" (where is x is chapter and y is a running number within the chapter,
- a figure is placed in close proximity to the section of the text, where it is discussed; there must be a reference in the text to the figure,
- figures must have a number-series which is distinct from that used for tables,
- figures may not be split between pages,
- in particular, if there are many figures, a list should be placed after the table of contents.

For each figure it is also necessary to note, that

- use a sans serif font and with a slightly smaller size (e.g. Arial 9 or10), which is different from the font used in the main text,
- a figure must have a *heading* (Arial 9 or 10, lower-case), which provides information about what the figure is about; the heading is placed *below* the figure,
- if the figure has been taken from some publication, then a reference must be included, i.e. "Figure x.y <figure heading> (ref. year, pp)". If a figure has been taken from some publication but changed or amended, then modified needs to added "(ref year, pp, modified),

- if a figure has been completely designed by the authors of the master-thesis, then no reference is required (not even "own figure"), since it is taken for granted that the figure has been drawn by the thesis-authors.

It is OK to use pictures and figures from scientific or scholarly publications, which of course requires an appropriate reference. However, cartoons, other drawings or photographs taken or cut from somewhere may not be used for copyright reasons. The same applies to poems, poetry, or extracts from fiction. The rules for copyrighted material are much stricter with regard to sketches and photographic material than for scientific text. In addition cartoons don't belong in scientific reports, such as master theses.

4.5 Tables and diagrams

Tables and diagrams offer flexible means for presenting material. Tables are not only useful for presenting quantitative data and statistics. They can also be purely text-based, which is useful for comparing different models or interview-statements.

Using text-tables when reviewing theories or other literature makes it possible to present theories or models in ways which makes it easier to compare and discuss them (section 2.3.2). This is important for selecting components and factor for the research-model that will be used in the investigation you are planning.

Also when presenting the empirical data from the investigation tables are very useful (section 2.3.4). Tables make it possible to give an account of the empirical data without retelling and repeating it in the main text (the detailed data should be included in the appendices). Presenting the empirical data using tables often makes it easier to take in the whole picture than when reporting the data as text. The discussion and reasoning can be oriented towards comparing the different companies and/or informants, as well as identifying patterns.

Table x.y Layout of table (<possible ref, year, pp>

Column-heading	*Column-heading*	*Column-heading*	*Column-heading*	*Column-heading*
Text, e.g component	*Subtext,* e.g. Characteristic-1.1 Characteristic-1.2	 10000 57,75	 5400,5 80,5	 15400,5 138,25
Text	Subtext, e.g. Characateristic-2.1 Characateristic-2.2	 540 2,3	 35 37	 575 39,3

Note, that

- tables must be consecutively numbered within a chapter (but not for each sub-chapter), i.e. "Table x.y" (where is x is chapter and y is a running number within the chapter),

- a table is placed in close proximity to the section of the text, where it is discussed. There must be a reference in the text to the table,
- tables (and diagrams) must have a number-series which is distinct from that used for figures,
- tables may not be split among several pages (if they don't comprise more than one page), instead text must be moved, so that the table will fit on one page,
- in particular, if there are many tables (or diagrams), a list should be placed after the table of contents.

For each table it is also necessary to

- use a sans serif font and with a slightly smaller size (e.g. Arial 9 or 10), which is different from the font used in the main text,
- make sure that the decimal-point is placed consistently (use tabs to ensure,
- a table must have a *heading* (Arial 9 or 10, lower-case), which provides information about what the table is about. The heading is placed *above* the table (table x.y),
- if the table has been taken from some publication, then a reference must be included, i.e. "Table x.y <table heading> (ref. year, pp)". If a table has been taken from some publication but changed or amended, then modified needs to added "(ref year, pp, modified),
- But if a table has been completely constructed by the authors of the master-thesis, then no reference is required (not even "own table").

Diagrams often provide a very good visual picture of empirical data and findings, which may make relationships and tendencies clear and visible. However, they need to be used with discrimination and judgment. There are many program packages making it easy and simple to produce various types of diagrams (e.g. graphs, histograms, circle-diagrams, cake-diagrams). They often include many traps and risks of misinterpretations (Huff 1982). In a three-dimensional diagram, it is the volumes of the columns and not their heights which are of significance, which means that three-dimensional diagrams may be seriously misleading. Primarily therefore two-dimensional diagrams should be used, and three-dimensional ones avoided. It is also essential to use uniform and consistent scales used on the axes in a series of diagrams, else making comparisons becomes much more difficult, since the eyes are fooled. It is not always certain that a diagram provides a better presentation of data than a table, so it is necessary to alternate between or to combine tables and figures.

4.6 Page-breaks

You should avoid partly empty pages before a table or a figure, instead move text. A table and figure don't need to follow exactly after the reference to the table or figure, but the distance should not be too great. Also in other instances, e.g. before a sub-chapter or a section, blank pages need to be avoided. Only before a new chapter it is allowed to have blank pages.

A heading always needs to be followed by some text on the same page. It is therefore inappropriate to have a heading at the bottom of the page, while the text starts on the next page. Furthermore it is not good idea if the last page in a chapter only contains one or two lines, then it is necessary to try to reorganize the text, e.g. by changing the division into paragraphs.

A master-thesis must have a *page-header*

- From the abstract-page and forward,
- No page-header on the title-page,
- The title of the thesis and authors' surnames are used, use Arial 9 or 10
- A blank line after the text to have a space before the main text.

A master-thesis must have *page-numbers* (pagination)

- Page-numbers start after the table of contents,
- Page-numbers must be running, including appendices and the list of references
- Page-numbers are put in the page-footer and centered.

4.7 Miscellaneous

Professional fields – such as informatics, computer science and others – have a large number of professional or technical terms, which are specific to the area. They are normally very useful for the professionals, but they may sometimes be difficult to understand by those outside the field. Acronyms and abbreviations are common and specific to professional fields, where they are very useful. Normally they are comprehensible within the area, but not to people outside the field. Too many acronyms and abbreviations may save some space, but at the cost of reducing the comprehensibility and readability of the text.

Therefore, it is necessary to consider and note

- avoid acronyms and abbreviations, use only established and well-known ones. A large number of abbreviations and acronyms makes the text hard to read.
- acronyms and abbreviations need to be explained the first time they are used,
- professional and technical terms must be explained the first time they are used,
- there must be a list of technical terms, acronyms and abbreviations in the master-thesis (after the table of contents or as the first appendix), in particular if there are many in the thesis.

When one wants to emphasize or stress something in the main text, there are some alternatives

- If emphasis needs to be added in the text, use *italics*, not **bold.** Italicizations need to be short and only consist of keywords. Bold is used in headings, since it becomes too heavy in the text.

- When one wants to make points (factors, characteristics etc.) without assigning numbers, then there are various types of bullet points, which may be used instead of minus-signs or hyphens, usually combined with indentations.

Long and complicated sentences with many interwoven subordinate clauses make for difficult reading and reduced comprehensibility. On the other hand very short sentences with just one clause make the text muddled and confusing, hence difficult to read. Unfortunately long and short sentences suggest that the author(s) have not considered the sentences and the text sufficiently.

Punctuation, i.e. subdividing a sentence, must be used both with care and correctly. Therefore note

- There is a difference between *dash* (–) and *hyphen* (-). A dash is preceded by and followed by a space, while a hyphen is not; a hyphen is also used when a word is divided into parts on different lines of text.
- *Slash* is not acceptable as punctuation in sentences, instead use "or". Slash can only be used when it is alternative or synonymous words or terms for the same thing, or when something is valid for both (e.g. bachelor-/master-theses). Furthermore, slash should not be used in order to separate different clauses (i.e. as comma or full-stop). When slash is used as punctuation, it is often difficult to know where the first clause (before the slash) starts and where the second clause (after the slash) ends. In other words the text loses clarity.

4.8 Using colours

Colours are often good ways of clarifying a figure and making it more comprehensible. However, that requires using colours with discrimination and judgment. In academic and scholarly reports, including master-theses, colours are used rarely and parsimoniously in order to improve clarity and readability of figures and diagrams. Colours are not used for purely esthetical reasons (because one thinks it is nice, or as decoration). The usage of colours needs to signify something, e.g. that different parts of a figure belong together, or that they are very different.

There often occur problems with colours when somebody wants to copy or print an article or theses in black-and-white. The differences disappear between columns in a histogram. Important distinctions in a figure may be difficult to see, it may be impossible to read text on coloured spaces.

Using colours may be useful but it should be made with judgment. It is necessary to consider that it often becomes extremely difficult to read text on strongly coloured spaces. It is necessary to avoid such combinations of colours which are difficult to read, e.g. white or other light text on a dark background (such as black, dark-violet). It is also necessary to

choose colours, so that the distinctions also appear in black-and-white. Various shades of grey may be difficult to separate. There are other types of indications that can be used, e.g. dots or broken lines, which are still readable in black-and-white.

Everybody does not have access to printers or copying-machines with colour, in addition colour-prints are often more expensive than black-and-white. It must be possible to copy or print theses using a black-and-white printer or copying-machine without losing important information or essential distinctions. It is therefore recommended to use colours rarely in master-theses – rather to less than too much.

5 Assessment criteria

The master-thesis is assessed in a final seminar. It is the product, the thesis, that is assessed – *not* the process. The assessment consists of

- summary, assessment protocol (appendix 2),
- detailed assessment.

Please note that it is the report (the master-thesis) which is assessed, not the process. This means that a thesis which has been well carried out (e.g. good interviews) but results in a master-thesis with inferior presentation and analysis (e.g. of the interviews) will risk being awarded a low grad. On the other hand a thesis which is less well conducted (e.g. the interviews are problematic) but where the authors are able to deal with the insufficiencies in the interviews has a reduced risk of a low grade, since the authors have demonstrated that they have some methodological awareness.

A master-thesis, where the proof-reading is careless (with many mistakes) or language-mistakes are common, makes a poor and slipshod impression. This may make the thesis difficult to read, which will risk having an impact on the grade. It is therefore crucial to correct any mistakes before the final seminar. It is also a good idea to ask somebody else to read the thesis, as well as to have it language-cleared. The same applies to careless references, i.e. references which are incorrect, insufficient or missing.

5.1 Summary

The summary involves assessing the overall impression of the thesis, the structure and main thread of the thesis, what contribution to knowledge does the thesis give. In addition what corrections need to be made with regard to the grade awarded. The review is graded (F/P) and the activity in the seminar (grades F/P), i.e. the participation in the discussion of other theses. The thesis is graded (A-E, F and F/P/PD).

The *overall impression* involves an assessment of how the authors have presented the background, the problem area and identified a problem within the area. Furthermore how they have formulated a research question, designed and carried out the study, and not least reported the study and the findings from the study. The *structure and main thread* refers to how well the thesis reflects the investigation, and how easy it is to follow the arguments. The thesis must be logically designed and easy to follow.

It is a requirement that a thesis provides some, however small, *contribution to knowledge.* The contribution to knowledge from the thesis means an assessment of what this is. It is not required to contribute new knowledge, which is pioneering or epoch-making, which is extremely rare. It may, however, be new knowledge about what phenomena look like and how phenomena are related among each other, in terms of further development of existing knowledge, application of existing theories or models in new areas or situations (new types of problems, new industries etc.), repeating or replicating previous studies.

After the final seminar no revisions or additions may be made, only *corrections* of misprints and misspellings may be made. When the corrections made, have been accepted by the examiner, a printed copy of the thesis must be delivered to the secretariat and a PDF-version must uploaded to the electronic data-base LUP Student Papers (appendix 4).

The *summary-sheet* (assessment protocol, appendix 2) with grade, and signed by both examiners, will not be handed out at the final seminar. The final grades on the theses will be decided in a meeting with all examiners, when all final seminars are concluded. Then all master theses are discussed. After this meeting with examiners the assessment protocols are handed to the student office, which will enter the grades into Ladok. Copies are distributed to the authors of each thesis, as well as to examiners, supervisors and course coordinator.

5.2 Detailed assessment

The detailed assessment encompasses:

- contents of thesis,
- layout and formal requirements,
- activity in the seminar.

5.2.1 Contents of the thesis

It is a fundamental requirement that the reader must be able to follow the investigation and the procedure from the description of a problem area, to identifying a problem and formulating a research question, to selecting theories and formulating a theoretical framework, furthermore to how the investigation has been designed and conducted, and finally to presenting findings and conclusions from the investigation. There must be a consistent reasoning and argumentation supporting *the chain of evidence.* It is the completeness, depth and quality with regard to argumentation, discussion, motivation and reasoning which are important. Simple statements, such as carrying out a qualitative or quantitative study, are not sufficient in order to describe which methods have been selected and how the investigation has been carried out.

Thus some factors are essential (chapter 2), i.e.

- problem background and formulating a research question,

- reviewing literature and developing a theoretical frame of reference,
- design of empirical study and methods chosen,
- presenting the empirical data and making a preliminary analysis,
- comprehensive analysis and discussions,
- findings and conclusions.

A thesis is introduced with a brief description of *the background to the problem area* of relevance for the thesis. This also involves a literature survey to find a problem area. Within this it is necessary to identify a problem that can be studied, the selection of a problem must be motivated and arguments presented. A discussion and argumentation needs to be carried out around the problem formulation, resulting in a motivated research question, which may be specified in terms of a couple of motivated sub-questions, as well as a purpose (goal) for the study. There is a need delimit the research question in order to make the problem manageable, these delimitations must also be discussed and motivated. It is not sufficient just to present purpose and delimitations, they must be motivated.

Apart from reviewing literature in order to identify a problem, another important task is reviewing literature about the object of study, e.g. ERP-system, the study will approach. The most important part of a literature-review consists of the theory and models, which provide the foundations for the investigation. The theoretical areas which are relevant for the thesis must be identified and argued for. They must be presented and previous relevant investigations discussed. The focus is on developing *a theoretical framework for the empirical investigation.* There is no need to make an exhaustive and lengthy presentation of all the literature and theories, which have been surveyed. Instead the literature and theories must be critically examined with regard to their usefulness and suitability for developing a theoretical framework which is related to the research question. The design and contents of the theoretical frame of reference need to be argued and motivated based on the research question and the purpose. The basis for the selection of theories and concepts for the framework must be presented and motivated.

The design of the empirical investigation and the methods selected must be presented and discussed. The discussion should demonstrate that the authors are able to use the literature on research methods in order to design and conduct an investigation. There is therefore no need to present what the methodology-literature says about various types of methods or techniques. Instead the emphasis needs to be on motivating the selection of methods and techniques from the perspective of the study and research question, where literature on research methods is used as support. There must be a discussion of what data to collect, with reference to the theoretical framework and the research question. The design of research instruments (questionnaires, interview guides etc) which will be used for collecting empirical data must be presented, which involves presenting and motivating questions or groups of questions. It may often be advantageous to use previously used instrument. Any amendments or revisions of these must be discussed and motivated.

Another crucial aspect is conducting the investigation, which involves presenting and motivating how informants (companies and/or interviewees) have been selected for interviews, or population and sample for questionnaires. Furthermore there must be an account of when and how interviews have been carried out or questionnaires have been distributed.

The processing of empirical data must be discussed and motivated. Material from interviews needs to be categorized and coded. The simplest method is to start from the questions posed, but these may need to be refined. The categories or codes that have been used on interviews must be discussed and motivated. How questionnaires have been processed and data compiled must be presented and motivated, e.g. which statistical processing have been made, how have the statistical quality been assured.

Ethical issues (with regard to code of conduct) are important on several occasions during an investigation. Therefore there is a need to discuss ethical aspects concerning data collection, selection of questions and design of questions in interview-guides and questionnaires. There needs to be discussions of ethical issues connected with carrying out an investigation (how interviews are carried out, questionnaires distributed and collected).

Finally *the research quality* of the study and the thesis must be discussed. How have the investigation been designed and carried out in order to satisfy scientific requirements with regard to reliability, validity and generalizability. This may also involve a discussion of why and in what ways these requirements have not been satisfied.

The empirical material must be presented in ways that makes interesting reading, and presents the major findings. It does not make interesting reading to report the data in detail, e.g. reporting interviews extensively and in detail; instead the details can be found in transcripts in appendices. Nor is it interesting to have all the tables from a quantitative study, instead these should be in an appendix.

Based on a broad and overall presentation of the empirical data, then a selection can be presented. This selection of data needs to be motivated and arguments presented. The starting points for presenting empirical data from interviews are the categories, codes or classifications made of the empirical material. It is completely unnecessary to extensively retelling the interviews. Overall presentations, e.g. using simple tables, which also may facilitate comparisons between informants or companies, may be more interesting. A simple basic analysis can be made as part of the presentation, and quotations (with reference-code to interview-protocol) should be few and carefully selected to illustrate the point made. A simple basic or preliminary analysis creates more interest for the findings in the reader. It also supports and provides a basis for a further and deeper analysis.

When presenting data from questionnaires, there is a need to make a motivated selection. Furthermore it needs to be discussed how questions can be combined with regard to a deeper analysis. There is no need to report everything (instead a complete compilation of results, in

tables or diagrams, must be included as an appendix). In the thesis proper a selection of these are presented. Results from the questionnaires need to be reported so that possible connections between various questions and responses are identified, which involves a simple preliminary analysis,

A *further analysis* and discussion of the empirical findings is central in the thesis. This involves making deeper analysis, explaining and interpreting the empirical results. This deeper analysis must be discussed, motivated and arguments presented – and also illustrated and supported by using carefully selected quotations from interviews. It must also be connected to the theories presented earlier in the thesis (for designing the theoretical framework). There must be a discussion and arguments for how the findings from the current study are related to findings from previous studies. A discussion summarizing the findings from the study concludes the further analysis.

Finally, the *conclusions* from the study are presented and discussed. This also involves discussing how the findings have answered the research question and hence contribute towards fulfilling the purpose of the study. If the study suggests research questions which may be interesting to approach in later studies, then these future research questions must be discussed and their connection with the reported study argued for.

5.2.2 Layout and formal requirements

The layout of the thesis and formal requirements encompasses a number of points, which must be satisfied. A good layout and adhering to formal requirements makes it easier to read the thesis. It also ensures that certain necessary aspects are included. These include (chapters 3-4):

- title-page,
- abstract,
- stylistic quality and readability,
- typographical design,
- headings and chapters,
- tables and figures,
- references (in the text and in a list),
- proof-reading and language-clearing.

The *title-page* should give the title of the thesis, the name of authors, supervisor and examiners, as well as the date of the final seminar. An *abstract* must include all the information required by the instructions for LUP Student Papers. *Stylistic quality* refers to the style used in the text. The text needs to be academic, which means that colloquial or everyday expressions must not be used and on the other hand old-fashioned or archaic expressions should not be used either. So the language in the thesis is crucial.

The typographical design must be attractive, avoiding partly blank pages (move text instead), avoiding headings at the bottom of a page etc. There must be a division and structure of chapters, subchapters and sections, which must be clear and intelligible. The number of levels should be just a few. Subchapters and sections should not be too brief. Chapters must have headings which a clear and informative, i.e. indicates the content. Chapter-headings like theory, method and empirics must be avoided; instead more informative headings should be used. Paragraphs of text may not include two or three lines, but neither should they be longer than half a page – in both cases it makes for difficult reading.

Tables must have headings and be numbered (within each chapter), and similarly with regard to *figures* and/or diagrams. Lists, if the number of tables or figures is large, are included after the table of contents. Tables and figures taken from some other publication need to have a reference.

There must be *references* (chapter 3) in the text and also a list at the end of the thesis, after the appendices. The list of references must include all publications mentioned or referred to in the text, which also includes those, where the original reference has not been used. The references must be in alphabetical order with all the information required to see what the publication is about (i.e. authors and title) and to be able to find it (publisher, journal etc.). References in the text must support the arguments and the discussion presented. They need to be included to a sufficient degree, but there is no need to exaggerate (i.e. references don't need to be repeated for each sentence). References must be correct according to the Harvard-system (using parentheses, but no footnotes for references). Notes (foot-notes or end-notes) may be used when something needs to be explained which is hard to do in the text proper.

It is a requirement that the master-thesis has been *proof-read.* A master-thesis, where the proof-reading is careless (with many mistakes) or language-mistakes are common, makes a poor and slipshod impression. It is therefore crucial to correct any mistakes before the final seminar. In many cases a *language-clearing* is also required, so it is often a good idea to ask somebody else to read the thesis before the final seminar.

5.2.3 Activity in the seminar

The activity in the seminar refers to how much and how constructively students participate in and contribute to the discussion in the seminar. Therefore this includes some aspects:

- defending their own thesis,
- reviewing and critically examining another thesis,
- participating in the discussion.

The authors (respondents) must be able to defend and argue for how they have carried out the investigation as well as the findings and conclusions they have arrived at. This may sometimes mean admitting that the reviewers have a better suggestion or proposal.

The review must include both positive and negative aspects of the thesis. The critique must be constructive, i.e. it must point at possible improvements. The review is a discussion between reviewers and authors, where the latter must have opportunities to refute reviewers' comments and present their reasons and arguments. Also the other participants in the seminar must take part in the discussion.

It is required that every participant in a final seminar has read the theses, which will be discussed. They are expected to be able to present views also on all theses, not just the one they have been assigned to review and critically examine.

6 Concluding the master-thesis

After the investigation has been carried out, it must also be reported in a master-thesis. This will be assessed, which takes place at a final seminar. It is the thesis that is assessed – *not* the process. The final seminar is the formal and official ending of the work with the investigation and reporting of the process and findings from it. Final seminars take place during a regular period at the end of May, with an additional opportunity in August of the same year. If you don't present your thesis during any of these opportunities, then you must start from the beginning with the module, submitting a new RP1, being assigned a new supervisor, and so on (see course syllabus).

The process concluding the master degree project encompasses some further activities:

- pre-final seminar with peer-reviews, supervisors lead the pre-final seminar
- application to final seminar (based on the pre-final seminar),
- final seminar with peer-reviews, an electronic version must be submitted to Urkund (to check for plagiarism etc), examiners lead the final seminar,
- correcting misprints and misspellings,
- filing of paper-copy for archival purposes,
- uploading an electronic version to the database, LUP student papers,

A master-thesis is a public and official document, which must be publicly available. Therefore it requires extraordinarily strong reasons in order to classify the document as secret. The assessment is in that case made according to the act of secrecy. Instead sensitive appendices may instead be excluded (also from the list of appendices).

6.1 Pre-final seminar and application to final seminar

Before a master-thesis may be presented at a final seminar it must be reviewed in a pre-final seminar. In the pre-final seminar the master-thesis is reviewed by another thesis-team in the same way as it will be reviewed in the final seminar. The pre-final seminar is organized by two supervisors. The pre-final seminar is a compulsory activity during the master degree project, which means that all the authors of a master-thesis are required to attend and take part in the pre-final seminar. It also means that a draft for a mater-thesis which does not successfully pass the pre-final seminar will not be recommended to be presented at a final seminar. The thesis-team must then attend another pre-final seminar in connection with the next round of pre-final seminars and final seminars (at the end of the next semester).

The participants in a pre-final seminar are

- the supervisors (but no examiners) who organize the pre-final seminar and distribute the announcement for the pre-final seminar,
- the authors of the thesis-drafts that will be discussed, discussants (reviewers) will be a appointed among the student-participants in seminar.

In the pre-final seminar a preliminary examination of the thesis-draft is made, as well as an assessment whether it has sufficient quality to be presented in a final seminar. The thesis-draft presented at the pre-final seminar must therefore be complete, nothing may be left out. In the pre-final seminar there will usually be various comments, suggestions and proposals about additions, changes and revisions in order to improve the draft. The authors are required to carry out these revisions and improvements before the final thesis is distributed for the final seminar. It is required that revisions and corrections based on the pre-final seminar have a sufficient quality. There will be no opportunities to make and revisions and corrections after the final seminar.

In the pre-final seminar (a rehearsal before the final seminar) the thesis-team defends their draft and the team will also critically review the draft of another thesis. All thesis-teams participating in a pre-final seminar must submit reviews of all the other thesis-drafts discussed in the pre-final seminar. The review must follow a specific protocol (appendix 3). The review is sent (electronically) to all the participants (supervisors and students) at the pre-final seminar the day before (not later than 12 o'clock) the seminar.

That the thesis-draft has been accepted to be presented at a final seminar does *not* mean that the thesis has been passed. There are no grades awarded in a pre-final seminar, since this is not examination. It is merely a *preliminary assessment* that the thesis may be presented at a final seminar. It does not imply any guarantee that the thesis will receive at least a pass-grade in the final seminar.

If the supervisors in the pre-final seminar agree that a draft for a master-thesis is sufficient and acceptable, then the authors and both supervisors will fill in an application for the final seminar (a specific form), which the supervisors have. This application is then given to thesis coordinator, who will plan and organize final seminars.

If the pre-final draft is not accepted, then a reworked and revised thesis-draft must be presented at the extra-ordinary seminars in august. In another case the thesis-team must start from the beginning the next the thesis-module is offered.

In addition to making the changes and revisions identified in the pre-final seminar, most theses and reports need have proof-reading made. An insufficient proof-reading with many misprints and misspellings makes a bad and careless impression. Language-clearing is also often necessary, since language-imperfections (mistakes, referential errors) means that the thesis does not make a reliable impression. It is a good idea to use the facilities offered by MS-Word, but it is also good idea to ask somebody else to read the thesis and check the

language used. It is important, that misprints and language-errors are corrected before the final seminar, otherwise there may be risk that the thesis is negatively assessed.

References must follow the guidelines (chapter 3). Careless references, which are incorrect, insufficient or missing, must not occur. It is important to check all references and correct them before the final seminar.

The changes and corrections that may be necessary after the pre-final seminar may include

- correcting misprints, misspellings and language mistakes, do a language-clearing,
- revise research question, purpose and delimitations,
- clarify discussion of methods,
- clarify discussion of findings,
- revise the relationship between conclusions and research question, tighten the conclusion,
- check references in the text and in the list of references.

6.2 Final seminar

The final seminar is the formal ending of the master degree project which has been written down as a master-thesis. The intention of a final seminar is to provide academic legitimacy through a careful and critical examination of a master-thesis presented at a final seminar. The final seminar is led by two examiners who have not been involved as supervisors of the theses discussed in the seminar (cf Student Rights).

Based on the applications to final seminars, these are planned and organized. Then some factors must be considered, i.e.

- the examiners: it is inappropriate that any of the supervisors in a pre-final seminar is also an examiner for the same master-thesis,
- students/thesis-authors: the combination of theses in the final seminar should be different from the pre-final seminar, so that the same thesis-teams don't meet again,
- access to seminar-rooms and not least the course-budget.

This means that planning the final seminars involves a fairly complex puzzle, which makes it impossible to consider any desires about when to have the final seminar. Furthermore, neither is it possible to provide any information about examiners in advance, this information will be on the announcement of the final seminar.

The final seminar involves defending one's own thesis, oral and written reviews on another master-thesis plus written reviews on the other theses discussed in the final seminar. It is the authors of the master-thesis who are responsible not the supervisor; thus the authors cannot

blame the supervisor when they are criticized. Furthermore a master-thesis is not finished until it has been discussed in a final seminar and then uploaded into LUP student papers.

The thesis-coordinator organizes the final seminar and disseminates announcements. Usually a final seminar includes four master-theses and lasts about five hours (normally 8-14 o'clock). The *announcement* provides information with regard to

- date and time of the final seminar, seminar-room,
- examiners, always two,
- date and time for distribution of master-theses (five work-days before the seminar), only electronically,
- reviewers for each master-thesis, the review (using the review-form, app 3) must be sent the day before the seminar to all participants (other students, examiners) no later than 12 o'clock the day before the final seminar,
- sending the master-thesis to Urkund to check for plagiarism, *before* the final seminar,
- when corrections (only misprints and misspellings) must be made, *after* the final seminar.
- handing in a paper copy and uploading an electronic copy to LUP student papers, but only after having received the assessment protocol.

A final seminar involves *examination and assessment,* so *attendance is compulsory* during the whole final seminar. The participants are

- every author to all master-theses presented in the final seminar,
- reviewers, which are appointed among the author-teams of the other theses in the final seminar. The authors of a master-thesis must be defend their thesis,
- two examiners, who will assess the master-theses, but grades are awarded later.

However, supervisors may not be present. Furthermore no other interested parties (e.g. fellow-students, company-representatives) may be present during the final seminar.

In order to be able to assess a master-thesis correctly and fairly the procedure of the final seminar is important. It is a prerequisite that every participant in the final seminar has read all master-theses presented, not only the one the team will review but also the others, and furthermore that everybody takes part in the discussion. Therefore during a final seminar the discussion of a master-thesis follows established academic procedures and rules:

- *Introduction.* The examiners open the seminar, welcome the participants and present the master-theses to be discussed,
- *Clarifications and corrections.* The author-team (the defenders) has an opportunity to provide information with regard to unclear points and misprints. This must concern inaccuracies and deficiencies which may lead to misunderstandings or in other way influence the contents of the thesis. Minor inaccuracies (e.g. misprints) may preferably be noted on a list of errata and distributed at the seminar. The reviewers and examiners should have been informed before the final seminar.

- *Overall assessment.* The reviewers open by giving an overall assessment and view of the master-thesis as a whole. This may focus on what is positive with the thesis, what is good in it, and what is the contribution of the thesis. Neither the reviewers nor the authors need to present the thesis.
- *Detailed review and discussion.* Next the detailed review follows. This is the main part in the discussion of a master-thesis. During this review the respondents (defenders, author-team) must have opportunities to respond to and comment on the reviewers' critique and questions. In other words the review must be a discussion between reviewers and defenders.
- *Summarizing assessment.* When the reviewers have finished their examination of the master-thesis and the defenders have had opportunities to respond, then the reviewers must provide a brief summarizing assessment of the merits and shortcomings, of positive as well as negative aspects.
- *General discussion.* The examiners will ask the other participants in the final seminar to give their points-of-views.
- *Terminating the discussion* of a master-thesis. The examiners summarize the discussion of the thesis and provide a verbal assessment of the master-thesis. The grade will not be given until end of the final seminar, when all the master-theses have been discussed.

Between each master-thesis there will be a short break. The examiners will not write any assessment protocol nor will they award any grades at the final seminar. There will be no opportunities for revisions or corrects (apart from misprints and misspellings) after the final seminar, instead these must have been made after the pre-final seminar.

If the review of another master-thesis is assessed as fail, then the reviewers must make a new review. The examiners will then give them another master-thesis, which they must write a written review on. This is submitted to the examiners a week after the final seminar.

When all master-theses have been discussed in final seminars, all examiners will meet for a discussion of grades on theses. Not until after this meeting (in the week before midsummer) will assessment protocols be written and grades finally awarded. The assessment protocol of a thesis is signed by the examiners of that thesis. The original is handed over to the secretariat, which archives the protocols and enters the grades to Ladok. Copies are given to the authors, supervisors, examiners and the thesis coordinator.

A master-thesis may be assessed

- *Pass or Pass with Distinction* (P, PD), only misprints and misspellings may be corrected. As soon as the authors have received the assessment protocol the master-thesis must be uploaded into LUP student papers, and the grade is entered into Ladok,
- *Fail,* then the authors must start from the beginning next time the module is offered, submitting a new TP1 and assigned a new supervisor.

6.3 Reviewing another master-thesis

Reviewing and refereeing scientific papers, before they are accepted for publication as articles in scientific journals or in proceedings from scientific conferences, is an essential feature in order to ensure scientific and scholarly quality (Smith 1999). This is also applicable to master-theses as academic papers.

The most distinctive feature of the discussion during a final seminar is a *critical attitude.* The reviewers must call attention to both *merits* and *shortcomings* in a master-thesis.

However, this does not mean that the reviewers (opponents) at any price should massacre the defenders' (authors') report and argumentation. A review should not take the form of a crushing and scathing review; instead it must endeavour to create a critical and improving discussion among reviewers and defenders. Of course the reviewers must be critical and elucidate the shortcomings in the thesis. However, the critique must be constructive and presented with due respect for the work the authors have invested in their master-thesis.

A review (Backman 2008, chap 4, Trost 2002) must consider the thesis as a whole. It is boring and monotonous to discuss the thesis chapter by chapter. Instead various issues should be focused, e.g. by using a particular format for the review (the protocol for reviewing a master-thesis, appendix 3).

The reviewers must discuss how problem, research question, theory, conducting the study, presenting and analyzing empirical data are connected. This includes how the theoretical framework has been applied when designing and selecting research methods and research instruments. Furthermore, it also includes how carrying out the investigation, analysis and interpretation of the findings are connected to the theoretical framework. It also includes how the findings are related to problem, research question and purpose. Other important questions are whether there is a common thread in the thesis and whether the interpretations have support in the empirical data and/or the theoretical framework. It is also possible for the reviewers to present alternative interpretations to the authors' (respondents'). Also the formal design of the master-thesis and the use of references must be considered, which in addition may mean identifying whether crucial references are missing (see also chap 5).

A critical review must not be characterized by fault-finding, a listing of minor mistakes and petty details. A small number may be discussed orally, provided they are crucial for understanding the master-thesis. The majority of such mistakes can be collected in a list of errata, which the reviewers can hand over to the authors. Alternatively, the reviewers may hand over a copy of the master-thesis, where they have marked mistakes and obscurities, to the authors. It is always of great value to have all these mistakes, so that they may be corrected before the master-thesis is uploaded into the electronic database LUP student papers.

The same protocol for reviews (appendix 3) is used both in the pre-final seminar and in the final seminar. An appropriate way of conducting the review is

- Start with the positive and try all the time to keep a positive and constructive tone,
- The discussion should start from the research problem and must respect the authors' choice of problem and research questions. How adequate is the theory selected? Have the selected research methods been appropriate? How are the findings connected with theory, method and problem?
- Don't put the emphasis on all mistakes and language shortcomings you may find,
- Don't start by remarking on misprints, obscurities, or how references have been written. These aspects may be considered at the very end of the review, but preferably in writing.

At the pre-final seminar as well as the final seminar the reviews must be sent to all participants in the pre-final seminar (both supervisors, all students) and in the final seminar (both examiners, all students) they day before the seminar.

6.4 After the final seminar

After the final seminar there are no opportunities to make any corrections and revisions (apart from misprints and misspellings). Instead these must be carried out after the pre-final seminar.

Final handing-in includes (appendix 4)

- A hard-copy (for archiving), handed to the secretariat (or the examiner responsible). This must be printed on one page, using a laser-printer, not stapled or bound in any way (no hard covers),
- A PDF-file for electronic publication in LUP student papers. It must be possible to print the document. Follow the instructions on the web-pages of the LUSEM-library,
- Electronic abstract according to the format used in LUP.

When the master-thesis has been uploaded into the LUP-database a message is generated automatically and sent to the secretariat. Then (and not until then) is the grade finally entered into Ladok. You don't need to notify the secretariat yourself that you have loaded your master-thesis, the system will do that automatically.

Appendices

Appendix 1 – Thesis Proposal 1

Master-thesis – Thesis Proposal 1

Master-thesis title (provisional)

Author 1
Surname (family name) ……..

Personal (first) name) ……

e-mail …….

Author 1
Surname (family name) ……..

Personal (first) name) ……

e-mail …….

Preferred supervisor (no guarantees are provided)

1. ……

2. …….

Lund yyyy-mm-dd

…… ……
Author-1 signature Author-2 signature

Hand-in x-day yyyy-mm-dd, to coordinator.

TP1 – Thesis Proposal 1 – Specification

Below you present your thesis proposal. You must write within the boxes (they will grow as you write). You must attempt to address the points above the boxes to the best of your ability. All boxes must have some text.
Don't remove the text above the boxes.

What ?
Problem area, research issue and research objectives.
Short introduction to the selected problem area and the research objectives (max 200 words)

- Background and problem area
- Research issue (question)
- Objectives or purpose (what do you want to achieve, expected findings)
- Delimitations of research question

What theories ?
Theoretical background
Short introduction to some theories of relevance for the research question (max 200 words)

- Theories selected
- Motivation for theories (why are you going to use them)
- Relevance of theories (how are they related to your research questions)

Why ?
Motivation and relevance.
Short motivation why the proposed study is of relevance for informatics (max 200 words)

- The problem in the context of informatics (why is it informatics)
- Expected contribution to informatics

How ?
Methodology for investigation of selected research issue.

Short description of the proposed methods to use for investigation, such as surveys, interviews, case studies or field studies, as well as methods for processing and analyzing data (max 200 words).
Note, NOT in terms of qualitative or quantitative (too crude)!

- What data will you collect, how will you collect the data
- Choice of methodology or approach (NOT qualitative or quantitative approach)
- Motivation (arguments) for methods, why do you choose these methods
- Selecting informants (companies, interview persons etc), how and why
- Quality assurance, consideration of validity, reliability, quality of sources and ethical issues

Internet as a source for empirical material?

Which are the possibilities and opportunities for finding data (empirical material) on Internet and in popular magazines or trade journals? Short description of some web-sites (e.g. from companies), which may be useful.

- What kind of webb-pages is it
- What kind of information do you find on them
- What kind of magazines (e.g. Computer World) is it
- What types of articles
- How can this material be used, how will you use it

Who ?

Persons identified as key experts, contact persons and other resource persons.
Short presentation of some key resource persons for getting started with the thesis work in terms of empirical investigations, field studies etc (max 200 words)

- Stakeholders (target group), to whom is the research issue of interest?
- Companies (and contact persons) for empirical investigations
- Possible readers of later drafts of the thesis (e.g. language clearing)
- Other resources?

References ?

Some examples of references.

Short presentation of some key scientific references with regard to the theoretical framework and the methodology to be used. Study. Write full references not just a web-address in alphabetical order.

- Publications of highest relevance for the research issue and study
- Scientific publications in terms of books (not textbooks)
- Articles published in scientific journals with a review-procedure (not popular journals nor trade-/industry-journals)
- Articles presented at scientific conferences with a review-procedure (not trade-conferences)

Scientific (scholarly) publications are available through the Lund University Library search system for journals. It is not sufficient that they can be found using Google or Google-Scholar, they need to be available via the Lund University Library search system.

Appendix 2 – Assessment protocol

Assessment protocol of Master-Thesis

Thesis title ……..

……..

Author ……..... Social security number ……

Author ……..... Social security number ……...

General impression

Structure and main thread

Contribution to knowledge

Final seminar yyyymmdd

Seminar activity .....

Thesis grade ……. …….

Lund yyyymmdd

…….. ……..

Examiner 1 signature Examiner 2 signature

The assessment protocol is handed to the secretariat and copies to the thesis-authors after the examiners' meeting.

Appendix 3 – Review protocol

Review of Master-Thesis, INF M03

Thesis title ……

……..

Thesis authors ……..

……

……

Reviewers …….

……

……

Date of seminar ……

Remove the dotted lines, and write instead thesis title and names.

This form is based on *"Assessment criteria for bachelor and master theses"*. Reviewing a thesis involves a critical examination of the thesis, identifying both positive and negative aspects providing both praise and constructive critique, i.e. critique that is useful for improving the thesis. It does not mean finding as many faults and mistakes as possible. A review is discussion of the various points below. It does not mean checking that the points have been satisfied, but how they are handled in the thesis.

Don't remove any text above the boxes. The boxes will grow as you write text into them.

1. Summary

Discuss the thesis

- overall impression
- main thread
- contribution to knowledge, what is new?

2. Thesis contents

2.1 Problem formulation

Discuss the problem formulation

- the discussion and arguments for the selection of problem, formulation of the research question,

- the arguments for the purpose,
- are the delimitations appropriate (not a repetition of previous choices)?

2.2 Theory and literature

Discuss and evaluate the choice of theory and literature for the investigation

- presentation and discussion selected theories,
- arguments for why selecting the theories,
- critical examination of theories,
- arguments for the theoretical choices made in order to develop a theoretical framework,
- presenting the final theoretical framework. The relationships between the presented theories and the framework. Arguments and motivations.

2.3 Method for the empirical investigation

Discuss how the empirical investigation has been design and carried out.

- presenting the method for the empirical investigation.
- selecting method(s) – arguments and motivation. How are they connected to the research question and the theoretical framework. Arguments and motivation.
- using methodology literature. Discuss the choice and motivation.
- describing and arguing for the design of questionnaires, interview-guides and other research instruments,
- processing and analyzing the material, presenting and arguing,
- research quality: validity, reliability, ethical aspects, critical examination of sources (i.e. empirical data).

2.4 Presenting empirical data

This includes both presenting empirical data in an impartial way and arousing the interest of the reader as well as making a preliminary analysis, which provides the basis for a subsequent and extensive analysis. Discuss

- the structure of the presentation of empirical material,
- how are various parts of the empirical material related to each other.
- is it easy for the reader to understand the findings?
- is the basis provided for an extended analysis?

2.5 Extended analysis and discussion

Based on the presentation of empirical data and the preliminary analysis an extended analysis must be carried out, relating the empirical findings to each other and to the theoretical framework

- the structure of the analysis,
- conducting the analysis,
- relationships with previously presented theories and the theoretical framework,
- does the discussion identify and promote the major findings,
- arguments and motivation.

2.6 Conclusions

Discuss the major findings and main conclusions

- relationships with theories and empirical data,
- connections to the research question,
- how has the research question been answered.

3. Layout and design

3.1 Layout and formal requirements

This is not a point that should take up much time during the seminar. Comments should be very limited. What may need to be considered – but only very briefly – are:

- references
- headings and chapters
- tables and figures
- abstract: does it provide an appropriate presentation of the thesis, arousing the interest of future readers
- readability.

3.2 Mistakes and corrections

On no account may this take up much time at the seminar. Only exceptional mistakes, which have important consequences for understanding the theses, should be discussed during the seminar.

Other comments should be given in writing, so make a separate list or make notations and/or comments in one copy of the thesis. The list or the thesis may then be given to the authors. It is often useful to have these corrections – but it is boring to have to listen to.

Finally

Send the review, via e-mail, no later than at 12 o'clock the day before

- Pre-final seminar: to authors, supervisors and other participants.
- Final seminar: to authors, examiners and other participants.

Appendix 4 – Handing in thesis

Inlämning av uppsats
Handing in Bachelor/Master Thesis

Efter att ni har fått bedömningsprotokollet med godkänt betyg så kan uppsatsen lämnas in:

After you have received the assessment protocol with at least a pass degree, the thesis may be handed in:

- Ett ex. av den slutgiltigt godkända uppsatsen lämnas in till ansvarig examinator eller till expeditionen (för arkivering). Obs! Det ska vara en originalutskrift (laser), enkelsidig, i lösblad (ej inbundet eller häftat), ej hålat.

- *Hand in one copy of your thesis, when definitely graded, to your examiner or to the Informatics reception desk (for the archives). Note: The copy must be an original print-out (laser), printed on one side only, and not stapled or punched.*

- Framsidan ska vara utskriven på papper med institutionens logo, som kan laddas ner från EHLs hemsida

- *The front page must have the logo of the department, which may be downloaded from the web-pages of LUSEM.*

- På framsidan ska skrivas uppsatstitel, författare, handledare och examinatorer samt månad och år för slutseminarium.

- *On the front page, write the title of the thesis, the names of author/s/, supervisor and examiners, and month and year of the final seminar.*

- För studenter på SYSK01 och SYSK02 gäller att ni måste skriva en läranderapport som gäller hela kursen SYSK01 (dvs uppsatsen och projektet). Denna ska läggas in i ett elektroniskt system enligt institutionens anvisningar.

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