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Engineers in Germany: No Shortage in Sight

by Karl Brenke

There is no let up in complaints about a potential lack of engineers in Germany. The Association of German Engineers (Verein Deutscher Ingenieure, VDI) recently declared that because of the high average age of engineers working in Germany (50 to 51), there will soon be a huge demand for a new generation of engineers.

Upon closer examination, these fears prove to be unfounded. Although there has been a slight increase in the average age of engineers in employment over the last decade, it is still well below the level quoted by the VDI. Accordingly, demand for new engineers in the medium term will be much lower. On average, engineers are in fact slightly younger than other academics in employment, and the percentage of older employees is not unusually high compared to other professions.

Since, on the one hand, the demand for new engineers to replace those leaving the profession is unlikely to be exceptionally high, at least this decade, and, on the other hand, there is currently a run on university places to study engineering, it is a surplus of these specialists that is to be expected rather than a shortage. A more realistic view of the future demand for engineers is urgently needed so that large numbers of young people are not encouraged to study subjects that might make it difficult for them to find a job in Germany.

For a country such as Germany with a focus on technology, it is crucial that steps are taken early to avoid demographically induced shortages in human capital resources. However, this long-term outlook should not be mistaken for what lies ahead on the market for engineers in this decade.

The Association of German Engineers (VDI) has been reporting a lack of engineers for years now.¹ It has already been shown elsewhere that complaints about a lack of these specialists are exaggerated.² An average age of 50 to 51 is now being cited for engineers. This would lead us to expect half of all engineers currently in employment will retire in the next 10 to 15 years. Even now, this would result in an annual demand for 40,000 new engineers.³

If these figures prove to be accurate, a considerable exchange of personnel among engineers would indeed be imminent, which would present companies with major challenges. The most problematic aspect of the feared wave of retirements would be very little time left for professional and practical knowledge to be passed on from those leaving the labor market to younger colleagues, or new entrants to the profession.

The following examines whether the data provided by the VDI are accurate. Here, the focus is on engineers who are normally employed in manufacturing⁴ or its suppliers⁵. The complaints voiced in the public debate are essentially only about a labor shortage of this particular type of engineers. The further analysis largely ignores construction-related engineers, that is, architects, interior designers, regional planners, civil engineers, structural engineers, and surveyors.

¹ See, inter alia, VDI, Ingenieurmonitor. Der Arbeitsmarkt für Ingenieure im Januar 2012 (in cooperation with the Cologne Institute for Economic Research, 2012). Available on the Internet at www.vdi.de/fileadmin/vdi_de/redakteur_dateien/dps_dateien/SK/Ingenieurmonitor/2011/Ingenieurmonitor_2012-02.pdf (accessed on February 22, 2012).

² K. Brenke, "Fachkräftemangel kurzfristig noch nicht in Sicht," Wochenbericht des DIW Berlin, no. 46 (2010).

³ See, for instance, an interview with the Chair of the VDI published in Spiegel Online on 15 February 2012. Available on the Internet at www.spiegel.de/karriere/berufsleben/0,1518,805470,00.html (accessed on February 22, 2012).

⁴ Including mining and energy management.

⁵ Temporary employment agencies, for instance.

Number of Engineers Employed in Germany

Information about the number of engineers in employment⁶ is essentially provided by two sources.⁷ The Federal Employment Agency's employment statistics show the number of people working as engineers and paying social security contributions. Since this applies to most engineers, the employment statistics provide information about the vast majority of this professional group. In June 2011, the date for which the most up-to-date information is currently available, there were 577,000 manufacturing-related engineers recorded as paying social security contributions.⁸

In addition, we can also use the German Microcensus, a regular official survey of the population based on a very large sample (one percent of the total population). However, for the purposes of the present study, it was only possible to use Microcensus data up to 2008. But since the prime concern here is the age of the engineers, this is not particularly problematic since age structures normally change at a very slow rate. Although, in exceptional cases, extraordinary events (age-selective mass redundancies or politically initiated early retirement schemes) can also heavily impact employment structures in the short term, nothing of this kind has occurred in the recent past.

Data from the Microcensus survey for 2008 allows us to calculate that 738,000 people claimed they worked as engineers. This is a third more than the total number of engineers in employment and paying social security contributions (June 2008: 551,000). This can be partially accounted for by the fact that the self-employed are also recorded in the Microcensus. These made up nine percent of all engineers on the labor market in 2008. Another four percent identified themselves as employees who are not subject to social security contributions—these primarily include civil servants.⁹ However, differences in the survey groups do not sufficiently explain the discrepancies between the employment statistics and the Microcensus. Apart from a certain sta-

tistical error tolerance and measurement inaccuracies, there were people who specified their occupation as engineers in the Microcensus and also indicated that they had the relevant qualifications, while their actual occupation was managing director, sales representative, teacher, or specialized journalist. In some cases, training as an engineer is required for this group of people, but not in all cases.

Not all engineers in gainful employment have a higher education degree. In West Germany, up until the 1970s, the title could also be acquired through years of experience in a technical profession; in addition, there were—as in the GDR—special vocational schools. Special vocational training academies still exist to this day. According to the 2008 Microcensus, a good sixth of those employed as engineers did not have a degree, while according to employment statistics for mid-2011, this applied to one-quarter.

No Trend toward an Aging Population of Engineers

The exact age of respondents is established in the Microcensus survey. In 2008, the average age of people working as engineers was 43.3; for those with a degree, it was 43. The average age is also influenced by the fact that engineers enter the labor market relatively late due to the lengthy training periods. The proportion of engineers in gainful employment aged 50 or over accounted for 29 percent.

As compared to 2000,¹⁰ the average age has increased by one year. According to the Microcensus, it was 42.3 at that time (41.8 for those with a degree). The difference between the two years is explained by the fact that the group of younger engineers played a greater role in 2000 than eight years later (see Figure 1). In 2008, the structure was more strongly marked by middle-aged cohorts, that is, by persons aged from 40 to 54. However, there were no considerable differences for older engineers, that is, those aged 55 or over: Their significance was even slightly higher in 2000 than in 2008.

In comparison to similar professional groups, the average age of engineers in 2008 was not particularly high. The average age of those with an academic education in gainful employment in other professions was 43.6. This is 0.3 years older than for all engineers and 0.6 years older than for engineers with a degree. The proportion of

⁶ For the sake of simplicity, the group comprising industry-related engineers will be referred to as "engineers".

⁷ The author would like to thank Matthias Klumpe and Anja Hlawatsch of the Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, the Statistical Office of Berlin-Brandenburg, as well as Jochen Kiwitt, the Federal Employment Agency, and the Central Statistics Service for their kind support and assistance in providing data.

⁸ Calculations made on the basis of the statistics of the Federal Employment Agency, *Arbeitsmarkt in Zahlen. Sozialversicherungspflichtig Beschäftigte nach Berufen (Klassifizierung der Berufe 1988)* (Nuremberg: 2012).

⁹ Presumably mainly civil servants who are responsible for testing and inspections.

¹⁰ The year 2000 was chosen not only because of the time interval, but also because the economic situation on the labor market was similar to that in 2008.

older people in employment is lower among engineers than among other academics (see Figure 2).

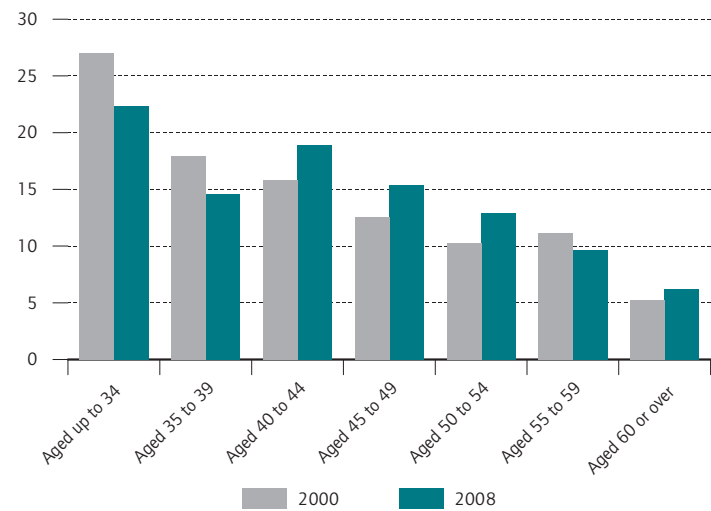
More recent figures are available for engineers in employment and subject to social security contributions. These also show that not even half of all engineers are aged over 50, and that their average age is not 50 to 51 (see table). This applies to all groups of engineers. Distinctions should be made here, however. The older age groups are relatively well represented by electrical engineers as well as mining and metallurgical engineers. These are professions where employment has been gradually declining over the past few years (see Figure 3). Companies have apparently not filled all the vacancies—which automatically leads to an aging of the personnel. Yet, the picture is different for mechanical and automotive engineering, as well as in particular for the large group of other engineers (including industrial engineers, REFA engineers,¹¹ and engineers working in specific fields), where employment has grown. Here, employment development has apparently been shaped to a large extent by the recruitment of young personnel. The older age groups are hardly higher represented among mechanical, automotive and other engineers than they are among technicians or skilled workers in the industrial sector, as well as with the average of all employees subject to social security contributions. With comparatively lengthy training periods, the low numbers of engineers representing the younger age groups is certainly not indicative of excessive aging among engineers.

These findings differ significantly from the VDI’s calculations on the age structure of engineers. This is already clearly evident from the Microcensus data. Considering that there have been no extraordinary developments on the labor market for engineers since 2008 that might have led to a distinct structural shift toward older engineers, the age structure will have only shifted slightly since then—if indeed there has been any change at all. It is inconceivable that from 2008 to date—in other words, over a period of about four years—the average age has increased by seven years to 50 to 51. The data of employees subject to social security contributions also reveal no excessive aging among engineers.

¹¹ Translator’s note: REFA was founded as the Reichsausschuss für Arbeitszeitermittlung (Reich Time and Motion Study Committee) and is now the Verband für Arbeitsstudien und Betriebsorganisation e.V. (Work Study and Work Organization Association).

Figure 1

Age Structure of People Employed in an Engineering Profession¹
Share in percent



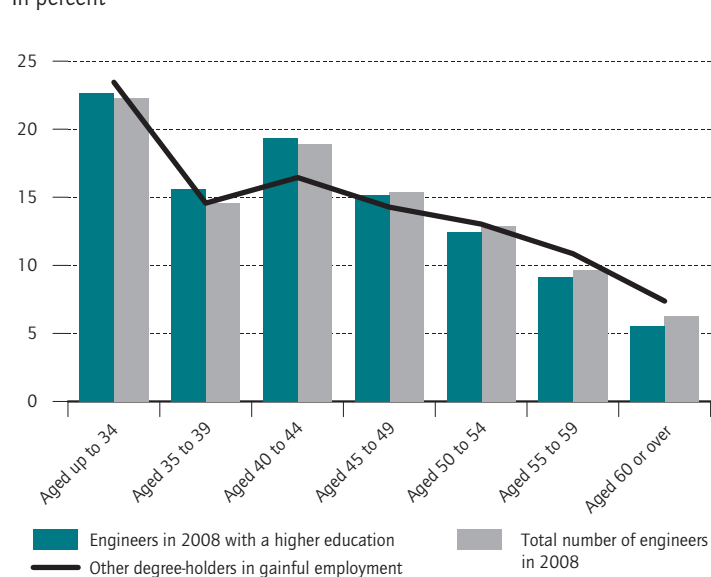
¹ Excluding architects, regional planners, civil engineers, and surveyors.
Sources: 2008 Microcensus; 2000 Microcensus (Scientific Use File), calculations by DIW Berlin.

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Shift in the structure toward the middle-aged cohorts.

Figure 2

Age Structure of Persons Employed in an Engineering Profession¹ and Other Degree-Holders in Gainful Employment²
In percent



¹ Excluding architects, regional planners, civil engineers, and surveyors.
² Universities of applied sciences and other universities (excluding degrees from a university of administrative sciences).
Sources: 2008 Microcensus; 2000 Microcensus (Scientific Use File), calculations by DIW Berlin.

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The proportion of older persons is lower among engineers than among other academics.

Tabelle

Age Structure of Persons Paying Social Security¹ and Employed in the Engineering and Selected Other Professions in June 2011

	Total	aged ... (in percent)				
		Under 25	25-34	35-44	45-54	55 or over
Industry-related engineers						
Mechanical and automotive engineers	157 353	1.6	23.7	29.1	30.4	15.2
Electrical engineers	150 310	0.9	16.2	29.7	36.2	17.0
Mining, metallurgical, and foundry engineers	5 454	0.6	15.8	21.6	37.4	24.6
Other manufacturing engineers	25 459	0.8	17.0	29.1	35.4	17.7
Other engineers	238 800	1.5	29.5	30.7	25.9	12.4
Total	577 376	1.3	23.8	29.9	30.3	14.7
Construction-related engineers						
Architects and civil engineers	128 207	0.9	21.9	30.5	29.7	17.0
Surveyors	9 054	0.8	16.5	27.9	33.5	21.3
Other professions in the natural sciences						
Chemists	42 096	1.2	22.9	29.5	29.3	17.1
Physicists, physics engineers, and mathematicians	24 497	1.1	28.9	27.6	25.5	16.9
Technicians						
Mechanical engineers	110 512	3.3	20.8	27.0	31.4	17.5
Electrical technicians	155 616	6.0	18.7	27.3	32.0	16.0
Laboratory technicians	26 924	3.9	15.5	24.4	35.5	20.8
Other manufacturing technicians	30 273	5.2	17.9	27.8	33.2	15.9
Technicians, not further specified	366 782	2.3	16.8	28.2	34.5	18.2
Industrial/production foremen	108 300	1.2	7.6	23.5	42.7	25.0
Common occupations in the manufacturing sector						
Chemical plant workers	165 746	8.1	17.5	25.9	33.1	15.3
Plastics processors	163 793	9.4	18.5	25.5	32.0	14.7
Lathe operators	114 014	16.5	18.4	21.8	27.4	15.9
Welders and flamecutters	79 554	5.8	18.1	24.9	33.2	18.0
Pipefitters	196 259	18.8	20.5	23.3	25.8	11.5
Toolmakers	108 131	17.2	17.7	22.2	26.4	16.5
Electricians and electrical fitters	445 553	16.9	21.0	22.2	25.3	14.5
Locksmiths, machinery fitters, and workshop fitters	524 067	14.7	18.3	22.7	28.3	15.9
All employees subject to paying social security contributions	28 381 343	11.2	21.3	24.3	28.2	14.9

¹ Including trainees.

Source: Federal Statistical Office, calculations by DIW Berlin.

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No Particular Problems in Meeting Current Demand

The future demand for employees is dependent on two factors at the macroeconomic level: on the one hand, the demand for new engineers to fill the gap left by those retiring or those leaving a particular profession, on the other hand, overall employment or that in a particular profession which is growing or declining. The number of engineers has increased recently; the number of employees subject to social security payments among these increased by an average of 1.5 percent annually from

2008 to 2011. Although this increase is not insignificant, it is not much higher than the growth rate for all employees subject to social security contributions (1.1 percent). In absolute terms, the number of engineers paying social security rose by almost 9,000 per year from 2008 to 2011. Assuming there was a similar development for engineers who are not subject to social security contributions, this means an average annual growth for all engineers of around 11,000 to 12,000 people. This equates with the demand for expansion.

Solely on the basis of retirement, the VDI expects 40,000 engineers per year will need to be replaced at present and in the coming years. The evaluation using employment statistics has shown that last year there were 577,000 engineers recorded as paying social security contributions. According to the results of the Microcensus—generously calculated—this figure increases to around 750,000. Here, however, the self-employed are also included, as well as employees who, although trained as engineers, are practicing other occupations which do not necessarily match their qualifications. According to the information provided by the VDI, for the group of engineers as a whole about five percent would need to be replaced each year.

On the basis of the sources available, it can be assumed that currently less than one-third and, therefore, no more than around 220,000 of all those employed as engineers or in a similar occupation are aged 50 or over. The number of working engineers who have reached the age of 55 is 110,000. A demand of 40,000 generated by those leaving the profession cannot realistically be derived from these figures. This would mean all engineers in employment currently aged 50 or over would have to retire within five and a half years. And those who are aged 55 or over at present would all have to give up work within less than three years.

If one age cohort of engineers who have turned 55 retires each year, this would comprise 11,000 people. Although it is probable that a higher number of older engineers might retire (if it were one and a half age cohorts, that would be 16,500 people each year), the demand generated would be 20,000, which should be taken as an absolute upper limit. Therefore, the need for expansion together with the need for new engineers due to retirement reaches 28,000 to 32,000 people each year. It also has to be considered that precisely for those engineers in the fields with employment growth, the proportion of older persons and thus the need for replacements is comparatively low.

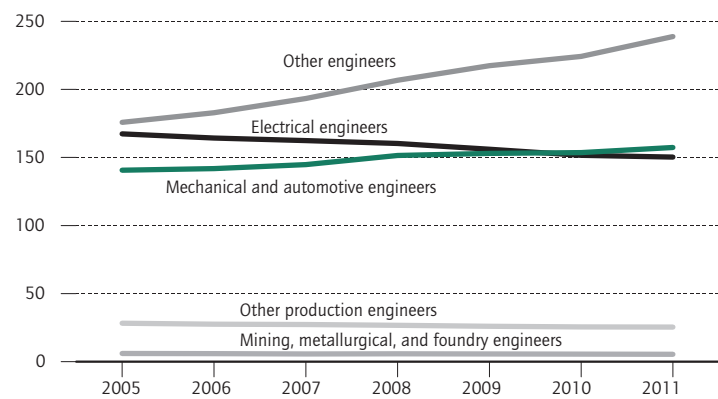
But even if the VDI's estimates were accurate, the demand generated from engineers leaving the profession and also any additional demand could be covered without any difficulty by the influx of university graduates onto the labor market. In 2010, over 50,000 students passed their final exams in a manufacturing-related engineering subject.¹² Over the next few years, the number of graduates will continue to grow, as there has been a re-

¹² Excluding student teachers. Excluding industrial engineers with an economics degree, there are 45,000 graduates. See Federal Statistical Office, "Prüfungen an Hochschulen 2010," Bildung und Kultur Fachserie 11, series 4.2 (Wiesbaden: 2011).

Figure 3

Development of the Number of Engineers in Gainful Employment and Paying Social Security

In thousands



Source: Federal Employment Agency.

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Strong growth only for other engineers, for example, industrial engineers.

gular run on the universities in the past few years, particularly on engineering subjects (see Figure 4). This trend has been continuing recently. For example, in 2011 the number of first-semester students studying mechanical/manufacturing engineering only was 58,600.¹³ Of course, many of those who begin their studies will not successfully complete them.¹⁴ Nevertheless, the number of students starting university is enormous when measured against the number of engineers in employment. In the same year, there were 157,000 employees subject to social security contributions working as mechanical and automotive engineers, 123,000 of whom had a university degree. There would also be about another 40,000 self-employed people and other employees in addition to this group.

Conclusion

The information presented above shows that the VDI's calculations concerning the average age of engineers in employment are greatly exaggerated. According to the

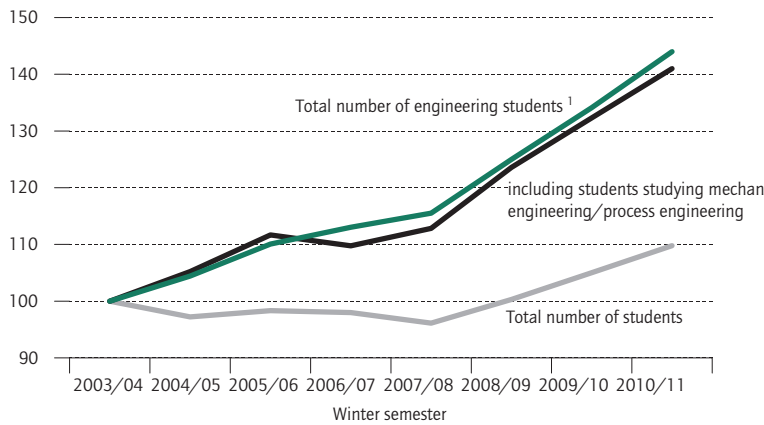
¹³ Federal Statistical Office, "Schnellmeldungsergebnisse der Hochschulstatistik zu Studierenden und Studienanfänger/-innen - vorläufige Ergebnisse. Wintersemester 2011/12," Bildung und Kultur (Wiesbaden: 2011).

¹⁴ The proportion of successful students of engineering calculated for the year 2009 shows values of slightly over 70 percent. Federal Statistical Office, "Erfolgsquoten 2009. Berechnung für die Studienanfängerjahrgänge 1997 bis 2001," Bildung und Kultur (Wiesbaden: 2011).

Figure 4

Development of the Number of Engineering Students¹ and All Students in Germany

Index: Winter semester 2003/04 = 100



¹ Excluding subjects of the subjects architecture, interior design, regional planning, civil engineering, surveying; including students of industrial engineering.
Source: Federal Statistical Office, calculations by DIW Berlin.

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The number of engineering students shows a clear above average increase.

Microcensus, less than one-third of all those working in an engineering profession in 2008 were aged 50 or over, and half of these were in the age group 55 or over. The same can be seen from the current employment statistics data. These also reveal that the proportion of older engineers is no higher than for technicians, some skilled workers in the industrial sector, or for the average of all those in gainful employment and subject to social security contributions—although the age structure of engineers is largely determined by their entering the labor market comparatively late due to the lengthy periods of training.

According to the data available, in the years to come, the demand for new engineers to replace those leaving the profession is expected to be only approximately half as high as that calculated by the VDI (around 20,000 instead of 40,000). Not least because of the economic upswing following the most recent financial crisis, additional demand rose from 11,000 to 12,000 persons. The high number of graduates coming out of the universities is certainly more than sufficient to meet the overall annual demand for engineers. It is to be expected that in view of the run on the universities in engineering subjects, the number of university graduates will continue to grow, and this will lead to a surplus. Of course, the-

re would be consequences for the labor market. It could become difficult for young engineers to enter the profession, which in turn could result in others being pushed out—the older engineers, for instance.

Another question is how the demand for engineers will develop in the very long term—also under the influence of demographic change. Undoubtedly, it makes sense for a country such as Germany with a focus on technology to take early precautions to meet resulting challenges. However, this long-term outlook should not be mistaken for what lies ahead on the market for engineers in the current decade.

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