BRIDGING

THE SKILLS

GAP

The Internet. E-Commerce. New media. AutoCAD. The explosive growth of information technology has transformed the way we live, work and do business. But the lack of high-technology workers with the right skills is a call to action for governments, educators and industry.

by Karen Hawthorne

Check the weekend classifieds. It's no surprise that the hottest jobs are in IT, telecommunications and microchip engineering. Business powerhouses like IBM and Nortel Networks are snapping up engineering grads before they leave campus. There's a recruitment war against U.S. giants like Microsoft to keep Canada's best here at home. Industry is calling for double the size of the pipeline graduating electrical, computer, software and communications engineers.

A numbers game

Widely-publicized surveys and studies point to Canada falling behind in the high-tech boom. Strong growth in the Canadian high-tech industry is expected to create 30,000 new positions over the next two years–especially project managers, senior software developers, technical consultants and systems engineers–according to a survey released earlier this year by the Information Technology Association of Canada. The Canadian Advanced Technology Association (CATA)

says that, in Ontario alone, more than 56,000 new professional IT workers will be needed over the next five years, although Ontario universities will produce only 14,000 IT graduates.

Although some experts dispute the numbers, Canadian economist and author Nuala Beck says there's a skills shortage "no matter how you shake or stir this stuff."

Despite predictions that its torrid growth pace would taper off, the U.S. economy continues to grow like "gangbusters," and Canada is in a big recovery with lots of jobs, development and government surpluses, Beck says, adding that growth absorbs skills: "We had a big skills surplus and, all of a sudden, there's a massive skills shortage–the greatest skills shortage of this past century."

Trouble is, we're still in the early stages

◄ The Deep River Science Academy enables high school students to work alongside professional engineers and scientists (see sidebar on p. 35). The student shown here is studying factors that impact on tree growth at the former Petawawa National Forestry Institute. *Photo: Pierre St. Jacques*

of what she calls the "whole new industrial revolution," in which high technology is transforming industry and culture–and every sector of engineering.

The virtual workforce

According to leaders in industry and education, new technologies and the removal of trade barriers are creating profound change in the workplace. To stay competitive, smaller firms are defining niche areas and partnering with others for work projects. At the same time, new communications tools and internal networks are enabling people to work in groups that can operate around the clock–regardless of where they live. The artificial walls that divide work teams are dissolving.

> "We had a big skills surplus and, all of a sudden, there's a massive skills shortage–the greatest skills shortage of this past century."
> *Nuala Beck, Economist and Author*

Partnerships to fuel Canada's human resources

There's a role for businesses, government and educators to play in developing the multiskilled, motivated people Ontario and Canada need to prosper–and that collaborative role is starting to flourish. Here is a sampling:

Many of today's employees may work 14-hour days, six days a week, so employers can't spare them for the time it usually takes to go back to school. Formed in 1995 by the Ontario education ministry's Council of Ontario Universities, the **Office for Advanced Skills (OPAS)** has responded to the need for time-efficient learning with modular training–chunks of training time on or off-site that are spaced out over a certain period and designed to meet the needs of the company. Programs include business, finance, marketing and project management.

Hatch University–**"Hatch-U"**–is a virtual corporate university launched this May by Hatch, a Mississauga-based engineering and consulting firm. A learning centre, with videoconferencing and an electronic whiteboard (a computerized projection screen the instructor can control by touch) links with students' computers around the world for interactive learning that teaches participants to apply new engineering technologies. Instruction also includes information technology, business management, organizational and leadership skills.

The Strategic Microelectronics Consortium, the national association for the microelectronics industry, developed the **Bridge Camp** program in collaboration with Canadian Microelectronics Corporation and Canadian universities to respond to the need for microelectronics engineers and designers in Canada. Comprising two intensive ten-day courses, the program exposes recent engineering graduates to real-world issues of microchip design. It is offered at Car-

leton University, the University of Toronto, McGill University and the University of British Columbia.

Later this fall, Centennial College will unveil its **Centre for Engineering Design and Rapid Manufacturing**, with funding from industry and government. It will help meet industry demand for expertise in rapid prototyping and manufacturing.

The Deep River Science Academy offers high school students a six-week summer program at leading laboratories, where they work alongside scientists and engineers on research projects. The academy also hires students from university undergraduate programs across the country to act as tutors for the program. Started in 1986, the program has expanded to three campuses: Deep River, Ontario; Pinawa, Manitoba; and Kelowna, British Columbia, with a bilingual campus opening next year at the University of New Brunswick in Fredericton.

PEO's **Engineer-in-Residence** outreach program places engineers in Ontario public schools for several hours a week as a resource for teachers and students. Now in its second year, the program is geared to help stimulate an interest in science and technology.

In partnership with Human Resources Development Canada, the Software Human Resource Council (SHRC) introduced the **National IT Youth Internship** in 1998 to create full-time employment opportunities for recent university and college graduates with small- to medium-sized, technology-based enterprises. SHRC is providing funding that will sponsor the placement of additional candidates for six months this September.

Annette Bergeron, P.Eng. (at far right), a participant in PEO's Engineer-in-Residence program, is in the classroom at St. Antoine Daniel Catholic Elementary School in Victoria Harbour, Ontario.

Universities enter race for high-tech grads

The word from the Council of Ontario Deans of Engineering is clear: the demand for computer, software and communications engineers will continue into the next decade, and engineering schools are doing something about it.

Establishing software engineering programs is high on the agenda, but the combination of shrinking budgets and providing up-to-the-minute facilities and faculty who are familiar with the latest industry practices means a constant struggle. The universities of Ottawa and Western Ontario and McMaster University are expected to graduate the first generation of software engineers from accredited engineering programs in 2001, with Carleton University following suit in 2003, and the University of Waterloo in 2004.

The University of Ottawa amalgamated its computer science and electrical/computer engineering departments in 1997 to create a designated technology centre: the School of Information Technology and Engineering (SITE). Similarly, the University of Toronto plans to open the Centre for Information Technology by September 2001, to house students in computer engineering, computer science, information engineering and mechatronics–an emerging field that combines electronics and mechanical systems.

Mohan Mathur, PhD, P.Eng., dean of engineering at Western and a member of the Council of Ontario Deans of Engineering, points out that prospects for engineers in general will continue to grow: "The need for engineering graduates in all disciplines will rise, because engineering provides a very good general education for the knowledge-based society we have become."

Traditionally, an engineering education is highly regarded for teaching "hard, technical skills." Now engineering schools are responding to the call from industry for graduates with both technical skills and "soft, entrepreneurial" skills like management, marketing, communication and problem-solving.

Western now offers concurrent degree programs that enable students to acquire two degrees by combining engineering with medicine (seven years), law (six years),

business, computer science, economics, psychology, international cultures, music and philosophy (five years). "These graduates will rapidly move into leadership positions because, in addition to technical competence, they possess a broader set of skills," Mathur says.

Tyseer Aboulnasr, PhD, P.Eng., engineering dean at the University of Ottawa, agrees that part of the skills shortage in IT is better filled by cross-discipline graduates, specifically graduates of traditional engineering programs with strong IT expertise. The University of Ottawa has introduced a double degree program in one of civil, chemical or mechanical engineering and computing technology–providing roughly the equivalent of a three-year computer science education, along with an undergraduate engineering degree.

The growing software, telecommunications and biotechnology industries comprise mostly small- to medium-sized companies. This work environment is different from that of big, stable corporations, says Aboulnasr, noting that the skills required to flourish in small, start-up companies are different and take a long time to develop.

Hatch-U is a virtual corporate university run by a Mississauga-based engineering and consulting firm (see sidebar, p. 35). Shown here is a Hatch-U instructor discussing production systems for a manufacturing facility.

In response to the shortage in entrepreneurial skills, the University of Ottawa has revamped its engineering management option, now offering a combined management and entrepreneurship option to give graduates the marketing, organizational and accounting skills needed to change an idea into a product.

"The infrastructure on which commerce is based is being reengineered," says John Roth, P.Eng., vice-chairman and chief executive officer for Nortel Networks. The Internet and network technologies are accelerating globalization, creating new ways to do business and opening up new fields of competition, he explains. "Electronic commerce (e-commerce) is now a competitive necessity rather than an option, and e-commerce over the Web is clearly the wave of the future."

Nortel already recruits from every province and hires about one out of every four graduates in computer science and electrical engineering. Roth says the demand for graduates with degrees in critical disciplines cannot be met by the universities' current supply of graduates. Fewer than 750 people with undergraduate electrical engineering degrees emerged from Ontario's universities in 1995, and fewer than 1,500 graduated with computer science degrees.

Brainpower: today's hot commodity

In the global marketplace, people and innovation have become the keys to jobs, growth and a competitive edge. Canadian industries require knowledge workers who are technically literate and adaptable. There's a high premium on people with strong interpersonal skills to fit into a collaborative culture where cross-functional teams work together.

"People have to work in teams, which has a lot of implications for the engineering industry, both globally and regionally, because branch offices and smaller consulting firms with their own area of niche expertise have to collaborate on project work," says Jacqueline Scott, PhD, president of the University College of Cape Breton. Scott chairs the Expert Panel on Skills, established in 1998 by the federal government's Advisory Council on Science and Technology, to report in

The hottest jobs are in IT, telecommunications and microchip engineering. Business powerhouses like IBM and Nortel Networks are snapping up engineering grads before they leave campus.

November on critical skills needed in various industry sectors and practical strategies to maintain or improve Canada's competitive position. In its series of hearings with industry representatives, the panel has heard calls for a broader skills set–including technical, communications, leadership and business–to accommodate the need for multi-skilled professionals in the new economy.

Scott says engineering programs are science- and technology-heavy to meet criteria for accreditation, so there's little curriculum space left for communication and leadership skills. The skills issue becomes a question of responsibility, she adds.

"So who's responsible? Individuals? Businesses? On the whole, business has not stepped up to the plate, encouraging and providing that lifelong training," Scott says, adding that, by 2010, two-thirds of the population will be in the workforce. The real challenge is not the "perceived skills shortage," but how to reskill an existing workforce, she stresses.

"The CEOs are telling us that they're looking for people with critical skills like problem-solving, adaptability and interpersonal skills," says Norman Shulman, PhD, executive director of the Office for Partnerships for Advanced Skills (OPAS). "But company recruiters are telling us they're looking for C++ (the latest programming language). There needs to be a mix between technical and essential skills," he says.

Established in 1995 by the education ministry's Council of Ontario Universities, OPAS is a partnership of all Ontario universities and several industry sectors. OPAS hosts roundtable forums with industry, government and academic representatives to open the lines of communication, examine what skills are needed in various sectors, and identify collaborative training solutions.

Shulman says that the "half-life" of specific technical training in the software sector is now six to nine months because of the pace of technological change. In entry-level spots, employees come in, and six months later they're told "thanks a heap

and good luck," because the company will hire the next crop of people with the very latest skills. "But if you keep cutting down the trees, there's nobody left," he says of the need for industry, government and educators to partner and explore ways to invest in Canada's human resources.

The brain drain

The problem of the skills shortage has less to do with the education system not keeping pace, than with the lack of development of Canada's best natural resource–its people, says Peter DeVita, P.Eng., PEO's President-elect.

"We have the best educational system in the world. We just don't use our people," says DeVita, who owns an electronic systems consulting firm. He points to the lack of investment in research, development and high-level design. "Because our top talent is underutilized, it is therefore undervalued."

DeVita believes that our best and brightest are going to the U.S. and elsewhere, where their talent is recognized and graduates can get twice the starting salaries.
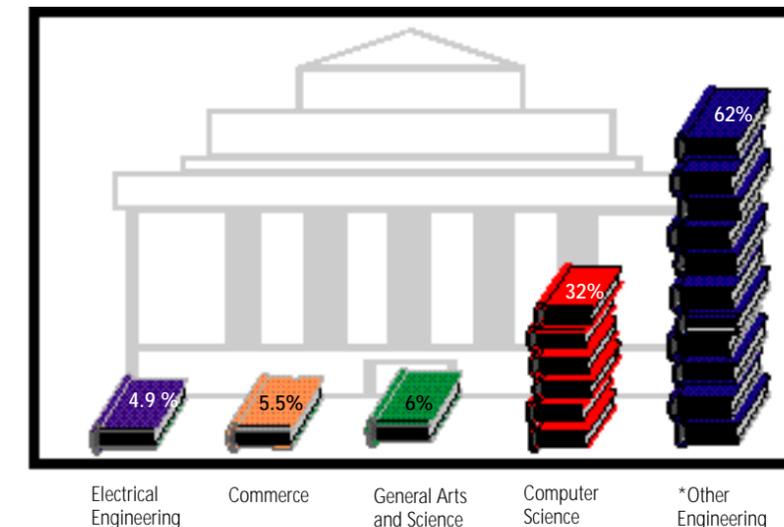
"I think we need to help more engineers start innovative, new Canadian firms in a vast array of technical areas, not just civil engineering consultants," he says.

Beck stresses there are two main factors pushing engineers and others south: Canadian taxes are too high and Canadian companies are too cheap. In a free market, engineers are going to go where the money is, potentially leaving Canadian companies with the huge cost of high turnover and no one to run engineering product development, she says.

Beck predicts that, in the next 18 months, Canadian companies will be forced to take action to retain and attract staff, following the lead of U.S. corporate culture by offering potential and existing employees bonuses, a stock purchase plan, continuing education, the fastest laptop and "cool projects in a neat space." ◆

Top studies

Growth in Canadian university enrolment (selected programs): 1994-97

Electrical Engineering	Commerce	General Arts and Science	Computer Science	*Other Engineering
4.9 %	5.5%	6%	32%	62%

*Includes biomedical, computer, petroleum and geophysical engineering. Source: Statistics Canada
Note: From 1994-97, total full-time university enrolments decreased from about 576,000, to about 573,000.