Can Virginia find solutions? States and regions throughout the United States compete powerfully for knowledge workers, counting on success as their prime strategy in attracting and retaining technology companies. Since the issue first burst upon the public radar screen in 1997, public discourse on Virginia’s information technology (IT) workforce challenges has become much more sophisticated. From that early cry to fill an estimated 19,000 vacant jobs in Northern Virginia and 23,000 statewide\(^1\) to current state estimates in the 30,000 range, practitioners now focus more on defining the skills and experience gap than on the numbers game.\(^2\) Nationally, the Information Technology Association of America (ITAA) estimates more than 800,000 unfilled IT jobs.\(^3\) By almost doubling their estimate from the previous year, ITAA underscores the pervasive shortage of IT workers throughout the economy, not just in technology-based companies. The number reflects increases in job categories that rely on IT skills and the heightened need for training, retraining, re-tooling, and expanding the IT workforce to those heretofore at the margins: the under-employed, unemployed, part-time, and semi-retired workers.

June 2000 research by the Virginia Center for Innovative Technology found numerous and varied IT job opportunities in Virginia (see figure 1). At each educational and professional level there are leaders—and laggards—both on the worker supply side and on the employer demand side, and there are market failures. National policy initiatives as well as a number of state initiatives focus on both long-term investments and short-term solutions. Long-term investments include improving all citizens’ access to computing power and Internet content over broadband networks, providing the ongoing training and hardware and software maintenance that this investment requires, and going to where people live rather than relying on them to find the appropriate resources in the right combinations. Short-term initiatives include ramping up industry certifications and developing internship opportunities, flexible immigration policies, and intensive training.

Virginia Employment Commission projections through 2006 indicate that the demand for IT and telecommunications workers will continue to surge over the next six years. Stakeholders have begun to focus on the needs that prudent public policy might be able to address, beginning with the recognition that IT drives the new economy and will soon be embedded in nearly every job and profession, while noting that there is no substitute for core foundation skills such as literacy and numeracy.\(^4\) June 2000 research by the Virginia Center for Innovative Technology found numerous and varied IT job opportunities in Virginia (see figure 1).

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Where we stood in year 2000

In Virginia, information technology and tourism, which follows in the number two spot, are the driving sectors of the economy, more than compensating for declines in traditional manufacturing, coal mining, and tobacco. IT provides higher wages (almost double) and higher skill jobs that are changing the nature of regional economies. Unfortunately, some of the regional economies are having difficulty responding to all of the elements of this change, and consequently, unemployment in some areas periodically climbs as high as 20 percent.

In 1999 Virginia’s Center for Innovative Technology (CIT) studied workforce needs in support of the Governor’s Commission on Information Technology, which had been tasked to review the workforce issue as one of its four focus areas. This commission examined vacancies in the major IT skill categories needed in Virginia, building on a typology developed by the Northwest Category Development Coordinating Center of the Northern Virginia Regional Partnership, a public-private partnership comprised of business, education, local government, and civic leaders that focuses on developing a world-class technology workforce throughout the Northern Virginia region. He has also worked in several career senior human service and workforce development agency positions with the Fairfax County, Va., government and as a budget examiner and appropriations analyst with the U.S. Office of Management and Budget.

Re-visited this issue a year and a half later, almost half of the jobs require at least a bachelor’s degree and five to seven years’ experience. However, employers seem to be looking at associate degrees somewhat more, and some also advertise for interns, which will give new entrants and job changers a leg up on the experience requirements. In addition, a greater number of jobs require “e-business” skills that did not even register on the list several years ago. Finally, the number of jobs posted on the online job boards, from which this research was drawn, has doubled in a year, probably indicating the migration of employers and job seekers to the Internet as well as some degree of increase in vacancies.

Table 1 gives a snapshot of regional jobs, skills, and experience needs as captured from a “cocktail” of online job boards.

The data in table 1 suggest that the Virginia IT industry workforce requirements:

- Primarily focus on expectations that candidates will have two to five years of work experience in the required technology application and
- Rarely allow for candidates with entry-level skills to be considered on paper. The table suggests that approximately 6 percent of listed positions required work experience of less than one year.

Upon closer examination, the available positions that require less than one year of experience are grouped into several categories, such as support specialists (who maintain the hardware and software on personal computers), web developers (who have emerged as an IT specialty with the rapid growth of the Internet), and programmers (who require a broad variety of related IT skills in high-demand software such as JAVA and C++ languages). Public policies that support the expansion of these types of technology skill sets are key in adding new IT workers within Virginia’s technology industry.

Partial solutions to date, but no universal answers

Since 1997 state, regional, and local initiatives have provided substantial leadership for private and public interests concerned with the Commonwealth’s IT workforce requirements. Given the immediate needs of the industry, many of these initiatives appropriately target short-term results, ideally serving as a catalyst for moving newly trained students immediately into the IT worker pipeline.
These efforts include both an increase in degreeed students, but also an enhanced focus towards retraining workers with newly developed technical skills. While it is impossible for the higher education system to produce experienced IT workers immediately, a variety of positive steps have been taken. For example, Virginia Tech now offers several quality IT education and training programs throughout the commonwealth, ranging from increasing computer access in rural communities to expanding IT training opportunities for urban, low-income housing residents. As of fall 2000, students may also enroll in an innovative, interdisciplinary master’s degree and certification program in information technology offered completely via the Internet. This initiative to move IT workforce training from the classroom to the Internet elevates educational access to a new level for both state and non-state residents.

Further extending its outreach efforts, Virginia Tech formed a partnership to assist economically disadvantaged areas of Southside Virginia by establishing a high bandwidth communications network and an institute for advanced learning and research. Working with the private sector, Virginia Tech will deploy a broad bandwidth communications network known as M SAP or Multimedia Service Access Point. Tech has teamed up with Averett College and Danville Community College to establish an institute that will offer advanced degrees and continuing education programs. Tech will also work with the local school systems to upgrade their network infrastructure and to train teachers on how best to incorporate web-based learning into the classroom.

George Mason University has created several new minors intended to address the shortage of qualified IT workers. A new minor in information technology, for example, has been designed for students who choose not to major in computer science, engineering, or IT but who want to shape their future working careers around the technology economy while majoring in fields such as history, English, or psychology. In two years, enrollments in the IT minor degree have increased to over 200 students as of fall 2000. GMU has also created the Top HATS Program, which targets high ability students from across the country who can transfer to GMU as juniors to study computer science, engineering applications, or IT. Through corporate sponsorships, Top HATS students have their tuition ($6,000 per year) completely paid and work part-time at Northern Virginia technology firms to gain further work experience during the school year. By fall 2000, GMU had enrolled 15 students in this unique technology scholarship program. In fall 1999, the school introduced the Global Co-Op program, which provides $50,000 scholarships to top international graduate students. The scholarships pay for two years of study and internships with sponsor companies. The university has also added an M.S. in telecommunications, as well as a Ph.D. in computer engineering and a Ph.D. in computer science. The School of IT & Engineering recently hired its own director of internship programs, who is charged with assisting area companies and students find the employment and the employees they need. This includes setting up new programs and partnerships, as well as providing career advice to the school’s many students already employed in the IT community.

The University of Virginia Northern Virginia Center (UVA NVC) has responded rapidly to the creation of several IT certificate programs that provide training in emerging IT specialties. The center features a 19-credit-hour undergraduate information technology certificate focused on providing training for liberal arts graduates, career changers, and other professionals seeking entrance into the field. Students are exposed to fundamental concepts, theory, and technology involved in information systems, as well as programming concepts, Java, IT business operations, web design, systems analysis and design, and project management. Other innovative programs offered by the center include a web content development certificate at the undergraduate level and technology leadership and e-commerce certificates at the graduate level.

The Virginia Community College System (VCCS) has responded rapidly by creating the Institute of Excellence for Information Technology, serving as a focal point of technology education for the 23 community colleges throughout the commonwealth. This institute will channel energy and resources into basic technology-skills development for the thousands of Virginia students who begin their education or upgrade their employment options in community colleges. Moreover, in 1998 VCCS created a partnership with Cisco Systems, the largest Internet network development company in the world, to develop Cisco Regional Training Academies at community college sites throughout Virginia. This example of an IT business-education partnership is a model for future collaboration in preparing necessary workforce skills.

Northern Virginia Community College is a regional leader in developing credit and non-credit education and training course offerings that respond to Northern Virginia’s workforce requirements. Through its Information Systems Technology Program, NOVA offers degree specializations in networking, applications

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<th>Table 1</th>
<th>Job listings by years of experience required</th>
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<tr>
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<td>8+</td>
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<tr>
<td>IT managers</td>
<td>21</td>
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<tr>
<td>IT marketers &amp; sellers</td>
<td>0</td>
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<tr>
<td>Other programmers</td>
<td>21</td>
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<tr>
<td>Database administrators</td>
<td>7</td>
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<tr>
<td>Support specialists</td>
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<tr>
<td>Business developers &amp; analysts</td>
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<tr>
<td>Web developers</td>
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</tr>
<tr>
<td>Network engineers</td>
<td>19</td>
</tr>
<tr>
<td>Telecom engineers/technicians</td>
<td>0</td>
</tr>
<tr>
<td>Computer/electronics technicians</td>
<td>0</td>
</tr>
<tr>
<td>Semiconductor designers</td>
<td>0</td>
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<tr>
<td>Totals</td>
<td>71</td>
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George Mason University
developed, and microcomputers. Developed with industry input, these programs are continually updated to meet the needs of employers. In fall 2000, NOVA offered more than 600 sections of almost 400 different courses with over 12,000 students enrolled. In May 2000, 500 IT students graduated from NOVA’s programs. Moreover, non-credit training and certifications are offered at all of NOVA’s campuses, with several campuses offering programs aimed at re-tooling students who lack technical training for entry level IT positions. The Technology Retraining Internship Program (TRIP) and the Fast Track Training Program were the first of these programs, which offer intensive instruction, mostly to students with liberal arts backgrounds.

NOVA has also developed a number of strategic partnerships with Northern Virginia IT companies. Telient, Inc., for example, provides 10 full scholarships and 10 paid internships annually to NOVA IT students. INTEL has funded a networking lab and will be providing scholarships. NOVA has also partnered with eComm Security, Axent Technologies, and Content Technologies to support the development of a new Internet security program curriculum, with donated services and products estimated to total several hundred thousand dollars.

The Northern Virginia Regional Partnership (NVRP) has targeted State Regional Competitiveness Program funds to exclusively focus on regional technology workforce issues. Through direct linkages with the Northern Virginia Technology Council, higher education institutions, local governments, and technology businesses, NVRP has expanded short-term technology workforce training for adults changing careers, in addition to expanding access to financial support to aid their career transition. The partnership has committed over $4 million to create and support innovative short-term technology training programs for adults to assist their transition into regional IT careers. Through May 2000, NVRP-supported training programs had reached over 3,700 adult students. Moreover, the IT Career Assistance Loan Program, jointly created by Sallie Mae and the NVRP, has reached 249 students and provided private transitional loans for technology training and living expenses in excess of $1 million.

The Virginia Workforce Council was created to provide statewide leadership in workforce development activities and to promote a well trained, highly skilled, and qualified workforce throughout the commonwealth. Chaired by Michael A. Daniels, a senior vice president at SAIC and former chairman of Network Solutions, Inc., the 40-member council oversaw implementation of the Workforce Investment Act during this past year. The council is developing new strategies for leveraging the Internet and information technology to build an integrated workforce services delivery system that will respond to regional and local requirements in all parts of Virginia. The council’s work will be implemented locally by the newly formed Workforce Investment Boards (WIBs) throughout the commonwealth. In addition, Anne Armstrong, president of the Center for Innovative Technology, chairs the High Tech Committee of the Virginia Workforce Council. The committee will forecast training needs, match new trainees to available jobs, and report on the state of the high tech workforce in the commonwealth, among other activities.

During the past two years, the governor and the Virginia General Assembly have also been actively working to develop common solutions for an appropriate state response to this vexing economic development issue. To date, not all parts of the commonwealth have experienced the benefits of the New Economy; nor have they experienced the shortage of IT workers in equal proportions. Both the General Assembly and Governor Gilmore have worked to balance those inconsistent realities within the state, while making every effort to continue progress and to place Virginia in a leadership position for IT workforce development. Following the completion of the third IT Commission Report in October 1999, the governor proposed several legislative initiatives to the General Assembly, including the creation of state tax incentives for the provision of student technology internships. The General Assembly did not enact the proposed student internship tax credit during the 2000 session and, hopefully, will reconsider and act upon that legislation during subsequent General Assembly sessions.

At the federal level, the U.S. House of Representatives passed H.R. 3582, the Federal Contractor Flexibility Act (introduced by Representative Tom Davis of Virginia), which requires federal agencies to justify the need for certain information technology education and experience requirements that are imposed on federal IT contractors. The issue of federal requirements for college degrees or multiple years of work experience has been repeatedly identified as a substantial barrier for new workers or highly trained students to gain employment with major federal IT contractors, particularly in Northern Virginia. H.R. 3582 was approved by the full House in May 2000 but was not acted upon by the Senate and will need to be reintroduced when the new Congress convenes in 2001. Separately, in a rare display of bipartisan agreement late in the 2000 session, the U.S. Congress agreed to increase the number of visas for highly skilled foreign workers. This legislative action will allow for the issuance of 195,000 visas for each of the next three years, an increase of 80,000 visas annually from the 1999 level. In fact, without this new legislation, the cap on H1B visas would have dropped to 107,500 for the new federal fiscal year.

Are current public efforts working and how much is enough?

Interested observers of government and public policy might expect that the primary response to Virginiac’s information technology workforce challenges is the responsibility of the public sectors, either at local, regional, state, or federal levels. Interestingly, many of the IT workforce initiatives that have been implemented, including the ones discussed in this article, have been targeted public responses to this tremendous technology workforce deficit. None of these initiatives, however, can be viewed as stand-alone solutions to Virginiac’s IT workforce shortage. Rather, these publicly funded efforts to add new IT employees to the commonwealth’s workforce should be viewed as the beginning efforts of a long-term economic development campaign.

At these initial stages of implementation, however, it seems appropriate to ask how much the public sector—particularly local, regional, and state government coffers—should invest to continually develop and expand the commonwealth’s IT workforce. What is the commonwealth’s strategic vision for its 21st centu-
ry technology workforce? How does continued state support for the information technology industry—and its many subsidiaries—translate into ongoing and sustained technology workforce efforts that will provide the "raw materials" of knowledge workers in future years? And how much should local and regional governments "invest," both now and in the future, based on the economic benefits to their jurisdictions from the higher earnings potential and elevated tax base of their trained citizens?

We do not have complete answers at this time and would note that many of those answers must be politically determined and decided, especially in the allocation of public resources to support additional workforce training and investment. But we would respectfully suggest that private-sector support must take on a larger share of Virginia's IT workforce solution and that the numerous public policy alternatives must not be borne solely by the public sector. Virginia Secretary of Technology Donald Upson has voiced his concern for the need of Virginia technology companies and businesses to be directly involved with responding to the state's knowledge worker challenge. Secretary Upson, who has substantial experience as a private sector technology executive and in senior federal and state government positions, notes that "Virginia's technology workforce challenges can only be solved with new thinking and active involvement by its technology companies and related businesses in adding new knowledge workers to the commonwealth. Publicly funded training initiatives and related supports can serve as a catalyst for action and change but are limited by size and scope to be the only IT workforce solution." In general, publicly funded training efforts are constrained by broader governmental resource restraints and may suffer from limited corporate support and participation.

Workforce development professionals in industry and academia recognize that on a nationwide basis, the private sector already conducts and supports most corporate workforce efforts through in-house training, corporate universities, distance learning, and continuing education subsidies for their workers. We are suggesting that those examples of corporate support be examined and targeted within the commonwealth's information technology industry and that new ways of bringing skilled workers into the industry be embraced.

Can Virginia public policies do more to encourage innovative ways for technology companies to hire newly skilled IT workers? We believe that public policies can be adopted to encourage and possibly expedite the retooling of workers into the IT industry or to retrain existing IT workers for newly emerging skills. Limited internship tax credits, training grants, IT career assistance loans, scholarships, and other forms of financial incentives are being considered or are actually being utilized. State and local public policies should continue to advocate these activities and expand those particularly successful efforts. But all of these incentives together are not likely to erase the overall IT workforce shortage in Virginia within the next decade, as projections for IT workforce requirements continue to escalate. A basic understanding of economics suggests that other market forces will prevail in encouraging or discouraging IT workers to be employed within Virginia.

The state, along with those technology-centric regions within the commonwealth, must continue efforts to build and maintain a world-class technology workforce. The singular challenge to training existing workers to meet new IT skill demands must continue unabated. But the journey towards that goal should include other factors that contribute to a world-class workforce beyond expanded IT training, including an outstanding quality of life; an equitable tax base for individuals, families, and businesses; reliable energy resources; excellent transportation options; and affordable living opportunities. Addressing these issues together, Virginia can continue to place itself above many other states and regions in the United States as the most desirable location to work in the technology industry.

Endnotes

1. 1997 Regional IT Workforce Study by the Northern Virginia Technology Council, Herndon, Va., 1997, IT Workforce Study by the Center For Innovative Technology, Herndon, Va., 1998. Regional IT Workforce Study commissioned by the Northern Virginia Regional Partnership, Herndon, Va.
