

COURSE GUIDE

MSc Thesis Environmental Technology MSc Thesis Urban Environmental Technology and Management

including Thesis Guideline for students and supervisors





Sub-department of Environmental Technology
Environmental Technology
2014



Cover of Brochure Environmental Technology. This brochure gives an overview of on-going projects to which MSc thesis subjects are related.

MSc Thesis Environmental Technology (ETE-80418, ETE-80421, ETE-80424, ETE-80427, ETE-80430, ETE-80433, ETE-80436, ETE-80439)

Language of instruction:	Dutch or English
Study load / Credit points:	respectively 18, 21, 24, 27, 30, 33, 36 or 39 Credits
Components:	Desk work Lab/model work Meetings Colloquia
Period/time:	1,2,3,4,5,6
Contact person:	dr ir DPBTB Strik (tel. 0317-483447; david.strik@wur.nl)
Examiners:	prof. dr ir CJN Buisman, prof. dr ir HHM Rijnaarts, prof. dr ir AJH Janssen, prof. dr ir G Zeeman, prof. dr ir B van der Wal
Examination:	Based on a report and oral presentation: Research competence (40%) Thesis report (40%) Colloquium (15%) Examination (5%) The marks of the Thesis Reporting on: Relevance research, clearness goals, delineation research; Theoretical underpinning, use of literature; Use of methods and data; Critical reflection on the research performed (discussion); must be at least 5.5.
Mandatory knowledge:	6 credits ETE including ETE-30306, ETE-30806 or ETE-32306. Or FPE-31306

**MSc Thesis Urban Environmental Technology and Management
(ETE-81824, ETE-81827, ETE-81830, ETE81833, ETE81836, ETE81839)**

Language of instruction:	Dutch or English
Study load / Credit points:	respectively 24, 27, 30, 33, 36 or 39 Credits
Components:	Deskwork Design/model work Meetings Colloquia
Period/time:	1,2,3,4,5,6
Contact person:	dr ir DPBTB Strik (tel. 0317-483447; david.strik@wur.nl)
Examiners:	prof. dr ir CJN Buisman, prof. dr ir HHM Rijnaarts, prof. dr ir AJH Janssen, prof. dr ir G Zeeman, prof. dr ir B van der Wal
Examination:	Based on a report and oral presentation: Research competence (40%) Thesis report (40%) Colloquium (15%) Examination (5%) The marks of the Thesis Reporting on: Relevance research, clearness goals, delineation research; Theoretical underpinning, use of literature; Use of methods and data; Critical reflection on the research performed (discussion); must be at least 5.5.
Mandatory knowledge for ETE-81824, ETE-81827, ETE-81830, ETE81833:	ETE22806 and ETE-34306
Mandatory knowledge for ETE81836, ETE81839 :	ETE22806 and ETE-34306 or ETE-33806

Profile of the course:

The student completes a dissertation advancing an original point of view as a result of research in the field of the Sub-department of Environmental Technology. A research proposal is written and performed research is evaluated and reported in a written report and colloquium. Details on the profile of the course are given in the ETE Thesis Guideline for students and supervisors (appendix 1).

Learning outcomes:

After the course the student is able:

- to prepare a research proposal.
- to use research competences to do research within the field of the Sub-department of Environmental Technology.
- to report results and to give an oral presentation including a critical reflection, conclusion and recommendation based on an environmental problem and performed research.
- to demonstrate the qualities expected of a Master of Science graduate

Activities:

Study theory, preparing research proposal, developing research competences, doing lab and/or desk work, data handling and analysis, reflecting, clarifying conclusions and recommendations, reporting and presenting

Study material:

Thesis Guideline for students and supervisors (appendix 1)
Sub-department of Environmental technology office and lab (safety) procedures (available at the secretary of Sub-department of Environmental Technology)

Course scheduling:

A thesis can be done during the whole academic year. Agreements on planning and topic must be made timely with supervisor(s). Important steps to be followed are part of the ETE Thesis Guideline for students and supervisors (appendix 1).

General regulations:

The Wageningen University Education and Examination Rules (EER) apply.

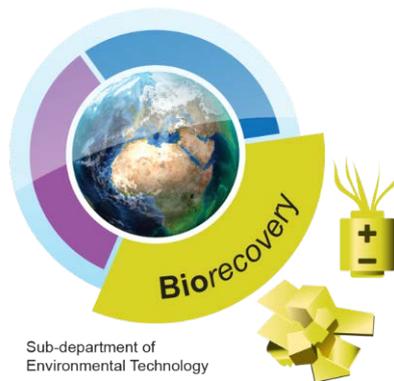
Appendice

Appendix A

ETE Thesis Guideline for students and supervisors

Appendix A

ETE Thesis Guideline for students and supervisors



Wageningen, March 2014

Version: 3-2014

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1 Introduction & outline

The objective of this document is to provide a guideline and advice on the process of carrying out an MSc thesis within the Sub-department of Environmental Technology (ETE). It contains information and advice on how to prepare an MSc thesis and also explains the evaluation criteria of the MSc theses. With this the authors expect to improve the quality of the students thesis and the research and education at the Sub-department of Environmental Technology.

In the next section the key characteristics of an MSc project are explained. Then the steps of carrying out an MSc thesis is explained in detail. In the **Watch out** sections advice and tips for MSc students and their supervisors can be found. The final section specifies the evaluation criteria of MSc theses. Supplemental information is provided in the appendices and via the secretary of Environmental Technology.

2 General guidelines

The thesis project is a key element of the Master of Science program at Wageningen University. Through the MSc thesis you earn the degree of a Master of Science. This degree is achieved by demonstrating that you have the professional qualities expected of a Master of Science graduate. The thesis project is the largest element in the Wageningen MSc curriculum, accounting up to 33 % of the overall MSc mark (18-39 ECTS) with duration up to 1,092 h, or 26 working weeks. Most students to a thesis of 6 months.

In the thesis project you demonstrate and learn competences'. Research competence and reporting skills including time management, team work, problem solving and verbal and written communication. Also, the MSc thesis is used to assess your domain-related competencies (i.e. expertise in a specific scientific area). The thesis project comprises an original and substantive science project that you formulate, plan, execute and evaluate independently.

Your thesis should be an original contribution to the existing stock of knowledge. We use the term originality in the sense of scientific originality. That is your thesis should be original from a scientist's perspective, not from that of a policy maker or manager. Your thesis should help to fill knowledge gaps and answers so far unanswered scientific questions. This can be achieved in the following ways (non-exhaustive list):

- Apply existing analytical frameworks in new contexts (i.e. cases)
- Developing new analytical frameworks (theories)

- Developing new environmental technologies
- Developing and evaluate new concepts of environmental technologies
- Investigating principles of emerging environmental technologies
- Improving existing methodologies or models
- Developing new methodologies or models
- Identifying new research problems

The originality and independency criteria also imply that theft of intellectual property (plagiarism) will not be accepted.

Quote of Library website "Avoiding plagiarism"

"An essential legal reason to acknowledge your sources is to avoid plagiarism. Plagiarism is a serious academic offence. It means that you present others' work as your own without clearly acknowledging the source of information. Any ideas or data which are not your own must be cited, including statistics, tables, figures, pictures, illustrations etc. For electronic sources on the World Wide Web (Internet) the same rules apply as to printed sources.

So be careful, if you fail to properly cite a source (even if unintentionally), it is considered plagiarism. Information of a general nature which is considered common knowledge, need not to be cited, e.g. it is common knowledge that nobody is in charge of the World Wide Web and anybody can publish on the World Wide Web. If you are in doubt whether it is considered common knowledge, it is better to cite a source than not.

Read the Wageningen University regulations on plagiarism in the Student Charter 2012-2013: Education and Examination Regulations for the Bachelor's study programmes or Master's study programmes (Art. 32 Use of plagiarism scanners and Art. 33 Fraud and misconduct: prohibitions)."

Quote of website:

"http://library.wur.nl/infoboard/7_citing/avoiding.html"

At Wageningen University we apply the "The Wageningen Code of Conduct for Scientific Practice - Principles of good scientific teaching and research " (http://www.wageningenur.nl/upload/fa339d13-1b7c-4d7e-b00e-d41d7f3a7d82_wageningen-code-of-conduct-scientific-practice.pdf)

Students must inform themselves on these standards for academic writing and literacy. Our academic training programs are designed to teach and inspire students to produce new intelligent and creative ideas, theories and results that can be compared and reflected to existing information in literature. Literally copying from internet or article texts into own documents and reports as "the best written English text you may think to provide" is not fitting in this approach. In fact, this is plagiarism and a

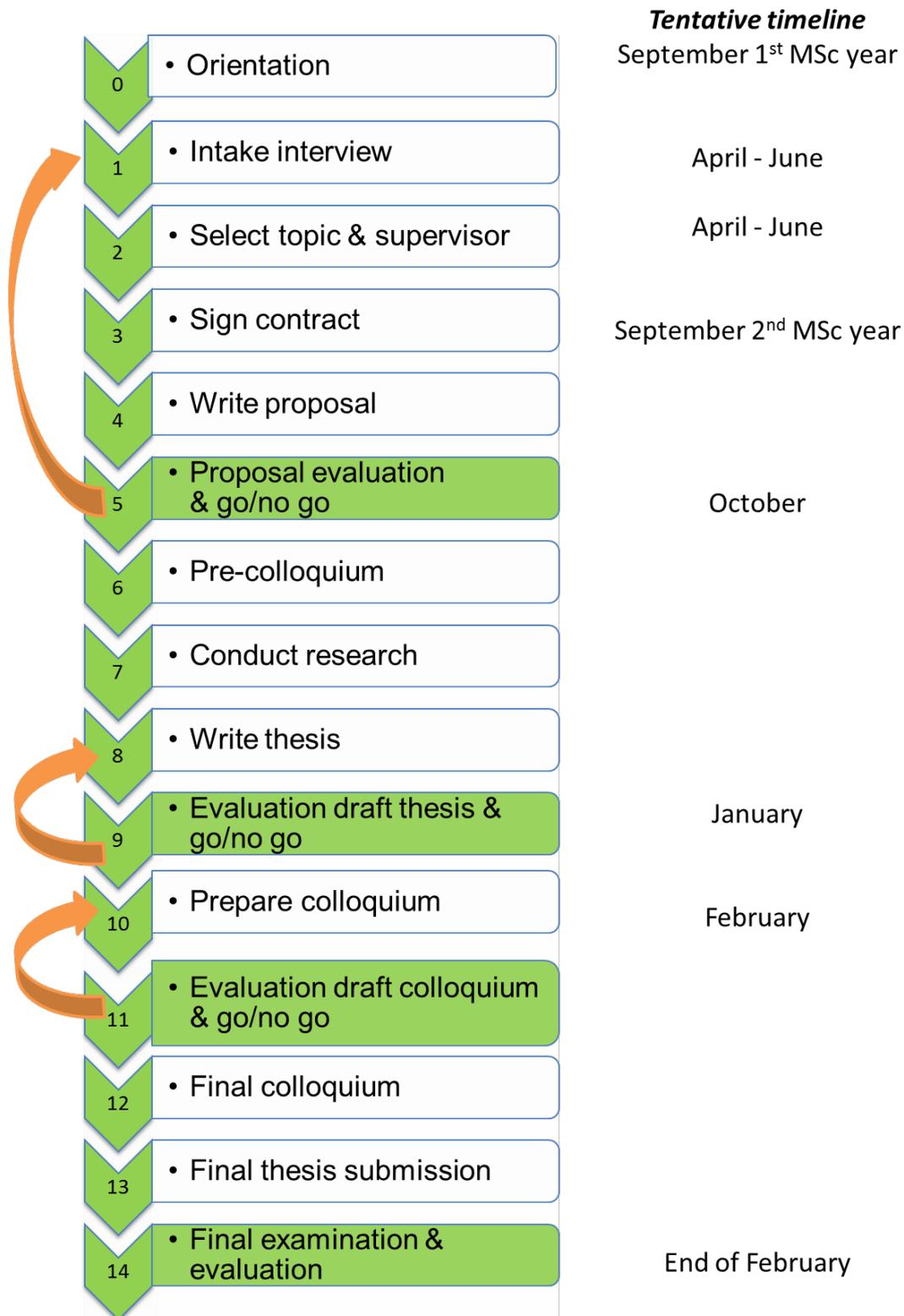
severe offence and illegal act in academic literacy and writing. Original writing produced by the students themselves, and adequate referencing, is the only way that will be accepted within WU. In case plagiarism is observed, measures will be taken.

!Watch out:

A thesis takes time. A 36 Credits thesis takes six months and should not take longer. Some cases students spend more time (e.g. seven to nine months on their thesis project), e.g. due to planning difficulties. Particularly when your thesis project requires collecting information in the field (i.e., when you want to do a field or 'natural' experiment), allow for sufficient time in your planning, and make your plan flexible so you can cope with delays and setbacks. Evenly, when you do bioreactor experiments and you would like to do receive more results, there is a risk that you will not finish your thesis within 6 months. So, prepare for your thesis project carefully. Make sure there are not delays needed so you can continue with your study program. You cannot finish a thesis and start with an internship at the same time.

3 The step plan to fulfil a thesis

Conducting an MSc thesis at the Sub-department of ETE in the programmes MUE, MES, MBT, etc., follows the steps described below.



0. Orientation

In September and April ETE organises a Thesis information evening and drink. Here the thesis coordinator hands out this course guide and introduces the Sub-department of ETE. Professors, PhD students and Postdocs will present their research and interests during a poster session. These moments are interesting as you can directly notice the atmosphere at our department. Regularly, also short lab-tours are organised to show actual experimental work. The ETE-brochure will be available including the research topics per Research Group and per PhD-project at our department.

The MSc research is in most cases directly related to an on-going PhD-project. An early orientation can give you guidance in selecting the direction of regular courses and final selection of your topic and supervisor. Also your Study advisor can inform you on the role of the thesis in the MSc program.

1. Intake interview

The student must contact the thesis coordinator to make an appointment for an intake interview. In case you follow the regular study program, the student will have an intake interview in the period of April to June. In case you do not follow the regular program make sure that the interview takes place about 4 to 6 months before the intended start date.

During the interview the thesis coordinator will complete an intake form, check on the mandatory knowledge, and together with the student analyse and evaluate the ambitions of the student and the thesis directions at ETE.

Next, appointments will be made on how to find the students' thesis supervisor and topic. Generally the thesis coordinator will direct you to 1 or more professors to talk on specific thesis subjects.

!Watch out:

Go for an intake interview in an early stage of your first study year of the MSc programme, this will give you a head start into your thesis project. Starting this interview too late will result in delays in your study, and you will not be able to complete the study in the nominal period, namely two study years.

2. Select topic and supervisor

Once you have obtained contact details of potential supervisors it is your responsibility to arrange appointments and discuss what projects they have to offer. You will then need to select a topic and make appointments on the start date.

!Watch out:

The supervisor is a staff member of the Sub-department of Environmental Technology with expertise in the topic or methods you selected for your MSc thesis project. This person will act as your coach and guide you through the project. He or she will help you frame your project, make suggestions for improvement, and offer advice when problems arise. Another person relevant for you is the examiner. The examiner is a full professor at the Sub-department of Environmental Technology. The examiner validates the quality of the work delivered by the Sub-department of Environment Technology of Wageningen University. (S)he acts as second internal reader of your thesis, attends your final presentation and will grade your thesis and oral presentation.

3. Sign contract

Before you start with your thesis proposal you will complete the thesis contract with your supervisor(s). The contract is between you and the supervisor(s) and includes appointments regarding planning, work facilities and special arrangements. The 'empty' contract will be provided by your supervisor. After completing the accepted thesis proposal the examiner will sign the contract and the thesis will start officially from the date the student started to prepare the accepted thesis proposal.

4. Write proposal

The students starts the thesis period by writing the thesis proposal. The thesis proposal is a document that provides arguments for researching a specific, topic or problem. A central part of the thesis proposal is the development of research questions and a method to respond to these questions. Your thesis proposal can be structured as follows:

1. **Introduction:** environmental problem statement, literature review (state-of-art), research aim: technological challenge or system to be developed, research question(s), hypothesis, objective(s)
2. **Methodology:** experimental set-up, procedure/approach and analysis
3. **Project time-plan:** detailed time plan of all activities until completion of the thesis in the form of a Gantt chart

5. Evaluation proposal & go/no go

After you and your supervisor are both satisfied with the thesis project proposal, this proposal becomes the formal basis for your thesis project. In case the proposal is not sufficient (mark minimal 6.0) after several drafts (maximum 5 times within a period of maximum 6 weeks) in 'Relevance research, clearness goals, delineation research', 'Theoretical

underpinning, use of literature' & 'Use of methods' the proposal will be rejected. In appendix 1 of these guidelines you can find the Rubric for assessment of MSc-thesis. In case the proposal is rejected, a meeting will be organised with an examiner, the thesis coordinator, supervisor(s) and student to reveal whether a rewriting or reselection of topic and supervisor is needed. In any case of proposal rejection; the student will have a delay in finishing the thesis. After completion of the accepted proposal, the thesis contract and the final version of the thesis proposal will be sent to your examiner. When your proposal and contract is approved and signed by the examiner, your thesis period officially starts, counting in general 1 month.

!Watch out:

Writing a thesis proposal is a not a trivial task. In nearly all cases this is an iterative process of 3 or more draft proposals (expect 3 to 4 weeks of work for this). Developing good research question has been a challenges for past MSc students. Therefore, we provide some guidelines on well formulated research questions below. These research questions combined with your research aim should be the focus of your work when you start to write a proposal. Furthermore, we advise students to develop these questions in close cooperation with their supervisor, who may have their case specific approach to guide you through this process.

A research aim is:

1. one broad statement of desired outcomes, or the general intentions of the research, which 'paint the picture' of your research proposal
2. emphasize what is to be accomplished, not how it is to be accomplished
3. address the long-term project outcomes, i.e. they should reflect the aspirations and expectations of the research topic

Research questions should guide you on the way to achieving this broad aim and prompt you to conduct the correct analyses, not deviating from achieving the overall aim of your research.

When formulating research aims and questions you should ask yourself the following questions:

1. What areas (related to my topic of interest) need further exploration?
2. What are the important research questions in my field that are/have not yet been? answered?

3. Can I answer the research question within the scope of an MSc project?
4. What type of data do I need to answer the research question?
5. Where can I find the data that I need to answer the research question (e.g. journals, books, internet resources, governments, people, laboratory experiments, companies)?
6. Can I access these data?
7. Do I have no more than 4 research questions?

!Watch out:

Remember that you cannot begin your MSc research until your thesis contract has been signed. This means that, in case your project involves overseas fieldwork, you cannot leave Wageningen before signing the contract with your supervisor.

6. Pre-colloquium

In the pre-colloquium you present your research proposal to an audience of the specific research group of your supervisor. In consultation with your supervisor you may choose to do this before finalising your research proposal, thereby getting valuable advice on your project. The duration of this colloquium is 15 minutes in total with 10 minutes presentation and 5 minutes discussion. In this colloquium you should present the rationale for your research, the environmental problem, aim of the research, key-research question(s), methodology (e.g. literature study, experimental set-up, materials and methods) and next step.

!Watch out:

Guidelines for colloquia are provided in section **Error! Reference source not found..** Do use the template provided by ETE and do not use Prezi. The latter especially because Prezi presentations are public and students often work on projects with certain confidentiality.

7. Conduct research

You can now start executing your thesis project. Remember to keep your supervisor well informed about the progress of your research. It is your responsibility to schedule regular meetings with your supervisor. Often you will have a PhD student or Postdoc as day2day supervisor and a professor as 1 to 2 twoweekly supervisor. Often your thesis will deal with several experiments that are related to each other. As soon as the results of the first experiment are present you should discuss this with your supervisor, as from this decisions can be made upon the start of the next experiment, either the research plan has to be adapted.

!Watch out:

Experience shows that students forget to contact their supervisors regularly when doing fieldwork abroad. Students have returned from overseas without having collected vital data. Hence, keep your supervisor informed of where you are and what you are doing and make this part of your research proposal. As a rule of thumb, inform your supervisor of your progress (every) second week as a minimum, but this can be more frequent when needed.

Do not forget to make regular back-ups of the digital information you produce in the course of your thesis project, preferably on a weekly basis on your M drive. We have had several students in the past that lost (parts of) their thesis work. Store the back-ups in different physical location (tip: do not carry back-ups around in the case of your laptop computer). Do not store or back-up your data on dropbox or google.docs since these storage locations are not provided by Wageningen University.

!Watch out:

When doing lab work as part of your thesis, be aware that your planning should take into account delays and setbacks. Before you start your lab work, make sure you have attended all the obliged safety tours and lectures. Take into account control or blank measurements into your experimental plan, preferably discuss your experimental plan with your supervisor before you start in the lab. Do not save the data analysis until the end of your thesis, but start as soon as possible so you can make adjustments when required. When you keep on having the same setback, discuss this with your supervisor instead of spending weeks without having any improvement.

8. Write thesis

At this stage of the project you bring theories and data together to arrive at final conclusions. This process is iterative and it is likely that you will run through 2 or more drafts before you have structured the material in a manner that communicates the research well. A general guideline is that the structure of the thesis should be logical and clear. An MSc thesis consists generally the following parts:

- Title page (incl. title of the thesis, your name, and reg. number department, date, names of supervisors, examiners)
- Abstract
- Table of content
- Acknowledgement
- Introduction
- Theoretical background
- Methodology

- Results
- Discussion
- Conclusion
- Recommendation
- Reference list
- Appendices
- List of abbreviations, glossary

!Watch out:

Your thesis is evaluated based on the criteria set out in appendix 1 of these guidelines (Rubric for assessment of MSc-thesis).

We recommend to start drafting your thesis report before you have finished all experiments or data collection; for instance by using the overall structure of the thesis given above and allocating specific aspect of your work in each of them. In the results section tables and figures are represented from which the hypothesis could be underpinned either rejected. In the discussion session the interpretation of the results are described. Minimal on the level within the report, but preferably what is the meaning of the obtained results when they are compared with international literature. See again appendix 1 on details.

9. Evaluation draft thesis & go/no go

After several discussions on the draft thesis a final draft will be delivered to the supervisors for evaluation. In case the draft is sufficient, the student can continue with the following steps: prepare colloquium and Final thesis submission.

In case the draft is not sufficient (mark minimal 6.0) in 'Relevance research, clearness goals, delineation research' & 'Theoretical underpinning, use of literature', 'Critical reflection on the research performed (discussion)'; the student cannot continue in preparing the colloquium. Instead the student must rewrite the thesis until the minimal mark is reached. In appendix 1 of these guidelines you can find the Rubric for assessment of MSc-thesis.

10. Prepare colloquium

In the final colloquium (oral presentation) you present your research results to a scientific audience with diverse background. The final colloquium is the final assessment of your MSc thesis. Your supervisor(s) and examiners will be present at this occasion.

A final colloquium should be arranged at least one month in advance by contacting the co-ordinators of the final colloquia. Colloquia for MSc students take place Tuesday afternoons. The duration of the colloquium is 30 minutes, comprising 20 minutes presentation and 10 minutes discussion.

The guidelines for the presentation are:

Structure of the presentation.

The structure should be: introduction (title; summary of the conclusion (= the message), results/discussion (skip the materials and methods as separate part of the presentation and inform the audience only if it is necessary to explain results), conclusion (and recommendations).

PowerPoint slides:

- No slide with contents of the presentation
- Each line should contain not more than six words
- Each slide not more than five lines
- A table should contain no more than 12 numbers
- A graph should contain no more than 3 lines
- Use the "sub-department" PowerPoint layout
- Do not use more than 10 slides

Contact with the audience

Don't look at the slides; look to the audience

General

- Presentation should be not more than 20 minutes. Check the time needed beforehand.
- Don't present all your results. Present only results that supports your message
- Don't frustrate your audience with your frustrations (leaking pumps; bad experiments etc)

11. Evaluation draft colloquium & go/no go

Your presentation (colloquium) must meet the guidelines as pointed-out under colloquium preparation. The presentation slides must be approved by the supervisor before the student can do the colloquium. After approval the supervisor will send a form or email the colloquium organisation and/or the student an email with the approval. Only after the supervisors has handed in the form or email to one of the colloquium coordinators, the student can give the final presentation.

!Watch out:

As an MSc student, you are expected to attend the colloquia and PhD presentations. This gives you an overview of the research projects that are going on at the department of Environmental Technology, and of how you want to set up your own presentation. You will have to attend at least 75% of all presentation you are working on your thesis, before you are allowed to give your own final presentation. Therefore we will bring an attendance list to the presentations. Colloquia are announced within the department by email.

12. Final colloquium

After approval of the draft colloquium the student can give the presentation to the scientific staff and students of ETE.

13. Final thesis submission

Based on the supervisors comments on the final draft, the student will finalise the thesis. You can only submit your thesis report after you supervisor has approved it and after you have done the final examination and evaluation.

Your final thesis must be submitted to the secretary (Liesbeth.Kesaulya@wur.nl) and supervisors in pdf format. A hard copy for your supervisors is desired too. Also you have to hand over all data and online documents applicable to your thesis. The student and the supervisor can make arrangements on this.

14. Final examination & evaluation

After the presentation and discussion with the scientific audience your supervisor and examiner will discuss your overall grade. Your supervisors will complete the evaluation form (appendix 3) in private. The mark for the thesis project result is a weighted average of four marks for the following aspects of your work: the professional skills you have displayed in the course of the project, the quality of your thesis report, and your performance in the final colloquium (oral presentation and examination). The supervisor(s) will apply the rubric (appendix 1). When they agreed on a grade they will invite you to join them telling you your mark and giving you detailed feedback on your thesis. Preferably, the evaluation is done after the colloquium presentation. Your supervisors can ask additional questions about your thesis and discuss the recommendations. This final discussion can be part of the examination of the thesis. Next the final marks can be made-up and the final mark of the thesis can be calculated. The evaluation form will be signed and handed in at the secretary. You will also have the opportunity to give feedback to your supervisor(s) during the evaluation.

!Watch out:

When aiming for a graduation ceremony make sure that your mark will be put in the system in time!



Appendix I – Rubric MSc evaluation

Rubric for assessment of MSc-thesis

Author: Arnold F. Moene, Meteorology and Air Quality Group, Wageningen University

Version: 1.0 (November 23, 2009)

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Item	Mark for item					
	2-3	4-5	6	7	8	9-10
1. Research competence (30-60%) *						
1.1. Commitment and perseverance	Student is not motivated. Student escapes work and gives up regularly.	Student has little motivation. Tends to be distracted easily. Has given up once or twice.	Student is motivated at times, but often sees the work as a compulsory task. Is distracted from thesis work now and then.	The student is motivated. Overcomes an occasional setback with help of the supervisor.	The student is motivated and/or overcomes an occasional setback on his own and considers the work as his "own" project.	The student is very motivated, goes at length to get the most out of the project. Takes complete control of his own project. Considers setbacks as an extra motivation.
1.2. Initiative and creativity	Student shows no initiative or new ideas at all.	Student picks up some initiatives and/or new ideas suggested by others (e.g. supervisor), but the selection is not motivated.	Student shows some initiative and/or together with the supervisor develops one or two new ideas on minor parts of the research.	Student initiates discussions on new ideas with supervisor and develops one or two own ideas on minor parts of the research.	Student has his own creative ideas on hypothesis formulation, design or data processing.	Innovative research methods and/or data-analysis methods developed. Possibly the scientific problem has been formulated by the student.
1.3. Independence	The student can only perform the project properly after repeated detailed instructions and with direct help from the supervisor.	The student needs frequent instructions and well-defined tasks from the supervisor and the supervisor needs careful checks to see if all tasks have been performed.	The supervisor is the main responsible for setting out the tasks, but the student is able to perform them mostly independently.	Student selects and plans the tasks together with the supervisor and performs these tasks on his own.	Student plans and performs tasks mostly independently, asks for help from the supervisor when needed.	Student plans and performs tasks independently and organizes his sources of help independently.
	No critical self-reflection at all.	No critical self-reflection at all.	Student is able to reflect on his functioning with the help of the supervisor only.	The student occasionally shows critical self-reflection.	Student actively performs critical self-reflection on some aspects of his functioning.	Student actively performs critical self-reflection on various aspects of his own functioning and performance.

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
1.4. Efficiency in working with data Note: depending on the characteristics of the thesis work, not all three aspects (experimental work, data analysis and model development) may be relevant and some may be omitted	Experimental work Student is not able to set up and/or execute an experiment.	Student is able to execute detailed instructions to some extent, but errors are made often, invalidating (part of) the experiment.	Student is able to execute an experiment that has been designed by someone else (without critical assessment of sources of error and uncertainty).	Student is able to execute an experiment that has been designed by someone else. Takes sources of error and uncertainty into account in a qualitative sense.	Student is able to judge the setup of an existing experiment and to include modifications if needed. Takes into account sources of error and uncertainty quantitatively.	Student is able to setup or modify an experiment exactly tailored to answering the research questions. Quantitative consideration of sources of error and uncertainty. Execution of the experiment is flawless.
	Data analysis Student is lost when using data. Is not able to use a spreadsheet program or any other appropriate data-processing program.	Student is able to organize the data, but is not able to perform checks and/or simple analyses.	Student is able to organize data and perform some simple checks; but the way the data are used does not clearly contribute to answering of the research questions and/or he is unable to analyse the data independently.	Student is able to organize the data, perform some basic checks and perform basic analyses that contribute to the research question.	Student is able to organize the data, perform commonly used checks and perform some advanced analyses on the data.	Student is able to organize the data, perform thorough checks and perform advanced and original analyses on the data.
	Model development Student is not able to make any modification/addition to an existing model.	Student modifies an existing model, but errors occur and persist. No validation.	Student is able to make minor modifications (say a single formula) to an existing model. Superficial validation or no validation at all.	Student is able to make major modifications to an existing model, based on literature. Validation using some basic measures of quality.	Student is able to make major modifications to an existing model, based on literature or own analyses. Validation using appropriate statistical measures.	Student is able to develop a model from scratch, or add an important new part to an existing model. Excellent theoretical basis for modelling as well as use of advanced validation methods.
1.5. Handling supervisor's comments and development of research	Student does not pick up suggestions and ideas of the supervisor.	The supervisor needs to act as an instructor and/or supervisor needs to suggest solutions for problems.	Student incorporates some of the comments of the supervisor, but ignores other without arguments.	Student incorporates most or all of the supervisor's comments.	Supervisor's comments are weighed by the student and asked for when needed.	Supervisor's comments are critically weighed by the student and asked for when needed, also from other staff members or students.
	Knowledge and insight of the student (in	There is some progress in the research skills of	The student is able to adopt some skills as	The student is able to adopt skills as they are	The student is able to adopt new skills mostly	The student has knowledge and insight

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
skills	relation to the prerequisites) is insufficient and the student is not able to take appropriate action to remedy this.	the student, but suggestions of the supervisor are also ignored occasionally.	they are presented during supervision.	presented during supervision and develops some skills independently as well.	independently, and asks for assistance from the supervisor if needed.	on a scientific level, i.e. he explores solutions on his own, increases skills and knowledge where necessary.
1.6. Keeping to the time schedule	Final version of thesis or colloquium more than 50% of the nominal period overdue without a valid reason (force majeure).	Final version of thesis or colloquium at most 50% of the nominal period overdue (without a valid reason).	Final version of thesis or colloquium at most 25% of nominal period overdue (without valid reason).	Final version of thesis or colloquium at most 10% of nominal period overdue (without valid reasons).	Final version of thesis or colloquium at most 5% of nominal period overdue (without good reasons).	Final version of thesis and colloquium finished within planned period (or overdue but with good reason).
	No time schedule made.	No realistic time schedule.	Mostly realistic time schedule, but no timely adjustment of time schedule.	Realistic time schedule, with some adjustments (but not enough or not all in time) in times only.	Realistic time schedule, with timely adjustments.	Realistic time schedule, with timely adjustments of both time and tasks.
2. Thesis report (30-60%) *						
2.1. Relevance research, clearness goals, delineation research	No link is made to existing research on the topic. No research context is described.	The context of the topic at hand is described in broad terms but there is no link between what is known and what will be researched.	The link between the thesis research and existing research does not go beyond the information provided by the supervisor.	Context of the research is defined well, with input from the student. There is a link between the context and research questions.	Context of the research is defined sharply and to-the-point. Research questions emerge directly from the described context.	Thesis research is positioned sharply in the relevant scientific field. Student is able to indicate the novelty and innovation of the research.
	There is no researchable research question and the delineation of the research is absent.	Most research questions are unclear, or not researchable and the delineation of the research is weak	At least either the research questions or the delineation of the research are clear.	The research questions and the delineation are mostly clear but could have been defined sharper at some points.	The research questions are clear and researchable and the delineation is clear.	The research questions are clear and formulated to-the-point and limits of the research are well-defined.
2.2. Theoretical underpinning, use of	No discussion of underlying theory.	There is some discussion of underlying theory, but the description shows serious errors.	Student has found the relevant theory, but the description has not been tailored to the research at hand or shows occasional errors.	Student has found the relevant theory, and has been partially successful in tailoring the description to the research at hand. Few errors occur.	Student has found the relevant theory, made a synthesis of it, and has been successful in tailoring the description to the research at hand.	Clear, complete and coherent overview of relevant theory on the level of an up-to-date review paper. Exactly tailored to the research at hand.

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
literature	No peer-reviewed/primary scientific papers in reference list except for those already suggested by the supervisor.	Only a couple of peer-reviewed papers in reference list.	Some peer-reviewed papers in reference list but also a significant body of gray literature.	Relevant peer-reviewed papers in reference list but also some gray literature or text books. Some included references less relevant.	Mostly peer-reviewed papers or specialized monographs in reference list. An occasional reference may be less relevant.	Almost exclusively peer-reviewed papers in reference list or specialized monographs (not text books). All papers included are relevant.
2.3. Use of methods and data	No description of methods and/or data.	Research is not reproducible due to insufficient information on data (collection and/or treatment) and analysis methods.	Some aspects of the research regarding data-collection, data-treatment, models or the analysis methods are described insufficiently so that that particular aspect of the research is not reproducible.	Description of the data (collection, treatment) or models as well as the analysis methods used is lacking in a number of places so that at most a more or less similar research could be performed.	Description of the data (collection, treatment) or models as well as the analysis methods used is mostly complete, but exact reproduction of the research is not possible due to lack of some details.	Description of the data (collection, treatment) or models as well as the analysis methods is complete and clear so that exact reproduction of the research is possible.
2.4. Critical reflection on the research performed (discussion)	No discussion and/or reflection on the research. Discussion only touches trivial or very general points of criticism.	Student identifies only some possible weaknesses and/or points at weaknesses which are in reality irrelevant or non-existent.	Student indicates most weaknesses in the research, but does not weigh their impact on the main results relative to each other.	Student indicates most weaknesses in the research and is able to weigh their impact on the main results relative to each other.	Student indicates all weaknesses in the research and weighs them relative to each other. Furthermore, (better) alternatives for the methods used are indicated.	Student is not only able to identify all possible weaknesses in the research, but is also able to indicate which weaknesses affect the conclusions most.
	No confrontation with existing literature.	Confrontation with irrelevant existing literature.	Only trivial reflection vis-à-vis existing literature.	Student identifies only most obvious conflicts and correspondences with existing literature. Student tries to describe the added value of his study but does not relate this to existing research.	Student shows minor and major conflicts and correspondences with literature and can identify the added value of his research relative to existing literature.	Student critically confronts results to existing literature and in case of conflicts is able to weigh own results relative to existing literature. Student is able to identify the contribution of his work to the development of scientific concepts.
2.5. Clarity of	No link between research questions,	Conclusions are drawn, but in many cases these	Conclusions are linked to the research questions,	Most conclusions well-linked to research	Clear link between research questions and	Clear link between research questions and

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
conclusions and recommendations	results and conclusions.	are only partial answers to the research question. Conclusions merely repeat results.	but not all questions are addressed. Some conclusions are not substantiated by results or merely repeat results.	questions and substantiated by results. Conclusions mostly formulated clearly but some vagueness in wording.	conclusions. All conclusions substantiated by results. Conclusions are formulated exact.	conclusions. Conclusions substantiated by results. Conclusions are formulated exact and concise. Conclusions are grouped/ordered in a logical way.
	No recommendations given.	Recommendations are absent or trivial.	Some recommendations are given, but the link of those to the conclusions is not always clear.	Recommendations are well-linked to the conclusions.	Recommendations are to-the-point, well-linked to the conclusions and original.	Recommendations are to-the-point, well-linked to the conclusions, original and are extensive enough to serve as project description for a new thesis project.
2.6. Writing skills	Thesis is badly structured. In many cases information appears in wrong locations. Level of detail is inappropriate throughout.	Main structure incorrect in some places, and placement of material in different chapters illogical in many places. Level of detail varies widely (information missing, or irrelevant information given).	Main structure is correct, but lower level hierarchy of sections is not logical in places. Some sections have overlapping functions leading to ambiguity in placement of information. Level of detail varies widely (information missing, or irrelevant information given).	Main structure correct, but placement of material in different chapters illogical in places. Level of detail inappropriate in a number of places (irrelevant information given).	Most sections have a clear and unique function. Hierarchy of sections is mostly correct. Ordering of sections is mostly logical. All information occurs at the correct place, with few exceptions. In most places level of detail is appropriate.	Well-structured: each section has a clear and unique function. Hierarchy of sections is correct. Ordering of sections is logical. All information occurs at the correct place. Level of detail is appropriate throughout.
	Formulations in the text are often incorrect/inexact inhibiting a correct interpretation of the text.	Vagueness and/or inexactness in wording occur regularly and affect the interpretation of the text.	The text is ambiguous in some places but this does not always inhibit a correct interpretation of the text.	Formulations in text are predominantly clear and exact. Thesis could have been written more concisely.	Formulations in text are clear and exact, as well as concise.	<i>Textual</i> quality of thesis (or manuscript in the form of a journal paper) is such that it could be acceptable for a peer-reviewed journal.
3. Colloquium (5%) *						
3.1. Graphical	Presentation has no structure.	Presentation has unclear structure.	Presentation is structured, though the audience gets lost in some places.	Presentation has a clear structure with only few exceptions.	Presentation has a clear structure. Mostly a good separation between the main message and side-	Presentation clearly structured, concise and to-the-point. Good separation between the

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
presentation					steps.	main message and side-steps.
	Unclear lay-out. Unbalanced use of text, graphs, tables or graphics throughout. Too small font size, too many slides.	Lay-out in many places insufficient: too much text and too few graphics (or graphs, tables) or vice verse.	Quality of the layout of the slides is mixed. Inappropriate use of text, tables, graphs and graphics in some places.	Lay-out is mostly clear, with unbalanced use of text, tables, graphs and graphics in few places only.	Lay-out is clear. Appropriate use of text, tables, graphs and graphics.	Lay-out is functional and clear. Clever use of graphs and graphics.
3.2. Verbal presentation and defence	Spoken in such a way that majority of audience could not follow the presentation.	Presentation is uninspired and/or monotonous and/or student reads from slides: attention of audience not captured.	Quality of presentation is mixed: sometimes clear, sometimes hard to follow.	Mostly clearly spoken. Perhaps monotonous in some places.	Clearly spoken.	Relaxed and lively though concentrated presentation. Clearly spoken.
	Level of audience not taken into consideration at all.	Level of audience hardly taken into consideration.	Presentation not at appropriate level of audience.	Level of presentation mostly targeted at audience.	Level of presentation well-targeted at audience. Student is able to adjust to some extent to signals from audience that certain parts are not understood.	Clear take-home message. Level well-targeted at audience. Student is able to adjust to signals from audience that certain parts are not understood.
	Bad timing (way too short or too long).	Timing not well kept (at most 30% deviation from planned time).	Timing not well kept (at most 20% deviation from planned time).	Timing is OK (at most 10% deviation from planned time).	Timing is OK.	Presentation finished well in time.
	Student is not able to answer questions.	Student is able to answer only the simplest questions.	Student answers at least half of the questions appropriately.	Student is able to answer nearly all questions in an appropriate way.	Student is able to answer all questions in an appropriate way, although not to-the-point in some cases.	Student is able to give appropriate, clear and to-the-point answers to all questions.
4. Examination (5%) *						
4.1. Defence of the thesis	Student is not able to defend/discuss his thesis. He does not master the contents.	The student has difficulty to explain the subject matter of the thesis.	Student is able to defend his thesis. He mostly masters the contents of what he	Student is able to defend his thesis. He masters the contents of what he wrote, but not	Student is able to defend his thesis, including indications where the work could	Student is able to freely discuss the contents of the thesis and to place the thesis in the context

Item	Mark for item					
	2-3	4-5	6	7	8	9-10
			wrote, but for a limited number of items he is not able to explain what he did, or why.	beyond that. Is not able to place thesis in scientific or practical context.	have been done better. Student is able to place thesis in either scientific or practical context.	of current scientific literature and practical contexts.
4.2. Knowledge of study domain	Student does not master the most basic knowledge (even below the starting level for the thesis).	The student does not understand all of the subject matter discussed in the thesis.	The student understands the subject matter of the thesis on a textbook level.	The student understands the subject matter of the thesis, including the literature used in the thesis.	Student is well on top of subjects discussed in thesis: not only does he understand but he is also aware of current discussions in the literature related to the thesis topic.	Student is well on top of subjects discussed in thesis: not only does he understand but he is also aware of discussions in the literature beyond (but related to) the topic of the thesis.

Appendix III - Evaluation form MSc thesis

MSc thesis evaluation Wageningen University-Sub-dept. Environmental Technology			
Fill out the single lined fields. Use a comma or a point as decimal sign, depending on the language chosen.			
Name chair group	Sub-department of Environmental Technology		
Name student			
Registration number			
Study programme	MES		
Specialisation	ETE		
Code thesis	ETE-80436 MSc Thesis Environmental Technology		
Short title thesis			
Date examination			Signature
Supervisor chair group			
Supervisor outside chair group (if so)			
Second reviewer/examiner			
		grading mark 1-10	relative weight *
Research competence (40%) *			40%
1 Commitment and perseverance		}	0.0
2 Initiative and creativity			
3 Independence			
4 Efficiency in working with data			
5 Handling supervisor's comments and development of research skills			
6 Keeping to the time schedule			
Thesis report (40%) *			40%
1 Relevance research, clearness goals, delineation research		}	0.0
2 Theoretical underpinning, use of literature			
3 Use of methods and data			
4 Critical reflection on the research performed (discussion)			
5 Clarity of conclusions and recommendations			
6 Writing skills			
Colloquium (15%) *			15%
1 Graphical presentation		}	0.0
2 Verbal presentation and defence			
Examination (5%) *			5%
1 Defence of the thesis		}	0.0
2 Knowledge of study domain			
* please choose weights such that there sum is 100.	TOTAL		0.0
	FINAL GRADE		0.0
Comment by supervisor			
Comment by 2nd reviewer/examiner			