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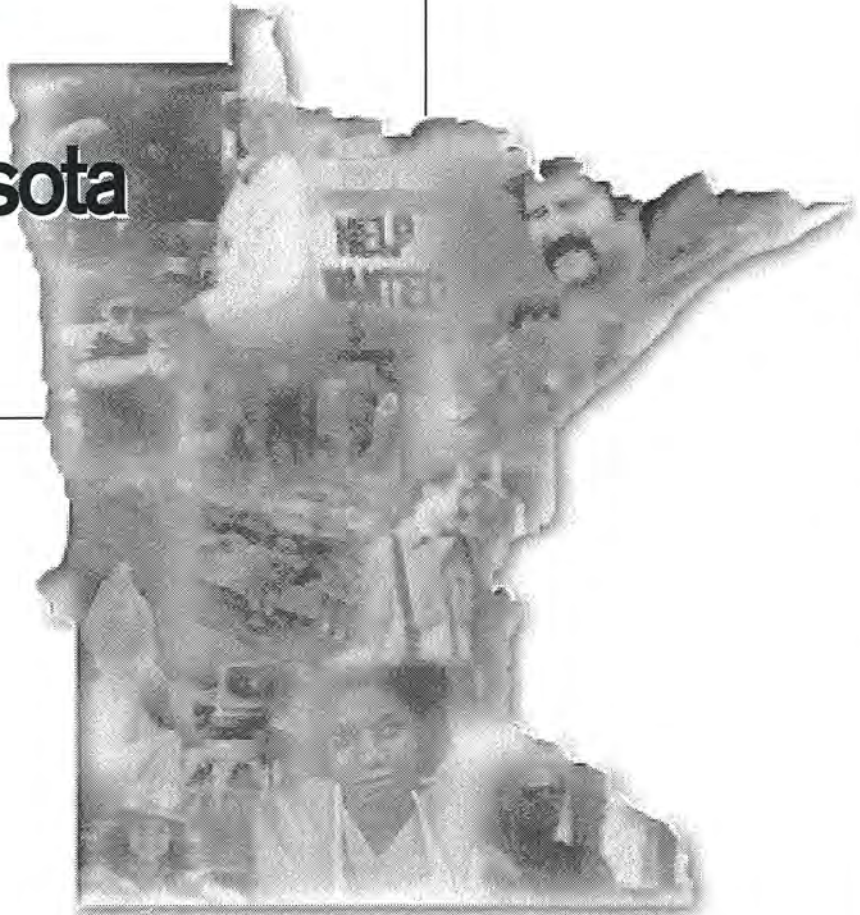


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BEYOND 2000:

Information Technology Workers in Minnesota

May 1998



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Minnesota Department of Economic Security
Research and Statistics Office

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Executive Summary

Minnesota's record-low unemployment rates and record-high workforce participation rates have left many employers scrambling to find workers. Statewide, employers say that there just aren't enough skilled workers available to meet demand. Recent employment projections indicate that employment growth will continue to outpace workforce growth in the coming years. Clearly, this problem is not going to go away soon.

For the many firms throughout the economy who employ information technology (IT) workers, the situation is even more serious. As the new century approaches and the IT industry continues its explosive growth, employers are having problems finding workers who are trained in the most current computer languages and applications.

Until now, little information about Minnesota's IT industry has been available. To find out how this vital sector of our economy has fared in recent years and what the future will bring, the Minnesota Department of Economic Security (MDES) looked at employment and wage trends for specific types of IT workers and surveyed Minnesota employers to see whether firms are having problems finding IT workers.

The survey results indicate that there is definitely reason for concern. Highlights include:

- Almost 90 percent of the survey's respondents think that there is a shortage of qualified IT workers in Minnesota. Among those who think there is a shortage, over 60 percent rate the shortage as "moderately" or "extremely" serious.
- Fifty-seven percent of survey respondents have had problems finding qualified IT workers. Forty-two percent said that worker shortages have affected their ability to fill work orders.
- Seventy-three percent of respondents have raised wages in an effort to find and retain workers, and 56 percent have made changes in the benefit packages they offer.
- Surveyed firms indicate that a large number of current IT vacancies exist, and 50 percent indicate that they plan to add to their IT workforce in the next 12 months.
- Employment in the computer and data processing services industry exploded during the 1990s, increasing by over 130 percent between 1990 and 1996. In addition, employment in specific IT occupations such as *computer programmers/aides*, *systems analysts*, *computer engineers*, and *computer scientists and other computer professionals* expanded by almost 70 percent between 1989 and 1996. Over the next decade, almost 8,800 workers will be needed each year to fill positions opening in these occupational areas.
- The average weekly wage for workers in the computer and data processing services industry increased by 39 percent between 1990 and 1996, compared with an overall wage increase of 25 percent.
- Approximately 1,000 students graduate each year from IT-related post-secondary programs in Minnesota, not nearly enough to fill the 8,800 positions that are projected to open each year between now and 2006.

Background

Around the country, one of the hottest issues among employers, workforce analysts, economists and educators has been the looming shortage of information technology (IT) workers. While much of the discussion on this issue has focused on the need for COBOL programmers to develop and implement solutions to the Year 2000 problem (the inability of most computer software programs to recognize four-digit dates), firms are trying to fill many different types of IT positions. Conventional wisdom says that many employers are searching high and low for qualified workers and are having trouble finding them. Even when a firm can find the qualified workers they need, often it is a challenge to get them to stay. Several recent national studies provide support for this view.

In 1997, the Information Technology Association of America (ITAA), in cooperation with Virginia Polytechnic Institute and State University, conducted a survey of 1,500 IT and non-IT firms around the country. Their results indicate that employers are indeed having trouble finding and training IT workers. Over 80 percent of respondents indicated that it is "somewhat" or "very" difficult to hire programmers, systems analysts and computer scientists/engineers, and over 50 percent indicated that retention is somewhat or very difficult. Respondents also said that a lack of qualified trainers makes upgrading the skills of existing employees difficult.

Based on the survey responses, ITAA calculated the number of programmer, systems analyst, and computer scientist/engineer positions currently open in IT and non-IT companies with 100 or more employees, and came up with an estimate of 346,000 openings. These estimates represent about 10 percent of current employment in these three occupations.¹ In other words, ITAA estimates that one IT position stands open for every 10 that are currently filled.

In another 1997 survey, the professional services firm Coopers & Lybrand found that 70 percent of CEOs in high-tech firms listed the lack of highly skilled, trained workers as the number one barrier to growth.² While high-tech company CEOs were generally optimistic about future growth in employment and revenues, many lowered their revenue growth expectations due to concerns about the supply of qualified workers; forecasts declined from 36.2 percent to 28.5 percent for the next 12 months. More than 80 percent of survey respondents plan to hire new staff in the coming year, adding a total of 19.8 percent to their total workforce.³

The results of these studies highlight what many consider to be the most serious ramifications of an IT worker shortage: lowered competitiveness and hampered growth. If high-tech firms,

¹ *Help Wanted: The IT Workforce Gap at the Dawn of a New Century*, Information Technology Association of America, 1997.

² *Trendsetter Barometer*, Coopers & Lybrand, October 1997.

³ *Trendsetter Barometer*, Coopers & Lybrand, October 1997.

which add thousands of high-skill, high-wage jobs to the U.S. economy every year, can't find the workers they need many will not be able to expand.

Many firms are already turning to other countries, like India, to find the workers they need. As telecommuting – which reduces the need for employers and employees to be physically located in the same building or even the same country – becomes a realistic option for more companies, this trend will likely continue.

IT Worker Shortage Survey

As these recent studies indicate, many U.S. employers are having problems finding qualified IT workers. But what is happening in Minnesota? Do employers think that there is a lack of qualified IT workers? How much does this shortage affect business? What types of IT workers are most in demand?

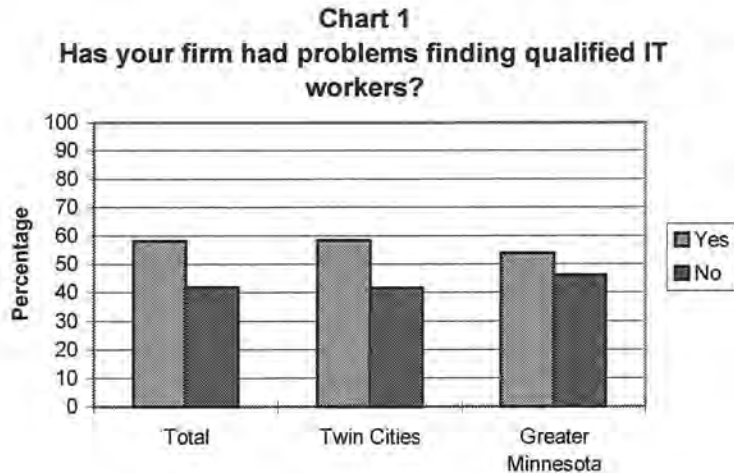
To find out the extent to which Minnesota employers are feeling the impact of the national IT worker shortage, MDES conducted a survey in February 1998. The results show that Minnesota employers are definitely having problems finding enough qualified IT workers to meet their staffing needs. For many employers, the dearth of workers means not being able to fill contracts; for others, it means not being able to aggressively pursue new business opportunities. In response to this shortage, employers are using a variety of tactics to attract and keep good workers, including significant wage increases, bonuses, increased vacation time and flexible scheduling options.

The extensive phone survey of Minnesota employers began with a stratified random sample of approximately 2,400 employers drawn from MDES employer databases. Employers in IT-intensive industries such as computer and data processing services, depository institutions, and computer and office equipment manufacturing were given more weight in the sample design than other industries, as were employers with over 250 workers. All employers in the computer and data processing services industry were included in the sample. An additional 130 members of the Minnesota High Technology Council were mailed copies of the survey. For more information about the sampling methodology, see ***Appendix A***.

A total of 814 employers provided usable responses by phone or mail for an overall response rate of 31.7 percent. Although the sample was designed to increase the likelihood that sampled firms actually employ IT workers, a sizable minority (39 percent) of responding firms did not have any IT staff or any intention of hiring IT staff. Their responses are not included in the analysis that follows. To see the survey instrument, see ***Appendix B***.

Finding Qualified Workers

The first question employers were asked was whether they personally had problems finding qualified IT workers. Anecdotal evidence and the results of the ITAA and Coopers & Lybrand studies suggest that nationally, a large percentage of firms that employ IT workers have had problems finding workers. The responses to this question indicate that this is also the case in Minnesota. See Chart 1.



Looking first at the overall responses, 57 percent of the responding firms answered “Yes” when asked whether they have had problems finding qualified IT workers. The percentage of firms with problems was slightly higher in the Twin Cities metropolitan area than in Greater Minnesota.

Firm size does not appear to have an affect on ability to find qualified workers. Looking at firms with 5-19 employees, 20-99 employees, and over 100

employees, the percentage of respondents that say they have had difficulties remains roughly the same.

When asked whether or not they personally felt that there was a shortage of IT workers in Minnesota, an overwhelming majority of respondents answered “yes.” Statewide, 88 percent of respondents think that there is a shortage of IT workers in Minnesota. Responses were similar from the Twin Cities and from Greater Minnesota; 89 percent of Twin Cities respondents indicated that they feel there is a shortage of IT workers, compared with 85 percent of Greater Minnesota respondents. Even respondents who have not personally had problems finding qualified workers feel that there is a problem. Several mentioned that they feel that they have been “lucky” thus far in finding workers but that they anticipate more problems in the future.

Not only do survey respondents feel that there is a shortage of IT workers in Minnesota, they also think the problem is a serious one. Among respondents who feel there is a shortage of IT workers in Minnesota, almost two-thirds, 61 percent, feel that the shortage is “moderately” or “extremely” serious. See Chart 2. The percentage of respondents who rate the shortage as moderately or extremely serious is roughly the same for the metro-area firms and those in Greater Minnesota, and for larger and smaller firms.



Based on these responses, employers do think that Minnesota is experiencing a shortage of IT workers. Is this shortage affecting their ability to meet client expectations? We asked employers whether the shortage affects their ability to fill work orders or contracts. Over 40 percent said "yes." Statewide, 41.6 percent of respondents said that the IT worker shortage affects their ability to do business. Here, the gap between metro and

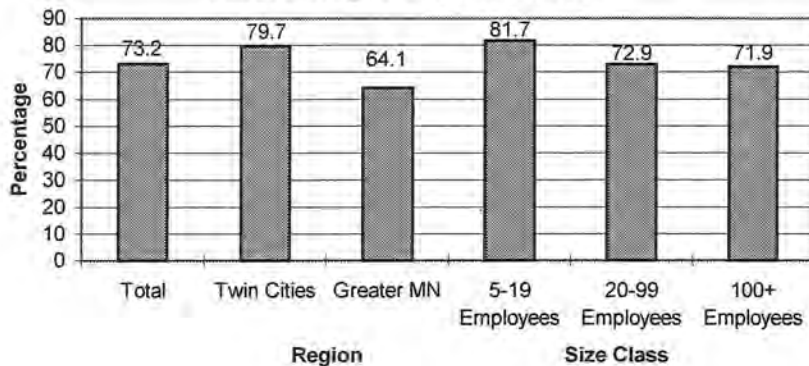
Greater Minnesota responses was more dramatic. While only about 27.8 percent of Greater Minnesota respondents indicated that the lack of workers has affected their ability to fill work orders, 46.2 percent of Twin Cities respondents had experienced this problem.

The true impact of the IT worker shortage on businesses may be even greater than these responses indicate. Some respondents indicated that they haven't had problems filling their work orders or contracts due to a lack of workers, but the number of contracts that they pursue or accept is smaller than it would be if they had all of the workers they need. In other words, some businesses are limiting the number of contracts or projects that they pursue because they know that they will be unable to find all of the necessary workers. Several respondents indicated that, if they could find 20, 50, or 100 employees qualified to do the job, they would be able to find enough business to keep them all busy.

In a tight labor market such as this, one way that employers can attract qualified workers is to raise wages and improve benefits. Anecdotal information about sky-high starting salaries for recent college graduates and experienced programmers, webmasters, and analysts is readily available, but concrete information about the methods employers use to lure qualified employees is not readily shared.

When asked whether wages for IT workers have increased in the last 12 months, the majority of employers, 73.2 percent, said that wages for these workers have gone up. See Chart 3. When responses are grouped by location or by firm size, only slight patterns are apparent. Employers in the Twin Cities area appear to be feeling more pressure to raise wages than their counterparts in Greater Minnesota. While just over 80 percent of responding metro-area employers raised wages for their IT workers within the last 12 months, only 64 percent of Greater Minnesota firms have done so.

Chart 3
Percentage of Responding Employers Who Have Raised Wages in the Past Year



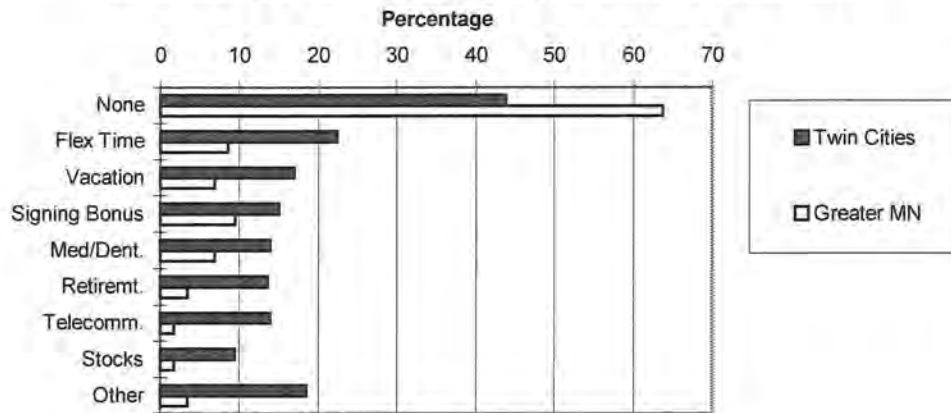
Firm size, again, appears to play a small role in whether or not firms have increased IT worker wages. Small employers were only slightly more likely to have increased wages than their larger counterparts, and in both cases the majority of respondents indicated that wage increases had occurred. However, with no information on wage trends available from these respondents, it is

impossible to tell whether starting salaries had initially been lower at smaller firms. If smaller firms had been offering lower wages than larger companies, the higher incidence of wage increases among smaller firms may have just brought them up to competitive rates.

Among firms that have increased wages for IT workers, the overwhelming majority of respondents (85 percent) indicated that wage increases fell into the 1 percent–25 percent range. Respondents differed little by location in terms of the size of wage increases; 91 percent of the outstate firms that raised wages fell into the 1 percent–25 percent category, as did 84 percent of the Twin Cities firms. Only four firms indicated that wages for IT workers had increased by more than 50 percent in the last year.

Another way that employers make a job more attractive is by offering strong benefit packages. In a tight labor market, when employers are competing to attract and keep the best workers, sometimes a more attractive benefits package can mean the difference between accepting and rejecting a job offer. In addition to traditional benefits such as health insurance, dental insurance, vacation time and retirement plans, some employers are finding that they need to offer such options as flexible work schedules and telecommuting. Other employers, while not adding new benefits, are improving existing ones by increasing vacation time, improving health or dental coverage, or increasing 401(k) matches or retirement plans.

Chart 4
What changes have you made to your benefits packages?



The survey responses show that many employers are changing the quantity or quality of the benefits they offer. However, increasing benefits in response to shortages is less common than raising wages.

Fifty-six percent of responding firms indicated that they had made some changes in their benefit packages as a way to attract or retain employees, compared with almost 75 percent who increased wages. Statewide, 34.4 percent of responding firms had increased both wages and benefits. It is important to note, however, that while almost half of the responding firms indicated no changes in benefit packages, there is no way to know how generous existing benefits are in those firms.

Among firms that did indicate changes in benefits, the most common change, at 19.8 percent, was the addition of flexible scheduling options. Eleven percent of respondents indicated that they have begun to offer telecommuting as an option. In its recent report *Minnesota Employee Benefits Survey*, MDES found that 36.6 percent of responding firms offered some type of alternative scheduling arrangements to employees.⁴ The most common type of flexible scheduling option cited by those employers was the compressed workweek or “flex time” option. Although, again, it is impossible to know what percentage of the firms that responded to this survey already offered such benefits, and thus did not need to add them, these results do provide some indication that flexible work arrangements are becoming more common throughout the economy.

While improving benefit packages or working to make a workplace more flexible or “employee friendly” helps out many employees, not all are benefiting from these changes. Many workers in the computer and data processing services industry, in particular, work on a contract basis rather than as traditional employees. Contract or contingent workers are, in general, less likely to be offered comprehensive benefit packages than are regular employees.

Just as employers in Greater Minnesota were less likely than Twin Cities employers to have increased wages in the last year to attract workers, these employers were also less likely to have made changes in the benefits they offer. Among Greater Minnesota firms, 36.2 percent had made changes in their benefit packages, compared to 56.2 percent of Twin Cities firms.

⁴ *Minnesota Employee Benefits Survey*, Minnesota Department of Economic Security, 1997.

Across the board, for each type of benefit, greater Minnesota firms were less likely to have made changes than firms in the metro area. Again, there is no way of knowing how average benefits compare between metro and Greater Minnesota respondents or among firms in general. If the benefits offered by the average Greater Minnesota respondent are already more attractive than those offered by Twin Cities area firms, responses to this question may simply reflect that reality. However, generally higher salaries and benefits in metropolitan areas make this unlikely.

Benefits falling into the "other" category include reimbursement for educational expenses, increased on-the-job training, and production bonuses. Several employers use different kinds of bonuses as a way to encourage loyalty to the company and find qualified workers; retention and referral bonuses appear to be relatively common.

Demand for Information Technology workers

In the final section of the survey, employers were asked specific questions about six different types of IT workers:

- LAN or network administrators
- Support specialists/technicians
- Database administrators
- Internet/web specialists
- Programmers
- Engineers/scientists

Respondents were asked how many workers they currently employ in each of these six categories, how many positions are currently available for each group of IT workers, and how many additional workers the company would like to hire in the next year, assuming that they could find all of the workers they need.

Altogether, the firms that responded to the survey employed 83,426 workers during the second quarter of 1997 (the most recent employment data available)⁵. Of these workers, approximately 7,300, or 8.8 percent, worked in one of the six IT categories.

⁵ ES-202 Program, MDES, 1998.

	Table 1		
	Employment of IT Workers		
	Firms	% of firms ⁶	Reported IT Employment
LAN/Network Admin.	268	57.3%	1064
Support Tech.	237	50.6%	1478
Database Admin.	166	35.5%	607
Web Specialists	138	29.5%	333
Programmers	224	47.9%	2588
Engineers/Scientists	75	16.0%	721
Other	62	13.2%	547
TOTAL			7338

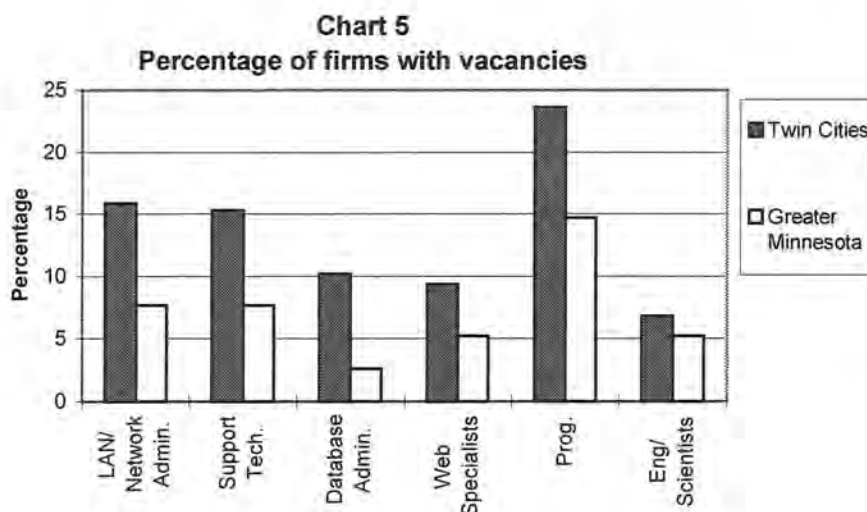
Among firms that were willing to provide employment information, the type of IT worker employed varied. More than 50 percent of the responding firms employ LAN or network administrators and support technicians. Relatively few firms employed computer engineers, computer scientists or web/internet specialists. This is not surprising given the low number of people

employed in these occupations in Minnesota relative to other IT occupations. Programmers were the most commonly employed IT workers among responding firms, both in terms of the number of firms employing programmers and the total number employed.

Approximately three-quarters of reported IT employment (74.6 percent) came from firms in the Twin Cities metropolitan area. While this percentage is lower than might be expected given the preponderance of IT firms in the Twin Cities, this result is most likely due to the sampling methodology, which stratified firms by region. There were few significant differences between metropolitan and Greater Minnesota firms in terms of IT staffing patterns. However, Greater Minnesota firms were slightly more likely to employ support specialists (57.8 percent versus 48.3 percent) than Twin Cities firms and slightly less likely to employ web specialists (25 percent versus 31 percent).

The percentage of responding firms with current vacancies varies by type of worker, and is relatively low for each worker type. Not all of the firms that have current openings in a given category currently employ workers in that category. Some firms have an opening for a lone programmer or webmaster; while other firms are looking to augment existing staff. As Chart 5 shows, programming vacancies show up the most frequently. Almost a quarter of the responding firms have programming positions available, and among firms that do currently employ programmers, 44.6 percent have openings for additional programmers.

⁶ Percentages in this table are based on the 468 firms who completed this portion of the survey.



Just as most IT employment is concentrated in the Twin Cities area, so are most of the current vacancies. Of the approximately 2,100 current vacancies listed by responding firms, 1,875, or 89 percent, were in the Twin Cities area.

One way to interpret vacancy information is

to look at vacancies as a percentage of total employment. Current IT vacancies among responding firms represent 2.5 percent of total employment and 27.9 percent of IT employment. In other words, responding firms have, on average, one open IT position for every 3.6 IT employees.

While knowing the percentage of responding firms with vacancies for specific types of workers is helpful, it can also be misleading. Because respondents were asked about the number of current vacancies, positions that may be opening up within two, three or six months would not be reported. Additionally, the timing of the survey may not coincide with the time when firms tend to do the most hiring. Thus, this information is more useful as a snapshot of demand at one point in time rather than as an overall picture of the job market for current and potential IT workers.

A better way to predict how the short-term job market for IT workers will look is to examine the number of workers that employers would like to hire in the near future. By looking at the "wish lists" of firms, or how much they would expand given a sufficient number of qualified workers, the gap between demand for, and supply of qualified workers becomes more clear.

Table 2 shows the number of responding firms that indicated a desire to hire more workers in each category over the next 12 months. The percentage of firms that hope to expand can be looked at in two different ways. The second column, "Percent of All Respondents," shows the percentage of all responding firms that indicated hiring plans for the next year⁷. Because many of the responding firms do not currently employ any workers in one or more of the six categories, this number is relatively low. Although it is tempting to use these numbers to project economy-wide demand for IT workers, the fact that the survey sample was heavily weighted toward firms that already employ IT workers means that the proportion of firms in Minnesota that hope to hire IT workers is actually lower than this. The third column, "Percent of 'Employing' Respondents," shows the percentage of firms who plan to expand in each area from an existing base of workers.

⁷ This percentage is based on the 468 firms who completed this portion of the survey.

This column shows that a significant percentage of respondents who currently have workers in each of these categories are interested in expanding their staffs, assuming that qualified workers can be

	Number of Firms	% of All Respondents	% of "Employing" Respondents	12-month Demand
LAN/Network Admin.	108	23.1	40.3	502
Support Tech.	102	21.8	43.0	501
Database Admin.	61	13.0	36.7	168
Web Specialist	60	12.8	43.5	218
Programmers	128	27.4	57.6	947
Eng/Scientist	31	6.6	41.3	307
Other	21	4.5	32.8	130
TOTAL				2,773

found. Almost half (49.6 percent) of all firms plan on adding staff in at least one category in the next 12 months. For each type of worker, at least 30 percent of the firms that employ that type of worker plan on hiring additional workers in the next year.

The highest projected 12-month demand, both in terms of the percentage of employers who wish to add to their current workforce and in terms of the number of workers that will be needed, is for programmers. Over 25 percent of all respondents, whether or not they currently employ programmers, said that they plan on hiring at least one programmer within the next year, and almost 60 percent of the respondents who currently employ at least one programmer plan to hire more. The projected 12-month demand for programmers among responding firms was roughly 950, or 36.6 percent of respondents' current programming workforce. While this finding might seem to contradict MDES 1996-2006 employment projections, which predict slower growth for programmers than for other IT workers (see page 18), it is likely that much of the projected growth in programming will be concentrated in the next few years due to the Year 2000 problem rather than being spread evenly across the 10-year projection period.

Short-term demand for LAN/network administrators and for support specialists/technicians is also relatively high with employers interested in hiring 500 additional workers in each category. The projected 12-month demand for these workers is equal to 47.2 percent of the LAN/network administrator workforce and 33.9 percent of the support specialist workforce.

Overall, responding firms indicated that, if they could find all of the workers they needed, they would like to expand their IT staff by 37.8 percent in the coming year. Again, the majority of this short-term demand comes from Twin Cities respondents, who indicated that they would expand their IT employment by 42.4 percent if they could find all of the workers they needed. Greater Minnesota respondents would expand their IT employment by 24.1 percent. These results are even higher than those found by Coopers & Lybrand in their 1997 survey, where high-tech CEO's indicated that they would like to expand their IT employment by 19.8 percent.⁸ However, it is unclear whether the CEOs surveyed by Coopers & Lybrand were downgrading hiring estimates in anticipation of difficulties in finding workers.

⁸ *Trendsetter Barometer*, Coopers & Lybrand, October 1997.

Trends in IT Employment in Minnesota

As the survey results indicate, many Minnesota employers are having serious problems finding enough qualified IT workers to meet demand. What these results reflect, though, is merely the culmination of a trend that has been developing for several years as IT employment in Minnesota has expanded dramatically. To get a more complete picture of IT employment in Minnesota and the outlook for IT workers, this section of the report will use MDES data to measure trends in employment and wages for IT workers and to examine the employment projections for these workers.

Identifying trends in IT employment is not always as easy as it sounds. There are many different ways to define IT workers, so the first question that needs to be asked is simply "Who are we talking about?" Basically, IT workers can be defined based on the industries in which they work, such as computer and data processing services or manufacturing, or by the specific jobs they perform, such as computer programming or systems analysis. Sometimes the distinctions between these two definitions of IT workers can be a bit slippery, but it is necessary to examine both industry-level and occupation-level employment changes in order to gain a complete picture of the health of Minnesota's IT sector.

The industry perspective: One way to define an IT worker is by the industry in which he or she works. Using this perspective, any worker who is employed by a company in the IT field, such as a software company, would be considered an IT worker, regardless of the work they do. For example, a typical firm in the computer and data processing *industry* would employ not only computer programmers and systems analysts but also many other types of workers, such as administrative assistants, human resources workers, marketers and delivery truck drivers, who are found throughout the economy. Employment growth in this industry could therefore be due to an increase in the number of programmers or in the number of marketers that firms in the industry employ. Clearly, employment trends at the industry level show only part of the picture: they show how changes in demand for a product such as a new type of software affect many different types of workers at a firm, not just those whose work is computer-related.

The occupational perspective: The other part of the picture comes from trends in occupational employment. Using this perspective, IT workers are defined not by the type of firms for which they work but by the type of work they do. For example, computer programmers are found not only in software design or consulting firms but also in retail store headquarters, banks, manufacturing plants and other types of firms in many different industries. An increase in the employment of programmers, then, shows how the demand for these workers has changed throughout the economy, not just in industries or firms that are generally considered to be highly computer-dependent.

Identifying IT Occupations and Industries

After clarifying the difference between industry-level and occupation-level definitions of IT workers, the next challenge when trying to describe employment trends in IT occupations is simply defining which occupations are really IT. Often, the terms IT and high-tech are used interchangeably to describe a certain type of highly skilled worker. Depending on how those jobs are defined, estimates of current employment and projected demand for workers can differ by large amounts. At the occupational level, this study focuses only on one specific type of worker, those who work in what are referred to here as the “core Information Technology occupations.”

While workers in many occupations, such as medical laboratory technicians, precision manufacturing or production workers, and financial or statistical analysts often perform highly technical tasks with cutting-edge software or other tools, discussion of IT occupations in this report is focused on four occupational areas found in the Occupational Employment Statistics (OES) classification system. These occupational areas – systems analysts, computer programmers/aides, computer engineers, and computer scientists and other computer professionals – are considered the “core” IT occupational areas.

Unquestionably, focusing only on these occupational areas and excluding workers in other arguably high-tech occupations will result in an underestimation of IT employment in Minnesota. However, what distinguishes these occupational areas from others is that the use of computers and computer-related technologies is fundamental to workers in these jobs. They stand at the heart of the IT worker shortage debate. The table below illustrates the distinction between the core IT occupations and other high-tech occupations.

Core Information Technology Occupations

Systems Analysts: Workers in this occupation analyze business, scientific and technical problems and they use computer technology/applications to solve those problems. Systems analysts may develop new computer systems or adapt existing systems to meet new business needs.

Computer Programmers/Aides: Computer programmers convert project specifications into various computer languages that instruct the computer how to perform a function. Computer programmer aides assist programmers or systems analysts by writing simple programs, entering completed programs or assisting in data processing.

Computer Scientists and Other Computer Professionals: Computer scientists design computers or conduct research to improve their design or functioning. Their work may primarily involve either theory or application, and it can focus on such areas as language development, games, hardware design or virtual reality. In the OES classification system, this occupation also serves as an “all other” category; occupations such as *network administrators*, *internet specialists*, *support specialists* and other computer professionals fall into this category.

Computer Engineers: Computer engineers primarily work in hardware and software development, designing computing devices or computer-related equipment.

Other high-tech occupations not included in study

Electrical and Electronic Assemblers	Surveying/Mapping Technicians
Electronics Technicians	Drafters/CAD
Data Processing Equipment Repairers	Radiologic Technologists
Computer Operators	Engineers
Robotics Technicians	Numerical Control/Process Control Programmers
Engineering Technicians and Technologists	Precision Instrument Makers
Precision Dental Laboratory Technicians	Electronic Pagination System Operators
Graphic Designers	Nuclear Medicine Technologists

While defining the main IT occupations is one good way to begin describing and analyzing IT employment, it is also important to look at workers in IT *industries*. In recent years, the emergence of new technologies in industries such as health services, business services, and certain types of manufacturing and wholesale trade means that programmers, systems analysts, and other IT workers can be found in a wide variety of industries. Given this proliferation of new technologies, how does one decide which are the "IT industries"?

One way of identifying IT industries is to look at the percentage of workers in an industry who work in the OES occupational areas described above. Using this definition, the most IT-intensive industries in 1996, according to the U.S. Bureau of Labor Statistics, were *computer and data processing services* (33.5 percent of workers in this industry are in the core IT occupations), *computer and office equipment manufacturing* (12.4 percent of workers), and *telegraph and communication services* (10 percent of workers)⁹.

While several Minnesota industries have high concentrations of IT workers, for the purposes of this study, discussion of the IT industry is limited to firms that are classified in Standard Industrial Classification (SIC) 737, *Computer and Data Processing Services*. This industry, which includes computer programming providers, software developers, systems designers, data processing service providers, maintenance services, computer rental/leasing firms and other consulting services is the most IT-intensive industry in Minnesota. In 1996, 30 percent of the workers in SIC 737 worked in one of the core IT occupational areas.

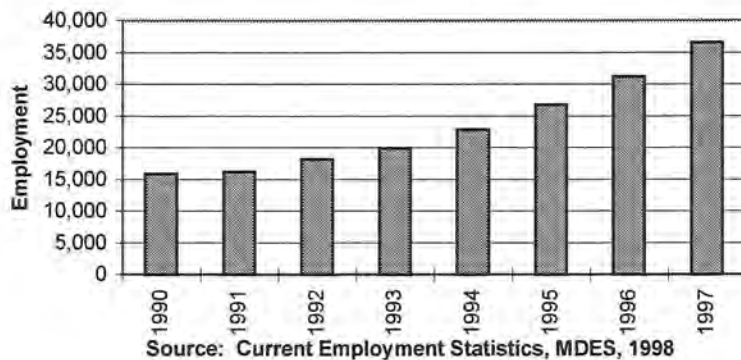
Computer and Data Processing Services Industry (SIC 737)

Nationally, employment in computer and data processing services has grown at a rapid rate during the 1990s. Between 1990 and 1997, approximately 570,000 jobs were added, bringing employment in this industry to just over 1.3 million. During these years, employment in computer and data processing services expanded by 73.8 percent, compared with only 11.8 percent across all industries.

⁹ *America's New Deficit: The Shortage of Information Technology Workers*, United States Department of Commerce, Office of Technology Policy, 1997.

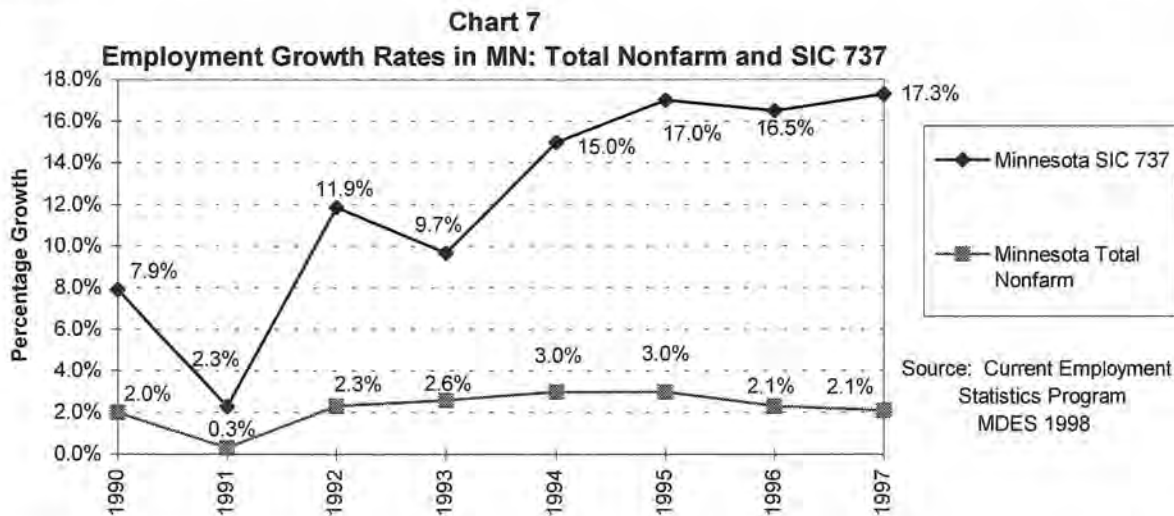
In Minnesota, growth in the computer and data processing services industry has been even more impressive, increasing by over 130 percent between 1990 and 1997. See Chart 6. This rate of growth far exceeds total nonfarm employment growth in Minnesota.

Chart 6
State of Minnesota Employment:
Computer and Data Processing Services



Furthermore, Minnesota's employment growth in computer and data processing services has exceeded national growth rates in each of the last seven years. Between 1990 and 1997, employment in the computer and data processing services industry in Minnesota jumped from approximately 15,850 to 36,560. Since 1994, statewide employment growth in this industry has been at or above 15 percent annually – higher than any other industry in Minnesota.

Chart 7 shows that annual average employment growth in SIC 737 for the last eight years has consistently outpaced total nonfarm employment growth. And although growth in this industry was strong throughout the 1990s, annual growth rates have become even more robust in the last four years. However, total nonfarm employment growth rates have remained relatively stable at between two percent and four percent. While total nonfarm employment in Minnesota increased by a healthy 16.7 percent between 1990 and 1997, employment in computer and data processing services more than doubled during the same period.¹⁰



¹⁰ In the past two years, employment growth rates have slowed slightly, in part due to slower workforce growth resulting in worker shortages.

This expansion has not been evenly distributed throughout the state. Almost all of this industry's workers are located in the Twin Cities metropolitan area; however, a larger percentage of computer and data processing services workers can now be found in Greater Minnesota than was the case several years ago. In 1990, 6.8 percent of the employment in SIC 737 was in Greater Minnesota; by 1996, that percentage had increased to 9.6 percent. Whether this is due to lower operating costs in Greater Minnesota, a greater number of high-tech firms locating in Greater Minnesota, a lack of qualified workers in the Twin Cities compared with availability in other parts of the state, the increasing prevalence of telecommuting or other factors is unclear.

Information Technology Occupations

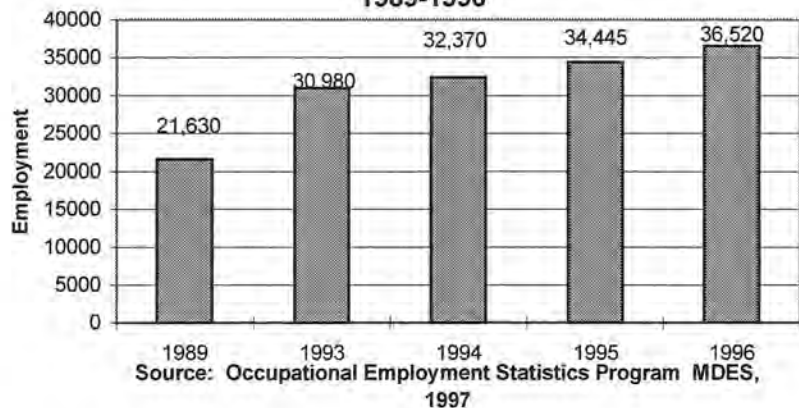
It is important to remember that workers in the computer and data processing services industry account for only part of the IT workforce. It is also important to look at employment in IT or computer-related occupations. While about 30 percent of the workers in the core IT occupations work in the computer and data processing services industry, these occupations are found throughout the economy and in a wide variety of industries.

On a national level, employment in the core IT occupations has increased tremendously in recent years. According to the U.S. Bureau of Labor Statistics, employment in these occupations expanded by 36 percent between 1989 and 1996 (the last year for which data is available), increasing from just over 1 million in 1989 to over 1.4 million in 1996. Once again, employment in these occupations in Minnesota has grown even faster than the national average.

Chart 8 shows how employment in the core IT occupations expanded in Minnesota between 1989 and 1996. During these years, employment grew by 68.8 percent in Minnesota, from 21,630 in 1989 to 36,520 in 1996 (data not available for all years). Due to changes in the way the Occupational Employment Statistics (OES) program classifies occupations and in the way that employers

report employment in each occupation, it is impossible to break down these figures to get reliable growth estimates for each IT occupation.

Chart 8
Employment in IT Occupations in Minnesota
1989-1996

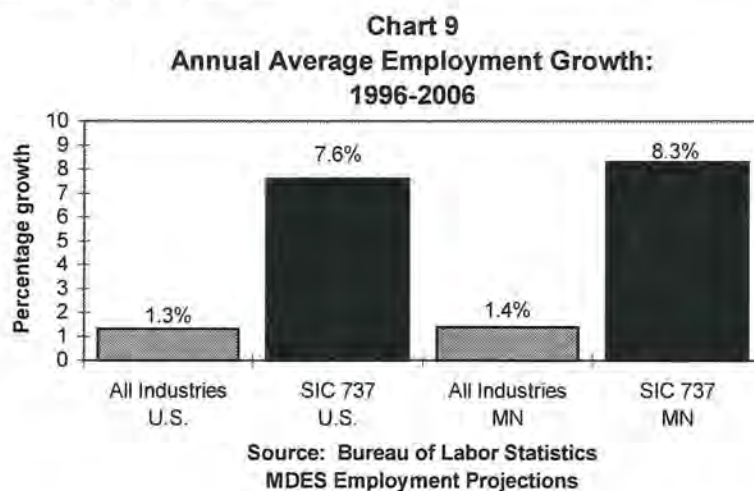


What does the future hold for IT workers?

While the preceding charts clearly show that employment in computer-related industries and occupations has expanded tremendously in recent years, students and job seekers also need to know how the job market will look a few years from now in order to make decisions about education, relocation or career changes. Approximately every two years, the Bureau of Labor Statistics (BLS) releases long-term projections of employment growth by industry and by occupation. These projections provide not only estimates of national employment growth but also the number of "new" jobs that will open due to actual growth in the industry or occupation and the number that will open due to replacement of current workers who retire or change occupations.

Computer and Data Processing Services (SIC 737)

The most recent national employment estimates published by the BLS span the years 1996-2006. These projections indicate that employment in computer and data processing services will grow faster than any other industry during this period, expanding nationally by 108 percent for an annual growth rate of 7.6 percent. Between 1996 and 2006, an additional 130,000 workers will be needed each year nationally to fill positions that open due to growth in the computer and data processing services industry. Growth in this industry will be significantly higher than overall employment growth. Across all industries, employment will expand by approximately 14 percent nationally between 1996 and 2006 for an annual growth rate of only 1.3 percent.

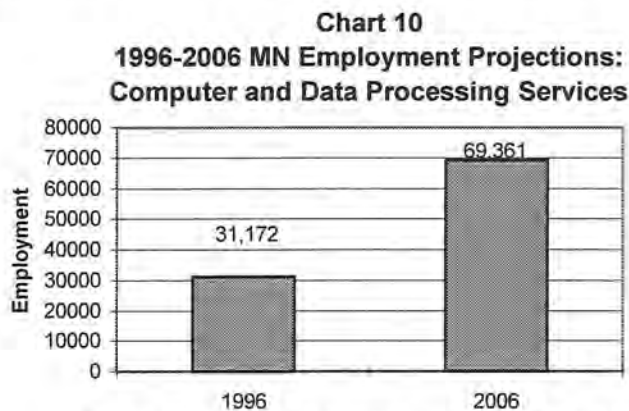


In Minnesota, growth is also expected to be quite strong in the computer and data processing services industry, and annual average employment growth rates in this industry are expected to surpass overall employment growth rates. As Chart 9 shows, employment growth in computer and data processing services is expected to be faster in Minnesota than nationally over the next 10 years,

expanding by 123 percent between 1996 and 2006 for an annual growth rate of 8.3 percent.

Assuming that the projected 8.3 percent annual growth rate in computer and data processing services holds, this industry will add approximately 38,200 jobs by 2006, jumping to nearly 70,000 from the 1996 level of 31,172. See Chart 10. In other words, in each year between

1996 and 2006, approximately 3,800 additional workers will be needed in Minnesota to fill positions opening due to growth in this industry.



Source: 1996-2006 Employment Projections, MDES, 1998

The projected 8.3 percent annual growth rate will make computer and data processing services the fastest-growing industry in Minnesota, although other industries will add a greater number of jobs. By 2006, computer and data processing services will be one of the seven largest industries in Minnesota.

Again, it is especially important not to confuse changes occurring at the industry level with changes

occurring at the occupational level. Demand for workers in IT *occupations*, which will be discussed in the next section, will increase in many industries, not just in computer and data processing services. Conversely, while many of the 3,800 additional workers that will be needed in the computer and data processing services *industry* each year will be IT workers, many other types of workers will also be needed in this industry to meet demand.

Information Technology Occupations

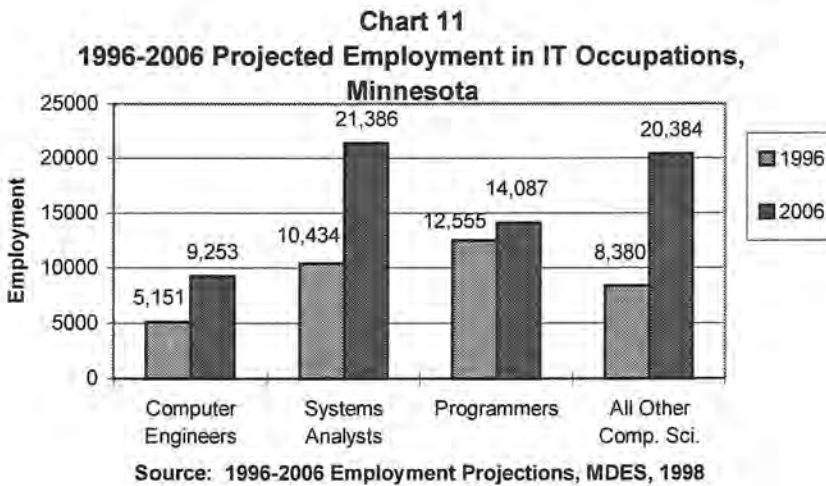
At the occupational level, the BLS again predicts very strong employment growth for IT workers over the next 10 years. National employment in the core IT occupations is expected to increase by 75 percent between 1996 and 2006, rising from 1.5 million to approximately 2.6 million jobs. An additional 1.7 million workers will be needed to replace workers who change occupations or leave the workforce, bringing the total demand to almost 2.9 million between now and 2006.¹¹ . Altogether, 290,000 workers will be needed in each of the next 10 years to fill these positions. Nationally, the fastest-growing occupations between 1996 and 2006 will all be computer-related.

Interestingly, while much of the discussion around IT worker shortages focuses on the short-term need for COBOL programmers to deal with the Year 2000 problem, national employment growth for programmers is expected to be slower, at 23 percent, than other IT occupations. However, the national economy is still projected to add approximately 130,000 programming jobs through 2006, and much of this growth may occur prior to the year 2000.

The slower projected growth for programmers may also reflect the increased use of automated tools and object-based techniques in building information systems today. Demand for computer programmers will likely slow in the long run as systems analysts increasingly make

¹¹ This figure represents total replacement needs, which includes persons changing occupations and persons leaving the workforce entirely. Persons changing employers but remaining in the same occupations are not included in this figure.

use of these new tools and techniques to produce code and systems. Routine coding tasks may be replaced by reusable computer code building blocks and sophisticated development tools used by systems analysts, an occupation where demand will continue to grow.



In Minnesota, IT occupations also are expected to be among the fastest growing. Between 1996 and 2006, employment in these occupations will increase by 78 percent, jumping from the current level of 36,520 to 65,110. See Chart 11. Approximately 28,600 jobs will open in the core IT occupations due to growth during those years. An additional

59,200 new workers will also be needed to fill replacement openings,¹² bringing the total demand to 87,800 workers between now and 2006.

In total, approximately 8,800 new workers will be needed in each of the next 10 years to fill positions that open due to growth or replacement of existing workers. The strongest growth is expected to be among "computer scientists and all other computer professionals" and systems analysts; employment in both of these occupations is expected to more than double between 1996 and 2006. Again, it is important to note that this growth in IT occupation employment will occur throughout the economy, not just in the IT industry.

In Minnesota, as on the national level, relatively slow growth is expected for computer programmers. Between 1996 and 2006, programming employment is projected to grow by 12.2 percent, slightly lower than the 15.6 percent growth projected for all occupations.

Examining the 1996-2006 projections for the core IT occupations brings an interesting trend to light. As more businesses contract out technical/computer-related functions, workers in the core IT occupations will increasingly be concentrated in the computer and data processing services industry. In 1996, approximately 30 percent of the workers in the core IT occupations worked in the computer and data processing services industry. By 2006, that percentage is expected to increase to 47.5 percent. In other words, employment in these occupational areas is projected to increase throughout the economy, but growth will be fastest in the computer and data processing services industry both nationally and in Minnesota.

¹² MDES 1996-2006 Employment Projections, 1998. This figure represents *total replacement* needs, which includes persons changing occupations and persons leaving the workforce. This figure does not include persons who change employers but remain employed in the same occupation.

Is there a shortage of IT workers?

The preceding overview of IT employment trends provides ample evidence that the outlook for IT workers in Minnesota is vibrant, with employment in the core IT occupations and in the computer and data processing services industry projected to increase dramatically over the next decade. So will there be enough qualified workers to fill these positions?

On a national level, there are concerns that the number of students completing computer science degrees, which are required for many IT positions, is declining. Between 1985 and 1996, the number of bachelors, masters and doctoral computer science degrees awarded decreased by 29 percent. The number of bachelors' degrees in computer science declined by 42 percent during the same period, with only 24,404 bachelor-level graduates in 1995.¹³

There is some evidence that this trend is starting to reverse. The Computing Research Association estimates that nationally, enrollment in college computer science programs rose five percent in 1995 and 40 percent in 1996. However, given the number of IT jobs that are expected to open nationally over the next 10 years, many more graduates will be needed.

In Minnesota, too, there is concern about the number of students graduating from computer science and other IT-related programs. Between 1994 and 1996, approximately 1,000 students per year graduated from IT-related programs at Minnesota universities, private colleges and community or technical colleges. Approximately 40 percent of these students graduated from two-year college programs.¹⁴

Another potential source of supply is existing workers who upgrade their skills to become qualified for IT positions or who attend short-term training programs that do not lead to credentialing. Unfortunately, there is no way to estimate with certainty the number of potential workers who become qualified for IT positions in this way. However, it is clear that graduation counts alone will underestimate the supply of new IT workers.

While the number of IT graduates from Minnesota colleges has remained relatively steady for the last few years, the numbers are not high enough to meet the projected demand for IT workers. Minnesota state colleges, private colleges and community and technical colleges are only graduating approximately 1,000 students per year from IT-related programs, not nearly enough to fill the 8,800 positions that are projected to open each year between now and 2006.

Educational institutions aren't producing enough qualified IT graduates. As a result, some employers are looking outside the state or outside the country to find qualified people. One indicator that employers are not finding enough qualified workers is the number of requests for certification of foreign workers.

¹³ U.S. Department of Education, National Center for Education Statistics, November 1997.

¹⁴ Minnesota Consumer Report on Vocational Technical College Programs, MDES, 1997.

When a firm wants to bring a foreign worker here for a specific occupation, the employer must submit an Alien Labor Certification (ALC) request to the Department of Labor to verify that the employee will be paid the actual or prevailing wage for the occupation. If the number of ALC requests by Minnesota employers for computer-related positions is high or increasing, then this may be another indicator that employers are having problems finding workers in Minnesota and are being forced to look elsewhere.

Nationally, between 1988 and 1995, the number of foreign computer professionals entering the United States increased by more than 450 percent.¹⁵ In Minnesota, too, the number of ALC requests has increased tremendously in the past five years. In 1993, 326 ALC requests were received; by 1997, that number had jumped to almost 1,900, an increase of 479%. Between 1995 and 1997, a total of almost 4,300 requests for certification of temporary or permanent workers were registered with MDES¹⁶. Of these requests, the overwhelming majority were for professional or technical workers, and close to half were for programmers/analysts. Because employers can submit one request to cover more than one opening, the actual number of positions employers are looking to fill is most likely higher than the number of requests alone would indicate.

While these numbers represent only a small portion of IT employment in Minnesota, they do demonstrate that some high-tech employers feel that they cannot find the workers they need within the state and are seeking to import qualified workers from elsewhere. Other employers, nationwide and in Minnesota, have chosen instead to outsource some functions, maintaining a workforce that is located in another state or country.

When the supply of qualified workers is not high enough to meet demand, then the laws of supply and demand dictate that this mismatch should cause wages to increase, which would lead to an increasing number of people wanting to work in these occupations. Examining trends in average weekly wages in the computer and data processing services industry provides evidence that this process has started.

If employers were able to find all of the qualified workers they need, wages in this industry would not rise more quickly than wages in other industries. If skilled workers are in short supply, however, wages will move upward as employers are forced to offer higher wages to attract and retain qualified workers and applicants learn that they can command higher wages than they might in a looser labor market.

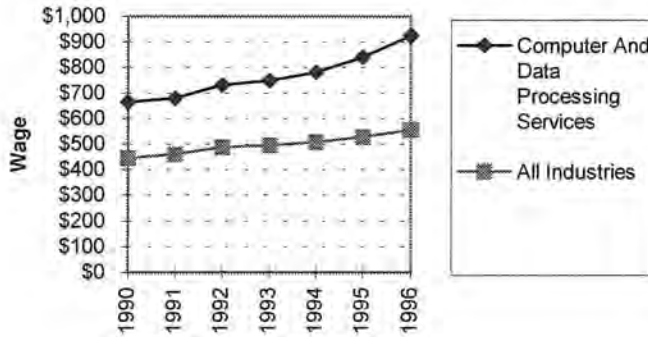
Have wages increased in the computer and data processing services industry in Minnesota? If so, how do the increases compare to overall wage increases? There is evidence of upward wage pressure in this industry. Chart 12 shows the average weekly wages in SIC 737 for the years 1990-1996 (the last complete year for which data is available) and average weekly wages for all industries in Minnesota. While wages have increased in all industries, averaging 3.8 percent per year, the increase has been more dramatic in computer and data processing

¹⁵ *Software Workers for the New Millennium*, National Software Alliance, 1998.

¹⁶ Alien Labor Certification Program, MDES.

services, where wage increases have averaged 5.2 percent per year and topped 7 percent for the last two years.

Chart 12: Average Weekly Wages



Source: ES-202 Program, MDES, 1997

Between 1990 and 1996, average weekly wages in the computer and data processing services industry rose by 39.3 percent compared with an increase of 24.8 percent across all industries. Again, while wage increases alone are not proof of a shortage of IT workers, the combination of high growth rates, upward pressure on wages, and anecdotal information from high-tech employers does indicate that employers are having to improve compensation packages in order to attract and retain qualified workers.

Looking into the Future

As the preceding sections indicate, there is very strong evidence that Minnesota is currently dealing with a shortage of IT workers. Employment in the computer and data processing services industry and in computer-related occupations throughout the economy has grown rapidly throughout the 1990s. The most recent employment projections indicate that this dramatic growth will continue. Asked about their experiences finding and keeping qualified IT workers, the majority of survey respondents said that they have been having problems. In addition, they said that these problems have led them to raise wages, improve benefits for IT and other workers, and scale down their pursuit of contracts.

However, while many employers are clearly having difficulty finding the IT workers they need, the survey results and analysis presented here merely provide a snapshot of current conditions. We also need to look to the future. The laws of supply and demand indicate that if demand for workers consistently exceeds supply, wages will increase and the supply of qualified workers will rise to meet the demand. If this does not occur, a long-term worker shortage will result. Clearly, we currently have a shortage of IT workers. But will supply rise in the future to relieve this problem?

While the number of computer science graduates from Minnesota two- and four-year colleges has remained relatively constant over the past few years, there is some evidence that the number of students who are choosing to pursue computer-related degrees is starting to increase. In the fall of 1995 (the most recent school year for which data was available), approximately 1,800 students were enrolled in IT-related programs at two-year community and technical colleges in Minnesota.¹⁷ At MnSCU's four-year colleges, enrollment has gradually increased from about 1,660 in 1994 to 2,000 in 1996.¹⁸ Enrollment in IT programs at the University of Minnesota, however, has remained constant over the last two years at around 750.

However, despite these increases in enrollment in computer-related programs, there is still reason for concern about the long-term supply of IT workers. Although Minnesota's total enrollment in computer-related programs is increasing, and is now nearing 5,000, it will be several years before these enrollment increases translate into a significantly higher number of graduates. Over the next few years, the number of new graduates entering the IT workforce will likely hover around 1,500 per year. Not all of those who do graduate will remain in Minnesota, nor will all choose to pursue careers related to their field of study. Some will continue their education. Meanwhile, employment projections for the next 10 years indicate that almost 8,800 new IT workers will be needed every year to fill positions that open due to growth or replacement of existing workers. This translates into a ratio of over five openings for every IT graduate. Clearly, the supply of IT workers still needs to increase dramatically.

¹⁷ Minnesota State Colleges and Universities (MnSCU)

¹⁸ Minnesota State Colleges and Universities (MnSCU)

With all the publicity surrounding the availability of IT jobs, both nationwide and here in Minnesota, why aren't more students choosing courses of study that will lead to these "hot jobs"? It is possible that some people are scared away by the same trend that is leading to the rapid growth in the IT field: rapid technological change. Many potential students may think, and not without reason, that any skills they learn in an academic program will be specific to a particular language or software program and will soon be out of date. Others may think that the classes they would have to take would require too much math, science or existing technical skills. Some students with strong technical skills may opt against four-year programs because of foreign language or other requirements. Still others may believe that they can gain the qualifications they need without spending four or five years in school.

Whatever the reason for the low number of computer science graduates, its effect on the future pool of qualified IT workers is a cause for serious concern. Students graduating with IT-related degrees face one of the hottest job markets of any field, with many positions offering high wages, good benefits, and the opportunity to work with cutting-edge technologies. In many ways, IT workers face a job-seekers market, where those with solid skills and training can write their own tickets. Clearly students and job seekers need to be made more aware of the opportunities available in this field and how they can qualify for these positions, and schools need to be producing graduates who possess the skills employers want.

One way to increase the supply of trained IT workers is to let students know that there are many different types of jobs in the IT field; it's not just about programming. While many IT positions do require computer science degrees, many people get jobs with degrees or certificates from technical or community college programs or just by having relevant experience. Community and technical colleges around the state offer programs such as *business computer programming, data processing technology, management information systems, computer installation and repair, business systems networking and telecommunications* and *computer programming*, which can lead to good jobs in the IT field. Graphic design, web page design and HTML programming courses also provide good training for many workers interested in specific types of IT work. Employers are also increasingly looking to their existing staff to find the IT help they need; many offer training in specific software packages, HTML or other programming languages as a way to upgrade the skills of their current staff.

Preparation for computer-related careers can even begin in elementary school with an increased focus on computer, math and science skills. Like most skills, computer and math skills are best learned at a young age, and students who grow up learning these "foreign languages" will feel more comfortable with many high-tech skills as they grow older. Given general concerns about math and science performance at the secondary level in Minnesota, an increasing focus on these hard skills could serve multiple purposes.

Employers can also play a key role in increasing the supply of qualified IT workers by developing partnerships with educational institutions. These partnerships can take many forms. Some employers have sponsored internships or mentoring programs that allow students to gain valuable work experience and give firms a chance to evaluate the skills of

future graduates for possible permanent hire. Others have donated time or equipment to schools. Still other firms have collaborated with schools or training providers in the development of computer-related or other technical courses. In this way, employers can establish links to training programs that can provide them with access to qualified employees in the future, and schools can feel more certain that their programs are providing students with skills that will be used in the real world.

Although opinions about the best way to increase the supply of qualified IT workers in Minnesota will differ depending on who is asked, one thing is clear. Right now, there are not enough skilled IT workers to meet demand, and the situation will only worsen as the number of IT graduates continues to lag behind employment growth. While this situation is causing problems for many employers, it also presents a unique opportunity for educators, employers and policy makers to promote growth in a high-skill, high-wage sector of our economy. By working to increase the supply of qualified IT workers throughout the state, these groups can have a tremendous impact on the future health of this dynamic field and on the ability of Minnesota firms to compete on an increasingly international playing field.

APPENDIX A: Survey Methodology

The sample selection process was conducted in two phases. First, a list of employers with a reasonable demand for IT workers was developed from the universe of all Minnesota employers covered under the state's Reemployment Insurance (RI) tax law. Using employment data from the Minnesota Occupational Employment Statistics (OES) program for the period 1993-1996, a distribution of IT employment by industry using the three-digit Standard Industrial Classification (SIC) code was constructed. The three-digit SIC code industries with less than 50 IT workers were excluded from the analysis. Thus, the list of employers with a reasonable demand for IT workers comprises all firms that belong to the three-digit SIC code industries having at least 50 IT workers. This list is referred to as the IT employer population.

Next, a random sample was selected from the IT employer population. This population was stratified by region of the state, size of employer, and level of IT employment. The IT employment stratum was defined at the three-digit SIC code industry level using the number of IT workers and the intensity of IT workers, which denotes IT workers as a proportion of total employment. Four groups were identified in the IT employment stratum: (1) industries with more than 1,000 IT workers (this included only SIC 737, computer and data processing services); (2) industries with 500 to 999 IT workers or with IT employment intensity greater than 5 percent; (3) industries with 100 to 499 IT workers; and (4) industries with 50 to 99 IT workers.

Using the size of employer stratum, employers were grouped into five categories according to the number of total employees: (1) very small employers with 5 to 19 employees; (2) small employers with 20 to 49 employees; (3) medium employers with 50 to 99 employees; (4) large employers with 100 to 249 employees; (5) very large employers with 250 employees or more. Similarly, employers were grouped into six regions: northeast, northwest, central, southwest, southeast and Twin Cities.

Applying these three strata resulted in an IT employer population containing 15,261 employers. The sample size was determined based on a tolerated error in the estimate of the probability of IT worker shortages of 5 percent and on a response rate of 50 percent. This level of response was obtained in the pretest of the questionnaire.

The total number of employers sampled was 2,438, representing a sampling rate of 16 percent. This number was obtained by: (1) determining the optimal sample size for each group in the IT employment stratum (2) allocating the sample among the various classes of firm size and region in proportion to their population totals and (3) adjusting the total sample. Employers in the sample were selected randomly, except for employers in industry SIC 737 code and employers in the large size class, which were all selected in the sample.

APPENDIX B: Survey Instrument

1. Has your firm had problems finding qualified IT workers? YES NO N/A

Do you feel that there is a shortage of IT workers in MN? If yes, how serious do you think the shortage is?

N/A (no shortage) Not Serious Mildly Serious Moderately Serious Extremely Serious

Is this problem affecting your ability to fulfill contracts or fill work orders?

N/A No Mildly Moderately Severely

2. To attract and retain qualified IT staff, how much have wages increased over the past year?

no increase 1-25% 26-50% 51-75% 76-100% Over 100%

Have you increased other benefits or offered new incentives specifically to attract IT workers? If so, do they include:

- a) No change b) increased vacation c) stock options d) retirement packages
 e) increased medical/dental f) signing bonuses g) flexible scheduling
 h) telecommuting i) other _____

3. I'm going to ask you about several different types of high-tech workers. Please tell me, for each category, approximately how many workers you currently have, how many vacancies you currently have, and how many workers you would like to hire in the next year if you could find all of the workers you need.

	Current Employment	Vacancies	Projected Demand (12 mo.)
A. LAN/Network administrators	_____	_____	_____
B. Support Specialists/Technicians	_____	_____	_____
C. Database managers/administrators	_____	_____	_____
D. Internet/Web specialists	_____	_____	_____
E. Programmers (ex. COBOL, C++)	_____	_____	_____
F. Engineers and Scientists	_____	_____	_____
G. Other _____	_____	_____	_____

Acknowledgments

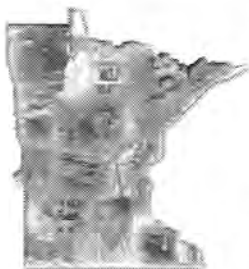
More than any other Research and Statistics Office publication in recent memory, this report was truly an office-wide effort. The author gratefully acknowledges the assistance of each person who contributed to this report.

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Diane Rydrych
Research and Statistics Office
Minnesota Department of Economic Security
May 1998



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