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Introduction of bachelor and demand for qualifications by the example of university-based technical studies

For Austria's universities the Bologna process is apparently linked with mental and institutional adjustment problems. This does not come as a surprise as consecutive study programmes represent a structural innovation compared to long university studies of 7 to 8 years until the first graduation in technology (with the purpose of the transition to science and research as a profession). What can be said based on the structure of labour market demand? The knowledge-based economy of the 21st century not only recruits graduates of technology for R&D tasks but mostly for other areas (such as sales, management or production). This study shows the relevance of consecutive studies based on labour market demand.

Internationally the bachelor's degree is the standard for first graduations in higher education (HE) - whether at universities or Fachhochschulen (universities of applied sciences, comparable to polytechnics, FHs). In Austria the introduction of the bachelor and master system as part of the Bologna process, in which all EU member states are taking part, is connected with much resistance and misunderstanding because this system represents an innovation compared to the tradition of long university-based studies - 7 to 8 years in technology until the first graduation.

The Bologna process aims to improve comparability of studies in Europe and therefore facilitate mobility in the Higher Education Area and employment system - which is especially important, in particular, for technologically relevant qualifications with internationally active workforce, research organisations and companies. At the same time this is undoubtedly a challenge for the university tradition in the German language countries because it implies that they need to deal with a far-reaching mental and structural change.

This study explores technical qualifications, on the one hand with a view to university studies and on the other with a view to demand on the labour market. Here the focus is on the introduction of bachelor studies as part of the Bologna process. The reference to the university-based technician's qualification is due to the fact that the Bologna process has hardly led to any public debate or criticism with regard to the Fachhochschule sector. The study therefore concentrates on aspects of the Bologna process by the example of university-based technical studies. The topic will surely look different in other subject specialisations. This means that the study helps

provide concrete input for discussions about the Bologna process.

For this purpose, the study first of all evaluates HE-related statistical data as well as data from relevant studies about the HE sector. In addition this study analyses data related to the demand for technicians (based on job advertisements on the internet and in print media) with respect to the structure of the need for staff - especially broken down by employment areas and specialisations.

University-based technical programmes: 7 years for diploma, almost 5 years for bachelor's degree

In the 2007/08 year group some 900 bachelor's degrees were awarded in technical university studies, corresponding to a share of 32 percent of first graduations. As well as bachelor's degrees there are still diploma degrees. The average study duration of university-based technical diploma studies was around 14 semesters, for a bachelor's degree 8.75 semesters. In other words: a bachelor has also studied almost 4.5 years on average in a technical field of studies. As a result the bachelor technical programmes at Austrian universities are - in an international comparison - still long studies until the first graduation.

Fields of employment and specialisations are essential for labour market demand

The analysis of the current job market for technical graduates (internet job vacancies in spring/summer 2010) reveals that the type of graduation obviously does not yet play a role in the demand for staff. Rather, the field of employment for technicians with top-level qualifications at company level is essential for demand:

TABLE 1:

Field of employment at companies based on job vacancies for university graduates of technical studies broken down by chosen courses of study, in % (line), 2010

Percentages which are clearly above average are highlighted

| Course of study (selection: at least 25 vacancies) | Field of employment at companies | | | | | Absolute total |
|--|----------------------------------|--|-----------------------------------|--|---|-------------------|
| | Pur- chasing | Manu- facturing, construc- tion ect. | R&D (basis for the ranking) | Management, administration, HR management | Marketing, sales, customer support | |
| Technical physics | 0.0 | 4.2 | 72.2 | 13.9 | 9.7 | 72 |
| Electronic engineering | 0.0 | 15.6 | 53.1 | 18.8 | 12.5 | 32 |
| Material sciences | 0.0 | 26.9 | 50.0 | 19.2 | 3.8 | 26 |
| Mechatronics | 0.0 | 19.4 | 45.6 | 35.0 | 0.0 | 103 |
| Electrical engineering | 0.0 | 17.9 | 42.2 | 25.4 | 14.5 | 173 |
| Informatics, computer engineering | 0.0 | 20.1 | 37.6 | 18.8 | 23.5 | 149 |
| Technical chemistry | 0.0 | 40.0 | 33.3 | 21.7 | 5.0 | 60 |
| Technical mathematics | 0.0 | 30.6 | 30.6 | 19.4 | 19.4 | 36 |
| Mechanical engineering | 0.0 | 21.8 | 29.5 | 39.9 | 8.8 | 193 |
| Process engineering | 0.0 | 25.4 | 28.6 | 39.7 | 6.3 | 63 |
| Automation technology | 0.0 | 44.4 | 22.2 | 27.8 | 5.6 | 36 |
| Business informatics | 0,0 | 25.6 | 20.5 | 20.5 | 33.3 | 39 |
| Civil engineering | 4.3 | 30.4 | 8.7 | 52.2 | 4.3 | 46 |
| Industrial engineering | 14.3 | 0.0 | 0.0 | 64.3 | 21.4 | 28 |
| Total | 1.3 | 23.7 | 27.9 | 32.4 | 14.6 | 775 |

Source: Survey of job vacancies in spring/summer 2010

In the period of observation, 32 percent of all vacancies were in “Management, administration, HR management”, around 28 percent in “Research and development”, 24 percent in “Manufacturing, construction, assembly, etc.”, and some 15 percent in “Marketing, sales, customer support”.

A reference to R&D in the job advertisements for university technicians was indicated in 72 percent of vacancies for technical physics, 9 percent for civil engineering, and 0 percent for industrial engineers. This means that it is not plausible for all technical sciences to explain the average study duration of 7 years until first graduation with the objective of producing internationally competitive top scientists if one considers the demand in the employment system outside HE institutions.

Overlap of uni and FH demand

One selection principle for the job advertisements which were included in the sample was that they searched for technical graduates from university. The following is important: Two thirds of the posts which were offered for graduates of university-based technical programmes were, at the same time, looking for FH graduates who are, in effect, qualified for three years less and in less “theory-dominated” study courses. This indicates that in the overwhelming majority of posts the average duration of seven years of branch specialisation cannot be justified by the demand on the labour market outside the science system.

Some 43 percent of vacancies for graduates of university-based technical studies were also accessible for graduates of colleges of engineering (HTL). As expected, this share was higher - namely around 62 percent - where the prerequisite was stated that the post for graduates of university-based technical studies was also advertised for graduates of technical FH programmes. Examining the intensity of competitors on the job market by quantitatively important study programmes reveals some differences: graduates of automation technology, for example, face above-average competition from both FH and HTL.

Specialist overqualification

In only 11 percent of the posts advertised for university technicians was merely one course of studies mentioned. The fact that in most job ads more than one technical study is mentioned can be interpreted as an indication of specialist overqualification in the long technical diploma programmes. In some cases, the condition demanded is simply that the candidate has completed a technical study course or also a technical or business programme. This indicates that graduates are overqualified in their specialisation due to long university programmes - this is true at least of the non-HE labour market for graduates.

University-based qualification as a guiding principle for future scientists - but increasing demand outside R&D

This shows a complex picture of university-based technical studies, the primary goal of which is to qualify future scientists at the highest level for universities or comparable research institutions. Traditionally the qualification of future managers in parts of industry has - more or less explicitly - been among the objectives. Meanwhile the areas of employment outside HE institutions have diversified to a far-reaching extent in the direction of manufacturing on the one hand and marketing, sales, customer support on the other, with overall demand for highly qualified technicians having risen rapidly.

The increasing demand for technologically versed staff cannot only be observed internationally but also manifests itself in the much-quoted "war for talent". Here the traditional picture of the Diplomingenieur (a master degree which is roughly equivalent to „C.Eng.“ in the UK) who has completed a long university study reflects only one sub-segment of labour market demand. This observation can be seen as proof of the theory - formulated by international HE research - that there exists a specialist overqualification related to the given labour market requirements for the majority of graduates in the German-speaking countries' system of long university studies.

Bachelor as the global benchmark

In the global non-HE-related labour market it is a fact that the bachelor's degree is the benchmark for technical HE education, whereas every other degree is considered a consecutive qualification or additional qualification. On the HE labour market itself, graduates without a Ph.D. degree are not competitive. With the extension of the demand for graduates outside the HE system the relevance of the bachelor's degree is therefore increasing. This is connected with far-reaching changes in the function and self-image of universities.

Opportunity to increase the success rate

In the national HE qualification system, the bachelor-master system should involve opportunities for improving coordination between university and labour market demand and reducing the number of late study dropouts. The latest data reveals that for every graduate of technical studies there is one student at universities who does not complete his or her studies and is not qualified as a short-term "trial student". Therefore many people with tertiary qualifications fall back, in formal terms, to the level of holders of the upper secondary level (Matura) because of the lack of two- and three-year short studies whereas internationally comparable learning outcomes are usually recognised as associate degrees or a variant of the bachelor's degree.

Diploma as Level 7 of 8 qualification levels in Europe

The European Qualifications Framework (EQF) takes account of the fact that internationally one or also two degrees below the diploma level are widespread and accepted on the labour market. This concerns Levels 5 and 6 of the EQF, Level 7 is planned to correspond to the master's degree.

The Austrian HE system of diploma studies therefore aimed to have Level 7 as the first graduation. Below the Diplomingenieur there was the level of HTL-Ingenieur, which is however not appropriately classified as a qualification in an international comparison and was hardly understood at all due to the special features of the Austrian education system. One consequence, which can frequently be observed, is that our technologically relevant human capital is underestimated with regard to the workforce, the companies and the entire national economy.

Internationalisation as the motor of change

In the long term the university-based and HE qualification system at the location of Austria will also not be able to remain outside the internationally common structure of the technological human capital. On the one hand because many internationally active companies recruit

staff in Austria and are familiar with the bachelor-master system, on the other hand because engineers who graduate in Austria as well as Austrian companies are active worldwide and in this connection need transparent qualifications to represent their expert knowledge.

Formation of new patterns of lifelong learning

Also the fact that some 90 percent of bachelor holders in technology enrol for master programmes by no means implies that the bachelor is not gaining labour market relevance in the long term. It will only be possible in the long term to assess employers' acceptance of the bachelor degree. In addition it needs to be considered that the behaviour regarding continued enrolment (transition to a master study) depends on the labour market situation, furthermore enrolment in an HE system without tuition fees has relatively little significance. Only the future will show which qualification strategies are attractive and successful, e.g. studying for the master degree while working, and which offers will be encouraged by universities and Fachhochschule institutions.

One third want to work in R&D

When analysing the study motives in technical bachelor studies at universities it is striking - as shown by the 2009 Student Social Survey - that only one third of respondents want to be active in the field of research and science in their later careers. This is in sharp contrast to the natural sciences, where the majority of students want to be active in research and science (56 percent).

Although some two thirds of technical university graduates are therefore not aiming to work in a scientific occupation, HE statistical data show that some 90 percent enrol in a master study immediately after acquiring the bachelor degree. This means that even among those who expect to be qualified for professions outside science and research, the bachelor degree is only seen by a minority at university as sufficient qualification for employment. This could simply be due to the fact that the bachelor was introduced only recently as a labour market qualification, however the negative public discourse about this topic might also play a role.

But overall it cannot be concluded that the bachelor will be of low quantitative relevance on the labour market in the long term. The following can be stated as reasons:

1. Since autumn 2008 the labour market situation has been more unfavourable for all study programmes than in the years before. A continuation of studies after the bachelor degree will therefore also depend on the development of opportunities on the labour market.
2. In the long term, experiences with the bachelor degree on the labour market compared to other degrees will have an impact on the study behaviour and on the companies' recruitment behaviour.
3. The analysis of registered vacancies in 2010 in the field of technology proves that only some 28 percent of job ads were oriented to university graduates for R&D. For most posts a seven-year technical specialisation - as is the average in the technical diploma studies - is therefore not required. The majority of graduates are overqualified in their field.
4. The overwhelming majority of posts for university graduates are also accessible for FH graduates (64 percent of posts); in 43 percent of vacancies for holders of the Diplomingenieur degree from university, these are also advertised for HTL graduates.
5. Both abroad and at home (high number of foreign employers and colleagues), graduates from Austrian universities in technical fields are moving on an internationally structured labour market for technicians, where the bachelor degree forms a world standard. Therefore they frequently compete with graduates who have completed shorter studies until their first degree but often already boast more professional practice.
6. Last but not least, if people start a master study, this does not necessarily also mean they will complete it, as a considerable number drop out prematurely, which also depends on employment and the labour market situation.

The entire study can be obtained from ibw in a printed form (ibw research report no. 162, ISBN 978-3-902742-36-0) or [online](#).