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Shortage of Technology Professionals despite Expansion of Higher Education Sector

Trend Analyses and Company Survey on Training and Employment in the Fields of Technology and the Sciences.

This study aims to analyse the employment situation of graduates of university-level in technology and the sciences as well as the annual influx of these graduates from university and Fachhochschule programmes into the labour market. The study also examines supply and demand for human resources specialised in technology and the sciences to identify suitable adjustment measures.

It is based on a written survey among HR managers in companies where related qualifications are in demand (between April and June 2006, a total of 187 enterprises that combined employ a staff of some 165,000 took part in the survey) as well as on exhaustive use of statistical material concerning training in study programmes, and employment in occupations, in technology and the sciences in Austria and in a European comparison.

Dynamic development of the R&D sector in Austria

The research and innovation sector, which is specifically dependent on the availability of highly qualified labour, has in recent years been captured by a strong growth dynamic. In the business enterprise sector alone, the number of science professionals with a university degree increased by 79 percent from 1998 to 2004.

A *head count* based on available surveys identifies slightly less than 40,000 science and engineering professionals. Being the largest employer in the research and innovation sector, the business enterprise sector currently employs nearly 70 percent of the gainfully employed in R&D and some two thirds of scientific research staff in Austria, calculated in full-time equivalents (FTEs), which is the usual measure to record human resources in the R&D sector.

In a European comparison, Austria ranks in the upper third as regards the share of R&D staff in total employment and, at the same time, impresses due to its growth dynamic (+ 5.6% p.a.), which trend will probably continue if innovation-related objectives are put into

reality. Increased investments in R&D therefore represent an engine for the rising demand for staff in the labour market, which was confirmed by the R&D statistics and the company survey.

With 1.77 percent or nearly 66,000 gainfully employed people in R&D (calculated in head count) Austria lies clearly above the EU country mean of 1.5 percent.

Difficulties in recruitment

When toting up annual degrees awarded by universities and Fachhochschule institutions in the large field of technology and the sciences, it was mainly the introduction of Fachhochschule programmes - despite stagnating or declining graduate figures at universities - that has led to an overall increase from below 3,000 to 5,300 graduates over the last decade.

Due to an increase in entries, a further growth in graduate numbers can be expected. Shortages in the labour market, however, are the result of too little growth in industry-oriented engineering disciplines as compared to intensified demand as a result of the economy being more and more based on knowledge and innovation.

Despite the increase in graduate figures in general, shortages do exist in specific engineering segments. This is confirmed in the 2006 survey by assessments made by HR managers who work at companies with an R&D department; they affirm that they observe tensions on the labour market at a higher level than in 2002/03:

- More than 65 percent have expanded employment of graduates of technological programmes from university or Fachhochschule - which corresponds to an increase by 17 percent as compared to 2002/03.
- 60 percent had difficulties to find suitable graduates of technological university programmes; in the case of Fachhochschule institutions, this figure was 41 percent - an increase by 11 percent as against 2002/03.

68 percent expect that the employment of graduates of technological university-based study programmes will intensify over the next three years (in 2002/2003, this figure was merely 49 percent); in the case of Fachhochschule, their share was 62 percent.

As regards recruitment problems, the following specialisations are by far most frequently mentioned: machinery technology, material sciences, electrical engineering, metallurgy and process engineering; in these cases and two other specialisations (viz.: plastics engineering and food and biotechnology), the number of companies weighted by company size that have had recruitment problems over the last couple of years exceeds the number of annual graduations by far.

The main finding of the study is the continuing shortage of 'Diplomingenieur' (i.e.: a master level degree; roughly equivalent to 'C.Eng.' in the UK) of specific disciplines despite increasing numbers of tertiary graduates overall, as well as in the vast field of technology and the sciences. Not even the strong expansion of technologically oriented Fachhochschule programmes has succeeded in eliminating this shortage. Also international staff search efforts, which are conducted regularly by as many as up to 60 percent of companies, are not able to fill existing gaps, as is shown by the company survey.

Growing employment opportunities for graduates of technological studies in all economic sectors

At present, an estimated total of 87,000 gainfully employed graduates of technological or scientific studies are active in relevant specialist and/or executive functions in Austria. According to figures provided by the

latest census, some 40 percent of all relevant graduates were employed as technological or scientific specialists, some 20 percent as executives, and slightly below 20 percent as teachers at secondary or tertiary educational institutions.

Graduates of technological or scientific studies are also strongly represented in companies of the material goods production sector not only in R&D but also in other employment areas (marketing/sales/customer support and account management; management/administration; HR management; manufacturing (including preparation)). In addition, they work in the business services sector (from R&D to consulting and training) in offices of consulting engineers, carry out consultant activities as civil engineers, work in teaching and research in the higher learning sector, and fulfil expert functions in public administration. This wide range of occupational activity areas and the mobility processes thus induced in positions outside R&D lead to a further intensification of recruitment problems of R&D-oriented companies, however.

Structure and scope of the shortage of technology professionals

In order to increase the offer and selection options for companies as compared to the difficult situation prevailing in recent years, a substantial increase of graduates in technology and the sciences is required. For the implementation of innovation-related objectives at the business location Austria, the key question regarding human resources will be whether there will be a sufficient number of engineering professionals for industry and particularly for R&D functions. Shortages are the result of relatively slow growth in engineering disciplines particularly in demand by enterprises. The applicants' lack of additional qualifications as well as too little geographical mobility on the part of graduates aggravate difficulties in staff search.

The low rate of women, above all in these study programmes - which are particularly in demand on the labour market - are a signal that urgent action is needed in this context as well as that huge opportunities are waiting for women in R&D.

The majority of industry-oriented engineering disciplines are characterised by substantial losses in graduate figures as compared to the mid-1990s. The lack in industry-oriented engineering disciplines, as mentioned in the beginning, will continue in the medium term. The expected growth in graduates of these study

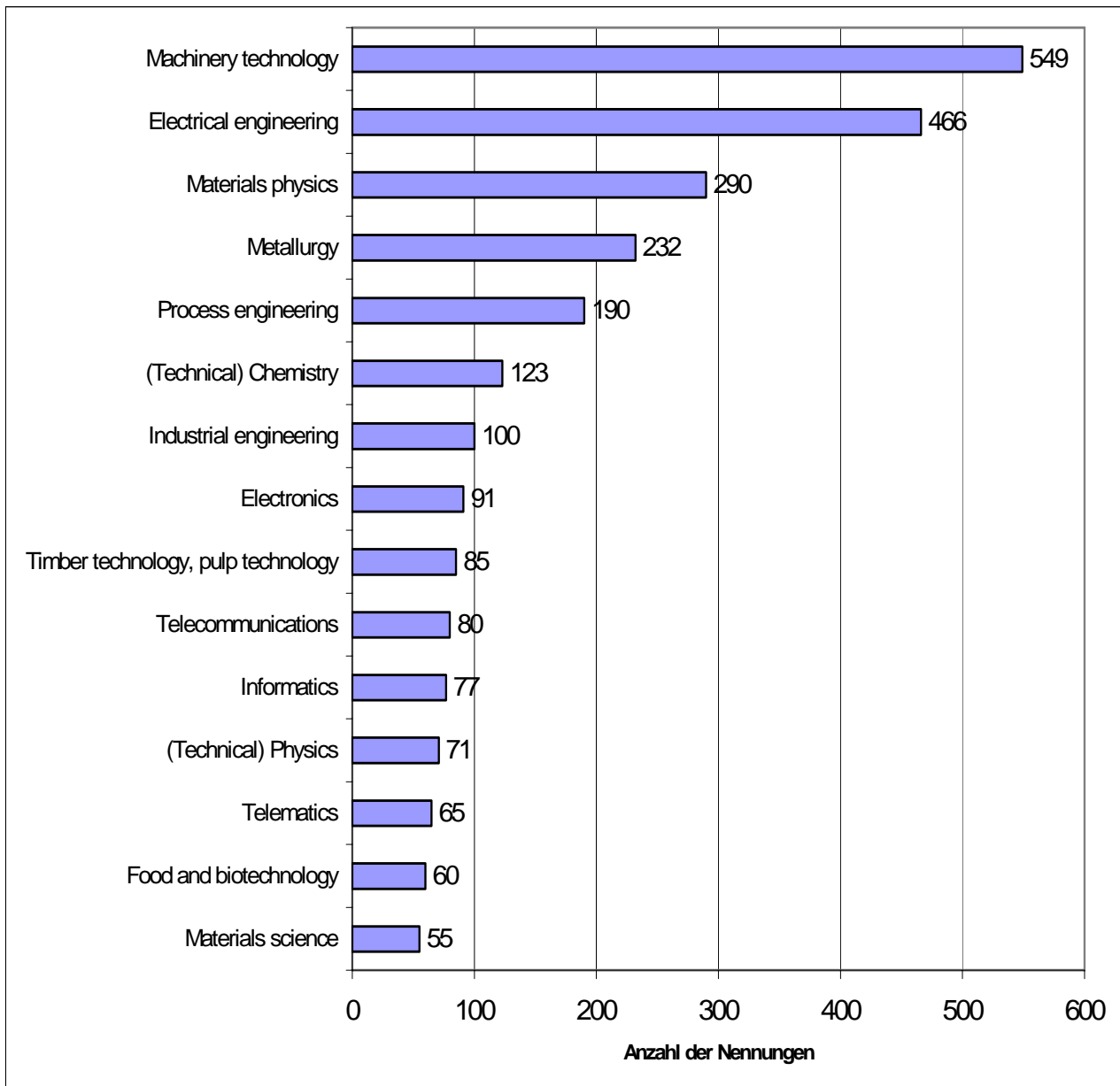
programmes (in total about 18 percent by 2010) will be too insignificant to be able to eliminate existing shortages and cover additional demand in case the growth trend continues.

When balancing the annual output of graduates with the annual substitute and additional demand by the year

2010 approximately, a minus of 1,000 graduates can be expected. This estimate relates to *specialisations* and industry-oriented engineering disciplines. The gap of 1,000 must be seen as the expected total number of 4,300 graduates in 15 specialisations with the largest labour market bottlenecks.

GRAPH 1:

Frequency of difficulties in recruitment over the last years, by specialisations



Source: ibw survey 2006

TABLE 2:

Estimate of shortage of technology professionals by 2010 on the basis of a forward projection of census data, the company survey and higher learning statistics

Feature	Trend		Forward projection		Change p.a. in %*
	1991	2001	2006	2010	
Graduates of technical or scientific studies in relevant specialist and/or executive occupations (university and Fachhochschule)	45,440	70,334	87,500	104,200	4.46 %
Gainfully employed graduates of technical or scientific university-based specialisations with lack of supply in 2006 according to company survey	30,364	47,954	60,300	72,405	4.68 %
Additional demand by 2010				3,200	4.68 %
Substitute demand by 2010				2,071	2.86 %
Demand and new supply a year (rounded to 100)				Forward estimate	
Substitute and additional demand by 2010				5,300	
New supply of university graduates ¹⁾				-2,000	
New supply of Fachhochschule graduates ²⁾				-2,300	
Forward estimate of shortage				1,000	

* Trend 1991-2001 and basis of forward projection

¹⁾ University graduates of technical and scientific study programmes with a lack of labour market supply according to the company survey: estimate based on figures of new students and success rate (60 percent)

²⁾ Graduates of Fachhochschule-based programmes in technology (excluding architecture, construction): estimate based on figures of new students and success rate (73 percent)

Source: Schneeberger / Petanovitsch 10/2006

European comparison

Austria's statistical backlog observed in country comparisons regarding the rate of engineering graduates (3.3 percent in Austria vs. 5.4 percent in the EU-15 mean), which has been the subject of many debates, is connected mainly with the delayed introduction of short university study programmes in this country. It is not due to preferences to enrol in technological or scientific study programmes (28 percent of graduates in Austria vs. 24 percent in the EU-15 mean) that makes the difference but the relatively low study rate overall (35 percent in Austria vs. 53 percent in the OECD country mean).

In the past, qualifications obtained at Austrian colleges of engineering (HTL) took on tasks which, in countries with a bachelor's degree tradition, are carried out by tertiary graduates in most cases. When applying the country comparison not to formal education but highly qualified R&D staff, no backlog can be identified for Austria: According to current comparative data, researchers (science and engineering professionals) make up 1.07 percent of total employment in Austria, in the EU-25 mean these were 0.91 percent.

As a measure to soften the situation in the labour market, particularly the provision of information regarding vocational and career opportunities in the growing R&D sector needs to be mentioned, which shows how interesting and promising R&D activities are. The example of informatics has shown that public discussions about career opportunities has effects on the selection of studies by entrants.

Other relevant measures include the following: improvement of recognition of previous knowledge at the interfaces between HTL - Fachhochschule - university; new offers preparing for the institutions of higher learning; and exploitation of the women's potential talents for R&D-related study programmes and occupations by means of secondary education paths that foster the basis as well as interest in a world of work characterised by technology and the sciences (e.g. by organising excursions to companies active in R&D).

This 'research brief' is a short version of the study Education & Economy No. 39 of the same title. Download: <http://www.ibw.at/html/buw/BW39.pdf>