

STUDY GUIDE

Master Thesis Innovation Sciences

(OEM06)

Document version: August 2016

Floor Alkemade

Table of Contents

1. Introduction	2
2. Intended learning outcomes.....	2
3. Admission criteria and formalities.....	2
4. Timing and deadlines.....	3
5. Master Thesis Project outline.....	4
6. Master Thesis Defense and evaluation criteria.....	5
7. Responsibilities of supervisors.....	7
8. Responsibilities of the student	8
Appendix 1: Master Thesis (report) formal requirements	9
Appendix 2: Literature references	10
Appendix 3: Principles Internship Agreements.....	11

1. Introduction

The master thesis project (MTP) is the final project in the master program Innovation Sciences. This text serves as a studyguide for the MTP, providing information for both students and supervisors. The Master Thesis Project is a 30 ECTS project that enables students to specialize in a subject that fits with ongoing research within the Innovation Sciences group. Students focus on one of these research themes and develop their own research proposal with support from their supervisor. After the research proposal has been approved the student executes the research and reports the result in the form of a written thesis and an oral presentation. The MTP can (partly) take place in an organization other than the university

The content of this document is an addition to the official master program regulations (the '*Education and Examination Regulations*', the '*Examination Rules and Procedures*' and the '*Graduation Regulations*'). In case of doubt, the official regulations prevail.

2. Intended learning outcomes

After completion of the MTP, the student is able to:

- Identify a relevant research topic that is embedded in the literature
- Present that topic in a clear research question
- Carry out the research necessary to answer that question
- Write a report in which the work is clearly and scientifically reflected
- Present the research outcomes in an oral presentation

3. Admission criteria and formalities

The Master Thesis Project is 30 ECTS, which corresponds to about 22 weeks of fulltime work, with a study load of 840 hours. Table 1 specifies the general planning and deadline. Section 4 of this document gives a more detailed description of the different phases of the MTP. In order to monitor the stages in the graduation process, several administrative forms are used, these forms can be downloaded from the educational portal page <https://studiegids.tue.nl/opleidingen/graduate-school/masters-programs/innovation-sciences/graduation/master-thesis>, see topic *Downloads*.

The student can start the MTP only after formal approval of the Exam Committee. The student has to apply to the IE&IS Administration Office to obtain a *Start MTP Certificate*, and send this certificate to the secretary of the Exam Committee. The form *Start Master Thesis* must be completed and handed in at the Administration Office at least ten working days before the actual MTP start date. The certificate will only be granted if all other elements (courses) of the master's degree program have been completed (with the exception that a maximum of 15 course related ECTS still may be open – these are courses that have been followed but for which the results are not in yet).

In the *Graduation Contract*, the members of the Assessment Committee (including the supervisor/ first assessor, second assessor, and third assessor), the subject of the MTP, and the time schedule, should be specified. The *Research Proposal* and *Graduation Contract* have to be signed by the supervisor, second assessor and the student, and have to be submitted to the Exam Committee for approval, within 3 weeks of the start of the MTP.

4. Timing and deadlines

Table 1 specifies the general planning for the MTP. In the *Research proposal*, the student further specifies this planning.

	Start in Q1	Start in Q2	Start in Q3	Start in Q4
Discussion with mentor about desired Master's thesis subject and possible Master's thesis supervisor / Final decision about topic and supervisor	Q4 Week 3	Q1 Week 3	Q2 Week 3	Q3 Week 3
Meeting with supervisor. Determine second and third assessor Send information to Letty Calame	Q4 Week 6	Q1 Week 6	Q2 Week 6	Q3 Week 6
Start MTP Meeting with supervisor	Q1 Week 1	Q2 Week 1	Q3 Week 1	Q4 Week 1
Submit Research Proposal to supervisor and second assessor	Q1 Week 2	Q2 Week 2	Q3 Week 2	Q4 Week 2
Meeting with supervisor, discuss comments	Q1 Week 3	Q2 Week 3	Q3 Week 3	Q4 Week 3
Submit revised proposal to exam committee using Research proposal form (approved by supervisor and second assessor)	Q1 Week 3	Q2 Week 3	Q3 Week 3	Q4 Week 3
Intermediary meetings with supervisor according to RP and discussion of draft chapters	Q1w6- Q2w3	Q2w6- Q3w3	Q3w6- Q4w3	Q4w6- Q1w3
Submit draft version complete thesis to supervisor and second assessor	Q2 w4	Q3 w4	Q4 w4	Q1 w4
Meeting with supervisor Discussion of feedback	Q2w6	Q2w6	Q2w6	Q2w6
Submit final version	Q2w8	Q2w8	Q2w8	Q2w8
Presentation and defense	Q2w10	Q3w10	Q4w10	Q1w10

Table 1: Time table MTP

5. Master Thesis Project outline

Step 1: Select a topic and a supervisor

A list of thesis supervisors can be found at: <https://studiegids.tue.nl/opleidingen/graduate-school/masters-programs/innovation-sciences/coaching-and-professional-skills/is-mentor-system/>. Consult with your mentor and/or the course coordinator in order to find a suitable topic. Many of our students go to an external organization to conduct part of the research. Working at an external organization often eases collection of data, and provides you with professional work experience.

Step 2: Research Proposal

Once you and your supervisor (and possibly your supervisor from the external organization) agree upon the general research question and approach, you specify this in a research proposal. In the research proposal you (1) Introduce the research question and explain clearly how it is embedded in the literature, (2) Explain why your project fits the Innovation Sciences domain and how it connects or contributes to the scientific discipline of Innovation Sciences, (3) Indicate **how** you are going to answer your research question. Describe for example what the (in)dependent variables are, what methodology you will use or develop and how you will collect your data (e.g., interviews, databases or other sources). Also describe how you will analyse your data, and (4) Provide three references of scientific articles and/or books that underlie the research proposal.

For your reference, the website also lists a few well-written proposals to use as example. Once your first and second supervisors agree with your proposal, you submit your proposal to the exam committee. The proposal has to be submitted within 3 weeks of the start of the thesis project. If the research proposal is not approved you will revise and resubmit within one week, in close cooperation with your supervisor.

Step 3 : Research phase

During this phase you regularly discuss your research and draft chapters with your first supervisor. The thesis should at least contain the following elements:

Introduction: In the introduction, you sketch the general context of your problem. You introduce your problem and rephrase it in theoretical terms, that is, you describe the underlying scientific problem. After a short description of the most important earlier contributions that address this problem, you identify the gap in the literature and state your main research aim or question. The introduction should also include a description of the scientific and societal relevance of your research as well as a short outline of the thesis.

Theory: In this section you explain the theoretical concepts you will use (starting from your RQ) and provide definitions. You also discuss the links (or your hypotheses about these links) between the main theoretical concepts.

Methods: In the methods section you describe how you will ‘measure’ your theoretical concepts and relations, and why you have chosen this approach. In addition this section also elaborates on the type of data you will collect and the data sources you use. Make explicit how following your methodology will provide an answer to your research question!

Results/Analysis: Here you present your actual results and relate these to the theory section or specific hypotheses you have introduced.

Conclusion. In the conclusions section you answer the research question.

Discussion. In the discussion section you reflect on the outcomes and quality of your work discussing limitations, and implications (both theoretical and managerial/policy).

References. The thesis should contain at least 20 references to relevant scientific articles or books. (see Appendix 2 for the appropriate format)

Press release and summary In addition to writing a Master Thesis report, you should also write a *press release* and a *summary*, according to the guidelines in the *Press release format* that can be downloaded from <https://studiegids.tue.nl/opleidingen/graduate-school/masters-programs/innovation-sciences/graduation/master-thesis/>.

6. Master Thesis Defense and evaluation criteria

After completion of the thesis, the student submits the thesis to the first, second, and third assessor. After all assessors have approved the Master Thesis, a date is set for the thesis defense. At least ten working days shall pass between the formal approval of the Master Thesis and the defense. The Exam Committee is informed immediately after the date and time have been set, at least ten working days before the oral exam. There should also be at least ten working days between the defense and the scheduled meeting of the Exam Committee.

The thesis defense (final examination) consists of:

1. An oral presentation by the student, with a maximum of 30 minutes, of the methodology and main results of the project;
2. An oral exam, in which the student is questioned on his/her project and thesis. The supervisor may invite other people to take part in the oral examination.

The *oral presentation* is public. However, it is an examination and as such the result is not known in advance. The student must be warned in advance that it is not a foregone conclusion that he/she will pass the examination. Before the meeting, the first supervisor must determine what the committee's assessment is of the work that has been delivered. If necessary the first supervisor must point out possible problems to the committee and the student. The assessment committee will grade the student according to the evaluation criteria a through g as defined below.

The assessment committee rates each of the seven criteria (*insufficient – sufficient – good – excellent*). The student passes if a maximum of one criterion is marked as *insufficient*, with the exception of criteria (b), (c) and (d), which should always be marked *sufficient* at least.

The committee then assigns a final grade to the master thesis project between 1 and 10 (half grades are allowed, e.g., 6.5 or 7.5).

- Excellent (9 or 10 = top 10%): thesis shows deep understanding of the topic, a substantial degree of creative engagement; faultless exposition, is clearly structured around a central thesis, and has clear signs of independent thought;
- Good pass (8): very clear and accurate exposition, good understanding of topic, structured around a central thesis, signs of independent thought;
- Sufficient (7 or 6): reasonably clear and accurate exposition, structured around a central thesis, adequate grasp of topic, transcending the course materials. Exhibits rather basic, but still acceptable, level of relevant knowledge and understanding. Faults in exposition may to some extent be compensated for by evidence of independent thought;
- Insufficient (< 6): fails to make low pass grade because of insufficiency in one or more of the criteria.

The seven criteria on which the MTP is evaluated are:

- 1) Competent in scientific disciplines
 - a. Advanced knowledge of and insight into technological systems and their components in a specific technology domain.
 - b. Thorough understanding of concepts, theoretical frameworks and methodologies of innovation sciences extending to the forefront of knowledge
 - c. Thorough multidisciplinary knowledge integrating innovation sciences knowledge with technological knowledge in relevant domains, and the ability to critically reflect on the scope and limitations of this knowledge.
 - d. Thorough knowledge of and advanced skills in the techniques of observation, data collection and analysis techniques in the innovation sciences domain, and an ability to critically reflect of the scope and limitations of these methods.

- 2) Competent in doing research
 - a. Ability to formulate research problems in terms of concepts and theories of innovation sciences.
 - b. Ability to independently develop and execute a research plan.
 - c. Ability to contribute independently to the development of scientific knowledge in one of the areas of the innovation sciences.
 - d. Ability to identify and analyze problems typical for the innovation sciences, by integrating technological and social sciences perspectives.
 - e. Ability to appraise relevant scientific evidence on its usefulness in addressing research problems.

- 3) Competent in designing
 - a. Ability to independently translate the outcomes of innovation sciences research into design, policy or strategy recommendations for innovation in existing and new socio-technical systems.
 - b. Ability to independently identify both the social and the technical implications of innovation sciences in design recommendations.

- 4) A scientific approach
 - a. Ability to apply and critically examine existing theories, concepts and models in the innovation sciences domain.
 - b. Ability to look beyond the borders of a specific discipline, to be sensitive to the relative contributions of various disciplines and to understand the knowledge demands of a specific discipline.
 - c. Ability to use a systematic approach characterized by the consistent application of existing theories, concepts and models In innovation sciences, and knowledge of current debates about this.

- 5) Basic intellectual skills
 - a. A reflective attitude, with an ability to critically and independently reflect on own thinking, decision making, and professional behavior.
 - b. A critical mindset and the ability to ask constructive questions regarding complex problems in the field.

- c. Ability to read and write scientific texts.
 - d. Ability to think in abstract terms, including the ability to develop (formal) models of phenomena and processes in the domain.
- 6) Competent in co-operating and communicating
- a. Capability of reporting and communicating the results of one's learning and decision making –including one's research outcomes --, both verbally and in writing, with academics and engineers in various domain, users, and the general public
 - b. Ability to recognize and deal with differences in work practices between scientific disciplines, and academics from other cultural backgrounds.
 - c. Ability to take a leading role in multi- or interdisciplinary teams of engineers and academics.
 - d. Ability to listen, read, talk and write in English on a professional level.
- 7) Takes account of the temporal, technological and social context
- a. Ability to reflect on the relation between the use of scientific knowledge and technology, the implicated social, normative and ethical issues, and the way in which knowledge and technology development is influenced by its social and historical context, and the ability to integrate such relations and implications in their scientific work.
 - b. Understanding of the different roles of engineers and related professionals in society, and the ability to determine one's own place as a professional in society.

If the student does not pass, the assessment committee may decide to:

- Either give the student the opportunity to improve the Master Thesis work, and decide on a second oral exam, which should take place within one month after the initial oral exam, or
- Discontinue the project and fail the student. In this case, the Examinations Committee decides whether the student receives the right on thesis supervision during the writing of a new thesis, on a new topic should the student decide to do this.

The Exam Committee regularly checks the assessments of the MTP's. This can be done both randomly and targeted (*e.g.*, for very high or low grades).

7. Responsibilities of supervisors

In general the thesis supervisor is the person who supervises the student's research. It is the first supervisor's responsibility that a thesis project meets all the necessary conditions. The first supervisor serves as a role-model of a researcher for students. He/she accompanies the student in selecting a good research question. Being a role-model means that the personal and professional behaviors of faculty members should be the standard that the student will emulate. Students' attitudes towards the discipline and the academy are conditioned by examples provided by mentors and thesis supervisors in the graduate school. More specifically, the first supervisor has the responsibility to:

- Assist the student with developing a thesis topic;
- Make sure that the research project is feasible and within scope of the innovation sciences master
- Regularly meet with the student

- In case of a project within an external organization, visit the organization at least once to meet with the supervisor from the organization and the student
- Provide timely and consistent high quality feedback to concepts of the research proposal, individual chapters and the concept version of the thesis.
- Fill out the assessment form.
- The first supervisor ensures the timely appointment of a second and third assessor;
- Student supervision and guidance will cost approximately 40 hours for the first supervisor (including thesis preparation).

In case of a thesis project in an organization (see Appendix 3), the first supervisor is responsible for ensuring that:

- The organization in which the project is being carried out demonstrates sufficient involvement; a capable company supervisor spends enough time and puts enough energy into the project, there is a clear problem area for the project, and the management of the company is interested in the project as such;
- The situation within the company for the graduation project offers sufficient opportunity for the successful completion of the project (reorganizations for example can lead to unworkable situations)

The second assessor will provide feedback on the research proposal, the concept thesis, and the final version (10 hours) and attend the thesis defense. The third assessor will only assess the final version (5 hours).

8. Responsibilities of the student

It should remain clear at all times that the project is the responsibility of the student. In other words, the student always maintains final responsibility for the proposal, the project, and the thesis. He/she must design and control the planning of the project and also draw up agendas and write up reports on discussions, meetings, and agreements.

It is the student's responsibility to be acquainted with all relevant regulations and procedures regarding the project and it is the student's responsibility to apply them. In particular the student will follow the TU/e guide for scientific conduct and will sign and submit the corresponding form to make this commitment explicit.

Appendix 1: Master Thesis (report) formal requirements

The final report must fulfill the following requirements:

- Maximum of 50 pages (main text)
- The report is written in English.
- A digital version of the graduation report must be delivered to the IE&IS Administration Office, at least five working days before the scheduled meeting of the Examinations Committee for which the student has put his/her name forward.
- The Master thesis is public and will be digitally published by the library. If the organization in which the graduation phase has taken place considers that publication of the research would harm its interests, the student must write the report such that it is suitable for publication. In general this will imply masking of data and possibly an appendix that is kept confidential. In this case the report must be readable without the appendix.
- A self-contained summary (of approximately three pages) must be included.
- The report is self-contained.
- The title page must include the title of the report, the author's name and student identity number, names of the supervisors and their respective Faculties, the title of the MSc program, the name of the student's Faculty, the name of the University and the publishing date. On the backside the subject codes and keywords must be placed. The standard layout can be downloaded
- Adequate subject codes and keywords must be included for characterising the master thesis. Subject codes must be chosen from the list of systematic codes from the TU/e Library. English keywords can be taken from the main thesaurus/keyword list. Also Dutch keywords might be included; these can be taken from the keyword register of the catalogue of the TU/e Library. The librarian can help you by choosing appropriate subject codes and keywords.
- Layout requirements
 - * Margins must be 1 inch (2.54 cm), left/right/top/bottom
 - * Footer contains only page numbers, centered
 - * Pages are numbered consecutively.
 - * base text font: Times New Roman 11 or 12 pt.
 - * heading font: Arial
- Figures, tables and other exhibits must be numbered. Numbering can be consecutive throughout the report or per chapter. In the latter case, the number must be preceded by the chapter number (e.g. Figure 2.1 is the first figure in chapter 2).
- Figures, tables and other exhibits must have a caption that is descriptive.
- Headings must be numbered.

Appendix 2: Literature references

All citations in the text should refer to:

- Single Author: the Author's name (without initials, unless there is ambiguity) and the year of publication;
- Two Authors: both Authors' names and the year of publication;
- Three or more Authors: first Author's name followed by "et al." and the year of publication.

Examples: "...as demonstrated in (Allan, 1996a, 1996b, 1999; Allan and Jones, 1995). Lee et al. (2000) have recently shown..."

In the literature list references should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c", etc., placed after the year of publication.

Examples:

Reference to a journal publication:

- Griffiths W, Judge G. "Testing and estimating location vectors when the error covariance matrix is unknown". *Journal of Econometrics* 1999; 54; p. 121-138 (note that journal names are not to be abbreviated).

Reference to a book:

- Hawawini G, Swary I. *Mergers and acquisitions in the U.S. banking industry: Evidence from the capital markets*. North-Holland: Amsterdam; 1990.

Reference to a chapter in an edited book:

- Brunner K, Melzer AH 2010. "Money Supply". In: Friedman BM, Hahn FH (Eds), *Handbook of monetary economics*, vol.1. North-Holland: Amsterdam; 2010. p. 357-396.

Citing and listing of Web references:

As a minimum, the full URL should be given, and the date the URL was accessed. Any further information, if known (author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

Appendix 3: Principles Internship Agreements

	Student	Mentor	Department
Compensation internship	The student will personally come to an agreement with the company about compensation	-	-
Confidentiality	If requested, the student can personally sign for confidentiality for the duration of the internship (with a possible prolongation of max. 5 years after the internship)	If requested, the mentor and the second assessor can sign for confidentiality for the duration of the internship (with a possible prolongation of max. 5 years after the internship)	-
	The student will personally assure that he/she can meet <u>all</u> requirements for graduation, including mandatory publication of the thesis in the university library (masking of data is not desirable)	-	-
IP	The student will personally prevent that he/she signs away his/her IP-rights <u>after</u> the internship; this can severely impede his/her career for the future	-	IP that is developed during the internship, according to the Dutch law, already completely belongs to the company in case of an <u>educational</u> internship; this does not require any additional agreements between the company and the educational institution

In case a company does not agree with the principles mentioned above, then please refer the negotiations to Eric van der Geer Rutten Rijswijk (e.v.d.geer@tue.nl)

IP that is developed during the internship, according to the Dutch law, already completely belongs to the company in case of an educational internship. This does not require any additional agreements between the company and the educational institution.

For the students, it is important to come to an agreement with the company about possible compensation and confidentiality, whereas for the latter holds that publication in the university library is mandatory for graduation; exceptions are not possible; masking of data is not desirable either. Furthermore, it is important for students' career paths that the company does not demand prolongation of the IP-rights long after the internship. For all aforementioned issues, the department can't and won't take responsibility. Possibly, in case the company insists, the mentor can sign a confidentiality agreement, but then solely regarding confidentiality.