
THE STRATEGIC IMPLICATIONS OF TECHNOLOGY ON JOB LOSS

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ABSTRACT

This paper investigates the impact of technology on job loss (both slowed growth rates and actual declines) across the economy (both manufacturing and service segments) and reflects on the strategic implications of that activity for firms and individuals. It argues that the technology-enabled economy will continue to expand and produce an increasing potential for further job losses or reallocation across all economic sectors. Firms able to create or adopt strategies for coping with the implications of technology in their respective industries may be able to convert a potentially difficult situation into an opportunity. Finally, this paper begins to investigate the question: how will (or can) the economy provide continued or future employment to displaced workers or alternatively give them and their firms some practical strategic coping mechanisms?

INTRODUCTION

Much has been written about the loss of jobs from first-world developed counties (i.e.: United States, Japan, Western Europe) to third-world developing countries (i.e.: Mexico, China, India). The focus often has been on manufacturing jobs simply because jobs lost in that sector provide politicians and labor leaders alike with opportunistic sound bites. However, many economists argue that the total drop in factory employment (in one country) is not due largely to foreign displacement (to another country). The loss of factory jobs is happening all over the world. From Drezner (2004), during the seven-year period 1995 to 2002, 22 million global factory jobs disappeared – not due to offshoring but due to increased productivity (which, even in the face of those lost factory jobs, resulted in a 30 percent increase in global industrial output since 1995). The implication, to both individuals and firms, of protracted job losses and/or reallocations is a topic of considerable importance and concern to anyone with an interest in the future. A generalized examination of options for firms and individuals faced with the changing conditions brought about by technology is a crucial starting point for determining how best to respond at both levels. This paper is a preliminary effort intended to consolidate many of the observations and information related to technology generated job losses with some initial suggestions on mediating their effect.

Substitute “advances in technology” for “increased productivity” and the underlying shift from a labor-intensive to a technology-enabled economy can be explained. This shift not only

explains the significant loss in global factory jobs, but the off-shoring effect seen, for example, in the movement of customer service call centers from the U.S. to India. Still, the shift of technology-enabled jobs from one country to another (whether they are manufacturing or service) is not a loss of jobs within the global economy. Economic arguments abound that such shifts are not only necessary but desirable since they lead to overall economic improvements. Of greater concern is the permanent loss of jobs (or those jobs never created) because of the increased use of technology.

Business Week estimates that every one percent of annual productivity growth allows U.S. corporations to eliminate about 1.3 million jobs. Productivity in the U.S. has grown almost two percent since 2001; that accounts for almost all of the 2.5 million jobs lost in the past three years. Many argue that the best remedy is for the government to help those workers find new employment, rather than trying to stop the jobs from being destroyed in the first place. So, as the argument goes, the loss of manufacturing jobs is not of major concern – just as the agriculture economy was transformed by the manufacturing economy, the manufacturing economy, in turn, will be transformed by the service economy. They might be different jobs, and some workers might suffer from the displacement effects, but the necessary jobs will be created none-the-less.

Agrawal and Farrell (2003), noting the aging U.S. population, suggests that the U.S. will need 15.6 million more workers by 2015 to maintain both current living standards and the current ratio of workers to the total population. But, where will those jobs come from? What happens when the simultaneous impact of automation, mechanization, and computerization not only continues to eliminate manufacturing jobs worldwide (between 1995 and 2002 the U.S. lost 11%, Japan lost 16%, Brazil lost 20%, and China lost 15% of its manufacturing job base) but also begins to eliminate service jobs at an increasing rate?

THE PATH TO JOB DISSOLUTION

The U.S. economy is down about 2 million jobs since 2001, despite a government report of 308,000 jobs added in March, 2004. In an economy that by most measures – from soaring corporate profits to rapid growth in output – is in high gear, the lack of significant job growth may seem puzzling but only because the underlying reason often is not identified. Outsourcing, whether offshore or locally, plays a role; however, a major factor is the use of technology, which has allowed employers to increase productivity with fewer workers.

Much of the public's attention has focused on "offshoring" – the decision by U.S. companies to send work to countries such as India and China – as the culprit in the lack of new employment. Yet, it is estimated that offshoring accounts for only 10 percent of the jobs lost and would affect less than 2 percent of employed Americans (Drezner, 2004). Clearly, offshoring is not the real culprit in the lack of new employment. Companies have learned how to do more – produce more goods, service, and profits – with fewer workers by using technology more effectively.

Technology is being used to streamline and automate operations and reduce the need for labor, while also requiring remaining workers to do more. Those changes mean that companies can respond to increased demand without hiring – at least without hiring as many workers as in the past. Even as the economy grows, many companies reap benefits by rethinking how they use people and technology.

New jobs are essential to sustaining the economy. The United States needs 150,000 new jobs each month to keep pace with the growth in the labor force; this is 1.8 million new jobs each year. Since 2001, while about 2.8 million people have been added to the labor force, the economy is down about 2 million jobs. Thus, the economy has been unable to sustain a rate of job preservation, let alone job growth, to absorb the increase in the labor force.

The problem is not in the jobs lost to offshoring. In the global economy, those jobs are not “lost” they are simply shifted from one location to another. In fact, as Bednarz (2004) points out, under some conditions the “lost” jobs may “shift back” to the local economy. While such economic shifts can be difficult for the individual workers involved, the impact on those workers often is dealt with effectively. In a growing economy, the argument goes; the affected workers are simply absorbed by the new jobs created.

The greater problem is in the jobs lost to technology. The use of technology makes efficiency improvements possible without replacing employees whose jobs no longer exist. Those are jobs truly lost to the economy. This requires the economy to create an increasing number of new jobs: both for new entrants to the labor force and for those replaced by technology. The question is: under what conditions will the economy sustain those higher rates of job creation? Further, the affected workers likely will need retraining to take advantage of the new, more technology-oriented jobs being created. The question is: what skills will workers need for the new jobs being created?

For example, secretarial positions shrank from 3,702,000 in 1992 to 2,302,000 in 2000 while computer systems analyst positions increased from 695,000 to 1,742,000. (Bajaj, 2004) The direct consequence is that employees will be forced to learn new skills as positions are replaced by less expensive technology. One result is that as firms race to acquire new more “efficient” means for conducting business, employees race to acquire new knowledge or training that will make them less easily replaced.

STRATEGIC IMPLICATIONS

Those questions speak to the critical importance of environmental scanning and the need to explore further from conventional sources of information. Technological changes, and the concomitant opportunities and threats, can originate from places, both geographically and intellectually remote, from those traditionally considered. Both firms and workers need to be aware of what changes are taking place and the likely impact of those changes, either in firm operations or in employment possibilities.

As early as 1983, *Retail & Distribution Management* (a London retail industry periodical) quoted Donald Harris (director of computing at Tesco, a UK shopping club similar to Sam's Club or Costco) on the threat and opportunity of technology. Mr. Harris argued that unless care is taken, the advent of advanced systems essential to maintaining economic stability will create serious job losses and, consequently, social disruption. The primary reason is that, because of the employment of new technologies, the service sector will have a decreasing capacity to absorb the labor displaced from the manufacturing sector.

Gottinger (1990) argued that the growing use of technology in the industrial and service sectors is expected to have implications for the employment of labor. This will create widespread structural unemployment and a large number of permanently unemployed people. The adoption of new technologies also will cause a polarization of the workforce into categories of high-skilled and low-skilled workers. The intermediate range of jobs, vital for a sense of upward mobility, will nearly be eliminated. Finally, while new jobs may be created to help balance the losses, they likely will be in high-skilled areas and create a need for massive retraining programs.

Papaconstantinou (1995) echoes Gottinger and notes that many people hold new technologies responsible for the extensive job losses in a wide range of industries as well as for the growing gap between skilled and unskilled workers. Yet, he recognizes that technological change is central to the process of growth and employment creation. It is what allows increases in productivity and in real incomes. Further, it is clear that the most important issue is not on the impact of technology on job loss, but on the impact on the nature and organization of work and on occupational structure and skill requirements of jobs. Thus, the introduction of new technologies changes skill requirements and the distribution of jobs across different occupations.

Addison, Fox, and Ruhm (2000) addressed the effect of technology on labor displacement. They noted that, while prior research highlighted the importance of international trade and technology as sources of secular changes in wage inequality and unemployment, none focused on job displacement; a potentially important component that has received attention from policymakers and the public. Their analysis provides evidence that the risk of job loss is relatively high for workers employed in industries investing heavily in computer technologies and with high R&D employment intensity. This is an indication that such industries are able to substitute technology for labor in their workforce. A secondary finding of interest is that workers who use computers at work face considerably lower risk of job loss. They had not previously seen that result reported in the literature and they interpreted this as an indicator of skill-based technological change.

In Chabrow (2004), Gene Huang, chief economist at Federal Express, states that the economy is being transformed by the rapid adoption of IT and the Internet. Whereas historically new technologies often took a generation for their impact to be fully felt – the internal combustion engine for example – this is not so with IT and the Internet; their influence has been almost immediate. That rapid adoption plays havoc with job creation. Traditionally, job growth depended on economic cycles – as the economy grew, so did employment. But, recent job growth has slowed because of

structural changes caused by IT-generated efficiencies. Huang said, “In purely cyclical adjustments you do expect labor to increase ...” but “... with the infusion of IT, you have a different factor [creating] a different situation.”

Givord and Maurin (2004) analyzed the changes in the risks of involuntary job loss in France between 1982 and 2002. They found that the risks were higher in the 1990s and in the 1980s. Using econometric analysis to separate the effects of institutional changes from the effects of new technologies, they show that job loss is significantly more pronounced in industries that have the largest share of R&D workers and the largest rate of new technology use. Their findings suggest that technological changes contribute to decreasing the incentive to keep workers for long periods of time and to increasing job insecurity.

This body of research indicates a need to be strategically aware of the impact of technology on both the firm and the individual. Firms will want to take advantage of the higher efficiency and greater cost controls possible when substituting technology for labor and they will want the higher profits that can be generated from such a strategy. Individuals will want to be aware of which jobs will be eliminated by technology, which jobs will be created by it, and what skills they will need to take advantage of the new jobs.

CONSEQUENCES FOR FIRMS

The strategic implications that technology imparts to firms is often a consequence of its interchangeability with other firm assets or its ability to provide a synergistic link with other firm activities. In some firms, technology is viewed as both a mechanism for and a means of increasing the overall efficiency of a firm's activities. Traditionally, one way to think of technology is that it provides the employee with the tools to become more efficient.

Alternatively, organizations are beginning to view technology as not only making the employee more efficient, but also as a mechanism for making the overall organization more efficient without the employee. It is this latter approach that may cause the greatest consternation among corporate critics because it implies that the employee is a disposable and readily replaceable component of a firm's business activities. It might be suggested however that employee replacement via technology is only an extension of firm behavior that initially began with the industrial revolution.

Perceptions that job loss due to the application of technology is somehow different now as compared to previous technology incarnations are not entirely correct. The industrial application of technology has always had as one of its side effects the ability to make some types of jobs disappear forever. After all, the Gutenberg printing press essentially decimated the illuminated manuscript business and the telegraph had a similar effect on pony express riders.

Technology supplanting individuals, as in ATMs, airline kiosks, automated ordering systems, self checkouts, etc., reduces overhead and improves productivity but also creates an increasing emphasis on efficiency rather than effectiveness. Although efficiency focuses on achieving results

without wasted time or effort, and so can result in a much greater increase in productivity, effectiveness focuses on achieving competent results. While American consumers have been quick to applaud the faster service and lower prices resulting from technology's efficient productivity, they also complain about reduced levels of competence and customer service. Still, the effort appears to be away from effectiveness (employees) toward efficiency (technology).

This shift is directed at reducing the most uncontrollable component of a firm's cost structure, i.e., the employee. Health care cost increases alone dictate the possibility of employee reduction as one mechanism for increasing the overall efficiency of a firm. Thus, for example, banks can reduce relative costs, and increase controllability over their costs, by shifting from employee-staffed branches to ATMs. This can improve operational efficiency and result in lower (or fewer increases) in customer service charges. At the same time, this reduces the effectiveness of customer service; customers now do their own service. This strategy may be attractive because, from the customers' viewpoint, the gain in efficiency may be greater than the loss in effectiveness.

Competitive strategy is first and foremost about outperforming rivals based on differences that can be preserved. Merrifield (2000) argues that a sustainable competitive advantage is essential for survival in a hyper-competitive global marketplace. While operational effectiveness might be part of an overall strategy (TQM, Benchmarking, etc.), it cannot generally support a competitive advantage either alone or for long. That is because while operational effectiveness is necessary, it is not sufficient to meet the threats faced in a competitive marketplace. Superior profitability becomes more difficult to maintain as marginal improvements in operational effectiveness provides little advantage relative to rivals. Operational effectiveness also is insufficient because of competitive convergence – the more firms attempt to adapt the winning “strategies” of their competitors the more they look alike. Once the competitive level of effectiveness has been reached, efficiency becomes a driving force in a competitive strategy.

Thus, the essential strategy is to not only achieve competitive effectiveness but to achieve operational efficiency by choosing to perform activities differently from rival firms. For example, Southwest Airlines has maintained a competitive advantage over full-service airlines through the application of specific technologies to replace people and so to provide similar services at a lower or constant cost. Similar effects can be noted for Wal-Mart and UPS in their use of logistics technologies.

It can be argued that technology-based advantages are short-lived because competitors can simply copy the technology. Indeed, that is true and explains, for example, why banks cannot compete on technology alone. But, it also explains why banks, to be competitive, must adopt the extant technology. Further, there is a significant difference between simply using technology and incorporating technology into a competitive strategy. That difference explains why full-service airlines – which simply add technology to an existing infrastructure – cannot compete effectively against Southwest Airlines – which uses technology strategically. For example, Southwest has closed three call centers, permanently displacing 1,100 employees, as 60 percent of its customers now

reserve flights on the firm's website (Bajaj, 2004, 6D). Improved productivity is further reflected in the number of passengers that check in using kiosks or online connections. Even with increasing growth, Southwest has been able to maintain its employee levels, thus controlling costs while increasing productivity, which is a key component of Southwest's overall success.

FIRM BASED COPING BEHAVIORS

Firms need to address the consequences of new technologies and incorporate it into their strategic thinking. They can do so by looking sideways and encouraging cross-industry analysis of how technology is being developed and used. They can create and support corporate "Bumble Bees," intra-organizational technology hives similar to the "skunk works" of earlier times. Firms can recognize the limitations of traditional planning processes, which too often focus on extrapolations from the known past rather than expectations about the vague future. They can do so by encouraging a more distant early warning approach and by tracking technologies that have potential for systematic, economy-wide changes.

Consider, for example, the potential impact of RFID technology on logistics and distribution, among other areas. Wal-Mart has determined that all of its suppliers adopt this technology because it will significantly improve its distribution capabilities while reducing costs. Many of Wal-Mart's suppliers, although they will meet the imposed deadlines (Lacy, 2004), are resisting the adoption of this technology; claiming it is too expensive or too complex to be implemented at this time. However, firms – even if they are not yet affected by Wal-Mart's decision – which recognize the importance of RFID as a systemic-change technology will be able to incorporate it into their strategic thinking and be able to, when necessary, integrate it into their own operations.

Firms must decide not only to embrace new technologies but also to adjust their attitudes toward their employees likely to be affected by the technologies. Employees must be viewed as strategic assets of the firm. Firms that can utilize new technologies while enabling their employees to adapt will be better positioned than those that do not. Firms should empower employees to become part of the technology process through adaptation, training, or some other mechanism. As Table 1 indicates, the use of technology requires a shift in behaviors, and consequences. Firms need to view new technologies as factors that "help" their employees do a better job or to do a job with greater efficiency. Employees need to view new technologies as factors that improve their ability to get "the job done." Technology is merely a tool. As such, it may not guarantee the creation of new jobs but it need not become the wedge that always results in job loss.

In order to cope with the introduction of new technology, firms must adopt a more aggressive approach to seek out new technologies and implement them when and where appropriate. Although not all inclusive by any means, there are three primary coping mechanisms that all firms ought to use. The first coping tool is awareness. Firms tend to become complacent with their current approaches to business and fail to consider the possibilities of what new technologies might bring to bear on their

business models. The organization must encourage a more generalized awareness on the part of its employees that they are a critical part of the technology alert system for that organization. Rather than maintain a single technology contact for the organization, the firm should adopt a more organic structure that allows individual employees to seek, find, report on and, in some cases, implement technology improvements in their respective areas. Since few organizations can look in all directions at the same time, allowing more employees the latitude to look around provides a larger base of technology screeners to search for ways that might help the organization be more efficient or effective. More critically, it places part of the technology search problem squarely on those most likely to be impacted by technology changes. If handled properly, a firm could seek out and explore a variety of technology opportunities and threats at a relatively low cost in different areas simultaneously at a significant advantage both to the individual doing a specific job as well as to the firm.

Table 1: Firm Behavior			
Old Behavior	Old Consequences	New Behavior	New Consequences
Enhance skills only when forced by customers, etc.	Employees lose effectiveness and efficiency.	Promotes ongoing skill enhancement.	Employees remain effective and become more efficient.
Avoid new trainings expenses whenever possible.	Employee obsolescence tolerated.	Actively provides opportunities to acquire new skills	Employee viewed as an upgradeable resource.
Views training as a necessary evil.	Avoids training efforts whenever possible.	Views training as a competitive necessity.	Seeks new mechanisms for improved training.

The second coping tool, beyond simple awareness, is a more structured approach to evaluating specific technology changes that will likely impact the firm or its operations. It is very difficult to predict the implications of revolutionary technology (but see the discussion that follows). It is, however, fairly easy to identify evolutionary changes in technology that will affect a firm and/or its business. Natural progression is often a good starting place for a company to evaluate the implications of changing technology on its operations. For example, speed and capability have increased steadily with succeeding generations of communication technology. Therefore, an obvious technology issue for any organization, where communication is a crucial component of its activity, is to evaluate the implications that faster speed and greater capability will have on those operations. Banks should not have been surprised when customers, desiring the convenience of on-line banking, wanted more information in real time to take advantage of their always-on broadband connections. It should not have been a surprise because it was clear that the evolution of high speed

communications was progressing across an array of service businesses, including financial institutions. Convenience as provided by precursor technologies such as bank's ATM experiences should also have prompted an awareness that customers would expect additional services sooner rather than later. Failure to recognize the evolutionary impact of one's own technology is frequently due to the lack of a structure to assess implications as changes occur. Without a structured assessment, it is difficult for an organization to put its own technology in perspective much less new technology that may enhance or supplant it.

The third coping tool is more problematic. An organization must consider radical innovations. These are problematic because their importance often goes unrecognized initially. One of the best examples is that of the Internet itself. Although a compilation of technologies, the Internet was initially viewed as almost irrelevant to most businesses. Yet, within a relatively short period, it became critical to business operations ranging from supply chain management to direct sales. Access to information alone has made it a mandatory part of virtually all organizations' communication strategies. Organizations both large and small failed to visualize how a technology tool such as the Internet might and probably would impact their businesses. It was not that for a lack of information. There were many sources that suggested new opportunities and threats would result. The problem is more an attitude that refuses to accept that radical innovations are actually more common than one might anticipate and that they create an environment in which "business is different." The truth is that no business is immune to the implications of technological change. The lack of awareness that many firms have toward technology is therefore compounded by an unsupported belief that somehow their organization or firm is immune to its effects. Without a systematic approach, that goes beyond the evolutionary, to reflect on what the organization is doing, could do or might do in terms of radical technological opportunities and/or threats that belief can be a barrier to a thoughtful strategic response. The general consequence is an organization that either ignores or minimizes the implications of radical technologies on their operations. You can not plan for things that you do not consider. Planning for radical change is crucial to being prepared. Even if you miss the exact technology, you are in a better position to adapt if you embrace the possibility that some technology as yet unspecified will require a significant strategic response.

CONSEQUENCES FOR INDIVIDUALS

Entry-level positions increasingly will be subject to alteration or dissolution as newer and less expensive technologies reduce the need for those jobs. As noted above, offshoring is expected to account for only ten percent of the jobs lost in the U.S. labor market. Technology will account for the other ninety percent; a much greater impact.

Consider, for example, the banking industry. Craig (1997) reports that since peaking in 1989, the industry's payrolls have shrunk. Between 1989 and 1995, banking employment fell more than 6 percent, while industry output increased 15 percent. An explanation for the contraction in jobs is

readily available. Technology has transformed the way banking is done; with obvious effects on labor demand. The explosion of ATM transactions is often cited as a primary reason for banking's dwindling payrolls. Even the name – automated teller machine – suggests the substitution use.

The most visible effect of ATMs has been to transform the multitude of fully staffed branch offices that existed in the 1970s into today's sparsely staffed branch located in grocery stores and other venues. Although a visible sign of technology, ATMs are not the only example. Less obvious examples may be more accurate computer models of loan risk that allow banks to substitute lower-skilled, and lower paid, employees for higher-skilled, and higher paid, loan officers.

These changes also have taken place in the travel industry with the adoption of web-based travel services, in the grocery industry with the adoption of self-checkout scanners, and in the service station industry with the adoption of pre-pay gas pumps. In all of those cases, a large number of transactions that had been processed by employees are now processed by technology. This effect is accelerating. Hotels and airlines and car rental agencies are installing kiosks that allow customers to check in or check out without human intervention. Voice mail, email, voice recognition, wireless connectivity, etc. can replace receptionists and secretaries in offices. Smart cards accessing interconnected systems through doctor's office and pharmacies could replace legions of clerks processing health insurance claims. Automobiles with self-diagnostic routines could alert owners and schedule repair visits eliminating all but the actual mechanic that completes the repairs.

How will individuals cope in such an environment? One approach seems to be the consequence of economic law; the new replaces the old and the old, however painful it might be, is swept away. This often is the response provided to the 50+ year old employee whose 30+ year job has just been eliminated by technology. The decision appears harsh, but as many economists argue, a necessary consequence of the competitive engine that drives the U.S. economy. Ramsaran (2004) notes that the savings created by such economic shifts free up resources for more highly skilled and higher-paying jobs.

Roberts (2004) well states the case, "But the loss of lower-paying, lower-skilled jobs – either to other countries or to other industries within a country – is an integral part of economic development. The change is always wrenching for those who lose their jobs, but the economy benefits as labor and capital are redirected toward higher value-added industries. And while there may be temporary dislocations of workers, persistently high unemployment is not the rule because workers eventually move to different jobs in new industries."

Thus, displaced workers face a clear choice; remain displaced or switch to the new jobs being created. Still, even for those willing to switch, two questions remain. What if technology replaces workers so that no new jobs are created? Even if new jobs are created, will they provide the same level of compensation and benefits as the jobs that are replaced?

INDIVIDUAL COPING BEHAVIORS

The strategic approach requires individuals to remain aware of the impact technology has on both job loss and job creation. To know and understand which types of jobs are being lost due to the use of technology and which types of jobs are being created by the use of technology.

Mishel (1989) analyzed the contraction of the U.S. manufacturing segment and showed that wages created by jobs in expanding industries were less than those of jobs lost in contracting industries, and that the difference was growing. His results are shown in Table 2.

Table 2: Industry Employment Shift, 1972 – 1986 Weekly Wage (1987 \$)			
	Expanding Industries	Contracting Industries	Wage Gap
1981 – 1986	\$287.51	\$422.20	\$(134.69)
1972 – 1981	\$295.65	\$361.13	\$(65.48)

From Mishel (1989) Table 4

This is an indication that not only do workers need to protect against job loss, but they to protect against job creation that produces lower-paying, less-desirable jobs.

Zavodny (2003) reports a connection between technology and job separation. Some of her results suggest that less educated workers may be more likely to experience an involuntary separation in technology intensive industries than more educated workers. That is, technology itself may be replacing those jobs that do not require high skill levels, and so less education. However, workers who remain cognizant of technology and continue to increase their educational attainment will find employment in a technology-enhanced workplace.

Whitacre (2004) tells workers to “prepare for the worst.” While her comments focus on jobs lost to offshoring, they apply equally well to jobs lost to technology. While you cannot prevent the loss of your job, you can plan ahead to prevent or minimize your losses. Obtaining and retaining jobs in the future will require flexibility, creativity, and life-long learning. Your plan should include answers to the following questions:

- ◆ What other fields interest me?
- ◆ Do I have the skills to move to that field?
- ◆ What are my true salary needs (not wants)?

On the positive side, *The Economist* (2004), again talking about offshoring but equally applicable to technology, argues that the jobs lost will be low-paying ones, such as bank tellers and switchboard operators. Job protectionist practices will not save such jobs. If they do not go overseas they will be replaced by technology. The new jobs created will demand skills to handle the deeper incorporation of information technology, and the pay for those jobs will be higher.

Whether Mishel or *The Economist* is right may depend both on where in the employment pool workers start and whether or not they take Zavodny's and Whitacre's advice. Certainly those who start with a higher propensity for education may be in a better position to meet Zavodny's conditions and to follow Whitacre's advice and in a better position to take advantage of the higher-paying, more-desirable jobs that are created.

Those who do so will take a multi-career approach and will continue to gain experience and training. They will develop the capability of recognizing potential threats and the skills to view them as opportunities. They also will recognize that any attempts to delay technology or block job loss are more likely to put them at risk for future employment. Instead, they will learn to embrace and take advantage of available technology and provide increasing value to their employers. Table 3 indicates how employees must alter their behavior to reflect the current realities of the job environment.

Table 3: Employee Behavior			
Old Behavior	Old Consequence	New Behavior	New Consequence
Enhance skills only when pushed.	Employee loses flexibility.	Ongoing skill enhancement.	Employee remains flexible.
Avoid new skills.	Employee obsolescence.	Actively seeks new skills.	Employee on the technology edge.
Views training as a necessary evil.	Avoids training whenever possible.	Views training as survival.	Seeks every training opportunity.

IMPLICATIONS FOR THE FUTURE

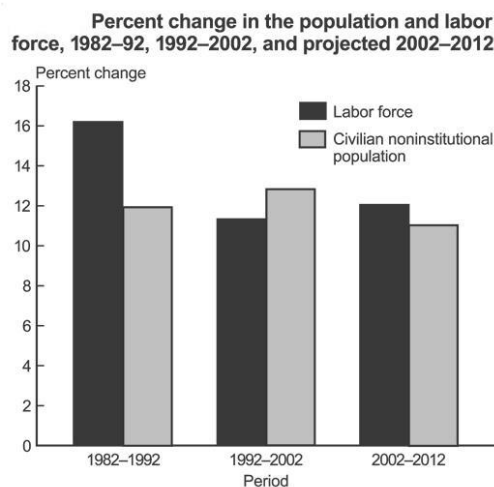
Technology is neither good nor bad. It is a tool like any other than can be used poorly, well or for purposes in between. The key is to recognize that regardless of what people might think they would prefer technological job dissolution or change is a fact of life. As jobs done by hand were replaced by jobs done by machine during the industrial revolution, we are now watching jobs once done by people now being replaced by technology.

The U.S. Department of Labor (2004) reported its predictions for occupational outlook for the ten year period 2002 – 2012 and, where appropriate, compared the predictions with actual results

from 1992 – 2002. The U.S. Department of Labor has a series of summary charts that have been selectively used to illustrate several areas where technology may lead to job loss and those areas where technology may lead to job creation. The trends that may be observed from the graphic presentation of Department of Labor data should not be overstated but they are quite clear in their implications. The role that technology is and will continue to play in both job loss and creation is readily apparent although its exact form can be expected to remain somewhat ambiguous.

First, as Chart 1: Percent change in the population and labor force, 1982-1992, 1992-2002, and projected 2002-2012 indicates, growth in the labor force is expected to exceed population growth during 2002 – 2012. That is, job growth should be sufficient to meet demand. The questions are, what kinds of jobs will be created – and which types will be eliminated?

Chart 1

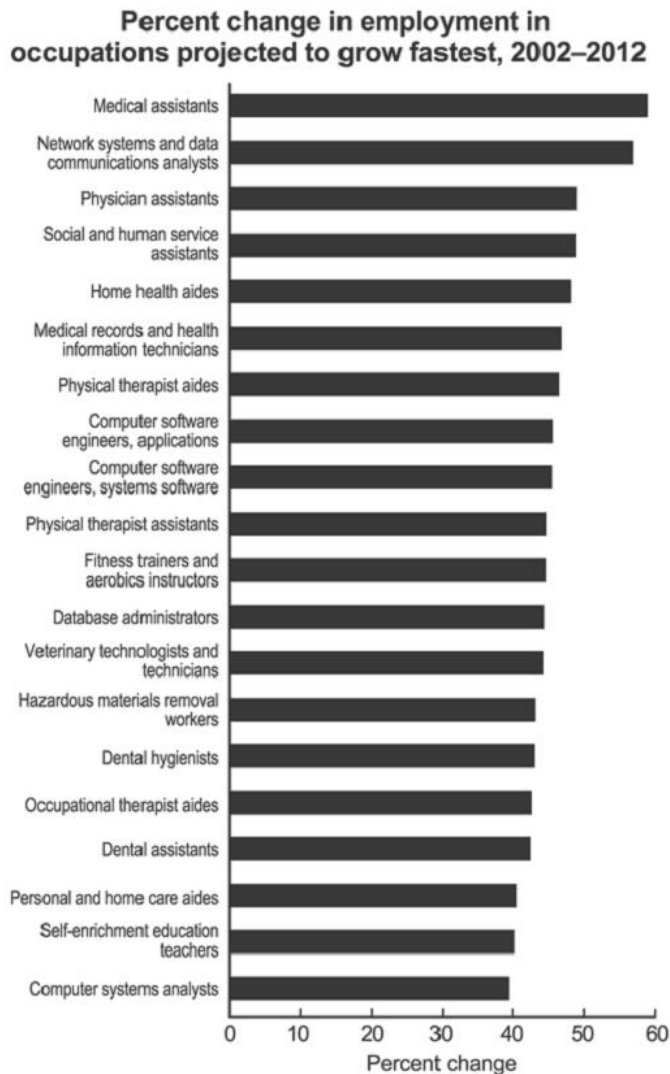


Source: Chart 1 from APPENDIX U.S. Department of Labor, Bureau of Labor Statistics Bulletin 2540: Occupational Outlook Handbook, 2004-05 Edition (June 2, 2004).

The jobs projected to grow the most, either in percent change in employment (see Chart 2) or in the largest numerical increases (see Chart 3), tend to fall in two major categories: personal services and technology. The personal services area includes health care, teaching, and retail or distribution services (clerks, waiters, truck drivers, etc.). These are jobs that, at present, cannot be eliminated by technology. However, they might be significantly changed by technology, which may change the skill set necessary to do those jobs. The technology area primarily includes those who will develop the new technology applications of the future (software engineers, database

administrators, systems analysts, etc.). These, of course, are jobs being created because of technology and will require higher skills than the jobs they replace.

Chart 2



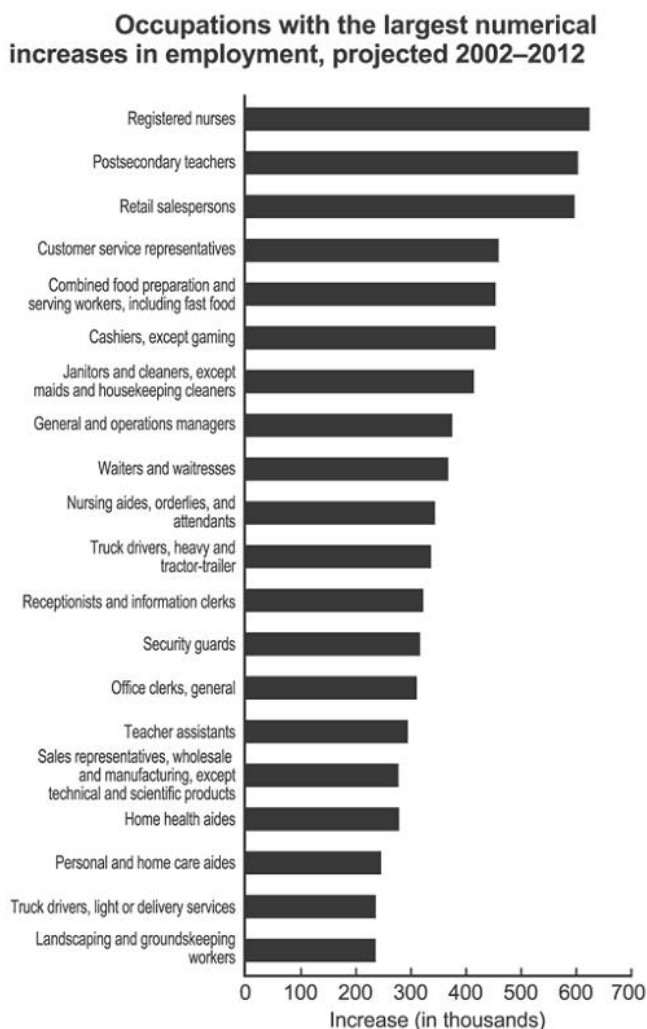
Source: Chart 7 from APPENDIX U.S. Department of Labor, Bureau of Labor Statistics Bulletin 2540: Occupational Outlook Handbook, 2004-05 Edition (June 2, 2004).

One consequence for those individuals whose jobs are eliminated is how best to respond. In order to obtain the new jobs being created, it is likely that the displaced individuals will need to cultivate new skills. Enhanced skill in the use and application of specific new technologies however

may not guarantee protection from future job loss. The pattern of job creation and loss via technological change is ongoing and it is probable that people will encounter this process multiple times during their work life. Thus, current exhortations for life-long learning may represent the only valid approach to career development in a technology-based economy.

The negative impact may become more pronounced if workers displaced multiple times choose to remove themselves from the learning process, and hence from the job market. In other cases, it may be a side effect of workers unwilling or unable to take a lesser position or reduced compensation. Regardless of what jobs might be available, an individual's perception of self worth could constrain the willingness to develop new skills or to accept interim employment.

Chart 3



Source: Chart 8 from APPENDIX U.S. Department of Labor, Bureau of Labor Statistics Bulletin 2540: Occupational Outlook Handbook, 2004-05 Edition (June 2, 2004).

Both situations are increasingly commonplace, as indicated by the number of displaced workers electing to opt out of the traditional job markets. According to Uchitelle and Leonhardt (2006, p. A14), more than one out of every eight men age 30 to 54 in the United States does not work; and many are missing from unemployment statistics because they have stopped looking for work.

As technology continues to impact the skills needed for successful employment, more and more individuals may find themselves unable or unwilling to gain the necessary skills and may be relegated to the long-term unemployed. If that trend both continues and increases, it could become a serious social issue. Nations, where the relative percentage of the long-term unemployed or under employed is increasing, face the prospect of difficult and potentially harsh choices. Firms operating in those nations face the real possibility that their efforts to improve productivity through new technology will prompt governmental reactions to counter the unemployment that is a byproduct of the increased productivity. In the end, governments concerned by the prospect of a large segment of the population being composed of unemployed and disaffected workers could restrict the improved technology that would enhance productivity.

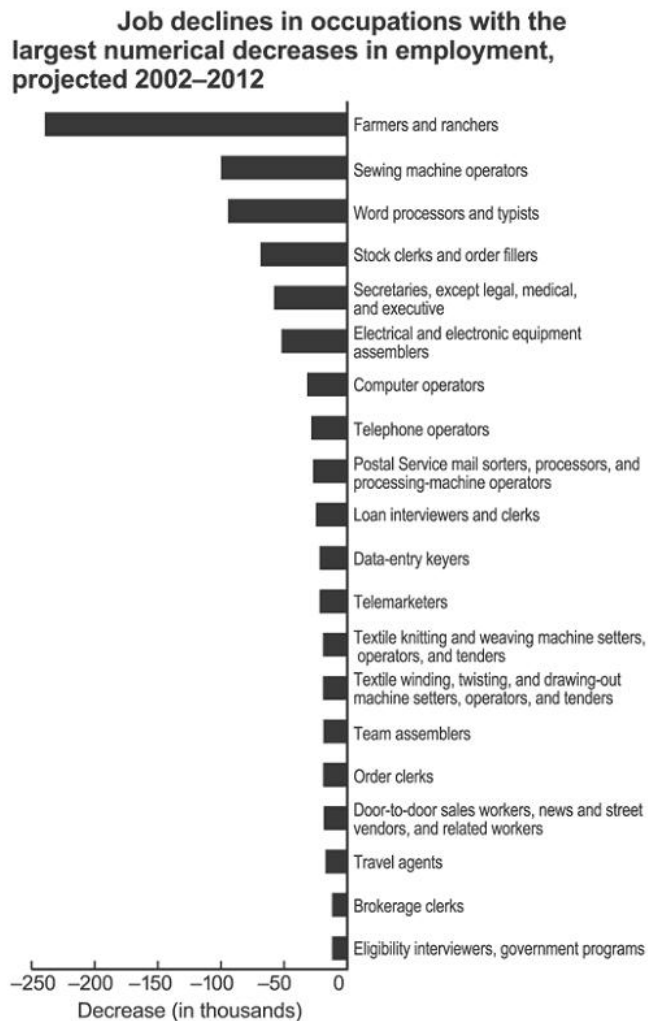
The areas of projected job declines are listed in Chart 4: Job declines in occupations with the largest numerical decreases in employment, projected 2002-2012. These include reductions in agriculture (farmers and ranchers) and certain manufacturing sectors (textile workers) as technology continues to enable those industries to produce more with fewer workers. However, of interest, are the service sector jobs in decline (word processors, secretaries, computer operators, telephone operators, Postal Service employees, order clerks, travel agents, etc.). These are jobs that are being replaced by technology (including those where technology enables offshoring).

The U.S. Department of Labor study states, "The majority of the 20 occupations with the largest numerical decreases are office and administrative support and production occupations, which are affected by increasing plant and factory automation and the implementation of office technology that reduces the needs for these workers. For example, employment of word processors and typists is expected to decline due to the proliferation of personal computers, which allows other workers to perform duties formerly assigned to word processors and typists."

These changes will not happen quickly; many of the jobs being replaced by technology will be available for a number of years. However, most of those jobs will grow at much slower rates and a large percentage of their needs will be for replacement workers, which also will slow over time. Chart 5: Number of jobs due to growth and replacements needs by major occupational group, project 2002 – 2012 (Appendix) shows that both service and professional jobs will maintain both high growth rates and high replacement rates. However, almost all of those jobs will be in areas that will require a bachelor's degree or higher. The mid-level jobs in office, sales, and management will experience much slower growth rates due to the impact of technological replacement. Finally, technology will continue to significantly reduce job growth and replacement needs in transportation, production, construction, and agriculture. The implications for firms and prospective employees are clear. Technology will continue to evolve and in so doing create conditions that necessitate constant

change. Firms must change to remain competitive and employees must change to remain employable. It will be to each one's advantage to recognize that the nature of the workplace has forever been altered.

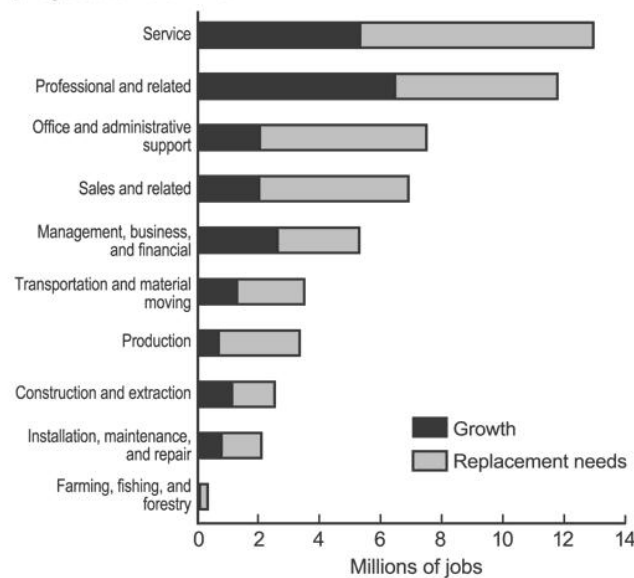
Chart 4



Source: Chart 9 from APPENDIX U.S. Department of Labor, Bureau of Labor Statistics Bulletin 2540: Occupational Outlook Handbook, 2004-05 Edition (June 2, 2004).

Chart 5

Number of jobs due to growth and replacement needs by major occupational group, projected 2002–2012



Source: Chart 10 from APPENDIX U.S. Department of Labor, Bureau of Labor Statistics Bulletin 2540: Occupational Outlook Handbook, 2004-05 Edition (June 2, 2004).

OBSERVATIONS AND CONCLUSIONS

Job loss and reallocation of resources will continue as a consequence of technological change. Inherently, change will require adjustment on the part of affected individuals as well as organizations. For many, these changes will be acutely painful and impart serious consequences, while for others; technological change will bring unexpected opportunities and rewards. The same pattern has been played again and again throughout history. However, there are mechanisms that might be utilized to minimize the negative consequences for individuals displaced and to encourage organizations to respond more intelligently. Those mechanisms include recognizing the strategic benefits of technology. Firms can do so by adapting and adopting technology that creates competitive advantages, and using technology to maintain that advantage. Individuals can do so by recognizing the impact of technology on job availability and maintaining education and skills to take advantage of those opportunities.

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