

Bulletin

Institute for Employment Research

ENGINEERING OCCUPATIONS: PROSPECTS TO THE YEAR 2000

Engineering Performance and Prospects

The engineering industry is composed of nine diverse sectors: metal goods not elsewhere specified; mechanical engineering; office machinery and electronic data processing equipment; electrical (including electronic) engineering; motor vehicles; aerospace equipment; ships and other vessels; other vehicles; and instrument engineering. Firms in the industry vary from very small, single establishment enterprises, to large, multi-national conglomerates. Outputs are heterogeneous, including consumer, capital and intermediate goods. A range of methods of production are used incorporating assembly, one-off, batch and continuous production. Trade in most product areas is highly competitive both nationally and internationally.

Overall Employment in Engineering

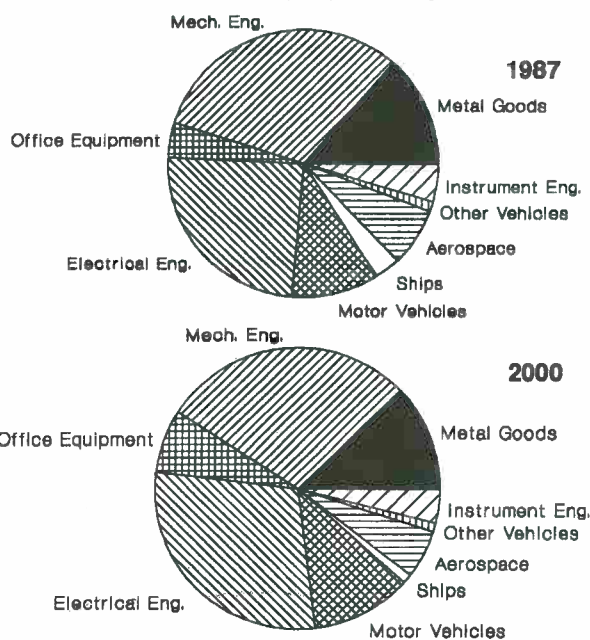
Between 1971 and 1981 just over one in five engineering jobs disappeared (776 thousand); from 1981 to 1987 a further one in five jobs were lost (623 thousand). The engineering industry is enjoying a period of relative stability following the massive restructuring which has taken place. Further job losses are predicted but at a much slower rate: between 1988 and 1992, 150 thousand jobs are likely to disappear, representing a 6 per cent decline in employment in engineering; further reductions of 45 thousand between 1992 and 1995 and 30 thousand between 1995 and 2000 are predicted, resulting in a 10 per cent fall between 1988 and 2000 (224 thousand).

Employment in Engineering 1971-2000 (000's)

	1971	1981	1987	1988	1992	1995	2000
Males	29.2	23.6	18.6	18.7	17.5	17.1	16.9
Females	8.3	6.1	4.8	4.9	4.6	4.5	4.5
Total	37.4	29.6	23.5	23.6	22.1	21.6	21.3

Job losses have been proportionately higher for females than males: 343 thousand female jobs were lost between 1971 and 1987 (42 per cent of female employment), compared with 1,056 thousand male jobs (36 per cent of male employment).

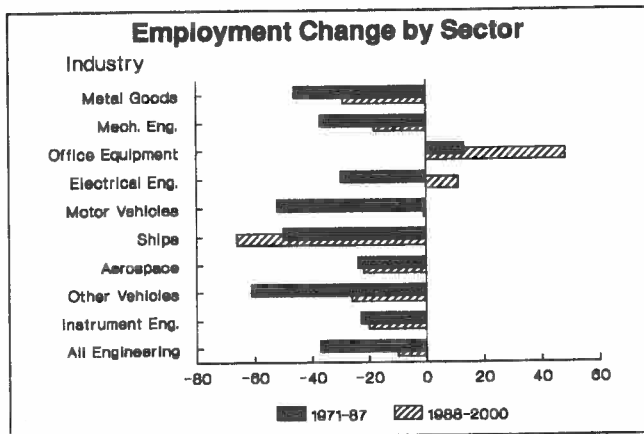
Distribution of Employment by Sector



However, female job losses from 1988 to 2000 are expected to be proportionately slightly lower than for males (8.5 per cent compared with 9.5 per cent respectively).

Employment by Industry

Mechanical engineering is the largest sector within the engineering industry; nearly one-third of all engineering employment is in this sector, although the proportion is predicted to fall slightly below 30 per cent by the year 2000. Electrical engineering currently has around 25 per cent of employment, growing to around an expected 30 per cent by the year 2000. Similarly, office equipment and electronic data processing exhibits a rising proportion of engineering employment over the period to the year 2000, while metal goods, ships and other vehicles show long-term declines.



The secular trends indicate a dichotomy between the more traditional elements of engineering (typified by mechanical) and the electronics based sectors. The distinction is perhaps clearest within the electrical engineering sector, where electronic engineering is growing relative to the more traditional, electrical engineering (which in many ways is more similar to mechanical engineering).

Job losses between 1971 and 1987 have been proportionately greatest in other vehicles (61 per cent); motor vehicles (52 per cent); ships and other vessels (50 per cent); metal goods (46 per cent); and mechanical engineering (37 per cent). Employment in these industries has been particularly affected by major process technological changes (such as the introduction of robotics, etc.) and by intense international competition. The decline in electrical engineering (30 per cent) is again the net outcome of the relatively good employment performance of the electronics sector and the higher job losses of electrical engineering. However, the performance of electronics has been nowhere near so good as some of our main industrial competitors, particularly Japan. Aerospace equipment and instrument engineering suffered proportionately lower rates of job losses in the same period (24 and 23 per cent respectively). Only office equipment and electronic data processing equipment experienced job gains in the period, growing by 13 per cent.

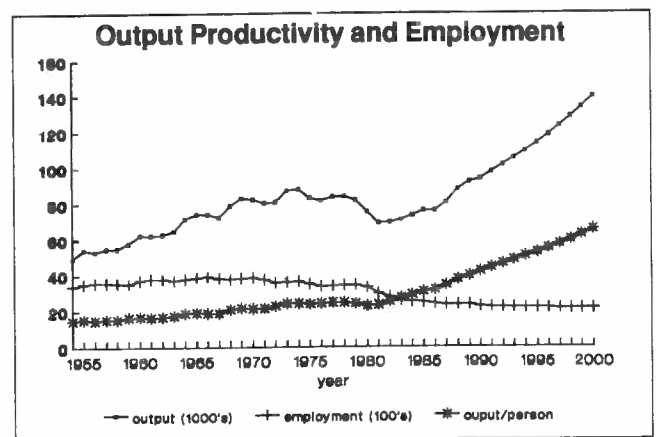
Further job losses are forecast between 1988 and 2000 in all but two sectors. Office machinery and electronic data processing equipment is expected to grow by 48 per cent and electrical engineering is predicted to grow by 11 per cent. The greatest losses in percentage terms are anticipated for ships and other vessels, where a 66 per cent fall in employment is expected. However, significant declines are also forecast in metal goods (29 per cent), other vehicles (26 per cent), aerospace equipment (22 per cent), instrument engineering (20 per cent), and mechanical engineering (18 per cent). Employment in motor vehicles is predicted to be approximately the same in the year 2000 as it was in 1988.

The highest rates of growth are predicted for office machinery and electronic data processing equipment. In this sector average growth of up to 10 per cent per annum is

forecast. Rates of around 6 per cent per annum are predicted for the electrical engineering sector, with most of the growth coming from electronics firms. Slower growth is anticipated in many of the other sectors, including: metal goods and mechanical engineering; motor vehicles; and other vehicle manufacture. While the outputs of the aerospace equipment and instrument engineering industries are predicted to grow strongly initially, the rates are then expected to fall back significantly in later years. Ships and vessels output is predicted to decline in the period 1985-1990, gradually worsening in the period 1995-2000.

Technological Change and Productivity Growth

The engineering industry has experienced continuous technological changes over the last few decades, a trend which is likely to continue into the foreseeable future. These technological changes involve the introduction of micro-computer controlled systems in both design and production. Computer-aided design (CAD) has revolutionised the design and drafting of engineering products. Production has incorporated the use of computer numerical control systems (CNC) and direct numerical controls (DNC) as well as flexible manufacturing systems (FMS). When the CAD system is integrated with a computer aided manufacturing system (CAM) the integrated CAD/CAM system can ultimately be used across the whole range of the engineering firm's activities, including ordering, bill paying, stock control, work organisation, dispatch, costing, invoicing, etc., as well as wage payments and personnel administration. While few firms have developed completely integrated systems, the majority of engineering firms are likely to continue along this route.



Technological changes have tended to result in a much more capital intensive industry, with significant increases in productivity which are expected to continue in the future. The growth in productivity is expected to be at its highest in all sectors during the period 1985-1990; high rates have already occurred during the first part of this period. Subsequently, however, growth in productivity is expected to moderate. There are major differences predicted across sectors over the

period 1990 to the year 2000: over 5 per cent growth in productivity per annum is forecast for office machinery and electronic data processing equipment; 4 to 5 per cent per annum in metal goods nes, instrument engineering, mechanical engineering, ships and other vessels and in other vehicle manufacture, while in motor vehicles and aerospace equipment the predicted average annual growth of productivity is somewhat less.

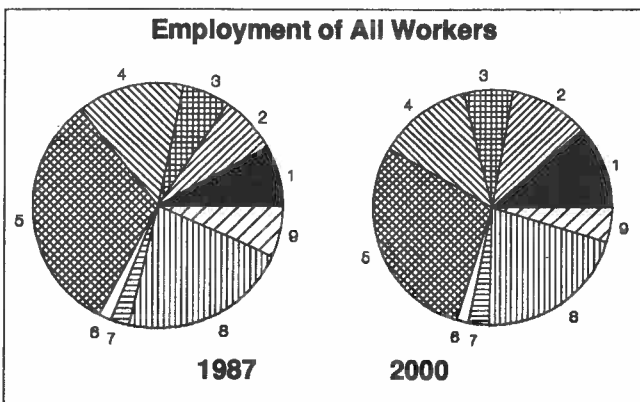
Changes in the Occupational Structure of Engineering

Technological changes, as well as affecting productivity, have also influenced the occupational structure of the engineering industry. The proportion of managerial, administrative and professional workers has increased, as has the proportion of associate professional and technical workers. At the same time there has been a slight rise in the proportion of the workforce in sales occupations. However there has been a substantial fall in the number of operatives of plant and machinery, as well as craft and skilled manual workers; while these occupations are still large, they now represent a smaller proportion of total employment. These trends are predicted to continue, with the engineering industry becoming increasingly dominated by technical, professional and managerial workers while the proportion of shop floor workers continues to diminish. At the same time, individuals working on the shop floor seem likely to become more highly skilled, developing computer-based skills, and their role will become more technical.

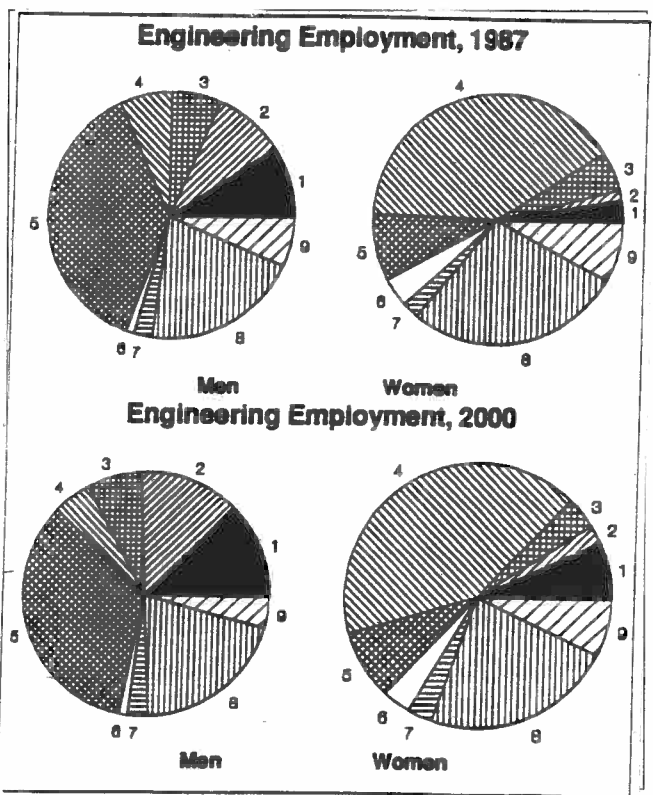
Gender Differences

Around 80 per cent of the labour force in the engineering industry is male. Females are concentrated in the lighter engineering sectors. In office machinery and electronic data processing equipment, electrical engineering and in instrument engineering around 30 per cent of the workforce is female. In metal goods nes the proportion is 20 per cent, while in mechanical engineering it is 16 per cent. In motor vehicle manufacture, aerospace equipment, other vehicles, ships and other vessels it ranges from 13 down to 8 per cent. There are no significant changes predicted in the proportion of the female workforce within individual sectors. Many of the unskilled female manual jobs will disappear. The dominant clerical and secretarial category is not predicted to grow. The gains in terms of female managerial, administrative and professional jobs will not compensate for job losses in the manual occupations.

The majority of female workers in the engineering industry are in the clerical and secretarial occupations where, currently, just over 40 per cent of female and 7 per cent of male workers are employed. Relatively few women are to be found in managerial, administrative and professional occupations: around 9 per cent of female employees are currently employed in these occupations, compared with 27 per cent of male employees. Relatively few female manual workers are found in the craft and skilled occupations, but about a quarter of all female employees are plant and machine operators, while less than 10 per cent of female workers have craft and



- 1. Managers and administrators
- 2. Professional occupations
- 3. Associate professional and technical occupations
- 4. Clerical and secretarial occupations
- 5. Craft and related occupations
- 6. Personal and protective service occupations
- 7. Sales occupations
- 8. Plant and machine operatives
- 9. Other occupations



skilled occupations. In contrast the greater proportion of males employed in manual occupations are to be found in skilled and craft occupations: around 20 per cent of male workers are plant and machine operatives; while around 36 per cent are craft and skilled workers.

The proportions of both male and female workers in the managerial, professional and administrative occupations are predicted to increase. The proportion of females is forecast to rise from 9 to 13 per cent by the year 2000; for males the proportion is expected to rise from 27 to 33 per cent. The proportion of males and females employed as clerical and secretarial workers is predicted to fall slightly. A modest rise is anticipated in the proportion of female workers employed in the craft and skilled occupations (i.e. from 8 to 9 per cent); at the same time the proportion of male workers in this category is expected to fall (from 36 to 34 per cent). The decline in the proportion employed as plant and machine

operatives is forecast to continue for both males and females: for females from 26 to 23 per cent by the year 2000; but only from 20.5 to 20 per cent for males.

Skill Shortages

The skill shortages reported recently by many engineering firms are, if anything, likely to worsen as the proportion of young people choosing careers in engineering continues to decline at a time when the number of school-leavers is in any case diminishing. Engineering has always relied very heavily on male school leavers as a source of labour, and training has typically taken place on joining the industry. In the future the industry may have to broaden its recruitment net to older workers, such as women returners or the long-term unemployed, and incorporate a different structure of training more suited to the needs of these groups.

This **Bulletin** was prepared by Jackie Lewis, Associate Fellow of the Institute for Employment Research and Senior Lecturer in the Business School at Wolverhampton Polytechnic.

THE INSTITUTE

The Institute for Employment Research was established by the University of Warwick in 1981. The fields in which the Institute aims to promote advanced study and research include

- the macroeconomic, industrial and spatial factors affecting employment
- the relationship between the labour market and the rest of the economy
- labour market behaviour and policy
- developments in population, education, training and household behaviour affecting the labour market
- comparative international research in relevant areas.

The Institute has grown out of the former Manpower Research Group which was created in 1975 with a major programme grant from the Manpower Services Commission. This followed previous research in the general field of labour economics and employment forecasting. Since 1978, assessments of the economy and employment at a highly disaggregated level have been prepared each year. This work gave rise to the publication of **Britain's Medium-Term Employment Prospects** (1987) and **Economic Change and Employment Policy** (1980). The **Review of the Economy and Employment** was first published in 1981 in order to make the findings of the assessment available more widely on a regular basis and to stimulate discussion about the changing structure of employment and its implications for policy.

The **Review of the Economy and Employment 1989** provides a detailed assessment of the changing structure of employment in the UK economy

- projections to 2000
- macroeconomic scenario
- changes in industrial employment
- changing patterns of employment status
- labour supply and unemployment
- the demand for skills

It is available, price £30 from: The Publications Secretary, Institute for Employment Research, University of Warwick, COVENTRY CV4 7AL