

# QUO VADIS CIVIL ENGINEERING EDUCATION: 20 YEARS AFTER BOLOGNA DECLARATION

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The Bologna Declaration of 29 European Higher Education Ministers caused the most inventive change on the higher education sector all over Europe since more than 200 years. The objective was to create a common European Higher Education Area with permeability, higher transparency and acceptance of university degrees across Europe. Since the declaration's signing in 1999, the bachelor and master's degrees successively replaced the former study program system of European universities and quality assurance methods were implemented. 20 years after the signature of the agreement, it is time to look back. The authors analyzed advantages as well as disadvantages of the modifications in the German study program structure and other related changes from the current state of view. Furthermore, the paper will give information whether objectives of the Bologna Declaration have been met and where the expected success is still being missed. For that, the paper provides information about the current study structure in Germany, students' statistics and development of academic mobility. Focus of the investigation was civil engineering programs as well as the resulting developments in universities' and faculties' management of German higher education institutions. The authors concluded that the main ideas of the Bologna Process found their way in the daily work of the universities. Nevertheless, the higher education reformation has not yet reached its aims.

*Keywords:* Bologna process, European higher education area, German higher education system, Modularization.

## 1 INTRODUCTION

For the last 20 years, European higher education institutions were busy with implementing a new system of degrees and program structures resulting from the agreement of the 29 European Higher Education Ministers, the Bologna Declaration (Hochschulrektorenkonferenz 2004). The idea behind the Bologna Process corresponds with the policy of the European Union but putting it into practice was and still is challenging for higher education institutions. Thus, e.g. bachelor and master's degrees shall replace the former national degrees, programs had to be structured into modules and quality assurance methods such as study program accreditation and students' course evaluation had to be organized. European higher education institutions should undergo these major changes to become more attractive for foreign students and to transport the European policy in the universities.

After 20 years of efforts, the authors investigated the results of these changes in German higher education with a focus on civil engineering education. After explaining the aims and means of the Bologna Process with discussing advantages and disadvantages for the German

higher education system, the authors will have a closer view on the current development on civil engineering education sector and analyze the results of the Bologna Process until the year 2019.

## **2 AIMS AND MEANS OF THE BOLOGNA PROCESS**

The original aims of the Bologna Process were permeability, higher transparency and acceptance of university degrees across Europe. Over the years, some of the objectives were specified and new ones were added such as for example

- Social dimension
- Lifelong learning
- Employability of graduates
- Student-centered teaching
- International dimension of the Bologna ideas
- Instruments for transparency

Basis for the Bologna Process are the Bologna Declaration of 1999 as well as outcomes of the follow-up conferences such as the Leuven/Louvain-la-Neuve Communiqué (2009) or the Paris Communiqué (2018). Nowadays the Bologna Process is implemented in 48 countries, which define the European Higher Education Area (EHEA) (Bologna Follow-up Group Secretariat 2019). Germany's motivation to take part in the Bologna process originally, but not exclusively, was driven by an estimated decline of the number of German first-year students entering German universities within the next decades caused by demographic reasons. Thus, more foreign students at German universities were expressively desired.

### **2.1 Advantages**

The ideas of the Bologna Process are suitable to create a unified European Higher Education Area with advantages for academics and society. Comparable degrees, Diploma Supplements and Transcripts of Records can support professional mobility (European Commission 2009). A credit point system should enable easy recognition of courses and examination results (European Commission 2009). Since the European Union and the European countries provide much more financial support for academic mobility, it is no longer a matter of money for students and staff to go abroad.

Universities structured their programs in modules and award credit points. Students and non-university externals continually evaluate universities and their programs (Quapp 2018).

### **2.2 Disadvantages**

For students and the society, the Bologna Process seems to be exclusively advantageous. However, for universities in Europe it means a comprehensive change and a plenty of new tasks and responsibility, mostly without additional human and financial resources (Burchard 2015). Some ideas do not work in practice or are critical regarding their compliance with constitutions or other legal regulations that will be explained in the following parts of the paper.

## **3 PROCESS RESULTS**

In Germany, in the year 2019, the Bologna Process has been implemented nearly nationwide. In the following, the authors will provide some statistical data and explanations.

### 3.1 Replace of Degrees

To ensure acceptance of university degrees of European universities in whole Europe, and all over the world, there was the plan to replace all the divergent national degrees by a harmonized degree system with a three-cycle structure – the bachelor degree on undergraduate level, the master degree on postgraduate level and the PhD degree as third cycle. In German civil engineering courses, the traditional degree “*Diplom-Ingenieur*” had to give way to the new degree system, against vehement resistance of building industry and other non-university stakeholders, not knowing what to expect from graduates of the new degree system.

Nearly all universities invented the new bachelor and master’s degrees. Nevertheless, they do not replace all former national degrees. In some German federal states, such as Saxony, national degrees such as “*Diplom-Ingenieur*” or “*Magister*” still will be awarded. The new degree system did not replace the *Diplom* and *Magister* degrees completely, but both exist now side by side, while the percentage of German programs awarding traditional degrees is quite low with only 1.8% of the total German study program offer (Hochschulrektorenkonferenz 2018). Currently, German higher education institutions enroll each year still more than 550 first year students in civil engineering *Diplom* programs (Die Deutsche Bauindustrie 2018). Furthermore, undergraduate programs which contribute to the public service mission, such as teacher training programs, law studies and medical studies, were not be replaced and award a national degree after successfully passing a state examination.

### 3.2 Modularization

Modularization means the combination of lectures and seminars with similar program contents in thematic units (Quapp and Holschemacher 2012). The curricula of the new study programs have to be structured in modules meeting the requirements of the Bologna Declaration. Furthermore, credit points according to the European Credit Transfer and Accumulation System (ECTS) must be awarded for each successfully completed module.

In Germany, meanwhile, all bachelor and master study programs are modularized, which also the universities must proof within a study program accreditation. Nevertheless, due to the strict requirements of the Bologna Process regarding module size or ECTS credit point’s number per term, in some cases the modularization obliges universities to form modules from courses which sometimes have no subject-specific connection point. Furthermore, examinations after each module increased the examination load of the students in comparison to the traditional degrees.

The Bologna Process requires the award of 60 credit points per academic year, which corresponds to 1,200-1,800 student’s working hours. But, until now, there is no comparable credit point calculating basis within European countries (one credit point ranges between 20 to 30 student’s working hours) (European Commission 2009). Furthermore, even in Germany, there is an absence of homogeneity concerning the length of study times and semesters. Higher education institutions can award between 180, 210 or even 240 ECTS credit points for a bachelor program depending on the period of study, which must be three, three and a half or four years. Master programs can be planned as 60, 90 or 120 ECTS credit point programs with one, one and a half, or two years duration. Thus, problems with the transition from first to second cycle will occur when students should award 300 credit points in total from the two cycles. This proves that ECTS credit points do not contribute to standardization in European Higher Education Area.

### **3.3 Academic Mobility**

In the Leuven/Louvain-la-Neuve Communiqué (2009), the European Higher Education Ministers agreed that in 2020 at least 20% of the graduates in the European Higher Education Area should have had a study or training period abroad. Until 2020, a Bologna Process Implementation Report should evaluate the main development in the EHEA since the Bologna Process began, including to what extent this mobility target was fulfilled (Paris Communiqué 2018).

#### **3.3.1 Students mobility**

Currently, Germany is the most important not English-speaking hosting nation worldwide for international students (Deutsches Zentrum für Hochschul- und Wissenschaftsforschung and Deutscher Akademischer Austauschdienst 2019). Since the year 2009, the number of foreign students in Germany increased for around 120,000 to 374,583, which corresponds to a foreign students' percentage of 13.2%. Most of them are coming from China and India, Austria, Russia, Italy and Syria. The majority, which means 38%, decides for engineering programs, followed by law studies, economics and social sciences (Deutsches Zentrum für Hochschul- und Wissenschaftsforschung and Deutscher Akademischer Austauschdienst 2019). Of German students, only around 5.5% spend study or training related time abroad. Most important hosting countries are Great Britain and USA, followed by France and Spain. Nevertheless, in the year 2018, 12% of Western European students and 6% of Middle and Eastern European students studied in a foreign country (Deutsches Zentrum für Hochschul- und Wissenschaftsforschung and Deutscher Akademischer Austauschdienst 2019). Until now, the Bologna Process did not reach its aim of 20% European students spending a study or training period abroad.

#### **3.3.2 Staff mobility**

Regarding international researchers' mobility, Germany is the third popular hosting country worldwide (Deutsches Zentrum für Hochschul- und Wissenschaftsforschung and Deutscher Akademischer Austauschdienst 2019). Currently, in Germany 12% of the scientific staff comes from abroad, including 6.8% of foreign professors. This number has increased from 34,212 researchers in 2011 to 47,537 in 2017. Most of them come from Italy, China, Austria and India. Of German researchers, in 2016, only 4% used a funded stay abroad to come in contact with the foreign academic community.

### **3.4 Recognition**

Introducing the ECTS credit point system and transparency instruments, such as the Diploma Supplement, should help to assess workloads and to recognize study periods spent at another institution as well as the new degrees from other universities. Nevertheless, recognition of workload end examinations in case of students' mobility still is a formal and difficult process for universities. On the one side, they are forced by the Lissabon Convention to recognize qualifications or study periods unless a substantial difference can be shown (Lissabon Convention 1997). On the other side, not only across Europe but even within Germany, students' workloads and educational contents are heterogeneous which requires a detailed, time-consuming check if universities want to ensure their degree quality.

### **3.5 Quality Control**

By the European Higher Education Area, quality as well as attractiveness of the European higher education systems should be increased, and universities were required to improve their quality

assurance procedures systematically (Paris Communiqué 2018). Study program accreditation and course evaluations shall measure and improve the quality of programs, lectures and lecturers.

### **3.5.1 Study program accreditation**

Since its implementation, study program accreditation was under criticism. Reasons for that were high workload and high costs for universities as well as the infringement of the constitutionally guaranteed freedom of research and teaching, Article 5(3) German Constitution. In the year 2016, the German Federal Constitutional Court (*Bundesverfassungsgericht*) found that the current system of study program accreditation currently applied in Germany was unconstitutional (Bundesverfassungsgericht 2016). Thus, the legislator in Germany created a new legal basis for the higher education accreditation with effect from 2018 (Quapp 2018). However, also in the new accreditation system the Academic Freedom continuously will be under attack.

### **3.5.2 Study course evaluation**

Beside the study program accreditation, law experts in Germany also criticized course evaluations by students as not compatible with the constitutionally guaranteed freedom of research and teaching (Quapp 2014). One of the reasons is that not the academic community but students decide about the quality of lectures and lecturers. This fact lets doubts arise if students, especially in the first undergraduate years, are able to differentiate between high quality and low quality teaching. Nevertheless, until now, the German Federal Constitutional Court did not yet decide about the compliance of course evaluation with the German constitution.

## **4 IMPACT ON CIVIL ENGINEERING PROGRAMS**

The Bologna Process had a huge impact on civil engineering programs in Germany. Beside the changes in the whole higher education system, universities lost the majority of the traditionally engineer programs graduating with the degree *Diplom-Ingenieur*. The German *Diplom* degree was well known and acknowledged worldwide (Dreyer 2018). With the reduction of study duration for the first cycle degree, there were skepticism and doubts regarding the employability of bachelor graduates.

Furthermore, in addition to scientific basics as well as classical civil engineering subjects, interdisciplinary courses and general subjects had to be included in the study plans reducing student's working hours for specific technical subjects. Thus, some universities shortened the practical training hours or overburdened the study programs to avoid disadvantages for graduates on the labor market (Quapp and Holschemacher 2010).

The modularization increased the number of examinations for civil engineering students. By replacing few big examinations through many small tests, short-term learning will be supported while losing the integrated and comprehensive understanding of a construction project.

In the first years of Bologna, the changes in the civil engineering programs were discussed intensively while the building industry had no interest in employing bachelor graduates. Meanwhile, also because of the increasing lack of civil engineers in Germany, employers hire bachelor graduates as well and often let undergo them a specialized in-house training.

## **5 CONCLUSION**

The goals and policies of the Bologna Process were agreed upon at European level, and then had to be implemented in national education systems and higher education institutions. But often, ideas conceived in theory are not easily to put into practice. Within the last 20 years, higher

education institutions in Europe were forced to spend much time and human resources to implement the changes resulting from the Bologna Process. And, this was not only a temporary procedure but resulted and will result in permanent efforts of the universities in future to meet the requirements from the Bologna Process, which targets have not been fulfilled yet. From the universities point of view, the question whether the output was worth the massive efforts of the last 20 years must be answered with “no”.

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