HÖGSKOLAN
DALARNA

General Study Plan: Doctoral Studies in Microdata Analysis

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DALARNA UNIVERSITY
Doctoral Programmes Board

1. Description of Subject

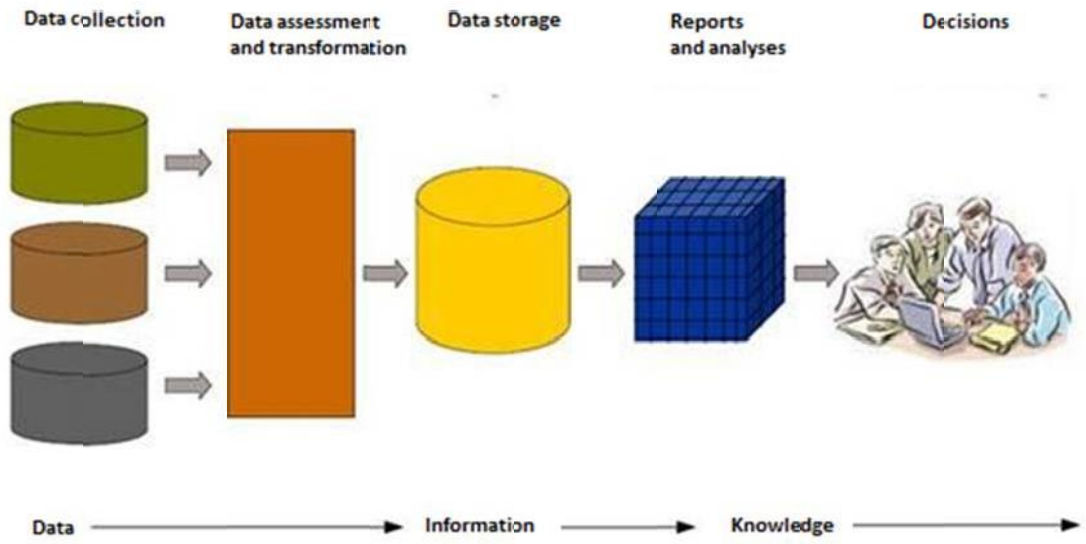
The subject of Microdata Analysis concerns complex processes in business and industry, and the built environment.

Microdata Analysis is a multidisciplinary field of knowledge that concerns the collection, modelling, compilation and interpretation of large data sets, together with underlying algorithms, methods and techniques. Microdata Analysis includes several interrelated domains such as artificial intelligence, decision support systems, management of limited resources, data modelling, design of experiments, focus groups, geographic information systems, visualisation, measurement techniques, optimisation, forecasting, simulation and statistical inference. This is a normative subject aimed at data-based decisions and actions.

2. Objectives for Doctoral Studies

The complex processes in business and industry and the built environment that are the focus of study in this field can be schematically illustrated using a figure: see below. The first part comprises the collection of data, and requires knowledge and understanding in various measurement techniques as well as design of experiments. The second and third parts comprise data capture, data processing and data storage, and require knowledge and understanding in advanced database methods as well as comprehension of the importance of metadata. The fourth part is the analysis, often in the form of mathematical modelling of data that requires skills in statistical modelling, forecasting methods, simulation techniques, visualisation and data mining. The fifth part comprises decision-making and action that requires an understanding of techniques such as benchmarking and counterfactual analysis, as well as economic decision-making and the dissemination of information within organisations.

Doctoral Studies in Microdata Analysis aims at students who wish to acquire skills in all parts of the process and in-depth expertise in a specific domain.



2.1 General Learning Outcomes

The outcomes, in accordance with the Degree Ordinance, Appendix 2 of the Higher Education Ordinance (1993:100), are as follows:

Licentiate Degree (*Licentiatexamen*)

Knowledge and understanding
For a Licentiate Degree, the doctoral student shall

- demonstrate knowledge and understanding in the field of research, including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills
For a Licentiate Degree, the doctoral student shall

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work,
- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Judgement and approach
For a Licentiate Degree, the doctoral student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research,
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Doctoral Degree (*Doktorsexamen*)

Knowledge and understanding
For a Doctoral Degree, the doctoral student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills
For a Doctoral Degree, the doctoral student shall

- demonstrate the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues and situations autonomously and critically,
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work,
- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research,
- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general,
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach
For a Doctoral Degree, the doctoral student shall
- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

2.2 Local Learning Outcomes

For a Licentiate Degree, the doctoral student shall

- demonstrate a theoretical understanding of the five parts of the microdata analysis process, and in-depth knowledge in a specific part,
- be able to manage and assess the handling of sensitive and confidential data concerning technical, social and ethical aspects,
- apply the acquired knowledge to select and adapt methods and techniques in order to manage complex, large and varying amounts of data,
- model the data and perform data analysis, in which methods and models from different paradigms are valued, selected, adapted and applied,
- develop hybrid approaches that combine quantitative and qualitative methods and techniques to solve various problems,
- integrate and incorporate microdata analysis methods and techniques to analyse practical problems in research or decision-making, and
- evaluate the strengths and limitations of methods and techniques in microdata analysis when used in research or as a support in decision-making.

For a Doctoral Degree, the doctoral student shall, in addition:

- demonstrate an ability to contribute to the development of the research field by being able to present and discuss research findings in an international context, in dialogue with researchers with different disciplinary backgrounds,
- be able to provide constructive feedback on the scientific work in microdata analysis that others have produced,

- demonstrate teaching skills that allow for the communication of research results and microdata analysis methods and techniques to different target groups, and
- demonstrate confidence in the choice and development of their scientific contribution.

3. Admission

3.1 General

Admission to doctoral level studies can be for either the Licentiate Degree or the Doctoral Degree.

The Director of the Doctoral Programme is responsible for the evaluation of applications and the ranking of applicants using the selection criteria presented in 3.3. The Doctoral Programme Committee decides on admission or non-admission based on the assessment of the application, interviews and references.

Prior to any decision on admission to doctoral studies, the following need to be considered:

1. Financial plan (or financial contract if the doctoral student has another employer than DU)
2. The adequacy of the collective supervisory competence: can the student receive good, professional supervision?

3.2 Qualifications

To be admitted to doctoral studies in Microdata Analysis, the applicant must meet both the general and specific entry requirements and have the capacity required to benefit from doctoral studies in this field.

General Entry Requirements
The General Entry Requirements for admission to doctoral studies are as follows:

1. A degree at master level,
2. Completion of 240 university credits of which 60 are at advanced level, or
3. Equivalent skills acquired through other means in either Sweden or another country.

The Doctoral Programme Committee may, in individual cases, make exemptions with regards to the General Entry Requirements, if there is good reason to do so.

Specific Entry Requirements
Specific Entry Requirements require that the applicant has successfully completed at least five courses in the following subjects:

Database Systems – 7.5 credits
Data Analysis and Statistics – 7.5 credits
Artificial Intelligence – 7.5 credits
Programming – 7.5 credits
Mathematics – 7.5 credits
Economics – 7.5 credits

Optimisation Techniques or Probability Theory – 7.5 credits
Decision Theory – 7.5 credits

3.3 Selection

Selection from among applicants who meet the entry requirements shall be made based on both their capacity to complete studies at the doctoral level successfully and the following criteria (in order of priority):

1. Personal suitability
2. Previous study results, with special focus on the quality of the applicant's independent work at masters level
3. English language skills, both written and oral
4. Other qualifications

For those applicants who are admitted to doctoral studies with financing from a specific research project, regard will be given to their qualifications in relation to the research project. For doctoral students who are employed elsewhere, that is to say not at Dalarna University, a review will be made of their planned doctoral work to check that it can make a general contribution to the subject.

3.4 Supervision

For every doctoral student, at least two supervisors will be appointed. One will be appointed as Principal Supervisor, and must hold at least the qualification of Docent and have completed the supervisor training course. The Co-Supervisor must hold at least a Doctoral Degree. The Principal Supervisor is to ensure a supervisory team that together can provide the doctoral student with scholarly support so that the student can successfully complete his/her doctoral studies. In conjunction with admission, the Doctoral Programme Committee will appoint the Principal Supervisor and in conjunction with the finalisation of an individual study plan by the Doctoral Programme Committee, the Co-Supervisor will be appointed.

The doctoral student is entitled to a change in supervisor without having to provide a reason. The supervisory team as a unit should also be reviewed upon a change in the doctoral student's research specialisation. The Director of the Doctoral Programme prepares any change in supervisor and the Doctoral Programme Committee makes the decision in those cases where the doctoral student and supervisor are in agreement. In cases of non-agreement, the doctoral student makes a formal request of change in supervisor to the Doctoral Programme Committee.

A doctoral student is entitled to 128 hours of supervision per year in accordance with the prescribed studies of 120 credits and 240 credits.

4. Programme Structure

4.1 General

The doctoral programme (licentiate) comprises four (two) years of full-time studies: a total of 240 (120) credits. The programme comprises obligatory courses totalling 30 credits and a

further 15 credits (Licentiate Degree) and 30 credits (Doctoral Degree) for elective courses. In addition, a thesis of 75 credits (Licentiate Degree) or 180 credits (Doctoral Degree) is required.

The licentiate thesis normally comprises two scientific papers, while the doctoral thesis as a standard comprises four scientific papers that are presented in seminars and reviewed externally on an ongoing basis, after which they are finalised. Before the doctoral student concludes his/her doctoral studies with a public defence (which here also includes the presentation of the licentiate thesis), all scientific papers in the thesis must have been presented in the seminar series that is relevant to the doctoral programme. The Principal Supervisor recommends the time, chairperson, opponent and Examiner or Examining Committee for the doctoral defence, after which the Doctoral Programme Committee makes a decision. With the decision, the Doctoral Programme Committee approves the presentation of the thesis, and must make the decision at the latest four weeks prior to the thesis defence.

The study period may be extended in the case of special circumstances, as stated in the Higher Education Ordinance. Special reasons may be sick leave, military service, work for trade unions and parental leave. The doctoral student should perform departmental work amounting to approximately 20 percent of the total study time and be compensated in the form of an equivalent extension to the study time.

4.2 Individual Study Plan and Financial Plan

At the latest three months after the applicant's admission, an Individual Study Plan shall be drawn up that describes the structure of the doctoral programme. The Individual Study Plan shall be developed by the doctoral student together with his/her Principal Supervisor, and it shall make clear the commitments of all parties involved, including the specific goals for the doctoral student and the arrangements for supervision.

The Individual Study Plan shall:

1. state the name of the Principal Supervisor and the Co-Supervisor
2. state the name of the person responsible for credit transfer
3. include a timeline for the doctoral student's study programme as well as a proposal for a title for the thesis and a description of planned scientific work
4. specify the arrangements in terms of supervision
5. include a plan as to the doctoral courses that the doctoral student intends to take
6. provide a description of other scholarly activities, such as attendance at seminars, conferences and research visits to other institutions.

The Doctoral Programme Committee is to approve the Individual Study Plan after review and preparation by the Director of the Doctoral Programme.

In the case of a doctoral student who has another employer, his/her manager at his/her place of employment must approve the entire study plan so that the programme can proceed such as it is described.

In the case of a doctoral student who has been admitted to a specific project with external financing or who has another place of employment than Dalarna University, the Individual Study Plan should have a high level of detail. This is to reduce the risk of the doctoral student

ending up in a position of conflict in terms of the outcomes of the doctoral programme and the goals of the project and employer.

The Individual Study Plan is reviewed once per academic year or more often if this is so stated in the Individual Study Plan. If the review shows a need for revisions to the Individual Study Plan, then these must be made by the doctoral student and the Principal Supervisor together. The Principal Supervisor must, in conjunction with the review, determine that the doctoral student is following the Individual Study Plan and any reasons for deviation.

Set Individual Study Plans, revised Individual Study Plans and completed credits must be documented. Significant deviations from the Individual Study Plan can result in the doctoral student being denied access to university resources in accordance with the Higher Education Ordinance. The Director of the Doctoral Programme will give the doctoral student the opportunity to put into writing his/her views on the Supervisor's report, after which a proposal as to a withdrawal of resources shall be submitted to the Doctoral Programme Committee for comments and the Vice-Chancellor for a decision. The proposal as to a withdrawal of resources must include a judgement as to how the University fulfilled its obligations to the doctoral student. To be included with the proposal are the Supervisor's letter, the doctoral student's written opinions on the matter, the written views of the Doctoral Programme Committee, and copies of the Individual Study Plan.

4.3 Courses

The Individual Study Plan will state which courses are to be included in the doctoral student's programme. There are three types. The compulsory courses are given on a regular basis by the School of Technology and Business Studies. The doctoral student complements these compulsory courses with elective courses and independent study courses based on the specific needs of the doctoral student's research specialisation.

The courses form a component of the requirements of the doctoral degree.

Licentiate Degree
A Licentiate Degree includes courses worth 45 credits, of which 30 are for compulsory courses.

These are compulsory courses in Microdata Analysis:
Data Collection and Data Quality, 5 credits
Complexity and Operations Research Methods for PhD-students, 7.5 credits
Statistical and Machine Learning, 10 credits
Economics of Leadership for PhD-students, 7.5 credits

Doctoral Degree
A Doctoral Degree includes courses worth 60 credits, of which 30 are for compulsory courses.

These are compulsory courses in Microdata Analysis:
Data Collection and Data Quality, 5 credits
Complexity and Operations Research Methods for PhD-students, 7.5 credits
Statistical and Machine Learning, 10 credits
Economics of Leadership for PhD-students, 7.5 credits

The Examiner for compulsory courses is normally the Course Coordinator.

A doctoral student who teaches and who does not have teaching qualifications is to take an undergraduate course (7.5 credits) in teaching, which can be included in his/her programme.

The doctoral student has the right to have his/her previous university education reviewed for possible credit transfer. The Individual Study Plan will state who is responsible for credit transfer, and that person will decide if a course can be transferred for credit and if so, for how many credits. In normal cases, it is the Principal Supervisor who has this role. To facilitate credit transfer, there needs to be a written syllabus in which objectives, content and number of credits are stated. For independent study courses that are given only at particular times, the Examiner shall provide documentation that confirms completion of the course and that provides details of the course content, study period, grading scale, and the English/Swedish title of the course.

4.4 Thesis

As part of his/her doctoral studies, the doctoral student shall write a thesis. The thesis is normally written in English. The thesis is to demonstrate the ability of the doctoral student to address the set research assignment independently at a satisfactorily scientific level. The scientific papers that form the thesis must meet a level of quality that will allow for publication in refereed scientific journals.

Licentiate Thesis

The thesis is 75 credits. In design, it comprises two scientific articles with a short summary that serves as an introduction to the thesis topic.

Doctoral Thesis

The doctoral thesis is for 180 credits. In design, it comprises a number of scientific articles with a summary (compilation thesis). The doctoral thesis normally comprises four scientific papers that are presented in a seminar on an ongoing basis. To be clear, it is not the number of articles in the thesis that is being assessed but rather the scientific quality and the independent contribution made by the doctoral student.

The thesis is evaluated in conjunction with a public defence. In the case of assessment of a licentiate thesis, an Examiner and an Opponent are selected, as well as a Chairperson for the defence itself. The Examiner must be qualified in the field of Microdata Analysis and be at least at the level of Associate Professor (or equivalent). The role of the Opponent is to explain and illustrate the scientific strengths and weaknesses of the thesis in terms of the research field to which the work of the doctoral student is contributing. The Opponent must therefore be scientifically qualified and active in the relevant research field. The standard expectation is that the Opponent must hold at least a Doctoral Degree.

In the assessment of a doctoral thesis, an Examining Committee is selected that comprises three members and at least one opponent, as well as a chairperson for the defence. The role of the opponent is to explain and illustrate the scientific strengths and weaknesses of the thesis in terms of the research field to which the work of the doctoral student is contributing.

As such, the opponent must be academically qualified in the relevant research field and active in the field, including at an international level. Normally, the opponent must hold a Doctoral Degree. When it is the case that one single opponent is not enough to present and discuss the thesis, two opponents can be selected. Together, the members of the Examining Committee

shall, with their collective knowledge base, be able to speak to the field of study that the thesis concerns. The composition of the Examining Committee shall be mostly at the competency level of Associate Professor, of whom one must be from another institution of higher education than Dalarna University. The Chairperson shall head the thesis defence, but must be prepared to step in as a member of the Examining Committee in the eventuality of an unexpected absence of such a member.

The thesis will be assessed using the grading scale fail (*underkänd*) or pass (*godkänd*).

5. Degree Requirements

To be awarded the degree, the doctoral student must receive a passing grade (*godkänd*) in both the courses that form part of the programme and the doctoral thesis or licentiate thesis. The Director of the Doctoral Programme checks and confirms that the doctoral student has met the formal requirements of the doctoral degree or licentiate degree.

Licentiate Degree

For a Licentiate Degree, 120 credits are required, of which 45 credits are for courses and the remaining 75 credits are for a licentiate thesis. The doctoral student must complete all compulsory courses totalling 30 credits before the Licentiate Degree can be awarded; further, the licentiate thesis must receive a passing grade (*godkänd*).

Doctor

For a Doctoral Degree, 240 credits are required, of which 60 credits are for courses and the remaining 180 credits are for a doctoral thesis. The doctoral student must complete all compulsory courses totalling 30 credits before the Doctoral Degree can be awarded; further, the doctoral thesis must receive a passing grade (*godkänd*).

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