

Graduate School

Master Thesis Manual

Industrial Engineering

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1. Introduction

In this text, we summarize the process of the Master Thesis Project for the Graduate School master programs Innovation Management (IM), Operations Management & Logistics (OML) (including the special master track Manufacturing Systems Engineering, MSE). This serves as a guideline for mentors and students. Also, in this text the evaluation criteria for the Master Thesis Project are defined. The content of this document is an addition to the official regulations (Education and Examination Regulations of the master programs, the Rules and Regulations of the Exam Committee IE of the programs, and the Graduation Regulations). In case of doubt, the official regulations will prevail.

The Master Thesis Project is the final project in the master program. Since it is a full time project of one entire semester (30 erts), a student should preferably have completed all other courses before starting this project. Hence this project is planned in the last (fourth) semester of the master program. It can however be started in the fall or in the spring semester, depending on the start date of the master program (September or February).

2. The process towards a Master Thesis

The structure of the master programs IM and OML and the special master program MSE can be found on the educational website; <https://educationguide.tue.nl/programs/graduate-school/>, see the topic 'Master's Programs'.

For IM, the program consists of:

- 30 credits in compulsory core courses;
- 30 credits of track elective courses (of which one elective course is obligatory or restricted);
- 30 credits of free electives (such as the Master Thesis Preparation course: literature review) including international experience;
- 30 credits for graduation (Master Thesis Project).

For OML, the program consists of:

- 10 credits in compulsory core courses;
- 20 + 15 credits of track elective courses;
- 40 credits of free electives including international experience;
- 5 credits of Master Thesis Preparation: literature study (is restricted/obligatory);
- 30 credits for graduation (Master Thesis Project).

For the special master track MSE, the program consists of:

- 30 credits in compulsory core courses
- 15 credits of specialization electives
- 30 credits of free electives including the international internship;
- 45 credits for graduation (Master Thesis Project).

For both IM, OML and MSE a research proposal is part of the Master Thesis Project. A list of available electives can be found on the educational website; see the topic 'Available Master Courses IM and OML' (also for MSE).

The semester in which the student starts with the program is defined as Semester 1. Any student that receives permission to follow master courses parallel to completing the preceding program (e.g. BSc program in Industrial Engineering or the Premaster program), should set their semester 1 as the semester which is 4 semesters before their expected graduation.

Students who enroll in the masterprogram during the year (other than per 1 September or 1 February) with questions about the curriculum and courses need to contact the Program Chair of the specific masterprogram.

The timeline towards the Master Thesis Project is then organized as follows:

- Semester 1: Orientation and application
 - Orientation on tracks and mentors (read about the tracks and the interests of the mentors)
 - Student/mentor decisions:
 - = Mentor decides on student autonomously
 - = Student discusses with mentor general research interest and study program for second and third semester including international term (formal approval)
- Semesters 2 and 3: Master Thesis Preparation
 - Student meets every two months with mentor to discuss research topics and questions, with possible company involvement
 - The role of mentor is role-model researcher, helping the student with the selection of a good (design-oriented) research question
- Semester 4: Master Thesis Project (full time)

In order to monitor the stages in the graduation process, several administrative forms are used (see Table 1). Since these forms might be updated in time, it is best to download a specific form at the time it is needed. All forms can be found on the educational website <https://educationguide.tue.nl/programs/graduate-school/> under the topic ‘Master’s programs’ and then ‘coaching and professional skills’/‘Mentor system’ (Form 1 and 2) or ‘Graduation’/‘Master Thesis’ (Form 3, 4, 5).

Table 1: Administrative forms belonging to the graduation procedures

Form	Time of submission	Signature (approval)	Download at educational website
1a: Mentor Assignment	2 nd half of 1 st semester	-Mentor -Student -Education Administration	Master OML https://studiegids.tue.nl/opleidingen/graduate-school/masters-programs/operations-management-and-logistics/graduation/
2: Electives	Start of 2 nd semester	-Mentor -Student -Exam Committee	Master IM https://studiegids.tue.nl/opleidingen/graduate-school/masters-programs/innovation-management
3: Start Master Thesis Project	End of 3 rd semester	-Mentor -2 nd Assessor -Education Administration	Master MSE https://studiegids.tue.nl/opleidingen/graduate-school/special-masters-tracks/special-masters-track-manufacturing-systems-engineering/
4: End Master Thesis Project	End of 4 th semester	-Mentor -Student - 3 rd Assessor -Education Administration	
5: Final Assessment	End of 4 th semester	-Mentor -2 nd Assessor -3 rd Assessor	

3. Assignment student to mentor

During the first semester, a student applies for a mentor. Before this, a general information meeting and master track information event (information about the mentors and their research lines) is held.

In the Master IM students fill in a track questionnaire. After the track matching phase the student receives the notification of his/her track. In the mentor orientation phase they fill in a theme questionnaire and after the mentor-matching phase the student receives a personal short list of mentors to contact. The student has interview meetings with first the short listed mentors. This is followed by a free market.

In the Master OML (including the special master track MSE), after the orientation phase, students can have (exploratory) talks with potential mentors. A student can contact multiple mentors; a mentor can consider several students. The student informs the mentor about the desired track(s).

In the end in both the Master IM as in the Master OML (including the special master track MSE), the student and mentor agree that the student will be guided by that mentor. For the Master OML this means also the decision on the chosen track. Together, mentor and student, fill in the Mentor Assignment Form (see Form 1: Mentor Assignment) and the form Declaration concerning the TU/e Code of Scientific conduct and the student sends the completed forms to the Education Administration.

As from this point there is a formal connection between the student and the mentor. The student will choose the electives based on the research area agreed upon. The mentor will reserve time and capacity for guiding the student.

4. Initial meeting between student and mentor

At the initial meeting of the mentor and student, the following items are discussed:

- The introduction of student and mentor (research interest of student and mentor);
- Agreements on supervision (ways of working/type of supervision, definition of working relationship, frequencies of meetings, ways of reporting, etc.);
- The student's program for the second and third semester, including elective courses and the international term;
- The professional skills development plan (based upon the results of the 'TU/e Diagnostic Test of Professional Skills'. With this skills assessment the student gets information about the current level in the various skills);
- The meaning of the TU/e Code of Scientific Conduct. To make clear exactly what is meant by academic integrity, a code has been drawn up identifying five central values, each of which is accompanied by a number of related norms and principles. The central values are: trustworthiness, intellectual honesty, openness, independence and societal responsibility.

As soon as possible the student fills in the Electives Form (see Form 2: Electives) for the selection of the electives, and submits this for mentor approval. When a student later decides to change the list of electives, a new form must be handed in. If the student decides to take an international term, the mentor also approves the specific selection of the international location and international courses. In case the total number of available places at a specific exchange location is limited, the program director decides on the priorities, and may decide, in consultation with the student and the mentor,

to select an alternative location. Notice that students do not need approval of the mentor for 15 credits in the free electives part of the degree program.

5. Master Thesis Preparation: Literature study (1ML05)

The Master Thesis Preparation course “Literature study (1ML05)” consists of 5 credits (nominal study load 140 hours), which is supervised by the mentor. For the Master OML it is a compulsory course, for the Master IM and the special master track MSE it is an optional course (free elective). A literature review surveys scholarly articles, books and other sources (e.g. dissertations, conference proceedings) relevant to a particular issue, area of research, or theory, providing a description, summary, and critical evaluation of the work.

The purpose of this course is to produce an overview of significant literature published on a topic. Typically, a review identifies relationships between studies, trends or patterns over time, and identifies gaps in the literature. The author generally takes a position with regard to the reviewed literature.

In this course a student practices and, through feedback from his/her mentor, learns how to conduct and write a literature review. It is recommended to study the article of Randolph (‘A guide to writing the dissertation literature review’) which is a guide to writing a literature review.

On completing this course, a student is able to:

- conduct a literature search and analyze the results of the search;
- identify patterns or trends in the literature;
- identify research gaps;
- structure and develop arguments to develop his or her own position with regard to the studied literature;
- improve his or her academic writing skills;
- provide a basis for developing a research proposal.

The recommended length of the paper is approx. 25 pages and is graded by the mentor. The literature study is graded based on:

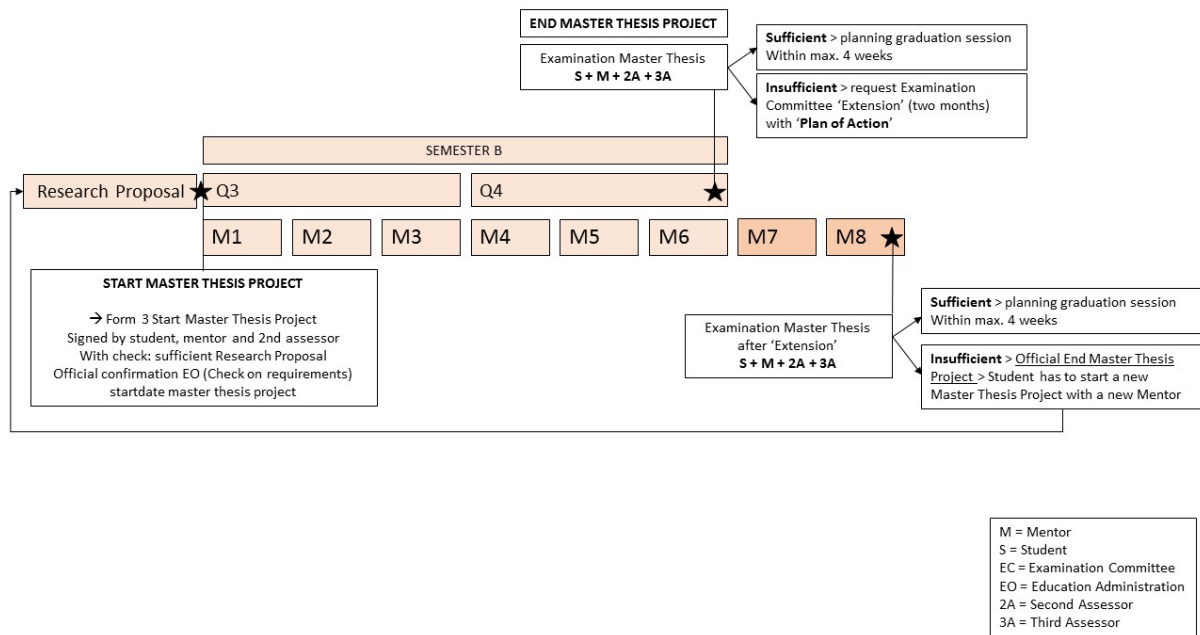
- a) quality of search and methodological rigor;
- b) quality of the analysis, arguments, and conclusions;
- c) structuring and presentation of materials, and quality of writing
- d) process.

The grade will be based mainly on the content (i.e. the criteria a and b). Structure and process (c and d) will account for a smaller part. The literature review (1ML05) may serve as a basis for the subject studied in the Master Thesis Project.

6. Master Thesis Project (1*M96)

The course code of the Master Thesis Project depends on the capacity group the mentor belongs to. The second character in the code denotes the group (B= IS, C=OPAC, J=HPM, Z=ITEM).

6.1. Master Thesis procedure



The Master Thesis Project involves writing a research proposal and the execution of the research. When the student has completed at least 80 ECTS of the master program (up to 10 ECTS, spread over 2 courses, can still be unfinished = the 10 ECTS Rule), and the Research Proposal is judged 'sufficient' by the mentor and 2nd supervisor, the student can start with the implementation of the research (graduation). The two unfinished courses have to be finalized prior to the graduation session. The literature study (1ML05) can be one of these courses and can be completed before or during the Master Thesis Project.

When the Research Proposal is judged 'sufficient' by the mentor and 2nd supervisor, the student arranges a meeting with his/her mentor and the 2nd supervisor in which the 'Start Master Thesis Form' (Form 3) is jointly filled in and signed. The student directly hands in the form to the Education Administration Office. The submission of the 'Start Master Thesis Form' (and other forms mentioned in Tabel 1.) is required to be able to graduate. The Education Administration Office, on behalf of the Exam Committee IE, checks whether the student has met all the requirements and sends the result of this check to the student and the mentor. The date that the student and the mentor receive a positive confirmation from the Education Administration Office is the formal start date of the graduation/the implementation of the research (this is explicitly mentioned in the response). In this confirmation, the end date of the Master Thesis Project is also mentioned.

The mentor and 2nd supervisor should not agree with the start of the implementation of the research (graduation) without a sufficient Research Proposal and the confirmation of the Education Administration Office that the student has met all requirements and the positive confirmation that graduation can formally start.

The nominal research time is calculated according to the size of the Master Thesis Project. In the Master IM and Master OML, the Master Thesis Project includes 30 ECTS (workload 840 hours). The nominal research time is the official start date (graduation) + the nominal duration of 21 weeks + 4 holiday weeks (total 25 weeks). The student cannot graduate within 16 weeks after the positive confirmation of the Education Administration Office. In the special master track MSE, the Master Thesis Project includes 45 ECTS (workload 1260 hours). The nominal research time is the official

start date + the nominal duration of 32 weeks + 4 holiday weeks (total 36 weeks). The student cannot graduate within 24 weeks.

In case the 'Start Master Thesis Form' is submitted later in the process, the first opportunity for possible graduation also automatically shifts in time (that is, 16 weeks after the official start date for the master IM and OML, and 24 weeks after the official start date for the special master track MSE). Therefore, for a nominal study duration timely submitting the 'Start Master Thesis Form' is necessary.

During the master's program the student discusses the research topic and possible research questions with the mentor. Based on these discussions (and eventually a business problem) the student starts with writing a research proposal. When writing the research proposal, the student is supported by means of 'best practices' (research proposal, research planning), online tutorial(s) and a format so the student knows what is expected (see CANVAS). The mentor and 2nd supervisor need to approve the research proposal prior to the implementation of the research (and as such the official graduation).

Within 25 weeks (or 36 weeks in case of the special master track MSE) the student submits the final Master Thesis Report for review to the 1st (mentor) and 2nd supervisor. Within 1 week, they give a definitive judgement whether the Master Thesis Report is defensible. The judgement 'defensible' is, however, no guarantee for graduation. When the Master Thesis Report is deemed defensible, the final graduation session can be scheduled. The graduation session (presentation and defense) must be scheduled within the nominal 25 weeks or maximum 4 weeks after the end of the 25 weeks (36 weeks in case of the special master track MSE). During the graduation session the Master Thesis Project is assessed by the MSc Thesis Assessment Committee. This committee consists of the 1st supervisor (mentor), the 2nd supervisor, and the 3rd assessor (see chapter 10 - The MSc Thesis Assessment Committee). The 3rd assessor receives the final Master Thesis Report no later than 2 weeks before the graduation session and gives written input for the final assessment (he/she is not present at the graduation session). For graduation the following products are required:

- The final Master Thesis Report (digital)
- A final assessment form (signed by the Master Thesis Assessment Committee)
- The Master Thesis presentation
- An oral defense
- A research poster for the Diploma Ceremony + photo
- A signed Code of Scientific Conduct (Master Thesis Project)
- The student has completed the 'professional skills' requirements (skills lab)

When the Master Thesis Report is deemed 'indefensible' at the end of the nominal 25 weeks (or 36 weeks in case of the special master track MSE), the student can apply for an extension of 8 weeks at the Exam Committee IE (the maximum duration of the Master Thesis Project then is 33 weeks from the official start date). This application is only taken into consideration when a confirmation of the 1st and 2nd supervisor is added (confirmation of the 3rd assessor is not needed) with: (1) that the Master Thesis Report is 'indefensible', (2) the reason(s) for the delay, and (3) an arguable 'Plan of action' for the remaining time. The student is granted 8 weeks extension provided the Exam Committee IE approves. The 8 weeks extension directly follows the nominal 25 weeks research time (or 36 weeks in case of the special master track MSE).

Within the passage of 33 weeks (25 weeks nominal research time + 8 weeks extension in case of the Master IM and OML) or 44 weeks (36 weeks nominal research time + 8 weeks extension in case of the special master track MSE) again the 1st and 2nd supervisor have to judge whether the Master

Thesis Report is 'defensible'. When the Master Thesis Report is deemed defensible, the final graduation session (presentation and defense) must be planned within the 33 weeks or maximum 4 weeks after the end of the 33 weeks (or 44 weeks in case of the special master track MSE).

When after this extended period the Master Thesis Report again is deemed 'indefensible' (insufficient assignment) or the final presentation was graded 'insufficient', the Master Thesis Project is officially ended (and with that also the supervision of the 1st supervisor, the mentor). The student is assigned to a new mentor at the same research group (initiated by the chair of the relevant research group or the graduation coordinator). Together with the new mentor the student starts writing a new research proposal (for a new Master Thesis Project). Should this Master Thesis Project again lead to an inadequate result, than the student has no longer right on guidance/supervision time from a mentor.

6.2. Research Proposal

The Master Thesis Project starts with writing the thesis proposal (it is part of the 30 ECTS in the master IM and OML, or 45 ECTS in the special master track MSE). The objective of the thesis proposal is to define the research questions, research methodology, project plan, and (if applicable) company deliverables of the thesis project. For an empirical study, it makes sense during the research proposal phase to already conduct some empirical work, especially focusing on the availability of data and the assessment of shared objectives between the researchers (student and mentor) and the company.

The research proposal embraces a research design and approach:

- Definition and discussion of research questions for the thesis project
- In case of company involvement: discussion of field data, field site, other data sources
- Research design for the thesis project (diagnosis and design, methodology; how to deal with the research questions)
- Project plan for the thesis project (time schedule, meetings, deliverables).

The mentor and the second assessor assess the research proposal on the following two main criteria and give a go or no go ('sufficient') for the implementation of the research proposal.

- Quality: does the Master Thesis Project, if executed according to the research proposal, reach a sufficient level of academic quality to allow the student to graduate at TU/e?
- Feasibility: is the execution of the research proposal, starting from the approval of the research proposal, feasible within the remaining weeks of the Master Thesis Project?

6.3. Master Thesis Project Requirements

The Master Thesis Project has the following requirements:

1. The master thesis project can only be started if no more than 10 ects on master courses remain to be completed. However, at any time the mentor and the student need to ensure an acceptable workload.
2. Topic and methodology should be within the domain and capabilities of the mentor.
3. The master thesis project meets academic research standards. This is secured by the fact that the mentor is a member of a research school.

4. The design orientation of the thesis is ensured. This implies that the project should not only result in an analysis, but also in a theoretical or applied design to address the problems identified in the analysis.
5. The size and depth of the project is such that it can be completed with a "pass" grade (≥ 6) by an average successful student within a period of 25 weeks (nominal duration of 21 weeks + 4 holiday weeks = total 25 weeks), with a study load of 840 hours (30 erts).
6. During the main trajectory, the student is working full-time on his/her Master Thesis Project.
7. From the start of the project until the defense of the thesis, a duration of 25 weeks (21 weeks + 4 holiday weeks, which is one semester) is available to the student. The student must defend the thesis *within this period*, where a maximum slack of four weeks is allowed for any problem related to scheduling the actual defense.
8. The motivation, embedding, and conclusions of the thesis proposal should not only take into account the detailed research focus of the thesis, but should cover a wider area of the research school involved. It also should explain how the thesis fits the master program (IM, OML or MSE).
9. The student should spend at least 20% of his/her time on campus and the mentor and student should keep in close contact.

A student which has been allowed to take MSc courses without having been formally admitted to the program is not allowed to start the Master Thesis Project before formally having been admitted to the MSc program.

7. Final Master Thesis Report, formal requirements

The final Master Thesis Report should meet specific formatting requirements (see Appendix 1).

In addition to writing a final Master Thesis Report, the student should also make a scientific poster in PowerPoint at A1 format. A scientific poster contains the main research question, methodology and results, illustrated by the most relevant figures and tables. Furthermore, the poster should be visually attractive by using photos, tables, and graphs. The poster should be made according to the guidelines in the poster manual that can be downloaded from <https://educationguide.tue.nl/programs/graduate-school/> under 'Master Programs' and then 'Graduation, Master Thesis'.

Special attention needs to be paid to possible confidentiality issues. The student needs to write a Master Thesis Report that does not contain any masked parts or masked data. The report is public and will be published in the library. If the organization in which the Master Thesis Project has taken place considers that publication of the research would harm its interests, the student can provide a separate appendix to them, which contains confidential data. However, this appendix is not part of the Master Thesis Report, nor will it be archived at the TU/e.

The Master Thesis Report must be written such that it is suitable for publication, it should not contain any masked parts, and it must be readable without the confidential appendix. In the Master Thesis Report, confidential numbers can be visualized for example by scaling them, or by leaving out axes details from graphs. The first supervisor needs to agree with the way data is presented in the Master Thesis Report, as the numerical data in the Master Thesis Report must be sufficiently clear in order to be able to grade the Master Thesis Project.

Before the final graduation session, the student must send the public Master Thesis Report as a pdf to the first supervisor. The organization at which the Master Thesis Project has taken place, must

already have agreed on publication of this version. Grading of the Master Thesis Project is based on this pdf. To be sure that the graded version of the report is published in the library, after grading, the first supervisor sends this pdf to the Educational Administration Office of IE&IS. The first supervisor should hand in the digital Master Thesis Report and graduation poster at the Education Administration Office at least 5 working days before the final examination meeting of the Exam Committee IE. Furthermore, the student has to send the form 'Graduation project' and the 'Declaration concerning the TU/e Code of Scientific Conduct for Master's/PDEng/PhD Thesis' also 5 working days before the final examination meeting of the Exam Committee IE. These forms can be downloaded from <https://educationguide.tue.nl/programs/graduate-school/> under 'Master Programs' and then 'Graduation'.

8. Responsibilities of the mentor

8.1. Preliminary activities

An intended mentor has to undertake some preliminary activities in preparation for the Master Thesis Projects that will be assigned to him/her.

- During an information event **the tracks and the matching procedure** are introduced.
- The mentor introduction (**themes/topics and methodology that is in the domain and capabilities of the different mentors**) is made by the track coordinators. The mentor supplies the information about his/her interests and research expertise.
- The mentor may have **contacts with companies** to advise potential graduates in choosing a project place. The student can also initiate a company search. However, the mentor has the final say whether the project qualifies as a potential Master Thesis Project under his/her supervision.
- The mentor thus needs to **sign off the Start Master Thesis Project Form** (see Form 3: Start Master Thesis Project).

8.2. Mentor-student relation

In general, the mentor serves as a researcher role-model for students. He or she accompanies the student in selecting a research question and a project place (if applicable). 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 in the Graduate School. These attitudes should include passion for the discipline, thirst for new knowledge, pride in the work product, respect for others, adherence to high ethical standards, and an ability to cope with change.

In the last phase of the graduation process the mentor acts as the **first Master Thesis supervisor**. The Master Thesis supervisor is the person who supervises the student's research. It is the first supervisor's responsibility that a Master Thesis Project meets all the necessary conditions, and therefore, the first supervisor has the final say on the conduct of the research project:

- The quality of the Master Thesis Project meets academic research standards.
- The project meets the standards of the department concerning its size and depth and continues to do so throughout the duration of the project.
- The maximum throughput time of the project (21 weeks + 4 holiday weeks = total 25 weeks) is not exceeded.
- The first supervisor ensures the composition of the MSc Thesis Assessment Committee and the timely appointment of the 2nd supervisor and 3rd assessor.

- The first supervisor assesses the Master Thesis Project and the reports related to it.
- The first supervisor ensures that the graduate takes responsibility for his work and agreements.
- The first supervisor, together with the student, ensures the workload during the Master Thesis process.
- The first supervisor is responsible for guidance and supervision, including formulating the project assignment and holding progress meetings. The first supervisor ensures that the student maintains progress in the project, and conducts all reasonable efforts necessary for the student to complete the project on time.

In case of a thesis project within an organization arranged by the first supervisor, the first supervisor spends effort to ensure that:

- Sufficient involvement of the organization in which the project is being carried out; 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.
- Sufficient opportunity within the company for the successful completion of the graduation project (reorganizations for example can lead to unworkable situations).

If the mentor is unable to fulfill his/her task within a specific project, the program director is responsible to resolve this.

9. Responsibilities of the student

The student can initiate a Master Thesis Project or start a master thesis project handed by the first supervisor. The first supervisor always decides whether the formulated Master Thesis Project is of sufficient quality and is suitable for attaining the learning objectives. It should remain clear at all times that the research process is the responsibility of the student. In other words, the student always maintains final responsibility for the delivered quality of the proposal, the project, and the Master Thesis Report.

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, including the timely submission of all relevant forms.

The student must design and control the planning of the project and also draw up agendas and write up reports on discussions, meetings, and agreements. Together with the first supervisor, the student ensures the workload during the Master Thesis process.

10. The MSc Thesis Assessment Committee

The mentor (1st thesis supervisor) of the graduate student takes the initiative to form the MSc Thesis Assessment Committee (3 weeks before signing and submitting form 4 'End Master Thesis Project'). The MSc Thesis Assessment Committee consists of three adherents (the mentor, the 2nd supervisor and the assessor). The members of the committee are selected conform the criteria with regard to the authorizations to evaluate examinations, as determined by the Exam Committee.

The composition of the MSc Thesis Assessment Committee is as follows:

- The first member of the MSc Thesis Assessment Committee is the supervising mentor who is qualified by the IE Exam Committee and acts as the first assessor;

- The second member of the MSc Thesis Assessment Committee is a second supervisor who can be from any research chair;
- The second supervisor can be a PhD candidate, under the condition that he/she has sufficient seniority by having successfully followed the TEACH course 'supervising MSc students', and is coached by a qualified faculty member other than the first mentor. In case the second supervisor is a PhD student, the assessment form can only be signed by the qualified faculty member. He/she has to be present at the final presentation;
- The third member of the MSc Thesis Assessment Committee acts as an assessor. Every person who can act as an 1st or 2nd supervisor autonomously can also act as a 3rd assessor. The assessor represents here a more disciplinary focus than the first and second supervisor and is qualified to judge the engineering aspects of the thesis.
- Each member of the assessment committee determines a grade for the written thesis based on the criteria of the assessment form. The 3rd assessor determines what grade he/she would give for the Master Thesis Report and communicates this timely to the 1st supervisor (written). If necessary, the members of the assessment committee discuss their grading of the master thesis report. The 3rd assessor doesn't have to be present at the final presentation.

11. Examination of the Master Thesis Project

After completion of the Master Thesis Report, the student submits the report to the 1st and 2nd supervisor for the judgement 'defensible'. If so, the date is set for the final graduation session (presentation and oral defense). There should be at least ten working days between the formal approval of the report by both supervisors and the graduation session. The 3rd assessor receives the final Master Thesis Report at least 2 weeks before the graduation session.

The Education Administration Office (and as a result also the Exam Committee IE) is informed immediately after the date and time has been set by the End Master Thesis Project Form (see Form 4: End Master Thesis Project) and by registration through OSIRIS, at least one month before the examination meeting of the Exam Committee IE (for dates of the examination meetings, see <https://educationguide.tue.nl/programs/graduate-school/masters-programs> under the topic 'Graduation'). The final graduation session must take place at least 5 working days before a meeting of the Exam Committee IE.

11.1. The graduation session

The graduation session consists of:

1. An oral presentation by the student (public), with a maximum of 45 minutes, of the methodology and main results of the project.
2. An oral defense with feedback to the student (not public), in which the student is questioned on the project and thesis. The assessors may invite other people to take part in the oral defense.

The **oral presentation** is public. However, it is an examination and as such the result is not known in advance. The graduate must be warned in advance that it is not a foregone conclusion that he/she will pass the examination.

The **oral defense**, e.g. the questioning of the graduate (not public) is a real examination after the oral presentation, in which the assessment committee tests the graduate. The 1st and 2nd supervisor bring their filled in assessment form with them (and the filled in assessment form of the 3rd assessor) and together they fill in and sign the final assessment form. The result and the explanation thereof are discussed with the graduate and the 1st and 2nd supervisor in a closed session.

At the end of the examination/defense session of the master thesis the mentor delivers a student' speech (it is handy for the mentor to take notes during the project about the way things are going and how the graduate performed).

11.2. The assessment of the work

The first supervisor must determine what the MSc Thesis Assessment 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 graduate.

The MSc Thesis Assessment Committee will grade the student according to the evaluation criteria defined in Appendix 2 (see Form 5: Final Assessment): evaluation criteria for the report and evaluation criteria for the process and other skills. On each of the nine criteria, the MSc Thesis Assessment Committee will mark either "insufficient – sufficient – good – excellent". The 3rd assessor only marks the criteria for the report. The grade for the report is given in half grades (1-10). Grades $\geq 5,5$ require at least 'sufficient' for evaluation criteria 1, 2 and 3. The grade for the process and other skills is also given in half grades (1-10). The final grade (1-10 in half grades) is determined by $0,7 \times$ the grade for the thesis (70%) and $0,3 \times$ the grade for the process and other skills (30%). The candidate passes if the grade is 6 or higher. The final grade is awarded as follows:

- Excellent (9 or 10 = top 10%): thesis shows deep understanding of the topic, a substantial degree of creative engagement with the issues; faultless exposition is clearly structured around a central thesis, and has clear signs of independent thought, student clearly develops new insights and contributes to theory explicitly. Grade 9: excellent, grade 10: above all expectations;
- Good pass (8, well above what can be expected): 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. Grade 6: just sufficient. Grade 7: adequate (according what can be expected);
- Insufficient (< 6): fails to make low pass grade because of insufficiency in one or more of the criteria.

Before the graduation session, each member of the MSc Thesis Assessment Committee determines a grade for the Master Thesis Report (using the first part of the assessment form, form 5). After the oral defense, the MSc Thesis Assessment Committee (the 1st and 2nd supervisor with written input of the 3rd assessor) provides a final grade for the Master Thesis Project. The chair of the MSc Thesis Assessment Committee (1st supervisor) fills in the final assessment form with the jointly determined grade and hands this form in the Educational Administration Office.

If the student does not pass, the MSc Thesis Assessment Committee may decide to:

- Either give the student the opportunity to improve the Master Thesis Work (when the student had no extension before). Then the student can apply for an extension of 8 weeks. This application is only taken into consideration when the insufficient assignment of the MSc Thesis Assessment Committee (1) and an arguable 'Plan of Action' for the remaining time (2), is added. The student is granted 8 weeks extension provided the Exam Committee IE agrees. The 8 weeks extension directly follows the graduation session date. Within these 8 weeks a second graduation session must be scheduled.
- The Master Thesis Project is officially ended (if the student had already extension before) and with that also the supervision of the 1st supervisor, the mentor. The student is assigned a new mentor at the same research group (initiated by the chair of the relevant research group or the graduation coordinator). Together with the new mentor the student starts writing a new research proposal (for a new Master Thesis Project). Should this Master Thesis Project again lead to an inadequate result (second time), than the student has no longer right on guidance/supervision time from a mentor.

The Exam Committee IE regularly checks the assessments of the Master Thesis Projects through random selection.

11.3. Diploma Ceremony

Two or three weeks before the next diploma ceremony the student receives an invitation at his or her postal address for this ceremony.

Appendix 1: Master Thesis: Formal requirements report

The final Master Thesis Report must meet the following requirements:

- Master Thesis Project of 30 ECTS (Master OML and Master IM): 50 pages (max. 75 pages),
Master Thesis Project of 45 ECTS (Master MSE, Double Degree): 75 pages (max. 100 pages)
(main text, excluding attachments)
- The Master Thesis Report is written in English.
- Special attention needs to be paid to possible confidentiality of the data. The student needs to write a Master Thesis Report that does not contain any masked parts or masked data. The report is public and will be published in the library. If the organization in which the graduation project has taken place considers that publication of the research would harm its interests, the student can provide a separate appendix to them, which contains confidential data. However, this appendix is not part of the Master Thesis Report, nor will it be archived at the TU/e.

The Master Thesis Report must be such that it is suitable for publication, it should not contain any masked parts, and it must be readable without the confidential appendix. In the Master Thesis Report, confidential numbers can be visualized for example by scaling them, or by leaving out axes details from graphs. The first supervisor needs to agree with the way data is presented in the Master Thesis Report, as the numerical data in the Master Thesis Report must be sufficiently clear in order to be able grade the Master Thesis Project.

Before the final graduation session, the student must send the public Master Thesis Report as a pdf to the first supervisor. The organization at which the Master Thesis Project has taken place, must already have agreed on publication of this version. Grading of the Master Thesis Project is based on this pdf. To be sure that the graded version of the report is published in the library, after grading, the first supervisor sends this pdf to the educational administration of IE&IS.

- A self-contained summary of approximately three pages must be included.
- The Master Thesis Report is self-contained (i.e. includes essentials of preliminary work such as the research proposal and, if applicable, literature study)
- The title page must include a title, the author's name, names of the supervisors and the publishing date. On the backside the thesis series and keywords must be placed.
- The final Master Thesis Report should be ready conform the agreement to the first supervisor (hardcopy/digital). The electronic version of the final Master Thesis Report must be delivered by the first supervisor to the Educational Administration Office of IE&IS, at least five working days before the *Exam Committee IE's* final examination meeting for which the student has put his/her name forward.
- 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: 11 or 12 pt
- Figures, tables and other exhibits must be numbered. Numbering can be per chapter or consecutive throughout the report. In the first 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.
- A header OR footer is allowed, but only for chapter/section/page-information. Company logos are not allowed.

- An electronic version of the report must also be handed in. This should be in pdf-format.

Literature references

All references in the text and literature list should be in the APA Referencing Style.

Writing about Your Research: Verb Tense

CONSISTENCY OF VERB TENSE helps ensure smooth expression in your writing. The practice of the discipline for which you write typically determines which verb tenses to use in various parts of a scientific document. In general, however, the following guidelines may help you know when to use past and present tense. If you have questions about tense or other writing concerns specific to your discipline, check with your adviser.

USE PAST TENSE. . .

To describe your methodology and report your results.

At the time you are writing your report, thesis, dissertation or article, you have already completed your study, so you should use past tense in your methodology section to record what you did, and in your results section to report what you found.

We hypothesized that adults would remember more items than children.

We extracted tannins from the leaves by bringing them to a boil in 50% methanol.

In experiment 2, response varied.

When referring to the work of previous researchers.

When citing previous research in your article, use past tense. Whatever a previous researcher said, did or wrote happened at some specific, definite time in the past and is not still being done. Results that were relevant only in the past or to a particular study and have not yet been generally accepted as fact also should be expressed in past tense:

Smith (2008) reported that adult respondents in his study remembered 30 percent more than children. (Smith's study was completed in the past and his finding was specific to that particular study.)

Previous research showed that children confuse the source of their memories more often than adults (Lindsey et al., 1991). (The research was conducted in the past, but the finding is now a widely accepted fact.)

To describe a fact, law or finding that is no longer considered valid and relevant.

Nineteenth-century physicians held that women got migraines because they were "the weaker sex," but current research shows that the causes of migraine are unrelated to gender. (Note the shift here from past tense [discredited belief] to present [current belief].)

USE PRESENT TENSE. . .

To express findings that continue to be true.

Use present tense to express general truths or facts or conclusions supported by research results that are unlikely to change - in other words, something that is believed to be always true:

Genetic information is encoded in the sequence of nucleotides on DNA.

Galileo asserted that the earth revolves the sun. (The asserting took place in the past, but the earth is still revolving around the sun. Note also that no source citation is needed here since it is a widely known and well-accepted fact that Galileo made this assertion.)

Sexual dimorphism in body size is common among butterflies (Singer1982). (Note how this statement differs from one in which you refer to the researcher's work in the sentence: "*Singer (1982) stated that sexual dimorphism in body size is common among butterflies.*" Here you use past tense to indicate what Singer reported, but present tense to indicate a research result that is unlikely to change.)

We chose Vietnam for this study because it has a long coastline. (Use past tense to indicate what you did [chose Vietnam], but present tense to indicate you assume that the length of Vietnam's coastline is unlikely to change.)

We used cornmeal to feed the fingerlings because it provides high nutritional content at a relatively low cost. (Past tense reflects what you did [used cornmeal], but present tense indicates that neither the nutritional content nor the cost of corn meal is likely to change.)

To refer to the article, thesis or dissertation itself.

Use the present tense in reference to the thesis or dissertation itself and what it contains, shows, etc. For example:

Table 3 shows that the main cause of weight increase was nutritional value of the feed. (Table 3 will always show this; it is now a fact that is unlikely to change, and will be true whenever anyone reads this sentence, so use present tense.)

To discuss your findings and present your conclusions. Also use present tense to discuss your results and their implications.

Weight increased as the nutritional value of feed increased. These results suggest that feeds higher in nutritional value contribute to greater weight gain in livestock. (Use past tense to indicate what you found [weight increased], but use present tense to suggest what the result implies.)

Sources: *Publication Manual of the American Psychological Association, 5th Ed. The Comprehensive Guide to Writing in the Health Sciences, University of Toronto.*