



CENTRE FOR QUALITY ASSESSMENT IN HIGHER EDUCATION

EVALUATION REPORT
STUDY FIELD of STATISTICS
at Vilnius University

Expert panel:

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Study Field Data*

I.

Title of the study programme	Econometrics
State code	6121AX003
Type of studies	University
Cycle of studies	First
Mode of study and duration (in years)	Full time, 4 years
Credit volume	240 ECTS
Qualification degree and (or) professional qualification	Bachelor of Mathematical Sciences
Language of instruction	Lithuanian, English
Minimum education required	Secondary
Registration date of the study programme	19 June, 2014

II.

Title of the study programme	Data Science
State code	6121AX004
Type of studies	University
Cycle of studies	First
Mode of study and duration (in years)	Full time, 4 years
Credit volume	240 ECTS
Qualification degree and (or) professional qualification	Bachelor of Mathematical Sciences
Language of instruction	Lithuanian, English
Minimum education required	Secondary
Registration date of the study programme	19 June, 2014

III.

Title of the study programme	Modelling and Data Analysis
State code	6211AX004
Type of studies	University
Cycle of studies	Second
Mode of study and duration (in years)	Full time, 1,5 years Part time, 2 years
Credit volume	90 ECTS
Qualification degree and (or) professional qualification	Master of Mathematical Sciences
Language of instruction	Lithuanian, English
Minimum education required	Higher university's education of Bachelor degree
Registration date of the study programme	15 January, 2008

** if there are **joint / two-fields / interdisciplinary** study programmes in the study field, please designate it in the foot-note*

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I. INTRODUCTION

1.1. BACKGROUND OF THE EVALUATION PROCESS

The evaluation of study fields is based on the Methodology of External Evaluation of Study Fields approved by the Director of the Centre for Quality Assessment in Higher Education (hereafter – SKVC) 31 December 2019 Order [No. V-149](#).

The evaluation is intended to help higher education institutions constantly improve their study process and to inform the public about the quality of studies.

The evaluation process consists of the main following stages: 1) *self-evaluation and self-evaluation report prepared by Higher Education Institution (hereafter – HEI); 2) site visit of the expert panel to the higher education institution; 3) production of the external evaluation report (EER) by the expert panel and its publication; 4) follow-up activities.*

On the basis of this external evaluation report of the study field SKVC takes a decision to accredit the study field either for 7 years or for 3 years. If the field evaluation is negative then the study field is not accredited.

The study field and cycle are **accredited for 7 years** if all evaluation areas are evaluated as exceptional (5 points), very good (4 points) or good (3 points).

The study field and cycle are **accredited for 3 years** if one of the evaluation areas was evaluated as satisfactory (2 points).

The study field and cycle are **not accredited** if at least one of the evaluation areas was evaluated as unsatisfactory (1 point).

1.2. EXPERT PANEL

The expert panel was assigned according to the Experts Selection Procedure (hereinafter referred to as the Procedure) as approved by the Director of Centre for Quality Assessment in Higher Education on 31 December 2019 [Order No. V-149](#). The site visit to the HEI was conducted by the panel on *17 December, 2021*.

1. **Prof. dr. Claudia Kirch (panel chairperson)** *Professor at Institute for Mathematical Stochastics, Faculty of Mathematics, Otto-von-Güricke-Universität Magdeburg (OVGU Magdeburg) Germany;*
2. **Prof. dr. Ričardas Krikštolaitis**, *Professor at Faculty of Informatics, Dep. of Mathematics and Statistics, Vytautas Magnus University, Lithuania;*
3. **Prof. dr. Pedro Francisco Delicado Useros**, *Professor at Faculty of Mathematics and Statistics, Polytechnic University of Catalunya, Spain;*
4. **Dr. Jūratė Petrauskienė**, *General Director of the Lithuanian Department of Statistics, Lithuania;*
5. **PhD. Monika Briedienė**, *doctoral student at Faculty of Informatics, Vytautas Magnus University, Lithuania.*

1.3. GENERAL INFORMATION

The documentation submitted by the HEI follows the outline recommended by SKVC. Along with the Self-evaluation report and annexes, the following additional documents have been provided by the HEI before, during and/or after the site visit:

No.	Name of the document
1.	List on additional evidence and factual questions
2.	Distribution of teachers by age
3.	List on changes to SP Econometrics
4.	Description of courses for SP Econometrics
5.	Description of courses for S Modelling and Data Analysis
6.	Description of courses for S Data Science
7.	Evidence on students involvement in research

1.4. BACKGROUND OF THE STUDY FIELD/STUDY FIELD POSITION/STATUS AND SIGNIFICANCE IN THE HEI

Vilnius University was established in 1579 and is the oldest and largest higher education institution in Lithuania. Its status is a public institution. The University's governance structure is defined in the Statute of Vilnius University, which stipulates that the self-governance of the University's community is implemented by the governing bodies of the University – the Senate, the Council, and the Rector – in their respective capacities. The University offers undergraduate, postgraduate and doctoral studies in the fields of humanities, social sciences, natural sciences, medical and healthcare sciences, and technological sciences. More than 80 bachelor's and integrated study programmes and 100 master's and professional studies (pedagogical) programmes are operated. Doctoral students can choose among nearly 30 research fields, while resident students can choose from more than 60 residency study programmes. The University offers studies in 12 study field groups and 59 study fields. Based on the data of 1st January 2021, there were 3095 academic employees at the University (of which 2355 were teaching staff and 740 were research staff); the University had 24716 students. The University has 15 core academic units (11 faculties, one centre, and one business school) and 12 core non-academic units.

Studies in the Statistics study field under evaluation are operated by the Faculty of Mathematics and Informatics (MIF), established in 1965. The current name of the faculty was given in 1998. Its main governing bodies are the Council, the Dean and the College of Studies in an advisory capacity. MIF currently consists of the Center for Digital Research and Computation and four institutes uniting eight departments: Institute of Informatics (Departments of Informatics, Computer and Data Modelling, Mathematical Informatics, Software Systems), Institute of Mathematics (Departments of Mathematical Analysis, Probability Theory and Number Theory), Applied Institute of Mathematics (Department of Differential Equations, Statistical Analysis) and Institute of Data Science and Digital Technologies. The institutes carry out both studies in the respective field and research

belonging to three research fields (according to the classification of fields of science and art, approved on 16-02-2019): Mathematics (N 001), Informatics (N 009) and Informatics Engineering (T 007).

Five scientific journals in the fields of Mathematics and Informatics are being published in VU: *Nonlinear Analysis: Modelling and Control* (included in the Web of Science database), *Proceedings of the Lithuanian Mathematical Society*, *Lithuanian Statistical Papers*, *Olympiads in Informatics* and *Informatica* (included in the Web of Science database). The majority of the members of the editorial boards of those journals are researchers and teachers of MIF. In addition, the majority of the editorial board of the *Lithuanian Mathematical Journal* (also included in the Web of Science database) published by Springer is made up of MIF staff.

II. GENERAL ASSESSMENT

Statistics study field and first-cycle at Vilnius University is given **positive** evaluation.

Study field and cycle assessment in points by evaluation areas

No.	Evaluation Area	Evaluation of an Area in points*
1.	Intended and achieved learning outcomes and curriculum	4
2.	Links between science (art) and studies	5
3.	Student admission and support	4
4.	Teaching and learning, student performance and graduate employment	4
5.	Teaching staff	5
6.	Learning facilities and resources	3
7.	Study quality management and public information	4
	Total:	29

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field is being developed systematically, has distinctive features;

4 (very good) - the field is evaluated very well in the national and international context, without any deficiencies;

5 (excellent) - the field is exceptionally good in the national and international context/environment.

Statistics study field and second-cycle at Vilnius University is given **positive** evaluation.

Study field and cycle assessment in points by evaluation areas

No.	Evaluation Area	Evaluation of an Area in points*
1.	Intended and achieved learning outcomes and curriculum	4
2.	Links between science (art) and studies	5
3.	Student admission and support	3
4.	Teaching and learning, student performance and graduate employment	4
5.	Teaching staff	4
6.	Learning facilities and resources	3
7.	Study quality management and public information	4
	Total:	27

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field is being developed systematically, has distinctive features;

4 (very good) - the field is evaluated very well in the national and international context, without any deficiencies;

5 (excellent) - the field is exceptionally good in the national and international context/environment.

III. STUDY FIELD ANALYSIS

3.1. INTENDED AND ACHIEVED LEARNING OUTCOMES AND CURRICULUM

Study aims, outcomes and content shall be assessed in accordance with the following indicators:

3.1.1. Evaluation of the conformity of the aims and outcomes of the field and cycle study programmes to the needs of the society and/or the labour market (not applicable to HEIs operating in exile conditions)

(1) Factual situation

Studies in the field of Statistics have been carried out at VU since 1997 at the Faculty of Mathematics and Informatics (MIF). Initially, there were only first and second cycle study programmes in Statistics. In 2000, first and second cycle studies in SP Econometrics were started. The interest in Statistics programmes was progressively decreasing until 2017, when the second-cycle in Statistics was discontinued (due to lack of applicants' interest). In 2018 the undergraduate Statistics programme (running since 1997) was substantially updated and transformed into Data Science (the programme has been supplemented with modern IT-related data analysis methods). This updating took into account the current realities (huge amounts of data are becoming available and classical statistical analysis tools are no longer sufficient to analyse them). When the new programme in Data Science started, the number of applicants to the new study programme was much larger than the ones to the previous program in Statistics. In 2016 two different specialisations – Econometrics and Data Science – were introduced in the postgraduate Econometrics study programme, and in 2018 this program changed its name to Modelling and Data Analysis (maintaining the previous two specialisations) (SER, pages 6-7).

Therefore, at this moment there are three study programmes in the Statistics study field at VU: the first-cycle in Data Science, first-cycle in Econometrics, and second-cycle in Modelling and Data Analysis (with two specialisations: Econometrics and Data Science).

Nowadays, Data Analyst, Data Scientist and Statistician are among the most in-demand professions in the world, and in particular in Lithuania, where these professions are constantly appearing on websites offering jobs to professionals. The demand for Data Analysts/Data Scientists/Statisticians is confirmed by business representatives. Only two HEI in Lithuania offer studies in the Statistics study field (VU and VTGU). Additionally, there are three more study programmes (in the Applied Mathematics study field) offering programmes related to Data Science (two in KTU, and another in VDU). The Econometrics program of VU is more specialised, and it is unique in Lithuania.

VU study programmes of statistics study field in both study cycles aim to develop statistical competencies, abstract logical thinking, broad erudition, motivation to deepen the skills and knowledge in statistics and to promote statistical literacy, the ability to maintain and enhance professional competence through lifelong learning (SER, page 11). The three programmes are

in close cooperation with Lithuanian business enterprises and state institutions (e.g., Euromonitor International or Creditinfo Lietuva, Bank of Lithuania, Danskebank, mainly by means of students' internships) (SER, page 10).

(2) Expert judgement/indicator analysis

The panel judges that the aims and outcomes of the three VU study programmes in the Statistics study field meet the needs of both society and the labour market. This judgement is informed by the broadly positive opinions of alumni and social partners at the site visit. Alumni confirm that the study programmes prepared them well for the professional career. In particular, they mention that the background they obtained at VU is allowing their continuous learning, since they arrived at work. Employers also confirm the good general training in practical and (especially) theoretical skills that the programmes provide. However, they mention some additional study contents which would benefit the study programmes, such as data management in practice (e.g., cleaning dirty data), statistical integration of administrative and Big data into sample surveys or more emphasis on Python programming. The opinion of the experts in the panel is that the inclusion of these contents in the study programmes would reinforce the connection between the studies and the needs of the labour market, which would benefit the study programmes. All parties agree that internships represent a good opportunity to get knowledge of the professional practice of the studies.

3.1.2. Evaluation of the conformity of the field and cycle study programme aims and outcomes with the mission, objectives of activities and strategy of the HEI

(1) Factual situation

Study programmes in the statistics field correspond to the mission and goals of Vilnius University provided in the statute (among other: to train competent scientists and other highly qualified specialists at an international level, to foster traditional academic values as impartiality and integrity; SER, page 12). Study programmes in the statistics field correspond to the strategic activity plan of Vilnius University 2018–2020 (among others: internationalisation of study programmes, openness to equality and diversity; SER, page 12). The internationalisation of the studies (one of the points in the strategic activity plan of VU) is possible because Master's studies (and some undergraduate courses) have been conducted in English for several years. This allows exchange students to take the courses together with Lithuanian students. To ensure academic integrity, students and staff must adhere to the Academic Ethics Code of Vilnius University (SER, page 44).

(2) Expert judgement/indicator analysis

The panel concludes that the aims and outcomes of the evaluated study programmes meet with the main mission, goals, and strategy of VU. The strategy of teaching Master's studies in English (as well as some undergraduate courses) is considered by the panel as a fundamental one for allowing internationalisation of the studies. The panel considers that the adherence to the Academic Ethics Code by students and staff is useful for ensuring impartiality and academic integrity.

3.1.3. Evaluation of the compliance of the field and cycle study programme with legal requirements

(1) Factual situation

Statistics field study programmes in VU were created and are operated in accordance with legal requirements (SER, Section 1.2). The aims and outcomes of study programmes in the statistics field in VU are formulated to correspond to the study results characteristic for each study cycle as defined in the Descriptor of Study Cycles. In particular, the study programmes provide a solid foundation in informatics, mathematical analysis, probability theory, mathematical and applied statistics (SER, Section 1.2). All the legal requirements are observed in the VU study programs in the Statistics field (SER, Section 1.2; in particular table 1 for first-cycle studies and table 2 for the second-cycle). In particular, the first-cycle programmes consist of 240 credits, 140 of which are composed by the study field subject (the legal minimum is 120), 15 are devoted to the final thesis (the legal minimum is 15), and the other 15 credits correspond to an internship (the legal minimum is 15). The master programme consists of 90 credits, 60 of which are composed by the study field subject (the legal minimum is 60), and 30 correspond to the final thesis (the legal minimum is 30). It is worth mentioning that the three study programmes significantly exceed the minimum legal requirements for student-teacher contact work, which is around 33 % in the first-cycle programmes (the legal minimum is 20 %) and approximately 20 % in the master programme (where the legal minimum is 10 %).

(2) Expert judgement/indicator analysis

The panel judges that the VU study programmes in the Statistics study field meet with the legal study requirements. In particular, the panel has verified that the three study programmes fulfil all the credit legal requirements for the whole study programmes, for the modules devoted to the field of study, for the final thesis, and for the internships.

3.1.4. Evaluation of compatibility of aims, learning outcomes, teaching/learning and assessment methods of the field and cycle study programmes

(1) Factual situation

According to the SER (Appendix 1), the aim of the Bachelor in Data Science is to prepare data analysis specialists who are able to effectively formulate, solve and interpret practical interdisciplinary problems in a language acceptable to the target audience, requiring knowledge of mathematical modelling and their integration with information technologies and covering such areas as stochastic and statistical modelling and analysis, optimisation and machine learning, data mining, analysis and management using appropriate software tools (statistical data analysis systems, database management systems, tools for computer clusters, etc.). The general and subject specific competencies pursued by the study programme, as well as its learning outcomes, are listed and grouped into 7 categories.

According to the SER (Appendix 1), the aim of the Bachelor study programme in Econometrics is to develop the students' ability in econometric modelling, providing the students with knowledge of modern statistics and economics, which will be useful in data collection, systematisation, analysis and interpretation; ability to apply statistical methods in economics, finance, and other areas related to uncertainty, critically evaluate statistical and economic information and explain it to the experts; to work both individually and in a team, constantly improving the level of knowledge. The general and subject specific competencies pursued by the study programme, as well as its learning outcomes, are listed and grouped into 11 categories.

According to the SER (Appendix 1), the aim of the second-cycle study programme in Modelling and Data Analysis is to prepare internationally recognised professionals in econometrics and data analysis who expertly utilise the up-to-date knowledge of economics and data science in developing advanced mathematical (statistical) models for private and public institutions for planning, management, forecasting and evaluation of their activities. The general and subject specific competencies pursued by the study programme, as well as its learning outcomes, are listed and grouped into 10 categories.

Teachers prepare the descriptions of course units following competencies and expected study results formulated in the description of the study programme, which ensures the achievement of the general goals of the program (SER, page 19 and Appendix 1). In particular, the descriptions of all course units indicate which study results the course unit allows to achieve. Annex 2 of the SER includes tables (one for each study programme) that, for each study programme result, show by which modules in the corresponding study plan it is covered.

Additionally, teachers choose study methods and assessment methods that allow measuring the compliance of achievements with specific study program results (SER, page 19). Annex 3 of the SER provides, in a schematic way, information about the coherence of study programmes outcomes, course unit (module) outcomes, and teaching, learning and assessment methods for each course unit (module) in the study plans.

Once a year, the Study Program Committee (SPC) reviews the study plans and assesses whether all the study results of the study programme are sufficiently and evenly covered and whether the appropriate study methods and assessment methods have been selected (SER, page 19).

(2) Expert judgement/indicator analysis

After having examined the factual situation (described above), the panel judges that the aims, learning outcomes, teaching and assessment methods are appropriate and valid for the three evaluated study programmes. In particular, from Annex 2 the panel has checked that the general and subject specific competencies pursued by the study programmes are effectively achieved by the different modules. Additionally, based on Annex 3, the panel concludes that teaching, learning and assessment methods are compatible with the study programmes aims. During the site visit, at the meeting with staff responsible for the preparation of the SER, the panel members were able to verify that the Study Program Committee (SPC) is very active, it

is always trying to improve the study programmes, identifying the major problems and looking for solutions.

3.1.5. Evaluation of the totality of the field and cycle study programme subjects/modules, which ensures consistent development of competences of students

(1) Factual situation

The structure and content of the first and second-cycle study programmes are focused on the consistent development of the indicated competencies, distributed over all study semesters and study subjects and in accordance with the requirements of the description of the cycles and the field of study (SER, page 14). The SPC ensures that knowledge about professional ethics and other forms of practical activity is consistently developed during the studies (SER, page 14).

At first and second courses, fundamental subjects are studied (mainly mathematics foundations, and some basic programming). Then the third course and the first semester of the fourth, introduce the main tools in Statistics and Data Science (many of them as elective subjects). Practice in the 8th semester provides students with the necessary practical skills in the fields studied by them. The final bachelor work demonstrates abilities acquired by a student throughout the studies (SER, Annex 2).

A similar structure is followed by the Bachelor in Econometrics.

Courses in the master programme in Modelling and Data Analysis (devoted mainly to advanced statistical modelling, advanced econometrics, big data analysis, optimization, machine learning, economics, finance, game theory) are arranged in two semesters, and the final work is developed during the third semester. From the beginning, students have to choose one of two elective specialisations: “Data Sciences” or “Econometrics” (SER, Annex 2).

During the site visit, at the meeting with students, those enrolled in the Data Science bachelor programme complained about the hard workload required in order to follow all the courses as they appear in the study program. They also reported certain inconsistencies in the sequence of modules.

(2) Expert judgement/indicator analysis

The panel considers that the three evaluated study programmes ensure consistent development of student competencies. The contents of the programmes look comprehensive and support the SER statement that the structure and content of the first and second-cycle study programmes are focused on the consistent development of the indicated competencies, distributed over all study semesters and study subjects and in accordance with the requirements of the description of the cycles and the field of study. Annex 2 shows that there is a balance of modules across mathematics, statistics, econometrics and programming fields. Important emerging trends (such as machine learning, artificial intelligence, neural networks, Python programming language) are also incorporated into the programmes.

The experts in the panel consider that the modules of the Bachelor in Data Science study programme are standard (at an international level) of a Statistics/Data Sciences degree. They are arranged in such a way that student abilities are consistently developed. The study programmes in Data Science and in Econometrics share many modules, mainly in the first 3 semesters. The main difference is that Data Science courses devoted to algorithmic and programming are replaced in Econometrics by courses on Economics, Econometrics or Finances.

The panel is of the opinion that the large workload of Data Science students is because this study programme is running as such only since 2018. Therefore, there is only one year of free-of-covid19 experience. It is expected that soon the SPC detects this problem and proposes a solution. Just in case, the panel would like to point out that with the new programme, the effective workload for students, numbers of exams, etc., could be constantly checked. In particular, it should be checked if smaller 5-credit units could be combined to larger 10-credit units. Additionally, the order of courses should be checked to help with the consistent development of competencies of students.

3.1.6. Evaluation of opportunities for students to personalise the structure of field study programmes according to their personal learning objectives and intended learning outcomes

(1) Factual situation

Students are provided with various opportunities to personalise their studies: individual study plans, academic exchanges, possibility to study foreign languages, minor studies and a certain number of credits dedicated to elective studies (SER, page 20). Part-time students of the Modelling and Data Analysis study program can choose among four different study plans (SER, page 20).

An additional way to gain flexibility is the possibility to easily move from one Bachelor programme to the other during the first two years of study, because of the high proportion of common courses between them.

(2) Expert judgement/indicator analysis

The panel judges that the study programmes in the Statistics study field at VU ensure clear opportunities for students to personalise the structure of their programme according to their personal objectives.

3.1.7. Evaluation of compliance of final theses with the field and cycle requirements

(1) Factual situation

The Final thesis is worth 15 credits at the bachelor programmes, and 30 at the master programme (5 of them devoted to a Master's thesis seminar). In 2014 the SPC approved a document ("Writing Coursework and Thesis: A Guide for Students") with methodological instructions for students preparing the final thesis. This document is annually updated. In the

last semester of the Master's programme Modelling and Data Analysis there is a Master's thesis seminar (5 credits), where students are introduced to the requirements for the final thesis. The SPC discusses and approves the topics of the final thesis, ensuring the compliance of the topics and content of the final thesis with the field studies (SER, page 21 and Appendix 6). According to the SER (SER, page 22), one of the strengths of the VU bachelor programmes in the Statistics study field is that compulsory professional internship is always closely linked to the final thesis.

(2) Expert judgement/indicator analysis

The panel judges that the Final Thesis for the evaluated study programmes at VU complies with the field and cycle requirements. The panel finds that the list of the final theses covers a large variety of updated and relevant topics in Statistics: applied statistics and econometric models, analysis of finance data, marketing, functional data analysis, time series, spatial statistics, biostatistics, big data, machine learning, among others. Additionally, the formal requirements have been checked by the panel.

Moreover, the panel believes that the master's thesis seminar has positive effects in the quality of the theses. Finally, it is well valued that all the master's theses which have been provided as examples were written in English.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. Study programmes of the first-cycle of Statistics and the second-cycle of Econometrics have been substantially transformed into study programmes of Data Science and Modelling and Data Analysis, which is an absolutely timely update.
2. The programmes in the field have similar content as international standards.
3. The students obtain the necessary background and skills for life-long learning enabling them, in particular, to quickly learn new methodology necessary in the job, in particular in this fast moving area.
4. Student internships represent a good opportunity to get knowledge of the professional practice of the studies. It is positive that they are linked to the final thesis.
5. The programmes offer certain flexibility in study plans allowing students to juggle work and studies and also allowing for some movement between different programmes of the department.

(2) Weaknesses:

1. It would be welcome if some common skills such as Python programming, data management and integration techniques or usage of compute clusters could already be practised more during the study programmes. To do so would reinforce the connection between the studies and the needs of the labour market.
2. As a new programme, the Bachelor programme in Data Science still requires (and gets) active monitoring to ensure that it can be studied in the proposed time by the majority of students. For the moment it has not been possible to properly calibrate the effective workload for students, numbers of exams, etc. In particular, it could be checked if

smaller 5-credit units could be combined into larger 10-credit units. Additionally, the order of courses could be checked to help with the consistent development of competencies of students.

3.2. LINKS BETWEEN SCIENCE (ART) AND STUDIES

Links between science (art) and study activities shall be assessed in accordance with the following indicators:

3.2.1. Evaluation of the sufficiency of the science (applied science, art) activities implemented by the HEI for the field of research (art) related to the field of study

(1) Factual situation

During the comparative international expert assessment performed in 2018, the Mathematics and Informatics research field, to which belong the field in Statistics, was evaluated with score 4 (very good) for the quality of R&D and the economic and social impact of R&D activities, and the score 5 (excellent) for the development potential of R&D activities.

The majority of research interests of VU teaching staff are concentrated on probability theory, mathematical statistics, econometrics, reliability theory, etc. They have publications in such high impact journals as *IEEE Transactions on Reliability*, *Bernoulli*, *IEEE transactions on reliability*, *Fuzzy sets and systems*, *Nonlinear analysis: modelling and control*, *Stochastic Analysis and Applications*, *Informatica*, *Stochastic Processes and their Applications*, etc.

According to Annex 4, in the period 2017-2021 17 teachers of the study programmes in the field of Statistics declared 35 scientific articles which are published in the Clarivate Analytics Web of Science database. Yet, 3 persons in this period didn't declare any scientific paper in the analysed period.

According to the presented results (SER, page 24, table 2.3) in the period 2017-2019 teaching staff of the analysed study field carried out 1 international and 5 national funded projects as well as two projects funded by the VU budget. Also, teaching staff assists various organisations by consulting on statistical modelling and data analysis, e.g. Ministry of Finance of the Republic of Lithuania.

(2) Expert judgement/indicator analysis

The panel concludes that the scientific research activities implemented by the teaching staff in the field of Statistics are very good and related to the field of study. The panel also concluded that research is recognized on both national and international level. The comparative expert assessment of R&D activities in 2018 shows the excellent potential in the development of R&D activities.

3.2.2. Evaluation of the link between the content of studies and the latest developments in science, art and technology

(1) Factual situation

The aims of the analysed programmes reflect the latest developments in science. The aim of the Data science programme is related to mathematical modelling and their integration with information technologies – covering areas such as stochastic and statistical modelling and analysis, optimisation and machine learning, data mining, analysis and management using appropriate software tools. The aim of the Econometrics programme is related to econometric modelling, providing students with knowledge of modern statistics and economics. The aim of the Modelling and Data Analysis programme is related to preparing internationally recognised professionals in econometrics and data analysis. These aims of programmes are well reflected in the final theses. The full list of topics of the final theses is presented in Annex 5.

Modules covering functional data analysis, financial econometrics, big data analysis, parametric and non-parametric statistics, panel data econometrics, multidimensional statistics, probabilistic machine learning and others covering the latest statistical and data analysis methods reflect the study programmes aims well.

(2) Expert judgement/indicator analysis

The panel states that the VU programmes in the field of Statistics do employ high quality teachers with extensive research experience in statistics. Some key topics: financial econometrics, big data analysis, functional data analysis, multidimensional statistics, artificial intelligence, machine learning, etc., show that the content of studies covers the latest knowledge in science.

3.2.3. Evaluation of conditions for students to get involved in scientific (applied science, art) activities consistent with their study cycle

(1) Factual situation

In the very first semesters students are introduced to the topics of Faculty of Mathematics and Informatics research activities, ongoing projects, opportunities and perspectives of cooperation with social partners. Research is carried out by students during the final works and courseworks. Also, graduate (and sometimes undergraduate) students are encouraged to make presentations at seminars and conferences.

In the 2017-2020 period more than 3 % of the first-cycle students were involved in research activities (1 student prepared a paper and 4 students were involved in the implementation of research projects). In the second-cycle programmes, more than one-third of the students participated in research activities.

Research work is included in the second-cycle programme with several obligatory courses: for full-time studies this includes Master's Thesis Seminar (5 ECTS), the Master Thesis (25

ECTS), for part-time studies this include Scientific Research (Master thesis project, study field: statistics) (10 ECTS), Master's Thesis Seminar (5 ECTS), the Master Thesis (15 ECTS).

(2) Expert judgement/indicator analysis

The panel concludes that students have very good opportunity to participate in scientific research activities related to the study field. Students can realise their own project activities, participate in scientific conferences, and write scientific articles.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. High quality teachers are employed in the field.
2. Topics of bachelor and master thesis fit very well with the latest challenges in real life and science and are directly related to the study field.
3. Students are involved in research activities.

(2) Weaknesses: none

3.3. STUDENT ADMISSION AND SUPPORT

Student admission and support shall be evaluated according to the following indicators:

3.3.1. Evaluation of the suitability and publicity of student selection and admission criteria and process

(1) Factual situation

Admission to Vilnius University first-cycle study programmes is organised during the General Admission period in accordance with the procedures of LAMA BPO (Association of Lithuanian Higher Education Institutions for Centralised Admissions), an institution authorised by the Ministry of Education, Science and Sports of the Republic of Lithuania and the Admission Procedure of Vilnius University. Admission to the second-cycle studies field is conducted following Vilnius University Admissions Procedure for Second-Cycle Study Programmes. The SER mentions that if a student is identified (at the time of admission during the interview of motivation assessment,) as lacking certain knowledge, he or she is given additional information before the start of each course.

However, students mentioned to the panel during the meeting that no retraining or bridging courses are being held and they have to study on their own and fill the gaps. The SER report (SER, page 29) also mentions that this issue was repeatedly discussed at the SPC meetings, however, the panel sees that the problem has not been fully resolved yet. This question is relevant, as in the additional documents, the authors of the SER state that almost half of the second-cycle students are admitted from other HEIs (2018: 12 students from MIF admitted to

second-cycle studies and 23 students from other HEIs admitted to second-cycle studies, 2019: 22 and 17, 2020: 20 and 15, 2021: 18 and 21, respectively).

All admission rules (for both cycles) are published on the University website. This was checked by a panel member, and she confirms that there are all necessary documents and information in Lithuanian and English online.

The report provides tables (SER, pages 28-29) that illustrate student enrollment, with data for 2017-2020 showing the number of students increasing. The data show that in 2017, 224 students applied for studies in the first circle of studies and 36 students applied for studies in the second circle, and in 2020, 401 students and 63, respectively. During the meeting with the team responsible for the preparation of the SER, it was emphasised that the updating of the bachelor's (SP from Statistics to Data Science) and master's (SP from Econometrics to Modelling and Data Analysis) programs title and course plans had a significant impact on this. The first-cycle econometrics programme also currently suffers from a decreasing number of learners (18 students in 2020 versus 39 in 2017).

(2) Expert judgement/indicator analysis

The panel conclude that the criteria for the selection and admission of the first-cycle students and the suitability and publicity of the process are appropriate. However, the situation regarding admission to the second-cycle raises questions, as students do not always feel ready and have the necessary knowledge. It is essential to ensure that admitted students have the necessary competencies and, in their absence, to organise retraining or bridging courses in a structured way. Perhaps, the method of assessing the suitability of a candidate's knowledge by the interview of motivation assessment is not sufficient and additional criteria should be introduced for the admission of second-cycle students.

The policy of publicising the programmes, organising events and fairs, and internal reorganisations (changing the name of the program, the content of the course) help to maintain the right number of students. The panel is therefore convinced that the appropriate procedures are in place and worth following in the future.

3.3.2. Evaluation of the procedure of recognition of foreign qualifications, partial studies and prior non-formal and informal learning and its application

(1) Factual situation

Individuals with knowledge and skills acquired through work experience, non-formal learning, self-directed learning, volunteering, etc. can formalise their non-formal learning outcomes. The SER mentions (SER, pages 29-30) all the necessary documents and legislation on which the crediting or non-crediting of knowledge and skills is based. The report emphasises that decisions about personal academic recognition take individual circumstances into account e.g. evaluating and recognizing similar or equivalent foreign qualifications, thereby ensuring the consistency of qualification recognition practice. It should also be noted

that no more than 75 % of the scope of first-cycle, second-cycle, integrated and joint study programmes may be recognized.

(2) Expert judgement/indicator analysis

The panel considers that there is a clearly defined process within the institution to the procedure of recognition of foreign qualifications, partial studies and prior non-formal and informal learning and its application. Several cases mentioned in the SER (SER, pages 30-31, table 3.7) prove that appropriate procedures are in place if the applicant wishes to follow this path.

3.3.3. Evaluation of conditions for ensuring academic mobility of students

(1) Factual situation

Studies abroad and international cooperation are overseen by the University's International Relations Department, while at the Faculty of Mathematics and Informatic there is an International Studies Coordinator and Vice-Dean for Academic Affairs responsible for international cooperation and studies abroad. News is actively published on the University and faculty websites, social networks, sent to students by email.

The tables in the SER shows (SER, pages 32-33) the University's active involvement in international programmes, a wide range of agreements with other universities (SER, page 32, table 3.8). The authors of the SER mention that the number of students who have taken advantage of academic mobility opportunities varies, according to the number of learners and pandemic situation. It can be seen that 8 students took advantage of these opportunities in 2017-2018, in 2018-2019 – 8 students (2 of them with internships abroad), 2019-2020 – 3 students.

In general, the number of students going to internships abroad at the Faculty is lower than the number of students who go to exchange studies. It is possible to notice that subjects in the study field of statistics are popular and are chosen by an ever-growing number of incoming international students.

(2) Expert judgement/indicator analysis

The panel agree that the current academic mobility policy is appropriate, even though students prefer exchange programs to internships. The data in the report (SER, page 32, table 3.9) shows that students are taking advantage of this opportunity (in the analysed period there were 19 outgoing and 50 incoming students). It is also commendable that the number of foreign students in the programs is increasing (it is clarified that in 2017 there were 16 and in 2020 21 students from abroad).

3.3.4. Assessment of the suitability, adequacy and effectiveness of the academic, financial, social, psychological and personal support provided to the students of the field

(1) Factual situation

Based on the information provided in the SER and summarizing the interviews with the students, it can be seen that all students of the field have the opportunity to receive support: academic information and consulting, career services, information technology services, library and information services, financial support, accommodation services, cultural and leisure services, the opportunity to participate in student activities, psychological services, spiritual and religious services and support and services for students with special needs. The main focus is on academic support to help the students study successfully, as well as the ability to establish themselves in the labour market after graduation. Despite these facts, students mentioned during the meeting that they needed more help when a student comes from another field of study, especially for second-cycle students (see also 3.3.1.).

(2) Expert judgement/indicator analysis

The panel consider that the University evaluates all possible student support systems, which do not only include the support required by the legislation, but also individual material or psychological support for a student, as well as mentoring assistance. To further improve the situation, the panel recommends paying more attention to bridging courses. It should be emphasised that VU must ensure that students admitted to the second-cycle have the necessary competencies to complete their studies successfully.

3.3.5 Evaluation of the sufficiency of study information and student counselling

(1) Factual situation

The SER (SER, pages 35-36) refers to students being introduced to their study programmes during VU integration week. All information about the study process is also provided to students in VU internal information systems. During the meeting with the students, they mentioned that all the systems used at the University are convenient and clear, but pointed out that the VUSIS system sometimes crashes at the time of subject registration.

Students are constantly given the opportunity and even encouraged to ask any questions they might have thus guaranteeing sufficient consultations. It was also mentioned during the meeting with the students that it does not take long to get a response from the administration, lecturers or other University staff. This improves communication between the student and the University.

(2) Expert judgement/indicator analysis

The panel agrees that students are provided with sufficient study information and study counselling. This was also agreed to by the students during the meeting, who also reported strong support from lecturers and a good information flow. It should be added that all existing information systems must function properly, i.e. all connection problems need to be fixed.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. The great interest of Lithuanian and international students in study programmes in the field of statistics. The number of foreign students in the programmes is increasing (as it was clarified that in 2017 there were 16 and in 2020 21 students from abroad).
2. Students are provided with appropriate, sufficient and effective academic, financial, social and psychological support. Also, they are provided with sufficient study information and study counselling.
3. The criteria for the selection and admission of the first-cycle students and the suitability and publicity of the process are appropriate.
4. The policy of internal reorganisations (changing the name of the programme, the content of the course) helped to maintain the right number of students.

(2) Weaknesses:

1. Bridging studies could be better organised for students entering from other specialities and without the necessary knowledge.
2. The VUSIS system sometimes crashes during subject registration.
3. Decreasing the number of students in the SP Econometrics (which, on the positive side, has already led the SPC to change the current programme to a more attractive one with different partners).

3.4. TEACHING AND LEARNING, STUDENT PERFORMANCE AND GRADUATE EMPLOYMENT

Studying, student performance and graduate employment shall be evaluated according to the following indicators:

3.4.1. Evaluation of the teaching and learning process that enables to take into account the needs of the students and enable them to achieve the intended learning outcomes

(1) Factual situation

The SER states that each teacher introduces the syllabus as well as necessary requirements during the first lecture of the course. The final assessment of study achievements in a course may be a cumulative grade, where the assessment strategy is chosen in such a way that it allows for appropriate measurement of students' abilities and their progress.

Master studies can be undertaken in full time or part time giving some flexibility to the individual student if they are working full-time or coming from a non-mathematical background. Contact learning is combined with self-study work and individual study tasks such as projects or presentations are also included. The lecture techniques are diverse and were appropriately adapted to online teaching during the pandemic. Homework tasks allow the student to understand their learning progress early on so that they still have a chance to react.

Students are provided with support such as academic counselling, vocational counselling or career orientation.

(2) Expert judgement/indicator analysis

The study programmes give some flexibility to each individual student's needs, for example, part time studies are possible. Students with a non-mathematical background also confirmed during the site visit that the University provided some necessary support for them (see also 3.3.1.).

A wide range of teaching and learning techniques is used as is common in the field, such as classical lectures and exercises, seminars, programming classes, discussion classes and individual reading among others. In response to the COVID-19 pandemic, lectures were moved to a remote format on short notice. At the site visit, the teaching staff confirm that the University helped with the transition by providing the necessary equipment such as graphic pads in addition to putting cameras in several lecture halls. The students also confirm that this went smoothly and in 1 particular the Master students appreciated the lecture recordings as it gave them more flexibility in balancing study and work. The panel was impressed with the study committee which seemed very active, in particular taking students' concerns very seriously and using them to improve the programme.

3.4.2. Evaluation of conditions ensuring access to study for socially vulnerable groups and students with special needs

(1) Factual situation

On the occasion of its 400th birthday, VU awarded 100 scholarships, which aim to encourage talented young people from financially challenged families to pursue higher education. There is one person specifically responsible for the coordination of disability matters at the Faculty of Mathematics and Informatics at VU, whom students with disabilities can consult on all matters. Infrastructure is increasing but not all lecture rooms are currently already accessible to students with disabilities such that lecture halls have to be changed. There is also equipment available at the faculty that can be used by students with disabilities if the need occurs. However, the faculty experiences a significant shortage of infrastructure for persons with reduced mobility.

(2) Expert judgement/indicator analysis

Study individualization plans are created if necessary for students with special needs, indeed according to the SER, currently, 5 such plans have been created for 4 students. Furthermore, teachers are informed at the beginning of each semester if teaching and learning methods need to be adapted correspondingly. The panel concludes that VU actively aims at ensuring access to study for socially vulnerable groups and students with special needs.

3.4.3. Evaluation of the systematic nature of the monitoring of student study progress and feedback to students to promote self-assessment and subsequent planning of study progress

(1) Factual situation

There exist several monitoring plans to monitor students progress on several levels. Within each module during the semester teachers provide feedback about completed tasks. Such feedback occurs on several levels including review of homework, individual and group discussions, short tests among others. The study administration department monitors the progress on the level of all students of a given year in a programme which is complemented by the analysis of the results of the exam sessions. According to a survey cited at the SER, the majority of students are satisfied by the feedback that is given to them.

(2) Expert judgement/indicator analysis

The panel concludes that the feedback given to students is adequate and there is a good monitoring system in place. However, general monitoring of the peer group by the administration department may not reflect the situation very well if the peer group is too small. In such situations, the experience of the teachers should be considered more informative.

3.4.4. Evaluation of employability of graduates and graduate career tracking in the study field.

(1) Factual situation

Bachelor studies have a duration of four years, which includes a professional internship during the last semester. According to the SER, students often get a job offer from the same company they did their internship with.

After completion of the Bachelor's programme students can continue their studies in the Master study programmes in related fields, after the Master's study programme students can continue with their doctoral studies.

There is an advisory group of the Dean consisting of social partners aimed at ensuring that the content of the study programmes agrees with the skills necessary for the job market.

The university is tracking graduate careers by several means: Objective indicators are obtained from state information systems, subjective data of sociological surveys are collected three times (after 1, 3 and 5 years of graduation).

According to the SER, one year after graduation 83 % of the first-cycle graduates and at least 86 % of the second-cycle graduates are employed on a contractual basis in Lithuania.

(2) Expert judgement/indicator analysis

Overall employment of the graduates is very positive providing additional evidence that well trained data scientists and statisticians are in high demand. During the site visit, alumni named some topics that could be included in the curriculum that would have been helpful on their jobs such as more emphasis on Python, data management and integration techniques or data cleansing (see 3.1.1).

However, what exactly is required on the job differs between different jobs. Additionally, in data science new methodology is quickly being developed so that it is most important that graduates are able to learn these new methodology based on the skills obtained in the programme. Both alumni and recent graduates confirm that the study programmes provide students with the necessary skill sets to successfully learn new methodology, use different programming languages that are new to them as well as that the technical knowledge of the students is great. Due to the fact that methodology used in practice is quickly changing in the field, it was also suggested to have a class with talks where social partners introduce important tools from their jobs.

3.4.5. Evaluation of the implementation of policies to ensure academic integrity, tolerance and non-discrimination

(1) Factual situation

Academic integrity is implemented on several levels: first, students who have violated academic ethics, may be censured or expelled from the University. In particular, questions are asked in such a way that the students demonstrate understanding and skill rather than reciting facts from teaching material. Also, the final assessment of a course is cumulative. A final thesis and research paper electronic overlapping identification system is available. There are procedures in place if academic integrity is violated.

Additionally, there is an anonymous hotline for such cases as well as violations of tolerance and non-discrimination. According to the SER during the last three academic years no cases of violation of academic integrity, tolerance and non-discrimination have been referred to the Academic Ethics Commission of the VU MIF.

(2) Expert judgement/indicator analysis

The panel concludes that policies are in place to ensure academic integrity, tolerance and non-discrimination and everything seems to be in order as indicated by the zero cases in the last three years. The hotline is particularly useful as – due to its anonymity – students can get help without having to worry about consequences.

3.4.6. Evaluation of the effectiveness of the application of procedures for the submission and examination of appeals and complaints regarding the study process within the field studies

(1) Factual situation

The VU resolution “Study regulations of Vilnius University” from 2018 defines the procedure for submitting and examining appeals and complaints. A student who does not agree with the final assessment of the course unit (module), no later than within seven calendar days from the date of publication of the final assessment of the course unit (module), has the right to apply to the dispute resolution commission of the core academic unit (faculty). Appeals against the final decisions of final examinations or final theses may not be approved. Student due to procedural violations of interim assessment, final course unit (module) assessment, final exam or final thesis defence, not later than within three working days after interim assessment, final course unit (module) assessment, final exam or final thesis defence, has the right to apply to the dispute resolution commission of the core academic unit (faculty) in a reasoned written manner. Since 2017 only one appeal to the Dispute Resolution Commission of MIF has been lodged (in 2019 by a student in the first year of the second-cycle of Modelling and Data Science).

(2) Expert judgement/indicator analysis

The panel judges that the procedures for submission and examination of appeals and complaints are in place and look effective. However, the deadlines for such a complaint are rather short in particular taking into account that students first need some time to come to a decision whether or not to appeal and then need some additional time to actually file a complaint.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. Very active SPC which is taking students' concerns seriously and puts a lot of effort into improving the programmes.
2. Advisory group of the dean consisting of social partners ensures that the content of the study programmes agrees with the skills necessary for the job market.
3. Individual needs of the student are taken into account by individual study plans and also allow for movements between programmes (e.g. opening up the Master programme for students with a non-mathematical background).

(2) Weaknesses:

1. The time for students to appeal seems rather short.

3.5. TEACHING STAFF

Study field teaching staff shall be evaluated in accordance with the following indicators:

3.5.1. Evaluation of the adequacy of the number, qualification and competence (scientific, didactic, professional) of teaching staff within a field study programme(s) at the HEI in order to achieve the learning outcomes

(1) Factual situation

A list of teaching staff is provided in Appendix 4 of the SER. Study field programmes implement 6 professors, 9 associated professors and 2 lecturers. 4 teachers are habilitated doctors and 11 teachers are doctors. The staff-student ratio is very good ranging between 0.088 and 0.81 (according to table 5.1 of the SER). The number of teachers is good and they all share a similar teaching load within the programme. Doctoral students are actively involved in the teaching process as assistants which should help in the long term to keep a balanced age mix of the teachers.

At the moment, there are too many teachers closer to retirement age. According to the additionally provided information, 50 % of the teaching staff of the second-cycle programme are 60 years or older. In the Econometrics study programme about 34 % of the teaching staff are 60 years or older and in the Data Science study programme – 30 % of the teaching staff are 60 years or older. On the other hand, in the Econometrics study programme, about 42 % of the teaching staff are 40 years or younger, in the Data Science programme – about 37 % of the teaching staff are 40 years or younger and in the second-cycle programme – 25 % of teaching staff are 40 years and younger.

A large proportion of the teachers are very active on all levels: research, research supervision and other scientific activities. Many of them have been published in the top international journals of the field (including *Bernoulli*, *Journal of Multivariate Analysis*, *Electronic journal of statistics*, *Stochastic processes* and their applications among others). Out of the 17 teachers, 11 have provided 3 publications from the last 5 years, 2 have provided 2 publications, 1 has provided one publication and only 3 have provided no publications. Additionally, several textbooks were published by teachers in the programme.

(2) Expert judgement/indicator analysis

The panel concludes that all formal requirements are met. Indeed the panel judges very positively the number, qualifications and competency of the staff within the Statistics study field. The qualification of many teachers is high as they are internationally visible and very active in their respective research areas.

However, VU needs to be careful as the age balance of the teachers at the master level is currently not good with too many teachers retiring within the next few years and not enough young teachers ready to take their place.

3.5.2. Evaluation of conditions for ensuring teaching staffs' academic mobility (not applicable to studies carried out by HEIs operating under the conditions of exile)

(1) Factual situation

Teaching visits are possible within the framework of the Erasmus+ programme and using the financial resources of the Education Exchange Support Fund. In the last years, several

members of the teaching staff have given lectures in various international universities internationally. Most lecturers are fluent in English. Furthermore, the staff is active in conference and seminar talks covering a broad range of modern topics.

During 3 academic years (period 2017-2020) on average 11 learning visits and 1 (2018-2019) and 2 (2017-2018) teaching visits were abroad by statistics study field teaching staff.

(2) Expert judgement/indicator analysis

The teaching staff seems to take advantage of academic mobility. Particularly noteworthy are several lectures delivered around the world by teachers involved in the programmes (such as at the University of Lille (France), the University of Rouen (France) or the University of Copenhagen (Denmark) to name just the most recent ones). International conference and research visits, which are the most common type of academic mobility in normal times, came to an abrupt stop during the pandemic, such that corresponding activities cannot be judged fairly during the evaluation period.

3.5.3. Evaluation of the conditions to improve the competences of the teaching staff

(1) Factual situation

According to the SER '[t]here is no systematic planning strategy for professional competences' (SER, page 50), however, central administration has organised teaching competence development training since 2017. In 2019 there were 16 different training programmes that teachers could choose from matching their varying scientific and pedagogical interests.

Teaching staff could improve competencies through various activities. Members of the teaching staff participated in various association activities (Lithuanian Mathematical Society, Lithuanian Operations Research Society, Lithuanian Statistics Society, etc.). Two professors are full members of the Lithuanian Academy of Sciences, four professors are laureates of the Lithuanian State Science Prize. The members of teaching staff are members of editorial boards of several international, regional and national journals.

(2) Expert judgement/indicator analysis

The University offers a variety of courses on different topics so that each teacher can select what is most helpful for him or her. Therefore, the panel concludes that the University provides appropriate conditions and resources to improve the competencies of the teaching staff.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. Strong scientific background of the majority of the teaching staff, good international visibility.

(2) Weaknesses:

1. Age balance in particular in the Master's programme should be given even more attention in the future as too many teachers are close to retirement age.

3.6. LEARNING FACILITIES AND RESOURCES

Study field learning facilities and resources should be evaluated according to the following criteria:

3.6.1. Evaluation of the suitability and adequacy of the physical, informational and financial resources of the field studies to ensure an effective learning process

(1) Factual situation

Section 6 of the SER describes the facilities of the VU Faculty of Mathematics and Informatics (MIF). Additionally, a PowerPoint presentation provided by VU complements this information. MIF consists of four buildings, three of which (in two places in Vilnius city) house teaching activities of the evaluated study programmes. Auditoriums, standard classrooms and computer classrooms are equipped with teacher's and students' technology tools that are international standard nowadays. High-speed and wireless internet access is available in all faculty buildings (Eduroam or MIF open WiFi). The three study programmes use mainly open source statistical software, such as the programming languages R and Python. In addition, the University staff and students can use licensed software, such as MATLAB/Simulink, SAS or SPSS (even on their personal computers). Students and academic staff can also use the VU supercomputer for free for research or teaching activities. The Moodle based Virtual Learning Environment is widely used at the University. MS Teams platform is used for distance learning. Various basic IT services for employees and students (e-mail, website hosting, etc.) are provided by VU.

Students of the MIF can use the reading room located in one of the faculty buildings (90 seats, open on weekdays from 9:00 to 17:00, more than 59.000 printed publications). Additionally, they can access the Central VU historical building or the new modern Scholarly Communication and Information Center (SCIC, open 24/7).

It is worth mentioning that more and more textbooks, papers, and other materials required for studying are available online (for instance, VU has purchased permanent access to eBooks on Cambridge Core and to Oxford Scholarship Online, among others). In particular, students of the Statistics study field can find the literature recommended by teachers for particular courses on the website specifically designed for them (www.statistika.mif.vu.lt), which contains many lecture notes and open-source textbooks.

The Faculty of Mathematics and Informatics experiences a significant shortage of infrastructure for persons with reduced mobility. However, in one of the buildings of the faculty lectures can be broadcast, making it possible to observe lectures remotely. Also, in this building, computer labs are accessible for students with mobility disabilities (SER, page 40). During the site visit, it was confirmed that the number of lecture halls accessible to persons with reduced mobility is limited and that lectures need to be transferred to such rooms if the need applies. On the other hand, students confirmed that the university helps with computers and such (e.g. during the online teaching of the COVID-19 pandemic) if a student cannot afford the necessary equipment.

During the site visit, at the meeting with senior management and faculty administration staff, the panel was informed that faculties at VU have no separate budget for infrastructures.

During the site visit, at the meeting with students, they pointed out that the computer system used for choosing the elective subjects sometimes crashes when this process starts (also mentioned in 3.3.5.). Later on, at the meeting with senior management and faculty administration staff, they acknowledged that this problem has suffered for about 5 years. They indicated that, unfortunately, the elective subjects choice process depends on the general services of VU. The University is planning to buy a new University information system which should solve this problem.

(2) Expert judgement/indicator analysis

Overall, the panel got the impression that the physical and informational resources are sufficiently adequate to ensure an effective learning process. Nevertheless, the MIF learning facilities and resources are far from being optimal. First, the faculty is spread over four buildings (three of which are used for the evaluated studies). Second, the buildings are somewhat old and not ready to be accessed by disabled people. Third, the centralised VU information system responsible for enrolling students frequently fails at critical moments.

These problems have already been detected years ago by the faculty managers. Nevertheless, their solution does not depend on the MIF, but on the VU, which is planning to buy a new information system and to provide a new building to the MIF, big enough to unify all the faculty activities. The panel got the impression that the centralised decision making at VU is not very efficient, in particular taking too much time.

The fact that the MIF has not a separate budget for infrastructures makes it almost impossible for the MIF to install lifting platforms, very expensive equipment. The Faculty is waiting to have a new building in 3 or 4 years. This building is included in the strategic plan of VU.

3.6.2. Evaluation of the planning and upgrading of resources needed to carry out the field studies

(1) Factual situation

Facilities used for the study process are constantly refurbished (table 6.3 of SER indicates that more than 100,000 € have been dedicated to that from 2017 to 2020). Additionally, both

hardware and software are being upgraded or installed as needed. The collection of books and journals is constantly being supplemented with new resources. The demand for new publications to be acquired is collected each year. In the same way, each year before the start of studies, teachers are asked about the required software and if it is free, it is being installed immediately (in the case of proprietary software, it depends on the budget) (Section 6 of the SER).

(2) Expert judgement/indicator analysis

The panel judges that the MIF has a satisfactory renewal policy for library services (for instance, updating access to scientific international databases) and information and local technology infrastructures. Additionally, physical facilities upgrades with a moderate cost (for instance, improving classrooms and computer classes) are also done. Nevertheless, high cost upgrades (such as a new centralised information system, or the new building for the MIF) depend on the VU government and are difficult to advance. Hopefully, the problems identified will be corrected in the coming years.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. Physical and informational resources are sufficiently adequate to ensure an effective learning process.
2. The senior management and faculty administration staff of the MIF have already identified the facilities limitations several years ago.
3. There is a plan to solve the identified facilities deficiencies.

(2) Weaknesses:

4. The MIF is spread over four buildings (three of which are used for the evaluated studies).
5. The buildings are old and not ready to be accessed by disabled people.
6. The centralised VU information system responsible for enrolling students frequently fails at critical moments.
7. The plan to solve the identified deficiencies depends on the VU government and the MIF cannot accelerate the solutions.
8. The MIF will have to wait several years for the new MIF building to become a reality.
9. The launch of the new information system depends on VU, not on the MIF solely.

3.7. STUDY QUALITY MANAGEMENT AND PUBLIC INFORMATION

Study quality management and publicity shall be evaluated according to the following indicators:

3.7.1. Evaluation of the effectiveness of the internal quality assurance system of the studies

(1) Factual situation

The study quality assurance system of VU was developed within the project “Development and Implementation of the Internal Study Quality Management System of Vilnius University” and is implemented in accordance with the study quality assurance provisions of the European Higher Education Area. Study quality assurance is based on fostering quality culture arising from the values enshrined in the mission of VU, monitoring and analysis of study data and internal dialogue on continuous quality improvement, which is based on collected data and external study evaluation results.

The model of the study quality management system in VU reflects:

- the core system processes: strategy implementation, development, evaluation and approval of study programmes intended to be carried out, evaluation and improvement of on-going study programmes, students’ admission (to Bachelor and Master studies), study process, residency study management, doctoral study management, student support and services; planning of research activities; implementation of research activities; evaluation/improvement of research activities; planning of University’s external services; delivery of University’s external services; evaluation/improvement of University’s external services;
- processes influencing the quality of studies: academic personnel management; material resource management; financial resource management; information resource management, project management. All complimentary processes influencing the quality of studies, as well as the research and learning environment form the basis for today’s study quality that satisfies the internal and external needs.

At the University, the SPC are responsible for the quality assurance and continuous improvement of study programs, which follow the Regulations of the Study Programme Committee in their activities. The Committee consists of the academic staff members, who are implementing the Programme, the representatives from students and social partners communities. The SPC reports to the Faculty Council, and informs it, at least once a year, on the study programme implementation matters.

(2) Expert judgement/indicator analysis

VU has been building up its quality culture, which is clearly apparent throughout the whole organisation. The University's commitment to quality is evident in its various processes and procedures. It ensures that processes are carried out effectively and are quality assured and that the learning is disseminated in a modern and clear fashion. VU sufficiently uses processes and procedures of internal quality assurance. As well as, the University analyses the results of external evaluation and accreditation of the study programmes; the results of students' satisfaction with studies; the results of academic staff satisfaction with the job; the results of doctoral studies quality research, thus identifying strengths and weaknesses. This enables them to efficiently address weaknesses by taking different measures. Therefore, the panel judges that effective internal quality assurance systems are in place.

3.7.2. Evaluation of the effectiveness of the involvement of stakeholders (students and other stakeholders) in internal quality assurance

(1) Factual situation

The Faculty organises the collection of feedback from the participants of the study process – students, doctoral students, lecturers, employers, social partners – according to the approved procedure and dissemination of information on the best practises of quality improvement. Attention is paid to students. They are invited to be active participants in the study process and to contribute to the improvement of the quality of studies. Progress of students' satisfaction with the quality of studies and the effectiveness of the measures applied are monitored twice per study year. The results obtained are widely used: in the improvement of programmes, in the development phase of planned programmes, in the improvement of the activities of the Faculty and the University.

Social stakeholders are involved in the processes of assessment and improvement of study programmes. Social partners conduct introductory or case study lectures for students, presenting them with the nature of work, tasks and issues arising in daily work, and share their experience.

(2) Expert judgement/indicator analysis

It can be stated that students and the academic community are involved in the internal quality assurance process. During the interviews, students confirmed that they are involved in the quality assurance process through different initiatives, filling in study quality questionnaires, evaluating study programmes and lecturers.

Social partners are also involved in some processes, such as students' internships evaluation, and giving introductory or case study lectures for students. However, more initiative and collaboration would be welcomed in order to agree on topics of bachelor and master thesis relevant to the social partners. Moreover, the opportunities of joint doctoral studies (e.g. through funding of the Research Council of Lithuania) could be exploited.

3.7.3. Evaluation of the collection, use and publication of information on studies, their evaluation and improvement processes and outcomes

(1) Factual situation

Main information about the study programmes' scope is easy to find on the Faculty's official website. Its presentation is accurate, transparent and contains the main points, such as information about the programme, programme specific requirements, programme structure and alumni, as well as detailed the Exchange Opportunities.

Users (teachers and students) use the VU Study Information System (VUSIS), which contains various applications and serves as the base of information about the management of the field study programmes. Its application enables the student administration to review and edit students' personal data, subject evaluation, registration for optional courses, topics of the final

thesis, as well as to issue certificates, recognize subjects attended at other higher education institutions, inform students about the results of their requests, final evaluations, etc. All student-related orders of the dean or the Rector (e.g., on the topics of research papers and final thesis, visits for partial studies at foreign universities, etc.) are prepared using VUSIS. This system is also used for preparation and printing diploma supplements. VUSIS contains information about admission (competitions, the number of persons admitted based on priorities), and statistics about students and studies.

(2) Expert judgement/indicator analysis

Public information that can be easily found on the Faculty website is of sufficient quality and oriented towards external interested parties (potential students, school teachers, etc.). Internal data distribution is processed via the University's information system VUSIS. Users (both students and teachers) have emphasised during the meetings that they find the system user-friendly, admit that it contains all the information needed and serves their needs.

Furthermore, students have noted that VUSIS is a good information system suitable for effective collaboration with the Faculty, however, stressed that the above-mentioned system sometimes crashes during subject registration (also mentioned in 3.3.5; 3.6.1.).

3.7.4. Evaluation of the opinion of the field students (collected in the ways and by the means chosen by the SKVC or the HEI) about the quality of the studies at the HEI

(1) Factual situation

Students are invited to be participants in the study process and to contribute to the improvement of the quality of studies. They participate at all levels of decision-making and are members of the University Council, Senate, Rectorate, University and Faculty Academic Ethics Commission, University and Faculty Dispute Resolution Commission, Faculty Councils, Study Programme Committees, Faculty Studies College. They can also express their opinion in two types of surveys, organised twice an academic year: about studies and specific subjects studied. Questionnaires are placed in the student information system at the end of each semester. Survey results are published on an internal website. The results obtained are widely analysed by the SPC and used to improve different processes, such as programmes' improvement, teaching staff evaluation, etc.

(2) Expert judgement/indicator analysis

During the meeting, the students stated that they have an opportunity to express their opinion on the quality of the study subject, and that the workload is suitable for them. They have also stressed that active participation in lectures is encouraged. The panel confirms that processes are in place to evaluate students' opinions on the programmes.

Strengths and weaknesses of this evaluation area:

(1) Strengths:

1. VU sufficiently uses processes and procedures of internal quality assurance.
2. Students and the academic community are fully involved in the internal quality assurance process.

(2) Weaknesses:

1. Even closer cooperation with social partners from both the private and public sectors would greatly help to better organise students' internships, as well as find topics of practical relevance for the final thesis from which students not planning on pursuing an academic career could greatly benefit.

V. RECOMMENDATIONS

Evaluation Area	Recommendations for the Evaluation Area (study cycle)
Intended and achieved learning outcomes and curriculum	<ol style="list-style-type: none"> 1. It would be welcome if some common skills such as Python programming, data management and integration techniques or usage of computing clusters could already be practised more during the study programmes. 2. As a new programme, the Bachelor programme in Data Science still requires active monitoring to calibrate the effective workload for students and to ensure that it can be studied in the proposed time by the majority of students. Additionally, the order of courses should be checked to help with the consistent development of competencies of students.
Links between science (art) and studies	<p>In addition to very strong scientific activities, teaching staff could take more attention to practical activities.</p>
Student admission and support	<ol style="list-style-type: none"> 1. Even though the pandemic situation is changing, leave it up to students to choose at least part of the distance learning or laboratory work. 2. It is essential to ensure that second-cycle admitted students have the necessary competencies and, in their absence, to organise retraining or bridging courses in a structured way.
Teaching and learning, student performance and graduate employment	<p>Reconsider the deadlines for students to appeal – can they be made longer?</p>
Teaching staff	<p>Age balance of teachers in particular at the Masters level needs to be improved and more younger people involved in the programme.</p>
Learning facilities and resources	<ol style="list-style-type: none"> 1. To move to a new building as soon as possible to unify all the MIF facilities, and to make MIF accessible for disabled people. 2. To renew the centralised VU information system responsible for enrolling students, which frequently fails at critical moments.
Study management quality and public information	<ol style="list-style-type: none"> 1. To pursue closer collaboration with social partners from both the private and public sectors that would enable the better organisation of students' internships. 2. To find topics of practical relevance for the final thesis from which students not planning on pursuing an academic career could greatly benefit.

VI. SUMMARY

Main positive and negative quality aspects of each evaluation area of the study field *Statistics at Vilnius University*:

The programmes in the field of statistics have similar content as international standards. Study programmes of the first-cycle of Statistics and the second-cycle of Econometrics have been substantially transformed into study programmes of Data Science and Modelling and Data Analysis, which is an absolutely timely update, as proved by the great interest of Lithuanian and international students in study programmes in the field of statistics. The students obtain the necessary background and skills for life-long learning enabling them, in particular, to quickly learn new methodology necessary in the job – in particular in this fast moving area. This fact is reflected in the topics of bachelor and master theses, which fit very well with the latest challenges in real life and science and are directly related to the study field. Furthermore, students are involved in research activities. It would be welcome if some common skills such as Python programming, data management techniques, Big data integration into sample surveys or usage of computing clusters could already be practised more during the study programme.

The programmes offer a certain flexibility in study plans allowing students to juggle work and studies and also allows for some movement between different programmes of the Faculty. Students are provided with appropriate study information and effective academic, financial, social and psychological support. Nevertheless, bridging studies could be better organised for students entering from other specialities and without the necessary knowledge.

The programmes benefit from teachers with a strong internationally visible research output, who are also active in statistical societies. Social partners are involved in several ways, most noticeably is the advisory group of the dean consisting of social partners. A better balance between partners from private companies and the public sector not only in this but also in study programme committees would be welcome. Even closer cooperation with social partners from both the private and public sectors would greatly help to better organise students' internships, as well as find topics of practical relevance for the final thesis from which students not planning on pursuing an academic career could greatly benefit.

The study committee seems very active, always improving the programme involving social partners as well as students in the effort. They have already identified the major problems and are looking for solutions. One such problem is the current age structure with a large portion of the teachers over the age of 60, such that attracting young teachers to the programmes is vital. Sufficient processes and procedures of internal quality assurance are used, in which students and the academic community are fully involved.

The continuously decreasing number of students in the Econometrics programme has already led the study committee to close the current programme and open a new, more attractive one with different partners to attract more students in the future again. As a new programme the Data science BSc. still requires (and gets) active monitoring to ensure that it can be

studied in the proposed time by the majority of students. In particular, it is recommended to consider decreasing the number of courses with corresponding exams by making the underlying units bigger. Additionally, it could be checked if the order of courses that build on each other is always well chosen.

Study management could benefit from a less error-prone study information system when a large number of users is trying to connect to it simultaneously e.g. to enrol in elective classes.

Regarding learning facilities and resources, they are sufficiently adequate to ensure an effective learning process. The senior management and faculty administration staff of the MIF have already identified the facilities limitations several years ago, and there is a plan to solve the identified facilities limitations. Among them, probably the most important is the spreading of the MIF over four old buildings, not ready to be accessed by disabled people. It is hoped that the MIF will not have to wait many years for the new MIF building, promised by VU, to become a reality.

Signature of expert panel chairperson:

Prof. dr. Claudia Kirch