The Software Shortage
Avron Barr and Shirley Tessler
SCIP Software Research Brief #97-1
March 3, 1997

Business thinking about software will undergo radical change in the next few years. A worldwide shortage of software talent will force business executives and product designers to realize that some mission-critical projects are beyond their capacity and that they must make difficult choices about what software to build. Since software has become a competitive weapon in many industries, strategic thinking about how to garner and deploy top software talent will become a common and crucial element of business planning.

The demand for software has risen steadily for many years. Once produced only by systems vendors and their MIS customers, software has spawned a $92B publishing industry and a $170B services industry. In addition, products of all sorts, from microwave ovens and cellular phones to automobiles and airplanes contain more and more software every year.

Our research at Stanford's Computer Industry Project (SCIP) indicates that the supply of software, which is dependent on the number of programmers, project managers, quality engineers, etc. who can produce good software, is not growing fast enough to keep pace with demand. Furthermore, while most people believe that offshore programmers from countries like India or Russia will be a significant resource, perhaps even a threat to the US jobs, we believe that the shortage of software talent is global and that it will get much worse in the coming years.

The Demand for Software Will Continue to Rise

As computers proliferate in society, software, the complex sequences of instructions that enable computers to do everything from run a microwave oven to track FedEx packages, becomes more numerous and more complex. Today's automobiles contain dozens of computers and millions of software instructions to control everything from the fuel injection to the anti-lock brakes. Each of these systems has to be designed, built, tested and maintained by trained professionals.

The supply/demand situation that we now face in software was masked in the early 1990's by massive layoffs in corporate IT departments, aerospace firms and the large computer hardware vendors. The hiring situation has already become a problem for corporate IT managers, and more recently for software publishers and services firms and even entrepreneurs in Silicon Valley, who are facing increased difficulty and delays in finding the talent they need. A 1997 survey of 2000 corporations by the Information Technology Association of America estimates that there are already 190,000 unfilled software positions in the US, not counting small business, government and non-profit employers, which were not surveyed.

The shortage of software people is not limited to the United States. Canada, the UK, Japan and Australia already report significant shortages. Continued growth in demand for software in both developed and developing economies will exacerbate an already serious situation.

Salaries Will Rise and Talent Will Migrate to the Where It's Most Appreciated

In times of shortage, prices go up. We predict that salaries for good software people will ramp up rapidly in coming months, causing people to change jobs more frequently, which in turn will cause project delays as replacements take longer to find, creating a demand spiral. In software publishing and services firms, higher salaries, stock options, and even seven-figure signing bonuses are being used to lure the top talent — these firms already know that software talent is key to their survival.

Hardest hit by the shortage are government shops and IT departments in "low tech" industries which are least able to attract and maintain top talent. As shortages of critical systems become commonplace, firms in many industries will be changing their perception of the importance of software and software talent.

No Help from Abroad

What about all those programmers in India, China, Russia and Eastern Europe? The Indian software export industry grew to $700M over the last 7 years, but the net impact was a tiny fraction of worldwide demand for software. Furthermore, we believe that it will be at least 10 years before any other nation becomes a major source of software products and services. China's economy is developing so fast, for example, that it will consume almost all of its software labor resources to develop its own government, communications, finance and industrial systems. Also, English is more of a barrier to building an export industry for China than it was for India.

Russia is a special case. Here, as in India, there are hundreds of thousands of talented software people who are not used effectively in their domestic economy. However, these programmers are really scientists trained in the Soviet aerospace effort. They are not inclined to work on mundane programming tasks like the Year 2000 problem, where the great demand for software labor could support Russian business development. Furthermore, the current difficulty of doing business in Russia will impede the growth of their software export industry for many years to come.

What Can Be Done?

In the short term, policies that make effective use of existing talent all over the world are mandated, including immigration legislation and investment in training and retraining talented programmers, both here and abroad, to fill industry needs.

Technologies to enhance the productivity of programmers will not have a major impact in the next decade, but R&D in this area must be accelerated.

In the long term, attracting talented young people to the field and enhancing our schools and curricula is the most important step we can take.