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Contributions are invited for this feature. News items on policies that concern the engineering education world, new courses and curricula either of a unique nature or of international interest, new innovative laboratories and concepts, funding news for engineering research projects involving international participation, special international continuing education courses and news, industry–university interaction, engineering faculty news, and developments in engineering education of international interest. Please send news items and conference information to the Editor-in-Chief. Public relations offices of universities and human resources divisions in industry are requested to contact the Editor with news items concerning engineering education and training.

United Kingdom

Fees are hindering foreign student recruitment
Student leaders have warned that some universities are in danger of pricing themselves out of the competitive overseas higher education market, as new figures reveal a yawning gap in the cost of tuition. The difference in the annual fees for similar undergraduate courses for overseas students is as high as £7,000, while there is a gap of up to £4,000 in taught postgraduate programmes. MBA students can pay up to £10,000 more than the cheapest course. Figures from the Committee of Vice-Chancellors and Principals this week show that for 1999–2000 overseas students will pay from £5,592 to £7,709 per year for an undergraduate arts degree, from £5,959 to £9,308 for a science, and from £11,525 for a clinical medicine degree.

Head of the British Council's promotions arm **Allan Barnes**, from the Education Counselling Service, said the gap has widened over the past three years. He said: 'It is up to the institution to position itself in the market, to decide what to charge, and take the risk that it can find enough customers at that price.' **Clive Saville**, chief executive of the UK Council for Overseas Student Affairs, said some fees appeared to have increased by up to 10 per cent in the past year. 'What concerns us most is the plight of the continuing student. It is very hard if they make a fine decision about where they can afford to go, only to find fees rise each year by twice or three times the rate of inflation,' he said.

Student leaders at Sheffield University have complained about plans to consider raising overseas student fees by thousands to 'maximise profits'.

Germany

Spearhead research and educational developments at the young Technical University in Hamburg
In the mainly conservative, state-dominated higher education systems of Europe, Hamburg-Harburg is one of a small number of institutions that are trying to break the mould. Sixteen months ago, it joined nine other state institutions in eight countries to form the European Consortium of Innovative Universities. The entrepreneurial institutions have been broadening their revenue base by conducting research and training for industry and local government, and by marketing the technical advances developed in their own laboratories. That all ten universities have strong engineering programs has helped make that possible, as has their relative youth. Officials at

the institutions say they are not burdened by a tradition of how things should be done.

Hamburg-Harburg was established in 1978 in the industrial suburb of Harburg, part of Hamburg, Germany's large, North Sea port. Much of what the university has accomplished in the two decades since—particularly its close cooperation with local industry and its unorthodox academic structure—has won at least the grudging respect of officials at other German institutions. 'Interdisciplinarity' is one of the things that sets Hamburg-Harburg apart. Faculties—the large units into which European universities are typically divided—do not exist here. Instead, the university has six interdisciplinary research departments. Each includes academics from various disciplines who work together in a broad area of inquiry. One department covers urban planning and environmental technology, another looks at computers and digital communications, and one is dedicated exclusively to medical technology. Each of those large departments is home to about 10 focused 'research sections.'

'The advantage of our organisation is that we have no organisation, or, at best, a very loose one,' says **Jörg Müller**, the vice-president of the university and head of the research section on microelectronics. 'Traditionally you have a wall around each faculty. Here we are really open. If I have a solution, I'll talk to my colleagues at the cafeteria and look for a problem.' In his laboratory on Hamburg-Harburg's attractive campus of four-story, brick buildings, Mr Müller develops tiny sensors. Working with doctors from the trauma unit of a local hospital, he is incorporating the sensors into screws that attach metal plates to broken bones to help them set. The sensors will transmit data via radio waves, allowing doctors to monitor whether the bones are healing properly. With a team of chemical engineers, Mr Müller is now developing roadside air-pollution sensors that are far smaller than earlier models. At one time it took a truck to transport such a sensor; now they are the size of waste-paper baskets.

The cross-fertilisation among the disciplines is made easier by the university's relatively small size. The academic staff has only 500 members, including 100 full-time professors. While the education of the institution's 3,500 students is organised along somewhat more traditional lines, it, too, is characterised by innovation. In 1994, Hamburg-Harburg became the first German technical university to introduce bachelor's degree programs as a shorter and more practical alternative to the traditional, five-to-seven-year basic degree, which is considered the equivalent of a US master's degree. Some 30 per cent of the institution's undergraduates now take the bachelor's degree option. The university has established joint master's degree programs with Chalmers University of Technology, in Sweden, and with the Asian Institute of Technology, in Thailand. About 16 per cent of the university's students are from foreign countries.

Hamburg-Harburg was established to help revitalise the economy of northern Germany, which was in crisis because of the collapse of the region's heavy industries. From the outset, the university was given more freedom to experiment than were other state institutions. In 1991, it became the first German university to receive its state support in one lump sum, to be used as Hamburg-Harburg officials saw fit. That was in contrast with the traditional German approach to university finance, where state money comes in instalments, with detailed instructions on how to spend it. The experiment was judged a success, and lump-sum financing is now gradually being introduced at other German institutions. Hamburg-Harburg also established close links to local industry. Almost one-third of its $85-million budget last year came in the form of competitive grants from private companies and state research agencies, a proportion quite high by German standards.

In 1993, the institution opened a technology centre adjacent to a large factory complex at which Daimler Benz Aerospace manufactures aeroplanes. Established to promote university cooperation with business, the centre is where the institution conducts paid research for companies, often involving graduate students, and where it offers specialised, advanced courses and seminars for industry engineers. 'You have to choose,' says **Udo Carl,** head of the university's research section on aeronautical engineering, which is based at the technology centre. 'Either you do pure research with no applications, or you agree to work on subjects which are of interest to industry and you accept certain conditions.' For example, Hamburg-Harburg researchers must often agree to delay publication of their findings by six months to give the sponsoring company time to get a jump on its competitors in using the knowledge. In turn, the university insists that all research be submitted for publication in scholarly journals. Still, **Hauke Trinks**, Hamburg-Harburg's recent president, says that he and his colleagues must not lose sight of their academic mission. 'The university was founded to give a technological impetus to local industry,' he says. 'We must be careful not to become a simple technical-service centre for the companies.'

The university retains the right to patent any important innovations it develops in its sponsored research. Each year, Hamburg-Harburg registers about 100 patents. Ownership and profits are generally split between the institution and the individual researchers involved in a patent. The institution now operates a wholly owned subsidiary, called TUHH Technologie, to handle the marketing of patented materials and processes. University officials say that while the sponsored research helps pay for modern equipment and provides top-notch training for students, it does not generate great wealth. In general, the

university's research sections break even financially from the sale of their inventions. Each year, TUHH Technologie also helps graduate students establish about 10 small companies to produce or market the innovations that they developed at the university.

Hamburg-Harburg is now serving as a model for university reform. When federal authorities were writing Germany's new higher education framework law, an important piece of reform legislation adopted by the parliament last year, they consulted extensively with Hamburg-Harburg officials. 'We're a little proud,' says Mr Trinks. 'The law contains many elements we initiated here.'

One of the institution's latest projects, however, has occasioned some criticism, and scepticism, for the way in which it combines state and private funds. Hamburg-Harburg has established an elite sister institution to offer intensive, two-year master's-degree programs for foreign nationals who are candidates for management positions in the overseas branches of German companies. 'We'd like to educate global engineers who understand global engineering and global politics,' says Mr Trinks. Called the Northern Institute of Technology, the new unit is a public-private partnership, something new for Germany. It is being built on state land, with the help of a $13-million grant from the Korber Foundation, a private German philanthropy that is active in higher education reform, established by a benefactor who made his money in the manufacture of cigarette making machines. Tuition will be a substantial $22,000 per year, to be paid by the students' employers. The institute is scheduled to open in July. Mr Trinks says that despite the high cost, German companies have expressed considerable interest in the program. Yet many educators here worry about the program's mixing of private and state resources, and what that portends for the future of Germany's tradition of tuition-free public higher education. 'It would be a success if they prove they can run higher education without the bureaucratic structure of German state higher education,' says **Klaus Landfried,** president of the German Rectors Conference. 'But I'd very much oppose a two-class system in which the rich can afford to send their children to private institutions that are subsidised by the state.'

Ireland

Ireland acts over high-tech skills shortage

The Irish government has announced an initiative aimed at heading off potential skill shortages in the information technology sector. An additional 5,400 higher education places will be created in the engineering, computer hardware and software areas. About e95 million (£63 million) will be spent on capital investment, and each extra place will cost up to e7,600 a year to maintain. Many of the world's leading computing firms, such as Intel and Hewlett Packard, have large plants in Ireland, which has a good record in competing with the United Kingdom and other countries for investment in high-tech areas. The numbers employed in the sector in Ireland more than doubled between 1990 and 1997 to 53,000 and are expected to more than double again by 2003. A high percentage of the jobs in the sector are for those with technician or degree-level qualifications.

Since 1995, companies have become concerned about the lack of technologically skilled labour. The pressure was particularly acute in the computer software, electronic technician and teleservices skills areas. An initial response was to allocate 1,800 university places to engineering and software, and this was followed in 1997 by an extra 3,200 places in software professional, electronic technician and teleservices staff courses. A e317 million scientific and technological investment fund was announced in November 1997, and was followed last year by a e228 million research and development fund. But even these measures were not enough to allay industry fears that a shortage of skilled personnel would slow down further investment. A report from an expert group on future skills needs last year called for an additional 5,400 higher education places. The government has now agreed to implement this recommendation.

The package is yet another political boost for education minister **Michael Martin,** regarded as the rising star of the Irish cabinet. It follows a related initiative to boost the numbers of secondary school students taking science subjects through increased grants to update school laboratories and the provision of additional in-service training for teachers.

USA

Declining numbers of high tech students

The number of students earning high-technology degrees from US institutions fell by 5 per cent from 1990 to 1996, according to a report by the American Electronics Association, an industry trade group. In addition, the report says, nearly half of the doctorates in high technology in 1996 were awarded to students from outside the USA. Despite low unemployment rates in high-technology industries, the association—the largest technological trade group in the country—found that the number of students earning degrees in fields such as computer science, engineering, engineering technology, mathematics, and physics declined between 1990 and 1996, from almost 219,000 to 207,684. Only one area studied by the group—business information systems—saw an increase in the number of degrees awarded, jumping from 13,048 in 1990 to 16,133 in 1996. Among the states, California conferred the most degrees in high-technology fields in 1996 with 20,809, but it

also experienced one of the greatest declines, awarding 1,600 fewer degrees than in 1990.

'What our research clearly shows is that the demand for technical workers far exceeds the available supply,' said **William T. Archey** the electronics association's president, in the report. 'The national failure to develop sufficient technical talent could substantially undermine the future growth of the US electronics and information technology industry.' In 1996, 45 per cent of the 8,515 doctorates awarded in high-technology fields were earned by foreigners studying in the United States, the report said. Breakdown for foreign nationals in 1996 is: Associate—1%; Bachelor—7%; Master—32%; Doctor—45%. Members of the association can purchase copies of the report for $95, and non-members for $190, by calling +1 408 987-4200, or by visiting the group's World-Wide-Web site: www.aenet.org.

High-tech degrees conferred 1990 vs. 1996

	1990	1996	Change
Engineering	73,883	71,388	−3%
Engineering Technology	58,456	49,327	−16%
Computer Science	45,135	44,774	−1%
Business Information Systems	13,048	16,133	+24%
Mathematics	21,044	19,141	−9%
Physics	7,254	6,921	−5%
Total high-tech Degrees	218,820	207,684	−5%

Top growing states by high-tech degrees 1990 vs. 1996

	1990	1996	Increase
1. Virginia	5,027	6,233	1,206
2. Texas	12,058	12,991	933
3. North Carolina	4,757	5,455	698
4. Utah	2,112	2,451	339
5. Minnesota	2,911	3,232	321

Top schools by high-tech degrees conferred 1996

1. Community College of the Air Force (AL): 2,590
2. Purdue University—Main Campus (IN): 2,418
3. Georgia Institute of Technology—Main Campus: 1,725
4. Massachusetts Institute of Technology: 1,584
5. Texas A&M University: 1,576

Source: US Department of Education

New Zealand

Court acts against vice-chancellor

In Volume 14 number 6 we reported on the critique vice-chancellor **Bryan Gould** of Waikato University was levelling at government higher education policy plans. The reaction to his reorganisation intentions followed swiftly: his powers have been curbed in a high court ruling that has been hailed as a landmark by New Zealand's Association of University Staff. The AUS won an injunction in the high court to stop proposals by Professor Gould that would restructure the university's seven schools into four. The judge ruled that the vice-chancellor and council had no power to implement the decision without that proposal having first been referred by the council to the academic board.

AUS president **Jane Kelsey** said the decision highlighted the tensions between the traditional concept of a university as a community of scholars and students and the new public-sector management ideology, as promoted in the government's white paper. Ms Kelsey said the time had come to seek a definitive statement about the powers of the vice- chancellors. 'It is a clear message to vice-chancellors that the academic community cannot be excluded from decisions that affect the core nature and functions of universities, that vice-chancellors cannot assume an unfettered managerial prerogative and that councils must take more active responsibility as guardians of the university charter,' she said.

Professor Gould said he was disappointed with aspects of the judgement and that the university would have to 'consider all of its options, because of the implications for the university and the tertiary sector as a whole. In effect, it calls into question my right as vice-chancellor to put in place management structures to meet the needs of the university in a rapidly changing environment.'

Israel

High technology education is given a boost

Israel's national goal of doubling, within five years, the number of its citizens who hold degrees in high-technology fields has presented the country's universities with a serious challenge—finding enough professors to do the teaching. Faculty recruiters for Israel's top undergraduate programs in computer engineering, computer science, and electrical engineering say they are fairly confident that they will be able find the needed talent over the next few years. As in the past, the recruiters are casting their nets among the many Israeli-born engineers and computer scientists now in graduate school, in postdoctoral programs, or teaching or doing research overseas, especially in the United States. The pool will be supplemented by Jewish

academics who are interested in moving to Israel. While a few voices in Israel's high-tech community recently have broached the idea that the universities would need to attract non-Jewish, non-Israeli engineers and computer scientists from places such as Asia, no one at the institutions says that that is likely at this time. University officials say they have no objection in principle to hiring non-Jewish faculty members—of which there already are a small number—but they add that they consider it unlikely that many non-Jews and non-Israelis would want to make the effort to learn Hebrew, the language of instruction at their institutions. Not all the institutions and programs were willing to specify how many new posts they will need to fill during the next five years. The figures provided by some of the institutions, however, suggest that the programs at the established universities will need to add close to 130 new full-time faculty members in high-tech fields. Some of the country's new, public, four-year institutions also have engineering and computer-science programs that are expected to need more faculty members, as do some private institutions and branches in Israel of foreign universities.

Part of the high-tech-enrolment expansion includes the establishment of a new engineering school at the Hebrew University of Jerusalem that is scheduled to open in October, with the start of the new academic year. According to the university's rector, **Menahem Ben-Sasson**, the engineering school will need to fill 25 full-time teaching positions in the next five years. Mr Ben-Sasson notes that, because the school is new, it will enjoy a certain grace period. During the first two years, it will need to offer only basic courses, and the university, for the most part, will be able to staff those by using current faculty members, including some in the natural sciences. Mr Ben-Sasson says that he thinks an offer from the Hebrew University School of Engineering would be attractive to religiously observant, Jewish engineers around the world who might be interested in living and teaching in Jerusalem.

During the same five-year span, enrolment in the computer-science department at the Technion-Israel Institute of Technology, the country's pre-eminent institution in engineering and technical fields, is targeted to grow from about 1,200 to 1,500 undergraduate majors. The increase will make the department the largest university computer science program in the world, according to **Azaria Paz**, a professor who recently completed a term as dean. The expansion will require the addition of 10 to 15 new teaching positions to the current 50. Fortunately, Mr Paz notes, the computer science faculty is younger than most other Technion faculties, where large cohorts of faculty members are now retiring and must be replaced. Like other Israeli universities—and institutions worldwide—the Technion must compete with both local and foreign industry for top-flight Ph.D.'s in high-tech fields. For Israeli universities, the competition is made even more difficult by the fact that faculty salaries at the public universities are set according to a collective bargaining agreement and are identical in all disciplines. A university cannot offer a computer science professor a salary higher than what it pays, in the favourite local example, to a professor of Assyrian. Some, like **Nili Cohen**, rector of Tel Aviv University, think that the universities will find it extremely difficult to expand their high-tech faculties if they are not allowed to pay higher salaries in those fields. It seems very unlikely, however, that they will be able to do so. Others say that incentives that have worked in the past will work again.

The one Israeli institution that sounds least confident of its ability to recruit enough new computer science and engineering faculty members is Ben Gurion University of the Negev, located near Beersheba, in the southern part of the country, far from the high-tech centres in Tel Aviv and Haifa. **Gabi Ben-Dor**, dean of the School of Engineering at Ben Gurion, says he needs to fill 60 faculty slots, including 15 in mathematics and physics, in order to double his program's undergraduate enrolment from the current 500 to 1,000 in the next five years. While he, too, thinks it will be necessary to offer candidates joint positions in industry and the university, he expects to have more trouble putting together such offers than his colleagues at Tel Aviv University and at the Technion. 'Our problem is that the high-tech industry in this area is not as large as that in the centre of the country,' says Mr Ben-Dor. 'But companies are starting to come.'