



Making Computer Professionals and Other Engineers

Low-Priced Commodities

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Even during the economic boom of the mid-nineties in the United States, many computer (and other technical) professionals, particularly those with fifteen or more years of experience, had difficulty finding satisfactory jobs. This was true despite loud complaints by U.S. industry about a shortage of computer experts and engineers.

Now that the boom has ended, the situation is much worse. Even new U.S. graduates are having trouble finding jobs. What is going on? What if these trends continue? What can we do about it?

We can summarize by saying that many employers are adapting the

"just-in-time" concept to computer professionals. The idea is to "rent," at a minimal price, people with the specific skills needed for a project, and then to dispense with them upon completion of their tasks. Technical professionals are pitted against one another in a race to the bottom as jobs are parceled out, on a global basis, to the low bidders. The process began around 1990, and the general outline was quite clear by 1996 [1].

Temporary Work

One aspect is the replacement of in-house technical staffs with temporary, or "contract" workers. A few receive the more exalted title of "consultant." Some contract directly

with the employer. Most are engaged through "job shops" — or "body shops." They usually are paid at per diem rates, with no medical insurance, vacation time, sick leave, or other benefits. Periods of employment with any one company may range from weeks to months. Some much sought-after specialists operate as true consultants. They usually do well financially (at least while their specialties are needed). Most do relatively routine work, for modest pay — especially considering the insecurity and lack of benefits.

For many, working in the above mode for a limited time may be very desirable. They enjoy the variety of work and the opportunity to acquire

different skills and knowledge. Some enjoy seeing different parts of the country and meeting new people frequently. They may feel that working in different types of organizations will facilitate making an intelligent choice about a permanent job.

But for most engineers, the prospect of spending their careers as temporary workers is very unpleasant. Those who enter technical professions usually do so because they are fascinated with technology and want to spend their time learning and applying technical knowledge. Having, every few months, to adapt to new work environments, adjust to different computer language dialects, and learn to get along with different sets of co-workers is something that many would find most distasteful. People who, in a stable environment, would attain a deep mastery of the technology they are working on, hate having to be "the new kid on the block" three or four times a year. Many dislike the financial insecurity. Continual concern about where their next assignment will come from is a source of great anxiety. Sometimes weeks or even months of inactivity may occur between jobs. Finally, particularly for those with families, the need to relocate frequently to different parts of the country can be very disturbing as they and their families are unable to sink roots in any community. Obviously this is very hard on children.

In the past, most companies employing significant numbers of technical professionals chose them carefully, regarding them as important assets. It was common to encourage and, at least partially, finance efforts to obtain graduate degrees. In-house training programs, seminars, lecture series, etc., were common, and staff members were encouraged to attend professional conferences. When the need arose for different skills, for example, when a new computer language became important, it was assumed that engineers would acquire these skills. Usually, such learning

processes were informal, involving self-study and people helping one another. Sometimes engineers were sent to take special (often very intensive) courses.

The result was that many technical professionals remained with the same company for a substantial part, sometimes all, of their careers.

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They acquired a deep understanding of the employer's products and were well situated to deal with problems and to contribute to the development of new versions. The value of retaining experienced engineers is illustrated in an article about the development of the DEC Alpha processors [2]. Organizations that abandoned this approach in favor of relying heavily on contractors often find that when troubles arise with their products, nobody on hand can deal with them because the original designers are gone. Taking the low road with respect to technical staffs may lead to short-run cost savings, but it frequently leads to disaster, as illustrated by the experience of NASA [3].

Hit the Ground Running

A basic component of the "just-in-time" approach to technical staffing is that employers insist on hiring only people who, immediately after being put on the payroll, can begin working directly on the company's problems. Thus, they hire only contractors with precisely the skills needed on the current job. For example, a company may filter out all job applicants not experienced with Oracle 8i. Veteran programmers familiar with related systems,

who would have no trouble in mastering the required knowledge in a few weeks, are rejected without even being interviewed, if their resumes do not include the magic words. Instead of focusing on the most capable people, the emphasis is placed on the precise skill set of the applicant.

Extensive general experience is considered a liability. It is clear that a major consideration is to pay as little as possible for technical talent. Thus, since those with considerable experience would be more costly, the tendency is not to hire them unless their experience precisely fits the immediate needs of the company. This is the essence of age discrimination. As indicated above, although it may improve the next quarterly earnings report, the long-term consequences are often harmful to employers — and to the public when the consequences are defective products.

Importing People

Apart from recent graduates of American schools, the largest pool of technical professionals that can be hired at minimal rates is outside the borders of the United States. Several Asian countries graduate significant numbers of computer professionals and engineers, and since pay scales in these countries are a fraction of U.S. rates, many of these people are happy to come to the U.S. Another source of workers in the United States is the former Soviet Union and other Eastern European countries where a similar situation prevails. Furthermore, in places like

Russia, the economic situation is such that large numbers of able, experienced technical professionals have great difficulty finding work.

This led to pressure by employers to amend U.S. immigration laws to allow the importing of computer professionals and engineers from abroad under a "temporary" program called H-1B. Each year, 65 000 H-1B visas were issued (the limit was later raised to 195 000), each at the request of a specific employer. Recently, as a result of a growing outcry resulting from significant unemployment among tech-

train their replacements.

The H-1B program was justified as being necessary to meet a severe shortage of technical professionals, particularly in the computer field. There was indeed a shortage. But it was a shortage of people with very narrowly defined skills who were willing to work long hours for modest pay. Evidence for this is the fact that employers interviewed only a small fraction of the people who applied for jobs, and made offers to a small subset of this group. While high salaries and other inducements were offered in some special cases,

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nical professionals in the U.S., the number was rolled back to 65 000. Some of these permits go to outstanding individuals with excellent credentials. But the great majority of H-1B permits go to very ordinary programmers or engineers.

The U.S. law ostensibly provides that H-1B visas be issued only when it is not possible to find U.S. residents capable of filling an employer's needs, and supposedly guards against the incoming engineers being grossly underpaid by American standards. But those safeguards apply only in a small subset of cases, are ineffectual, and are rarely enforced. Those with H-1B visas are essentially tied to their employers (often job shops), are generally underpaid, and are easily induced to work long hours without extra compensation [4]. There are examples of companies that have discharged most of their technical staffs, replacing them with H-1B people at a significant payroll savings. In a number of cases, as a condition for receiving severance pay, displaced programmers have been required to

for the most part, average compensation (including non-salary forms) of engineers and other computer professionals never increased at a rate significantly faster than compensation in most other occupations. Competent, experienced computer professionals sent out scores of resumes without ever being called for interviews. Many left the field, to become salespeople in computer retail stores or to sell real estate. Twenty years after graduation, most computer science graduates are no longer in the computer field. These factors belie the claim that employers were desperate to find programmers or engineers. More detailed information, with extensive references can be found in an excellent online article by Norman Matloff [5], [6].

More recently, another mechanism, the L1 visa, has surfaced for bringing in technical professionals. This was ostensibly to allow companies to bring their overseas employees to the U.S. There are no limits on the number of L1 visas that can be issued annually.

Exporting the Jobs

Importing people from abroad to work at lower pay scales is one way to drive down salaries in the U.S. A complementary technique is to export the work to where people are paid a fraction of what they would get here, even as H-1B visa holders. In India, an engineer can live very well on one fifth of an American salary. Hence many American-based companies have outsourced work to places such as India, or the Philippines. Engineers in Russia have been engaged by U.S. firms to design chips. An article in the New York Times business section about Romania [7] states, "For less than \$5000 a year, a foreign company can hire the best and brightest [engineers] here to do work for which it would pay at least \$60 000 a year in the United States." This article mentions a satellite facility built by Raytheon in Romania that employed 300 people, with plans to increase that number to 500.

These arrangements are, ironically, made feasible by enhanced communications facilities developed mainly by Americans. Although these facilities do make it possible to outsource certain projects, in many cases there are serious problems associated with coordinating work done abroad with other parts of a project being carried out in the U.S. However, large potential salary savings, and improving long distance communications facilities, are accelerating the trend to contract out work to overseas companies, as well as for U.S. companies to open offshore facilities. When entire projects move overseas, the communications problems are lessened, as is also the case when manufacturing is outsourced. Eventually, a tipping point is reached where communications problems are lessened by moving additional jobs to the offshore facility. Increased exporting of technical work seems likely [8]. IBM, for example, plans substantial expansions of its offshore facilities in places like India [9].

Importing people and exporting work reinforce one another. H-1B visa holders are often returned home to facilitate outsourced projects. On the other hand, companies argue that if they could not use H-1B employees they would have to outsource the work to countries with low salary scales.

What is now in the early stages for technical professionals has been carried virtually to completion for U.S. manufacturing workers. Shoe manufacturing, the clothing industry, and electronics manufacturing, have largely vanished from the U.S. These industries have relocated to where wages are extremely low. When workers outside the U.S. succeed, perhaps thru unions, in raising their pay scales significantly, the manufacturers simply move elsewhere. Perhaps the first instance of such factory flight occurred a century ago in the U.S. when the textile industry relocated from New England to the South seeking cheap labor. When salaries in the American South increased, the jobs were exported to low-wage countries in Asia or Latin America.

A good case can be made that many social problems in the U.S. stem largely from the outflow of good manufacturing jobs. Note also that many higher-level technical jobs go with exported factories.

What Is the Basic Nature of the Problem and What Can We Do?

The core of the problem is the treatment of technical professionals as commodities to be rented at the lowest price determined by a global free market. (A similar statement might be made about people in other occupations.) The end result of this treatment would be that, while a relatively small number of "superstars" might survive professionally, most computer professionals and engineers in this country would be forced to find other work.

Individuals might try to understand the system and maneuver as

best they can to stay employed. They might try to guess what skills are likely to be important over the next few years and then acquire those skills. The goal would be to become one of the relatively few hard-to-replace technical professionals. Those who succeed at this might do well, but many very able, hard-working people might not be good enough (or lucky enough) at the guessing part. By definition, most people would not be winners in this race. Many winners would find themselves leading stressful lives quite different from what they envisioned when they chose their professions. Individuals, with few exceptions, can't do it alone.

Large organizations are doing the damage, and real solutions are going to require action by other large organizations. Rather than pleading with corporate managers to act responsibly toward their employees and communities, legislation must be enacted to protect more farsighted and responsible managements from being handicapped in the short term with respect to less scrupulous organizations. The terms of international trade and national tax laws must be changed to discourage making technical professionals (and, for that matter other working people) into low priced commodities.

Why can't we just let the "free market" take care of the problem? Blind trust that somehow the "invisible hand" will make things come out all right is not likely to be rewarded. The corporations that influence government policy and that implicitly cooperate on such matters as salary standards for programmers or engineers display no such blind trust. In order to protect their careers, technical professionals will have to unite, perhaps thru their professional societies (or even unions!), and ally themselves with other groups, to redress the balance. And we shouldn't be distracted by those who express horror at the idea of interfering with "free trade".

In an idealized economic model, Ricardo [8] showed how free trade benefits all participants when each trading partner exchanges what it produces most efficiently for what other participants produce most efficiently. If, for example, due to differences in climate and soil conditions, the U.S. produces corn more efficiently than it produces bananas, and Guatemala produces bananas more efficiently than it produces corn, then everybody benefits when American corn is traded for Guatemalan bananas. It is this theory that underlies the valid arguments for the benefits of free trade. But in no way does it justify encouraging U.S. companies to set up semi-conductor factories in Malaysia to exploit the fact that workers in Malaysia are paid far less than American workers.

There are situations where imports of manufactured goods are fully justifiable on other grounds. Japanese automobiles are popular in the U.S. because they are high quality products, not because they are cheaply produced by low paid workers or designed by low paid engineers. Similarly, although Danish engineers and factory workers are at least as well paid as their American counterparts, wind turbines produced in Denmark are highly competitive in the U.S. due to their excellent technological features. These are examples of fair competition based on efforts to produce good products at reasonable prices, rather than on taking advantage of people living in poverty.

Xenophobia?

It is important to understand that these arguments against the H-1B visa program do not constitute an attack on people based on nationality, but rather a defense of the careers of technical professionals currently in the U.S., whoever they are and however they came to be here. The people who come here under the H-1B program are, as a whole, decent, hard-working people, often pres-

sured into working long hours at substandard (for the U.S.) pay rates. They are not the cause of the problem — often they are among the victims. Many currently out-of-work technical professionals are themselves former H-1B employees who achieved permanent resident status.

The problem is with the system that permits organizations to operate in this fashion. Clearly these organizations are not motivated by a desire to improve the well being of engineers in India or Russia. If the American people decide that justice requires that we do something to raise living standards of technical professionals in India or Russia, then the burden ought to be born by our country as a whole, and not imposed arbitrarily on those in this country (via birth or immigration) who chose to go thru the arduous educational process necessary to become a technical professional. Supporters of the H-1B program should be asked if they favor dismantling all restrictions on entry to the U.S., and then whether they think all international borders ought to be obliterated.

While this discussion has been focused on the situation in the U.S., it should be recognized that, in varying degrees, the same problem exists in many other nations — or would exist if their laws permitted it. What other industrialized countries today permit foreign nationals to enter freely and take jobs as engineers?

Our tax system, which currently acts to encourage companies to establish offshore facilities, could be amended to penalize such behavior. Protecting the livelihoods of U.S.-based technical professionals by legislating taxes on the import into the U.S. of software (or other products) produced by people paid

far less than American engineers and programmers is a very reasonable idea that should be debated on its merits. Attacking it with slogans based on the words "free trade" is not a constructive contribution to the discussion. Similarly, allowing corporations to bring in large numbers of programmers from low-wage countries in order to depress salaries for U.S.-based programmers must be justified by real arguments, not by references to the Statue of Liberty, or by spurious claims that there is a severe shortage of such people in the U.S.

Consider, at least briefly, what this situation looks like from outside the U.S. Where are the H-1B technical professionals coming from, and why? What is the effect on the countries exporting engineers to the U.S.? It is not hard to see why engineers in impoverished countries would want to come to the U.S. Many want to remain permanently to enjoy a higher living standard. Others plan to return home with enough money to make them relatively wealthy there. Is this good for their countries as a whole? Although the exporting country, in many cases, receives an influx of valuable foreign exchange thru remittances by H-1B holders, it is losing a great many bright young people who have been educated at great expense. Perhaps consideration should be given to how the U.S. might help these countries utilize these people at home to build the industrial infrastructure that could lift their fellow citizens out of poverty.

Substantial Political Force

There are millions of computer and other technical professionals in the U.S. These, with their families, constitute a substantial political force if properly organized. There are no

good practical or moral reasons why they should not use their power in an organized way to protect their careers. Once the effort is properly initiated, it should be possible to gain support from other organized groups to enact appropriate legislation to prevent the destruction of the technical professions in this country, and to protect people doing other kinds of work from similar abuse. Doubtless, thoughtful readers will find ways to improve on the specific suggestions made here.

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