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ABSTRACT

This paper reviews trends in the use of international outsourcing in the Information Technology (IT) industry and explores implications for the U.S. workforce. Workforce employment projections and the trend for globalization in the IT industry are analyzed. An analogy is developed between current trends in IT workforce and the globalization of the auto industry during the latter part of the 20th century. The conclusion is that recent dips in U.S. IT employment may represent more than a transitory reflection of current economic conditions. International IT providers may be capturing a permanent share of U.S. IT expenditures and thus reducing the long term need for U.S. IT employment. IT industry and educational institutions need to plan accordingly for these new global workforce realities.

INTRODUCTION

The early part of the 21th century has witnessed a reduction in the need for Information Technology (IT) workers and software developers in the U.S. In 2000 there were as many as 500,000 unfilled U.S. technology positions; by 2002 many technology workers, including software developers, were unemployed. The most obvious causes of this trend were economic recession, the collapse of the dot.com industry, and the end of Y2K. However, international efforts are underway, particularly in India, to permanently capture a share of the U.S. IT business. In many ways the U.S. IT and software industry employment is beginning to resemble the auto industry of the last century. This trend needs to be further explored and tracked so that industry, education, and government might take appropriate action to ensure that the U.S. remains a leader in the IT and software industries.

U.S. INFORMATION TECHNOLOGY LABOR TRENDS

After a decade of unparalleled growth, the U.S. IT industry is in somewhat of a retreat. The Information Technology Association of America (ITAA) estimates that total IT workforce shrank from 10.4 million to 9.9 million in 2002, representing a loss of over 500,000 technology jobs (ITAA, 2002). Figure 1 shows ITAA's total IT employment estimates from 2000 – 2003. The IT categories measured by ITAA include those most likely to be involved in software development: programming/software engineer, tech support, enterprise systems, database development/administration, web development/administration, network design/administration, digital media, tech writing, and other. For programming/software engineers, the single largest ITAA category, employment fell by nearly 200,000 to just over 2 million (ITAA, 2002). ITAA estimated that IT employment recovered somewhat by the beginning of 2003, but not enough to offset previous losses (ITAA, 2003). In addition, the drop in demand has resulted in a reported 8% salary decline for technology professionals in 2002 (George, 2002). Much of this decline has been attributed to the recent national economic slowdown and the collapse of the dot-com industry.
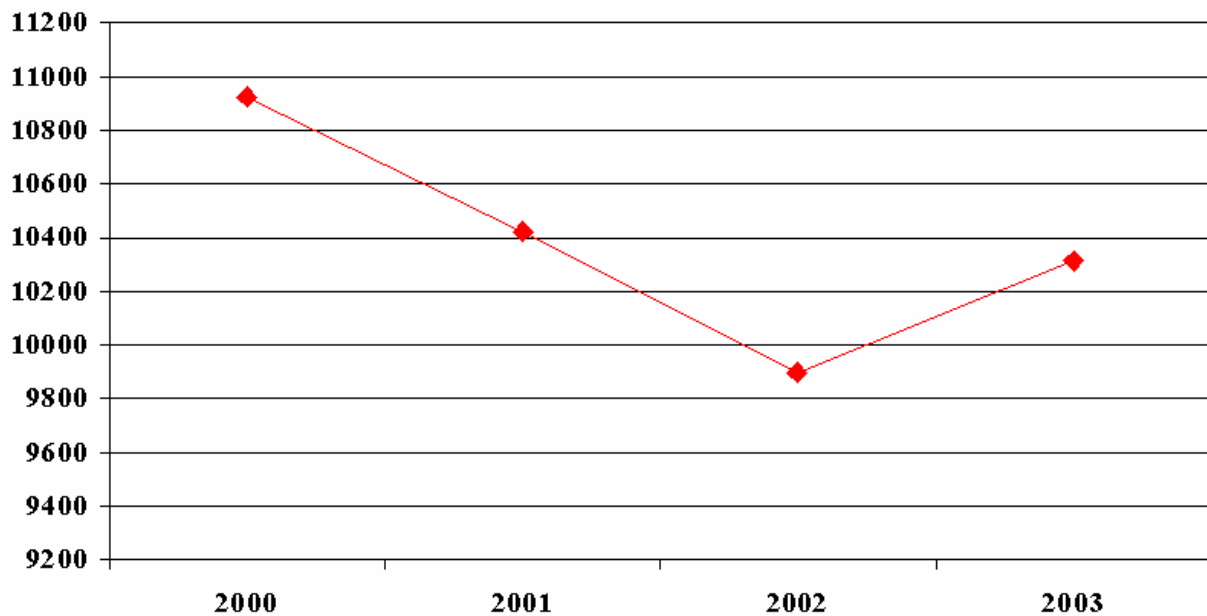

Figure 1: Total Employment of Information Technology Workers (ITAA)
(employment in thousands)

The long-term outlook for IT workers would appear more optimistic. Despite the reversal in IT employment, companies project an increase aggregate demand and unfilled IT positions to increase in 2003 (ITAA, 2002). The U.S. Bureau of Labor Statistics continues to project high growth for IT through the end of this decade. All computer and data processing services are expected to grow by 86%, with IT professional employment projected to grow by over 105% by 2010. Software engineers and analysts are the most rapidly growing occupation, expecting to grow by 144% (USDL, 2002). So despite the

current economic and employment slowdown, industry analysts are projecting a booming future for those entering the IT profession. But are there other factors beyond projected demand that affect this positive scenario for IT employment?

GROWTH OF OFFSHORE INFORMATION TECHNOLOGY OUTSOURCING

An emerging complicating factor in the U.S. IT employment outlook is the rapid growth in the international outsourcing of IT development and services. The shortages of U.S. technology workers in the 1990's led to a willingness of U.S. firms to outsource IT projects internationally. More recently with a general economic downturn and high levels of satisfaction with offshore labor, businesses are looking even more to international outsourcing efforts as a way to cut costs and improve productivity. As of early 2002, as many as 45% of Fortune 500 companies were utilizing offshore outsourcing for IT-related projects. Large U.S. firms (over 5000 employees) have led this trend and are expected to more than triple their offshore budgets by 2005. In addition, middle level companies (1000-5000 employees) are now rapidly entering the offshore market and are expected to increase their share of U.S. offshore demand from 1% in 2001 to 10% in 2005 (Overby, 2002). Gartner predicts that 40 per cent of U.S. enterprises will be either engaging in or piloting IT outsourcing by 2004 (Gongloff, 2003).

The major countries involved in offshore development include India, China, Philippines, Mexico, Ireland, Malaysia, and Singapore (NASSCOM-Kinsey, 2002), with Vietnam (Tran, 2002), Russia (Chazan, 2001), and Canada (Gallager, 2002) eager to seriously enter the market. India remains the clear leader in global IT outsourcing with an increasing supply of English-speaking, technologically-educated, and low-cost workers, combined with a rapidly improving telecommunication infrastructure. These factors plus an early adoption of international software quality standards ensures that India will continue to provide increasing outsourcing services for years to come. In an industry well known for cost and defect excess, it is little wonder that India's well-positioned software outsource industry would flourish. Even during the year preceding March 2003, in what were slow business times in the U.S. and amidst unsettling world events, India's primary software development companies saw revenues rise from 12% to 30% (Hayes and McDougal, 2003). The vast majority of this business was outsourced development work coming from U.S. corporations.

These trends indicate that the downturn in the U.S. technology professions may not be as short term as the Labor Department indicates. Many of the jobs being lost in the U.S. may be lost forever with the continuation of outsourcing of high-tech domestic labor to offshore firms. The fear is that this may be a replay of the 1950s when Japanese auto makers captured market share and created jobs by adopting U.S.-developed management transformation techniques.

INFLUX OF INTERNATIONAL VISA EMPLOYEES INTO U.S. WORKFORCE

Also affecting U.S. IT employment figures is the influx of international visa recipients in the high tech field. As the IT industry faced severe labor shortages in the late 1990's, many argued correctly that U.S. educational institutions could not meet the increasing demand for technology workers. Consequently, the Immigration and Naturalization Service (INS) began to accept more applications for international temporary workers through the use H-1B visas. The American Competitiveness in the 21st Century Act of 2000 raised the annual cap on H-1B visas to 80,000 through 2004 (Overby, 2002). Although the data is sketchy, in 2000 there were nearly 542,000 visa holders in the U.S., with as many as 50% of them holding IT positions (Watson, 2001). Even with the recent downturn in U.S. IT employment, the federal government recently has not reduced the number of H-1B visas. In fact, in Spring 2002 the government announced that it would no longer utilize H-1B visa application fees to train American workers in tech skills, but would rather use these funds to speed up processing of permanent alien labor certification (Bjorhus, 2002). As Figure 2 shows, given current projections, the number of potential H-1B visa holders in the U.S. will reach more than 930,000 by 2004, with 500,000 in IT employment. Of new H-1B IT-related applications, as many as 50% fall into the category of systems analysis and programming (Watson, 2001). These trends all but guarantee that international workers will remain a significant factor in the U.S. IT workforce for the foreseeable future.
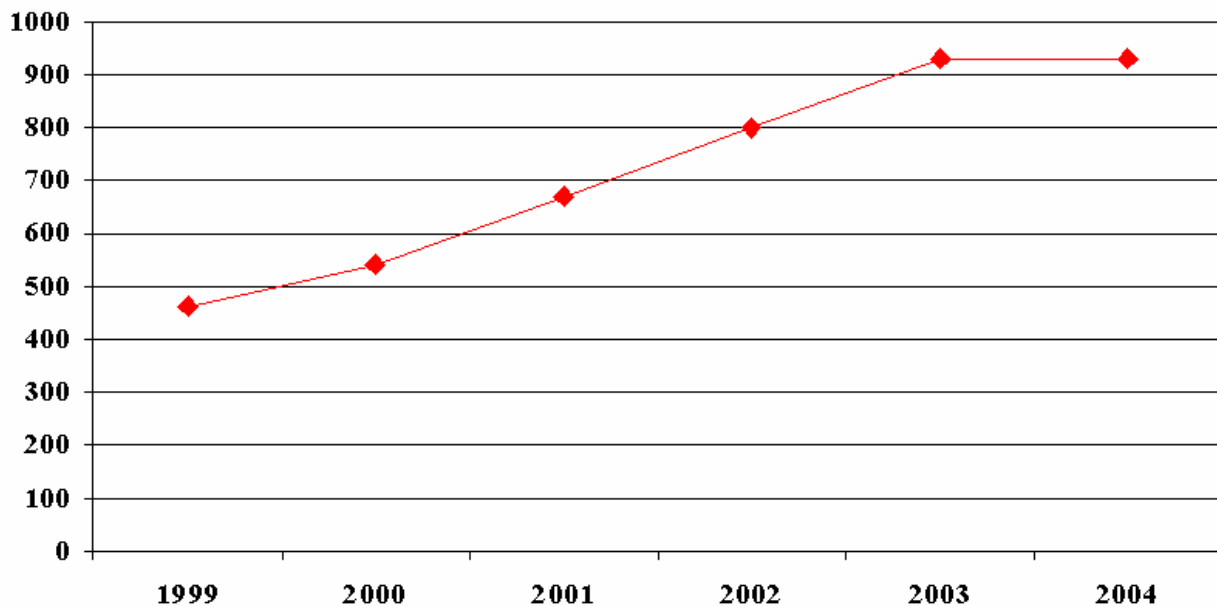

Figure 2: Potential Total H-1B Visa Holders, All Occupations
(visa holders in thousands)

Further complicating U.S. IT employment is the growth in the use of L1 visas (Vaas, 2003). L1 visas allow an international based firm to bring essentially an unlimited number of international workers to the U.S. to work on contracts with U.S. firms. A large share of technology contracting within the U.S. is performed by either H-1B or L1 visas

holders. While the reliance on these visa workers cannot be technically termed as "international outsourcing," their increased usage has a definite impact on the U.S. domestic labor force.

ANALOGY TO AUTO INDUSTRY EXPERIENCE

The international outsourcing of IT services and software development is beginning to resemble the pattern of the U.S. automobile industry during the latter part of the 20th century. In 1947 the U.S. commanded 82% of world auto production. As other countries acquired the means of production and increasing internal demand from 1950 – 1970, they began producing autos. Although slipping in terms of percentage of world market, U.S. manufacturers still dominated the U.S. domestic market as late as 1970. U.S. autoworkers reached peak employment in 1979. By the late 1970's, auto imports began to make a rising, but not destabilizing, impact on the U.S. market (Singleton, 1992). Besides significantly lower labor rates, the Japanese began to incorporate disciplined quality methods into the production process, championed by American quality guru, Deming.

In the early 1980's the Japanese began to make inroads in the U.S. domestic auto market, and by the mid-1980's imports from Japan reached over 20% of U.S. auto sales. In response U.S. auto manufactures lobbied for and received import tariffs on foreign produced autos. Largely as a response to the import tariffs, the Japanese then began to transplant auto production to the U.S. utilizing American workers and Japanese production methods. By 1990 Japanese total share of the U.S. auto market had reached 33%.
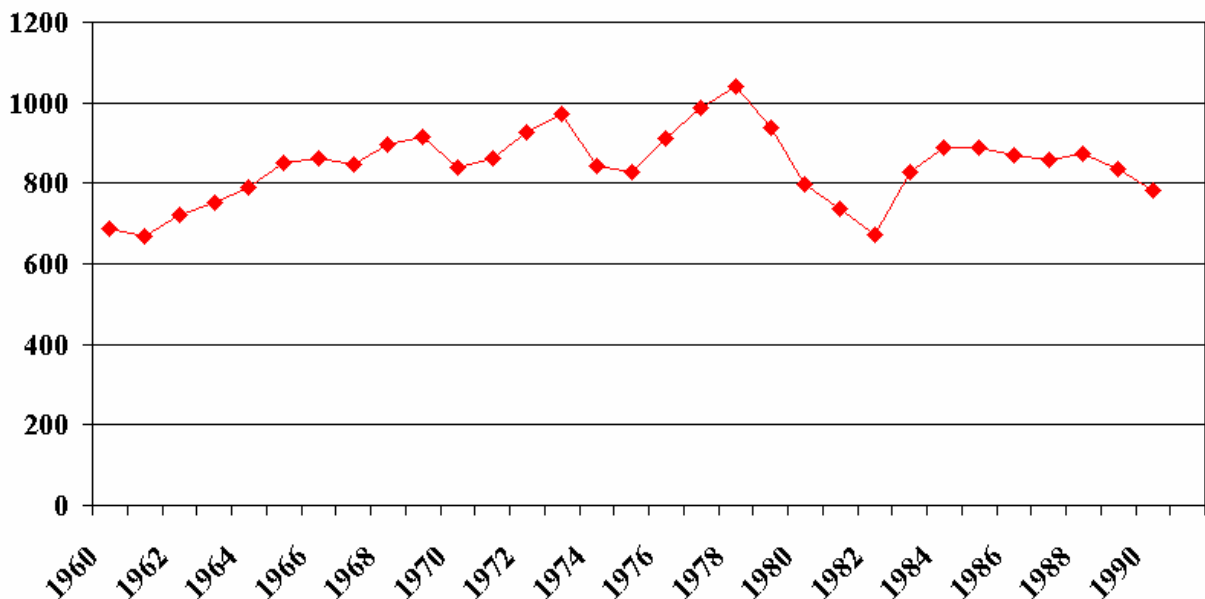

Figure 3: Motor Vehicle and Equipment Employment (USDL)
(employment in thousands)

Correspondingly, the number of U.S. autoworkers declined by 265,000 workers from 1979 to 1989, a loss of 24% of the 1979 workforce. Figure 3 shows the employment rates of U.S. autoworkers from 1960 – 1991. At the same time, world demand for autos rose at a staggering rate, from around 5 million units in 1946 to 50 million in 1990 (Singleton, 1992). The U.S. share of the world market slowly declined to around 26% by 1990. Since the middle 1990s, U.S. auto employment has hovered around 900,000 – 1,000,000 (USDL, 2002).

The volatility in the U.S. auto market over this period was certainly not all the result of Japanese labor costs and quality production methods. Other contributing factors included shifting consumer auto preferences, energy costs, technological improvements, and several intervening economic recessions (Singleton, 1992). Even though the industry recovered from recessionary downturns, auto employment never returned to 1979 levels despite ever-increasing world demand for autos. It is clear that lower labor costs and an early shift to quality methods by foreign producers significantly contributed to a sharp decline in U.S. autoworkers overall employment. The ability of the rest of the world to produce quality and cost effective autos meant that the U.S. could no longer dominate the world auto market and had to adjust production methods to maintain the majority of the U.S. domestic market share. These adjustments meant that even as U.S. auto plants production was rising in gross measures between 1950 and 1990, worker levels were declining. A long-term decline in demand for autoworkers resulting in foreign competition was somewhat masked by the short-term factors mentioned above.

Similarities between the Information Technology and Auto Industry Trends

How does the current U.S. IT industry resemble the auto industry experience? Through the latter part of the 20th century, the U.S. IT industry remained the clear dominant force in world development.   The worldwide demand for IT services and software also grew rapidly.   As developed nations became increasingly dependent on IT services and software in all walks of life and developing countries also saw increasing needs, world demand for IT and software producers far exceeded supply. With the added Y2K scare of the late 1990's, shortages in the IT workforce reached all-time highs, with no end in sight.

With the increased world demand and resulting labor shortages, international producers began building a capacity for IT services and software production. American large and multi-national corporations provided assistance and capital in building this capacity, which seemingly was not making a dent in the increasing domestic labor shortage. American firms also lobbied the federal government to increase the supply of international workers skilled in IT services. India established lofty national goals to produce IT education, infrastructure, and workers for the purpose of exporting services and labor to the U.S. and Europe. International investors created software centers for software export that not only produced software at very inexpensive rates by U.S. standards, but also met emerging software quality standards. Indian software companies, in particular, gained a reputation for quality by adopting rapidly emerging international quality standards. These standards included the Capability Maturity Model (CMM), Personal Software Process (PSP) and Team Software Process (TSP), all developed by Watts Humphrey at the Software Engineering Institute at Carnegie Mellon.

By 2002 with Y2K and dot.com fever over and a worldwide economic slump beginning, demand for domestic IT labor subsided. Still offshore IT capacity and production continues to increase. With U.S. and multinational firms ever more conscious about cutting costs, off-shore rates become even more attractive

There are many similarities between the current situation in the IT industry and the auto market of 1970-1990. These include:

- Held worldwide dominance in production and labor

- Experienced rapidly rising global demand for product

- Faced foreign competition that emphasized cost and quality

- Racked by severe economic downturn

- Experienced large drop-offs in employment

- End products become assemblage of globally produced components

- International firms begin setting up shop in U.S.

- International competition early adoption of U.S. developed quality methods

Like the auto industry of the 1970's, the U.S. IT industry may be at a crossroads. The Department of Labor still predicts IT services and software development employment to be among the fastest growing occupations in the next ten years. The prevailing wisdom is that once the economy recovers from recession, the U.S. IT industry will quickly transform the current labor surplus into a shortage again.

Once the auto industry realized that much of their market share was moving offshore, responses were initiated. Aging auto plants were closed; those that remained were updated with new technology. U.S. auto manufacturers adopted the quality methods advanced by Deming in Japan. The auto industry lobbied and gained legal protection in the form of import tariffs. However, the U.S. dominance and growth were never re-captured.

The question the IT industry may be facing today is, "How can we learn from the auto industry experience?" How the U.S. responds might shape the success of the future U.S. IT workforce in the globally competitive market.

Potential Response by Industry, Government, and Education

Following the auto industry example, the U.S. IT industry might lobby government leaders to provide some legal protection from international competition. But given the U.S. current political climate and predisposition for globalization, this request is not likely to receive much favor with government or economic leaders. Also, since as much

as 90% of IT service employment resides in non-IT companies such as banking, insurance, manufacturing, etc., the IT industry does not have as much collective voice as did the auto industry of the last century. Software industry leaders would be better served by reducing the competitive advantage of international producers. One way to do this would be to adopt the same quality standards prominent in India. The resultant increase in quality would make U.S. IT services and software developers more attractive through increased productivity and lowered overall costs of production. Another approach the U.S. IT industry might adopt is creating development teams that consist of collaborations between domestic and off-shore team members. Such teams could share strengths and take advantage of productivity gains achieved through time differentials, diverse and flexible employees, and "best shore" initiatives (Hayes and McDougal, 2003).

Educators also need to continue to track this trend. There are many potential research and teaching implications. The IT employment trend and its similarity to the auto industry demand continued observation and study. Appropriate action can only follow careful research and analysis. Also, regardless of whether the U.S. IT and software employment continues to decline, the globalization of the software industry is here to stay. For students to be competitive and be employed in the increasing global work environment, they need to be a) comfortable working in a multi-cultural environment, b) able to operate in globally distributive work teams, and c) trained in quality IT and software development techniques (Muthuswamy and Crow, 2003). Computing curricula needs to be adjusted so graduates are comfortable in these new realities. In addition, educators need to consider which types of IT employment are likely to remain in the U.S. and which are those that are likely to be outsourced in the global market. For example, standard programming projects are more easily outsourced than more strategic business interests such as high-level requirements definition or project management (Gaudin, 2002). Educators may need to rethink the critical core skills required of every student in a computing curriculum.

Government, business, and education leaders might also consider partnering to create U.S. high-quality software centers. Such centers would maintain high-quality standards, produce software at competitive prices, and provide a source of data and research for educators. Government could provide grants for start-up funds. Once up and running, the software centers would be profit ventures competing openly with both international and domestic competition. Universities could maintain affiliations with the centers so they might supply domain-specific training and conduct research on effects of incorporating quality standards into the software development process. A number of U.S and multi-national firms, such as Boeing and Motorola, have developed similar centers here and overseas.

CONCLUSION

The recent downturn in IT and software employment may continue even as the economy improves. Global providers of IT services, especially in India, are poised to permanently capture a large share of IT service and labor. In many ways the international outsourcing of IT services and software development is beginning to resemble the pattern of the U.S.

automobile industry during the latter part of the 20th century. U.S. IT education and business leaders need to study and respond accordingly to this global challenge.

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