BENS4039 Master's Seminar I and project planning: Instructions for the research plan

# General considerations about the research plan

You need a plan to do good scientific research. It is important to think in advance in detail, how is the research project going to proceed, what kind of samples and data are needed, what are the methods to be used and what is the theoretical basis of the research. The initial plan can be written after an initial literature survey.

The research plan is a compact description of the research, and it can be edited and changed later during the research project. To make a good plan, you need to know the topic, the relevant literature, the theoretical and methodological background. It is also important to find out if some data is already available. The plan contains a prediction, how to project should proceed, and what are the possible and expected results.

The research plan serves two main purposes: it will help the research and it will be used to present the research to other people like the supervisor, collaborators. The research plan can also be used to apply funding to the research. This applies also to the plan prepared for the master’s seminar, possibly you can use it for grant applications. In all parts of research, it is essential to pay attention to the r[esponsible science and research etchics.](https://www.jyu.fi/en/research/responsible-conduct-of-research-and-research-ethics-at-the-university-of-jyvaskyla)

In the plan, you will first need to define the **research problem.** This is the general framework of the research. The research problem can be rather broad, and it helps to motivate the research. Some examples of the research problem:

“Does climate change increase the expansion of invasive species”

“How does antibiotics resistance expand in bacterial populations”

The research problem is further specified by the formulation of **research questions.**  These questions should be defined as explicitly as possible because their purpose is to focus the research on such problems that can be answered using the resources and time that are available.

To further help the planning of experiments or data collection and analysis, it is useful to define **research hypotheses.** A hypothesis is something that t can be supported or refuted through carefully crafted experimentation or observation. This is why setting of hypotheses is one of the most important parts of the research plan. The hypotheses is often constructed as a statement of expectations. It is important to justify the hypotheses either based on theory, theoretical model, observations, or previous research.

The research question and the hypotheses should determine the **research set-up**: what kind of data is collected and how it is analysed. An alternative approach is sometimes called grounded theory (original in sociology research) or hypothesis generating research (which often involves massive data collection with automated methods). This means that data is collected without an initial hypothesis and the hypotheses are then formulated based on the data analysis.

In either case, in **hypothesis-driven**, or in data-drive, **hypothesis generating research**, there are often **practical limitations in the availability of data**. How much resources and time are needed to collect the data? Are there some ethical constrains? This leads to compromises between the research set-up and the practical implementation, that should be considered in the research plan.

There may also be **practical limitations in the use methods**. If your research question requires expensive equipment that are not easily available at or near your study site, or some methods may require skills that you do not have time to learn, you should consider revising your research questions so that it is realistic to get results in the expected time frame.

In all these considerations, it is important to read research reports on similar topics and compare their conceptual and methodological choices to your plan. It is also important to discuss with the supervisors and colleagues. The supervisors are there to guide and instruct you in all stage of research!

# How to write a research plan

The technical format of the research plan (cover page, font, formatting, reference lists etc) should be the same as used for the master’s thesis in the Department biological and Environmental Science, University of Jyväskylä. However, the Sub-headers of the research plan differ somewhat from the final thesis and there is also more flexibility in structure the research plan than in the final thesis. It is important the Microsoft Word Template file for MSC thesis is used for the MSc thesis plan as well. The idea of the template file is that the user always uses the styles given in the template and does not change fonts, paragraph formatting or anything else manually.

The department of biological and environmental science recommends the following structure for the research plan.

Title page

**Abstract**

For native Finnish speakers, the abstract if written both in Finnish and in English

Table of content

List of Abbreviations (+optional list of special terminology)

Introduction

Includes the background, research topic/aims, study questions, hypotheses and predictions (Normally aims etc are at the end of introduction, but is also possible to have them under a separate heading)

Materials and Methods

This title can vary: Data Collection and Analysis

Here you explain your research system and methodology. Also, why this approach was chosen.

This includes statistical analysis.

This includes (ethical) research permits etc.

This differs a bit from the final thesis: standard reagent sources are not needed, but on the other hand, sample sizes, number of repeats etc. are important

Project management

Time management,

Risk analysis

Safety analysis

Financial plan

Collaborators and supervision arrangements

Data management plan

References

Title page

The first page containing the working **title** of the master’s thesis, name of the student, Master's programme, date, and department affiliation.

Abstract

The next pages contain the **Abstract**. If your basic education is in Finnish language you write abstract both in Finnish and in English on separate pages. The length of the abstract is one page, maximum about 2200 characters, including spaces. You should use the Abstract form of the MSci thesis. The abstract is written as a single paragraph. Please use standard English language and avoid unnecessary special terminology and avoid abbreviations This is because the reader does not necessarily have deep knowledge in your special field and the aim of the abstract is to also convince such readers. Your task is to show that your topic is interesting and timely. The Abstract should be a short description of both your seminar presentation and your research plan. It should contain the following element (note no subtitles allowed): 1) Background: what it the background of your research in general context 2) Motivation: What is your general research problem and why is your topic interesting (what is not known in the field). 3) What is your research question: Which problem/unknown do you aim to solve? 4) Methods: What are the main methods you plan you use (not to be described in detail) and what is the data you plan to collect. And finally, 5) how do the data help answering the research question.

Table of Content, Terminology and Abbreviations

After the abstract you add the table of content. Please use the automatic tool of Microsoft Word to generate this. After that, abbreviation and terminology are listed on a separate page. See the instructions for the MSc thesis.

Introduction

The main text starts with **Introduction** that explains the background of the plan. Here you need to explain, why the subject is important and what is already known. The aim is to familiarize yourself (and the reader) to the subject and critically review the literature. It is also important to introduce the main concepts and terminology used in the field. Please use reliable references and try to cite as much as possible original research papers. Review articles are great help when you search literature, but they should not be the only source of information. Using review articles only gives a lazy impression. In the end of the introduction, you present your study questions, hypotheses, counterhypotheses, and predictions (if possible). Often it helps to divide the questions to smaller parts.

Methods/data collection and analysis

Here you explain the data collection or experimental system or experimental design. You can use figures or diagrams to explain the experiments in detail. You need to explain how experimental samples are collected, how they are analysed etc. If you need some legal or ethical permission for the research, these should also be mentioned here in detail (including the reference numbers of the permits).

**Statistical analysis** is described in the methods sections as a separate chapter (if this is relevant to the study). You should consider here the sample size that is required to get statistically significant results. In this consideration you should have an idea what is the magnitude of the measured changes in relation to measurement error or background variation.

Project management

The next part of the research plan is **project management.** This contains **time management, risk analysis, safety assessment, financial plans, collaboration and supervision arrangements and the data management plan.** In time management you estimate the time needed for each part of the project. You should consider the whole project which starts from planning and ends when the final thesis in submitted to the library. In most cases students (and researchers in general) underestimate the time needed for most of the steps. There is a myriad of project management instructions, templates and software that may help you in this task. It is recommended that you take some time to get familiar with this kind of resources. The time/project management plan can be presented either graphically or as a Table. You are welcome to use the format of your choice.Here is an example of a simple Gannt table for time management plan:

Chart, waterfall chart

Description automatically generated

It is also important to make a **risk analysis**. Which part of the work has the highest risk of failing? Could there be a failure that would prevent finalization of the work? What should you do if these risks come real? Do you need plan B? When do you decide to use the alternative approaches? You do not need to consider normal risks of everyday life such as getting sick, being late from the bus, traffic accident etc., but for instance exceptional weather conditions during your planned week of field work should be considered.

From year 2022 onwards, a **safety assessment** is also required in the research plan. The difference with risk analysis and safety assessment is that risk analysis considers scientific risks, whereas safety assessment should consider the practical risk related to personal and environmental safety. You should find out what kind of hazardous chemical or instruments you will use during the research, what kind of safety measures need to be considered in laboratory work or in field work. For instance: you should never do field work alone or work in the laboratory alone. As above, only special safety concerns related to the work need to be mentioned, not everyday life risks.

**Financial plan**. In most cases your personal income during master’s thesis work is covered by your personal study allowance or student loan. In addition, there often are other costs that are in most cases covered by your supervisor. It is good to be aware of these costs and estimate them in the research plan (chemicals, reagents, laboratory material, shipment costs, traveling costs, costs that are allocated for instrument usage etc). You do not need to consider the costs of university premises and in the department of biological and environmental science most instruments are available for use to all researcher, but you must discuss in advance with the person responsible for each instrument and laboratory space. Sometimes it is possible to apply small research grant even to master’s thesis project. Your supervisor should help you in finding out Foundations who might fund your research.

In the final part of the project management section, you describe **collaborators and supervisors** as well as the **data management plan**. It is important to consider which kind of data will be produced during the project, where it will be saved, who will own it and how it is going to be used after your work. Do you plan to publish the results as an independent scientific paper in some publication series (in addition to the master’s thesis)? Often the master’s thesis is part of a larger project. Thus, the data may be used as a part of some collaborative paper, or perhaps part of someone else's PhD thesis. These are issues that need to be discussed beforehand with your supervisors and collaborators. Also discuss, where the original data is going to be saved and who are the owners of the data. In those cases when the data contains some sensitive information, like information that could be linked to personal information or for instance the location of endangered species, it may be necessary to include a plan how the data is destroyed after analysis. The general principle is that master’s thesis will publicly available after it has been graded and approved. The student needs to submit an electronic copy of the thesis at this point to the [University library.](https://kirjasto.jyu.fi/publish-and-buy/publishing-your-thesis?set_language=en)

References

The research plan ends with the **reference list** that should include all references cited in the plan. We highly recommend that you use some reference management program to generate both in-text citations and the reference list. University of Jyväskylä recommends Zotero or Mendeley that are both free programs for the students and can be installed in your own computer. The work together with either Microsoft Words or with Open Office packages. The Department uses the same format as Boreal Environmental Research -journal and the template file for this journal can be found in the programmes. If you write you thesis in Finnish, the Department provides you a Zotero template file adjusted to Finnish language.