

**IMPACTS OF THE BOLOGNA DECLARATION ON  
FOREST SCIENCE DEGREE PROGRAMMES OF THE  
TECHNISCHE UNIVERSITÄT MÜNCHEN**

**GERHARD MÜLLER-STARCK AND MICHAEL SUDA**

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# **IMPACTS OF THE BOLOGNA DECLARATION ON FOREST SCIENCE DEGREE PROGRAMMES OF THE TECHNISCHE UNIVERSITÄT MÜNCHEN**

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## **Abstract**

The implementation of the Joint Declaration of the European Ministers of Education (Bologna Declaration, 1999), strongly influenced structures and features of higher education in the fields of forest science. Expectations were raised with respect to the improvement of quality and flexibility of corresponding degree programmes. The present contribution surveys major dynamics at the Technische Universität München (TUM), Germany, and tries to answer the question of whether or not these expectations were fulfilled in the past two decades. In particular, structures and dynamics of study programmes are the focus with inclusion of new vocational combinations. Students' mobility is another important aspect, as well as the improvement of the compatibility of module structures and the transferability of ECTS credits. Generally, an adequate response of higher education to the demands of the job market was challenging in the past and will be in future.

**Keywords:** Forest science, study programmes, diploma, BSc, MSc, Technische Universität München.

## **Introduction**

The replacement of the Diploma curriculum by consecutive Bachelor (BSc) and Master (MSc) curricula may require an unexpected long period: In case of the Study Program Division Forest Science and Resource Management (FSRM, Forstwissenschaft und Ressourcenmanagement) of the Technische Universität München (TUM), the Diploma curriculum was offered parallel to BSc and MSc curricula for nearly 10 years. This long period was the consequence of authorisation of students of the Diploma curriculum to refuse the transit to BSc or MSc curricula, respectively. The obligation to offer parallel Diploma and BSc/MSc curricula longer than expected was a heavy load for the Study Programme Division FSRM due to the extended demand for teaching and room capacity.

## **Diploma**

At the TUM Study Programme Division FSRM, the standard Diploma curriculum, required a duration of 4.5 years, i.e. 4 years studies, 4 months internship, and an examination period (9 terms in total). In the late 1990th the demand of our graduates

by the job market decreased substantially. This was one main reason to change the structure of the diploma programme. One main goal was to offer more flexibility and to balance in between the dimensions of sustainability (ecosystem, production and society; more details and perspectives e.g. Suda and Rollmann, 2001; Suda and Beck, 2001).

As an example, during the year 2003, a total of 296 credit points (CP; equivalent to the European ECTS system) needed to be achieved, 266 CP without diploma thesis, i.e. on average 33 CP per term, distributed as follows:

Study year 1:	19 courses, mostly basics:	69 CP
Study year 2:	22 courses, basics & FSRM specific:	67 CP
Study year 3:	27 courses FSRM specific:	85 CP
Study year 4:	3 extension blocks (out of 18):	45 CP
Diploma thesis		30 CP

With respect to students' mobility, the Diploma curriculum provided an extent of flexibility, which had grown during the last two decades before its termination. This tendency was the consequence particularly of the extended scope of action with respect to the chronology of examinations, the increased eligibility of subjects, and the acknowledgement of external course achievements in most cases. Students were given more flexibility and time possibilities to plan and execute their studies.

Consequently, students' mobility increased so that up to 5% of all students spent one term at an university abroad (ERASMUS programme and „free movers“). Problems with the acknowledgement of external course achievements were the exception rather than the rule. Anyway, these figures are still behind the ambitious goals of the EU-Leuven Communiqué which aims at a rate of 20 percent of all outgoing students within EHEA (European Higher Education Area), who collect at least a minimum of one credit point from another university (EU, 2009).

Quality management with respect to the Diploma curricula was the responsibility of the organizers of the respective programmes. Until 2009, the Study Programme Division FSRM was subject to programme accreditation by the ACQUIN Akkreditierungsagentur (Agency for accreditation).

PhD programmes follow the standards of the TUM (for survey see Müller-Starck *et al.*, 2013). In case of the Study Programme Division FSRM, small scale structured PhD student programmes were run in addition, lasting approximately three or four years. In case of a publication in a reviewed journal or in peer reviewed proceedings of an international congress, PhD students could (and still can) receive financial support from the TUM outside their employment contracts and scholarships, respectively. Today, for all PhD students it is mandatory to attend a Graduate School at TUM.

Since 1997, the organisation Münchener Forstwissenschaftliche Gesellschaft e.V. (MfG), is active independently from the Alumni Network of the TUM. It maintains contacts among the alumni within the forest sector. It is dedicated as a dialogue platform between employed foresters, graduates and students. The MfG communicates current research activities, events at the Study Programme Division FSRM, and it provides contacts to enterprises for the graduates. Regular meetings and a publication series help to achieve these goals. Although it cannot be considered as an established career service, this alumni platform supplies links to the job market. Generally, the Diploma was, and still is, widely accepted by the state forest service as well as by municipal and private forest owners. Most of the employees in these sectors graduated together.

## **Bachelor**

In contrast to the Diploma degree, the BSc degree offers a new dimension of flexibility because graduates' expertise can be expanded, upgraded or generally increased in value in combination with an additional MSc curriculum at the same university or any other higher education institution, in the home country or abroad.

At early stages, the establishment of the BSc system caused a variety of problems. The main reason for this was the lacking ability to look at the BSc as a new and independent category: BSc curricula were derived from the former Diploma under substantial reduction of the study period, at least by one year, in case of the TUM by 1.5 years (from 9 to 6 terms). Consequently, workloads of students increased considerably in most cases, so that BSc curricula started suffering from compression and corresponding regimentation. Flexibility diminished due to the declining portion of elective fields and subjects, in comparison to the Diploma system.

Students' mobility decreased considerably, with lowest values in 2011 and 2012 (a total of three and four outgoing students, respectively). Students risked an involuntary prolongation of their studies up to one year in case they wanted to study one term abroad. Suggestions were made to overcome these restrictions (Ziesak and Müller-Starck, 2014, Müller-Starck *et al.*, 2015) but the situation did not change essentially. This is one of the major reasons why the BSc curriculum had to be reorganized, starting in 2014 (for details see Müller-Starck and Weber, 2016). This new structure followed the demand of the quality management agency of TUM. In order to stimulate students to spend one term, or part of it, abroad without an involuntary prolongation of studies, the 6th (last) BSc term was, and still is dedicated as mobility window (summer term in Figure 1). The 30 CP are segmented as follows: Internship and Bachelor's Thesis (10 CP each), Elective subject and Examination module (5 CP each). The examination period is kept flexible within a specific frame.

Bachelor of Science in Forest Science and Resource Management

6 SuSe (31 CP)	Internship (11 CP)		Bachelor Thesis (10 CP)		Bachelor Colloquium (5 CP)	Elective Module (5 CP)
5 WiSe (30 CP)	Forest Planning (5 CP)	Forest and Environmental Policy (5 CP)	Landscapedevelopment (5 CP)	Commodity Markets and Qualitymanagement (5 CP)	Elective Module (5 CP)	Elective Module (5 CP)
4 SuSe (30 CP)	Natural Resources Soil and Site (8 CP)	Natural Resources Vegetation (5 CP)	Law (5 CP)	Silviculture (6 CP)	Forest Protection (5 CP)	Project (5 CP)
3 WiSe (30 CP)			Forest Operation and Logistic (5 CP)	Business Administration Forest Enterprises (5 CP)	Forest Growth and Environment (6 CP)	Technology and Recycling Lines of Timber (5 CP)
2 SuSe (29 CP)	Material Properties of Timber (5 CP)	Physics (5 CP)	Statistics and Informatics (6 CP)	Forest Inventory (6 CP)	Ecoclimatology (5 CP)	Dendrology (5 CP)
1 WiSe (30 CP)	Chemistry (6 CP)	Forest and Environmental History (3 CP)	Biology (8 CP)	Introduction Economy (5 CP)		
Total: 180 CP	Modules Examination: Basic and Orientation (GOP)		Modules der Bachelor-Examina		Internship	Modules Elective Field
	Examination Module					

Figure 1: BSc curriculum Forest Science and Resource Management (Forstwissenschaft und Ressourcenmanagement). SoSe, WiSe stands for summer and winter term (semester), respectively.

Courses in basic sciences are now offered jointly to all students of different faculties. At subsequent stages, students elect three out of four major Fields of Concentration. Like every curriculum, the BSc curriculum is object to TUM's quality management system and accreditation (Müller-Starck *et al.* 2021).

The critical response of the job market was a severe problem at the beginning. Missing acceptance or at least sceptical attitudes by state and private forest services towards BSc graduates from universities was the rule rather than the exception. Different competences of BSc graduates of the TUM in comparison to those from universities of applied science (Fachhochschulen) were the major reason. This constellation has not changed totally. BSc graduates' field of employment can match with their education in a great extent, as long as they attended a forest polytechnic engineers curriculum as shown for instance in Finland (Rekola and Lautanen, 2015).

**Master**

There are two Master curricula, Forest and Wood Science (courses in German), and Sustainable Resource Management (SRM, courses in English). Both are object to the TUM's quality management system and accreditation. Each curriculum consists of

four terms, the last one dedicated to the Master’s thesis. Analogously as in the BSc curriculum, students can spend the last term (or part of it) abroad.

In case of the curriculum MSc in Forest and Wood Science (Forst- und Holzwissenschaft , Figure 2), students select three Fields of Concentration out of the following six, which altogether offer a remarkable range of specialisations:

- Timber, raw material and wood-based products,
- Forest management in mountainous regions,
- Forest management,
- International forestry and agroforestry,
- Site assessment and land use,
- Landscape development and nature conservation.

Master of Science Forest and Wood Science						
1 Semester = 30 CP						
(4) SuSe	Master’s Thesis 30 CP					
(3) WiSe	<b>Concentration</b> [3 modules of areas Ecology, Economy, Production and/or Utilization of Wood] 15 CP			<b>Required Elective Optional Courses</b> [Ecology, Production, Socio-Economis or Utilization of Wood] 5 CP	<b>Required Elective Optional Courses</b> [Ecology, Production, Socio-Economis or Utilization of Wood] 5 CP	<b>Required Elective Optional Courses</b> [Ecology, Production, Socio-Economis or Utilization of Wood] 5 CP
(2) SuSe	<b>Concentration</b> [3 modules of areas Ecology, Economy, Production and/or Utilization of Wood] 15 CP			<b>Concentration</b> [3 modules of areas Ecology, Economy, Production and/or Utilization of Wood] 15 CP		
(1) WiSe	<b>Methods in Ecology, Economy and Social Science</b> 5 CP	<b>Methods of Research in Forest and Wood Science</b> 5 CP	<b>Lecture Series</b> 5 CP	<b>General Education Subjects</b> 5 CP	<b>Internship 10 CP (8 weeks)</b>	

Figure 2: MSc curriculum Forest and Wood Science ( Forst- und Holzwissenschaft ). SoSe , WiSe stands for summer and winter term (semester), respectively.

One demand of the quality management is, that the fields of concentration need much more flexibility. This offers the chance to include more topics in peripheral areas of forest science.

In the case of SRM (Figure 3), the flexibility of the MSc curriculum was increased by extending existing subjects (e.g. renewable resources includes non-matter sources such as wind and solar energy) or by condensing the curriculum via replacing compulsory courses by a limited number of major Fields of Concentration, out of which students will select a defined number (for details see Weber and Müller-Starck, 2016). Furthermore, methodological competences are strengthened, e.g. by means of planning and modelling tools.

The job market acceptance of MSc graduates, including by state and private forest services, is much better than that of BSc graduates. In this sense, MSc can be

considered to be equivalent to Diploma in the classical forestry related fields and better in adjacent fields, depending on the specialisation of the respective graduates.

International Master of Science Program (MSc) in Sustainable Resource Management (1 semester = 30 Credits (CP))						
4 SS	Master's Thesis 30 CP					
3 WS	„Fields of Concentration“ (2 „Concentrations“ consisting of 4 Modules) Total number of Credits: 10 CP		Human Resources and Corporate Social Responsibility 5 CP	Research Tools in Resource Management 5 CP	Internship 10 CP	
2 SS	„Fields of Concentration“ (2 „Concentrations“ consisting of 4 Modules) Total number of Credits: 30 CP					
1 WS	Natural Resources – Trails, Management, System Analysis 5 CP	Introduction to Economics and Ecology 5 CP	Inventory Methods and GIS 5 CP	Project Management and Public Relations 5 CP	Scientific Writing and Presenting 5 CP	International Communication 5 CP

Figure 3: MSc curriculum Sustainable Resource Management. Duration is 4 terms, each with 30 credits (CP). SS, WS stands for summer and winter semester, respectively.

## Conclusions

The transition from the university Diploma curriculum to BSc and MSc curricula caused criticism, particularly by state and private forest services, and resulted in uncertainties with respect to the employability of graduates. After a period of adaptation, the matching of educational tasks and the demands of the job market seems to be improved in small steps. Today, even a lack of graduates on the job market may occur.

Generally, the combination of BSc and MSc, especially at different higher educational institutions, opens a new dimension of graduate’s employability and offers better options with respect to entrepreneurial independency and self-employment. Important devices are career service activities and in particular, life long learning strategies (e.g. Mapeto and Cossatti, 2017; Ziesak and Rosset, 2017). Both are on the way but need to be intensified. Alumni networks, which are active at the TUM and the Study Programme Division FSRM, supply contacts, impulses, and experiences with respect to the job market.

Parallel to the introduction of BSc and MSc curricula, quality management standards were considerably improved and degree programmes were stimulated to be attractive and internationally competitive. Impacts of the Standards and Guidelines for Quality

Assurance in the European Higher Education Area are evident. Within two years both programmes have to be revised. One major aspect is, that the programmes should be kept flexible.

The overall impression is that the step from Diploma to BSc and MSc was beneficial but that further improvement is necessary, particularly with respect to the structure of BSc curricula. In order to enhance students' mobility, a better compatibility of module structures and the transferability of ECTS credits among universities is needed. This may also hold for the majority of MSc curricula. Furthermore, links between MSc and PhD programmes (Bologna Cycles 2 and 3) could additionally strengthen expertise of graduates.

An adequate response to both, changing European educational standards and changing demands of the job market is challenging now and will be so in future.

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