

testing rating conferences (Keller *et al.*, 2012), a combination of short questionnaires and group interviews.

- *Facilitation of students' access to evaluation results:* Students generally have online access to the results of course and examination evaluations. For their study planning, however, they need above all information about which qualifications are in demand in the coming career, and which courses and internship companies are considered particularly suitable for achieving the desired competencies. For students with a focus on forest sciences, the student organisation already offers such information in cooperation with the responsible institute. Our goal is to extend this best practice example to all other majors in the EnvSci programme.

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SYSTEM ACCREDITATION AND QUALITY MANAGEMENT AT THE TECHNISCHE UNIVERSITÄT MÜNCHEN

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Abstract

At the Technische Universität München (TUM), Germany, Programme accreditation has been replaced by System accreditation. Impacts are noticeable in forest science degree programmes. TUM's quality management system has been introduced as an administrative tool for university-wide evaluation and fine-tuning of the quality of education (teaching and learning). Its chief objective is to design, implement, and enhance degree programmes to be attractive, challenging and internationally competitive. Focusing on students and the quality of their academic training, this system covers all related academic processes, i.e. from the introduction of a programme to its continuing operation, evaluation, and optimization.

The success of this quality management system depends on the participation and commitment of everyone affiliated with TUM. In accordance with criteria established on an inter-university basis, quality management measures are implemented throughout schools, colleges and additional scientific and non-scientific TUM institutions. Quality management and accreditation should not be treated as an exclusive system inside universities. Flexibility is required in order to adapt degree programmes to the needs of future students, and to balance academic freedom and demands of the job market.

Keywords: Forest science, accreditation, quality management, TUM, BSc, MSc.

Introduction

Until 2009, the study programme division forest science and resource management (Studienfakultät für Forstwissenschaft und Ressourcenmanagement) of the Technische Universität München (TUM) was subject of Programme accreditation. This type of accreditation was implemented by the ACQUIN Akkreditierungsagentur. It was initiated and financed by the Study Programme Division.

In 2014, TUM became subject of System accreditation following the regulations of the Swiss Centre of Accreditation and Quality Assurance in Higher Education. The decision is valid until September 30, 2020. It applies to all degree programmes that have passed TUM's internal quality management assessment procedures. Consequently, programme accreditation of the Study Programme Division Forest Science and Resource Management was replaced by system accreditation.

System accreditation

The TUM System accreditation procedure essentially consists of a self-evaluation followed by a series of external appraisals which are conducted by agencies certified by the Swiss Accreditation Council.

The benchmarks used in this procedure include the European Standards and Guidelines for Quality Assurance in Higher Education (ESG) and criteria specified by the Standing Conference of the Ministers of Education in Germany (Kultusministerkonferenz) and the Swiss Accreditation Council.

In Bavaria, all Bachelor's and Master's programmes are subject to accreditation (Article 10 Bayerisches Hochschulgesetz). By agreement with the Bavarian State Ministry of Sciences, Research and Arts, TUM formally committed itself to system accreditation in May 2005. Those central service units, which represent areas where teaching and learning intersect, are included in the accreditation procedure. For survey of the involved institutions and regulations see Figure 1.

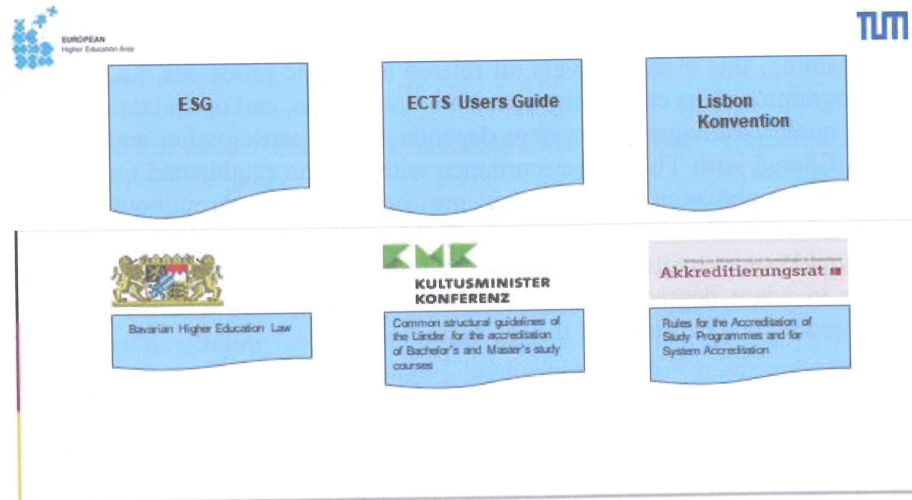


Figure 1: Frame conditions for accreditation. ESG= Standards and Guidelines for Quality Assurance in the European Higher Education Area (Anonymous, 2019).

The timetable for accreditation is illustrated in Figure 2. The accreditation procedure of TUM started in 2014 and was followed by an application for re-accreditation and corresponding admission in 2017. The A self-report followed 2018, and at least two on-site visits will complete the procedure before the next accreditation cycle will start.

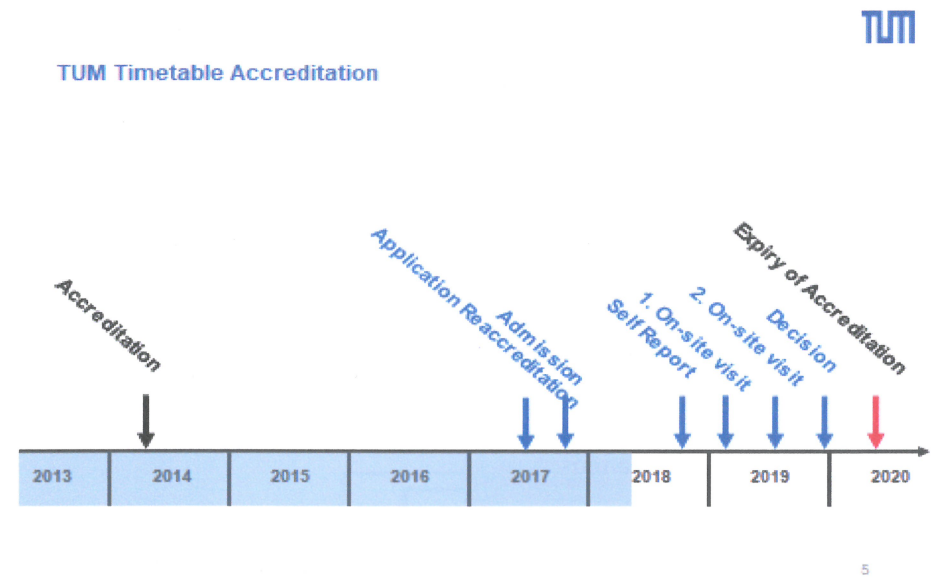


Figure 2: Timetable of the current TUM accreditation procedure and subsequent actions. (Anonymous, 2014; 2019).

Quality management

A significant element of the Bologna process, following the Bologna Declaration (1999), is quality assurance (Anonymous 2016). The initial version of “Standards and Guidelines for Quality Assurance in the European Higher Education Area” (ESG) originates from 2005. A revised version was adopted by the ministers responsible for higher education in Europe in 2015. In Germany, the Musterrechtsverordnung (Anonymous, 2017) defined corresponding ESG criteria. In order to fulfil these criteria, TUM established quality management (QM) in the following way:

TUM's quality management system is an administrative tool used university-wide to evaluate and fine-tune all factors affecting the quality of teaching and learning. Its chief objective is to design, implement, and enhance degree programmes that are attractive, challenging and internationally competitive. This system covers the entire degree programme life cycle and all related academic processes: introduction, operation, evaluation, and optimisation.

In order to establish a QM system, TUM engaged qualified staff, which is distributed all over the TUM faculties and collaborates with scientists and administrative employees at TUM. Consequently, QM is a coordinating point of scientists, lecturers and administration staff, that collects the different perspectives and leads the varied aspects to common solutions in terms of course development processes. The success of the QM system depends on the participation and commitment of everyone affiliated with TUM and the collaboration between the specific staff and the scientists and administrative employees at TUM. In accordance with criteria established on an inter-university basis, QM measures are implemented

throughout TUM's schools and colleges and additional scientific and non-scientific TUM institutions.

TUM views itself as an entrepreneurial university that serves as a responsible partner to industry and society. Consequently, QM initiatives are not limited to searching for optimal solutions within the frame-work of a state institution of higher education. Strategic goals are continually reviewed and refined. Active participation in the optimisation of the QM frame-work itself is of prime importance.

In case of study programmes, an overall QM cycle was defined which consists of a four step to-do list:

- Plan: Set quality objectives and identify potential targets for optimisation;
- Do: Select and implement appropriate optimisation measures;
- Check: Monitor the effects of these measures, draft follow-up recommendations;
- Act: Implement these recommendations.

Development of a new study programme

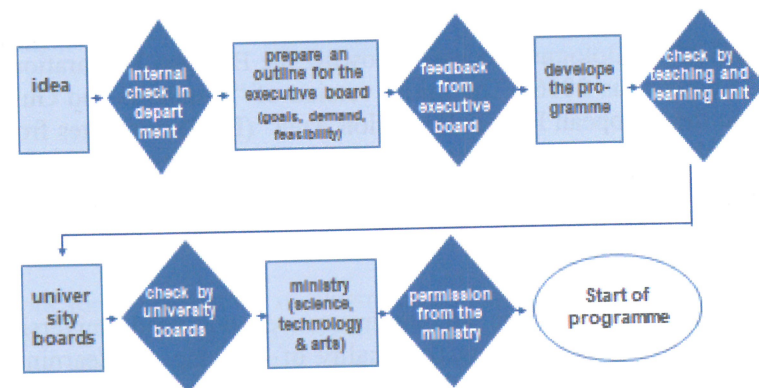


Figure 3: Pathway from the initiative to the start of a new study programme (Anonymous, 2019).

During the life cycle of any study programme, its operation is evaluated and re-evaluated in case of structural modifications. If it is intended to establish a new study programme, a dialogue with inner university boards and the responsible ministry is required. The workflow is depicted in Figure 3.

In general, study and teaching follows a complex organisational structure. In Figure 4, administrative workflows and responsibilities of faculties (schools) are surveyed. Conventional institutions such as the Ministry of Science, the TUM Supervisory Board, the Executive Board, the Senate, and the Faculties, still are decision-making bodies but in addition, new boards are involved: Extended University Steering Committee (EHP), Student's Service Centre (SSZ), University Unit Study and Teaching (HRSL), Managing Board Teaching and Parliament. For organisational details and definitions, and for QM with respect to academic and students affairs see Anonymous (2014, 2019).

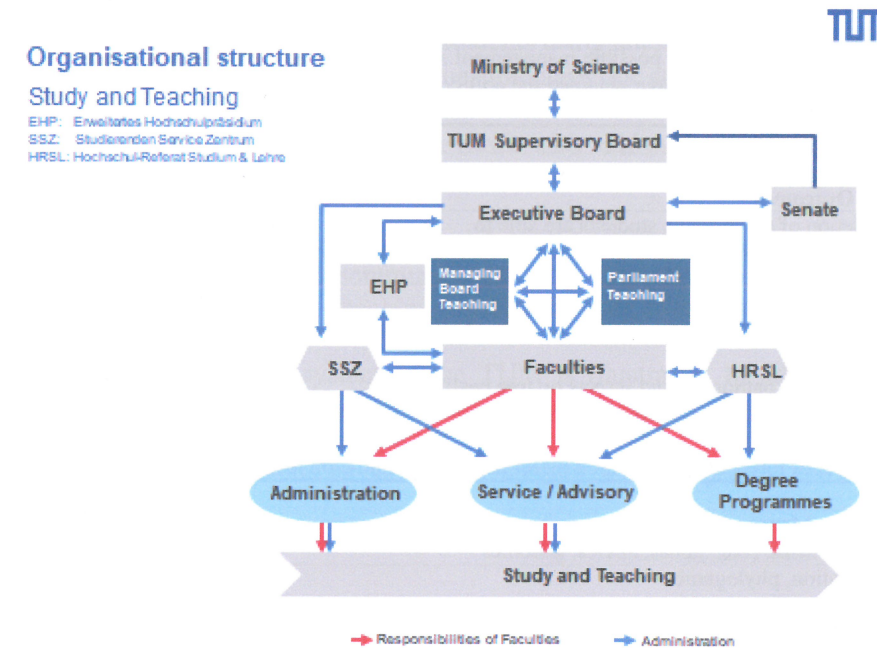


Figure 4: Survey of institutions and boards which are involved in any decisions concerning study and teaching at the TUM (Anonymous, 2019).

Study programme documentation, evaluation and feedback

In both, Bachelor and Master programmes, the modules are documented within the same framework. It includes basic information about the respective module level, the language, the duration and the occurrence; it embraces also numbering of credits, total hours, self-study hours, and contact hours per semester. In the description of achievement and assessment methods, type and duration of assessment, and the date for assessment retake are communicated. The description of content, intended learning outcomes and teaching methods is a major element of the module description. As an example, in Table 1 a module description is compiled which is part of the Master programme "Sustainable Resource Management".

Table 1: Description of the module "Genetic Resources Management and Forest Protection"

Genetic Resources Management and Forest Protection				
Module Level:	Master	Credits:	5 Credits	
Language:	English	Occurrence:	winter semester	Duration: one-semester
Total Hours:	150h	Contact Hours:	50h	Self-study Hours: 100h
Assessment Retake:	Next semester			
Description of Achievement and Assessment Methods				
The learning outcome will be assessed by a written exam (duration 60 min) where the students have to analyse the risk of given pest and abiotic hazard-scenarios and to develop adequate management strategies. Furthermore, they have to analyse a case study and interpret the genetic diversity situation presented there, including discussion of possible management strategies and problems. In this way, the students can demonstrate that they have obtained the ability to use their knowledge in real world management situations.				
(Recommended) Prerequisites				
None				
Intended Learning Outcomes				
On successful completion of the module, students are able to				
- assess genetic diversity patterns in natural populations of different groups of organisms (mammals, birds, plants);				
- understand the importance of maximising genetic diversity;				
- understand the impact of biotic and abiotic factors on vitality and stability of individual trees and forests;				
- assess the impact of fungal pathogens and insects on tree health;				
- apply their ecological knowledge to minimise and forecast the risk of damages by fungal pathogens and insect pests;				
- characterise the impact of forest management on insect populations and crop loss.				
Content				
Part I: Genetic Resource Management				
1. introduction: DNA, genetic code, genes, alleles, genomes				
2. speciation, hybridization, phylogenies				
3. basics of population genetics				
4. genetic variation in forest ecosystems				
5. tree breeding, gene conservation & sampling strategies, certification of gene resources				
6. genetics of plants and animals in the mountains				
7. genetics of plants and animals in the tropics				
8. sustainable management strategies				
Part II: Forest Protection- pathogens, insect pests, climatic and abiotic factors.				
a) fungal pathogens in forest ecosystems				
1. fungal pathogens-woody plant interactions worldwide (incl. Phytophthora pathogens)				
2. techniques to identify fungal pathogens in forest ecosystems				
3. techniques to inhibit pathogen spread				
4. management strategies for nurseries and forest ecosystems				
b) insect pests in forest ecosystems				
1. insect morphology, anatomy and development				
2. insect biology				
3. herbivorous insects on trees				
4. economically important herbivorous insects				
5. pest control (monitoring and forecast)				
7. insect pest management				
c) abiotic hazards				
This part addresses risks of non-biotic damages (wind, water in different aggregation states, fire, pollutants, extreme climate conditions) and its interactions with pests and diseases as well as preventive management activities.				

Teaching and Learning Methods	
lectures and presentations, field trip (optional)	
Media:	
lectures and presentations (pdfs)	
Module Structure	
Course 1	Genetic Resource Management
Course 2	Biotic and Abiotic Forest Protection

Evaluation is conducted at three levels:

- Course level: Course evaluation by students using questionnaires (one per semester).
- Degree programme level: Online questionnaires for students and graduates.(every two years).
- School or department level: Peer reviews with self-evaluation and on-site visit (every four years).

These evaluations are documented by the QM circle of the respective school and department, respectively, and communicated to the Executive Board, the Managing Board Teaching, and the Parliament Teaching (see Figure 4).

In Figure 5, the feedback system of the TUM is illustrated. In addition to conventional feedback procedures, which are mainly based on students and graduates opinion polls, feedback from employers and experts is important for TUM. This feedback constellation is supplemented by statements of students changing their subjects and those who failed ("drop-outs").

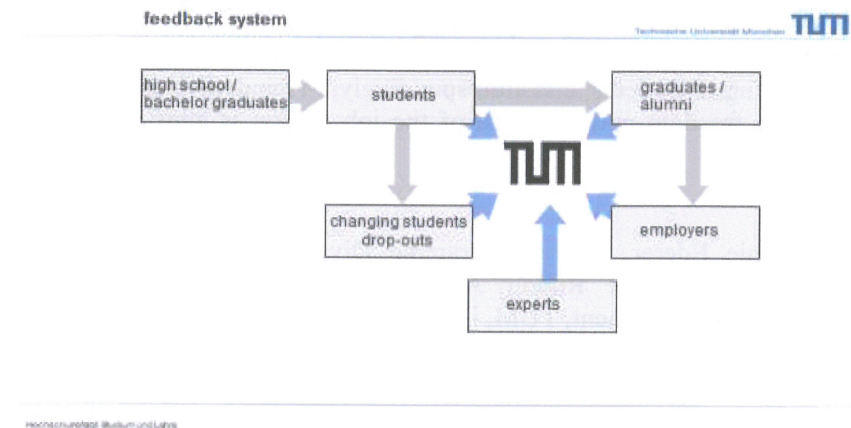


Figure 5: Illustration of feedback from students, drop-outs, employers and experts (Anonymous, 2019).

Feedback from employers and the job market in general is important for the Study Programme Division Forest Science and Resource Management because practice orientation is a significant element of degree programmes (e.g. Epema *et al.*, 2016; Müller-Starck and Weber, 2016; Weber and Müller-Starck, 2016). The improvement of students' mobility (Ziesak and Müller-Starck, 2014) and the resulting experiences are further components of a feedback system.

At the university level, a circle of experts is associated to the TUM, whose members represent major fields of economy, politics and science. Such external input is a significant additional element of the TUM quality assurance system.

Concluding remarks

The TUM System accreditation terminated the former programme accreditation of the Study Programme Division Forest Science and Resource Management, and thus restricted the scope of action in this field. Furthermore, the administrative complexity was increased considerably.

On the other hand, the financial burden was reduced for the Study Programme Division Forest Science and Resource Management, and manifold benefit was achieved as a consequence of the TUM quality management. This system is used university-wide. It covers all academic processes, i.e. from the introduction of a degree programme through its continuing operation, evaluation, and optimisation. It allows to evaluate and fine-tune the quality of teaching and learning particularly at the level of courses and of degree programmes. Thus, it stimulates degree programmes to be attractive, challenging and internationally competitive.

Feedback is an essential component of the quality management. It is based on students' and graduates' opinion polls, but also on the responses of employers and experts in those fields which are relevant for the respective degree programme.

It seems necessary that accreditation and quality management should not be handled as exclusive systems inside universities. Flexibility is required in order to adapt degree programmes to the needs of future students, and correspondingly, to the dynamics of the job market. Balancing academic freedom and demands of the job market is considered as a continuous challenge.

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