Jonathan Harris
21F.034

IT and the Global Labor Market

The dot com boom of the mid 1990s ushered in a new wave of technological optimism. One success story after another served to tempt another digital speculator to enter the field. Of course, like many other types of speculation, the market eventually burst, taking with it a number of disappointed investors. It turns out that many of these investors neglected to develop sound business plans, or in some case, failed to develop business plans at all. Why did people feel that the Internet and other manifestations of information technology would be so lucrative that a sound business plan was not even necessary?

Conversely, perhaps a better question to ask is how the advent of information technology has added value to firms. Many people operate with the vague notion that computers and other forms of information technology allow firms to carry out business processes faster and more accurately, but the exact mechanism by which information technology allows firms to extract value in the form of increased productivity is less widely known. Knowledge of the ways in which information technology can improve a firm's operations is paramount to understanding its limitations, particularly its role in making the economies of developing nations more competitive globally.

In answering the question of how information technology increases productivity, I will look at the utilization of information technology in the service and manufacturing sectors of the U.S. economy during the 1990s. The 1990s were a time of great innovation in terms of information technology integration and will serve to give considerable insight as to the role information technology actually plays in today's business practices.

Following that discussion, I will examine the implications of IT on the burgeoning service sectors of the developing world, especially in relation to the contentious issue of offshoring.

General Analysis

While most of the US economy experienced positive growth in the 1990s, the majority of productivity growth was concentrated in about six, highly competitive sectors. Those sectors were semiconductors, wholesale, securities, retail, computer manufacturing and telecommunications. From 1993-2000, these six sectors accounted for 32 percent of GDP and 76 percent of productivity growth (McKinsey). In particular, computer manufacturing, semiconductors and telecommunications, the three IT-producing sectors, contributed disproportionately to economic growth during the 1990s. These sectors accounted for eight percent of the GDP, but accounted for 36 percent of productivity growth (McKinsey). Both the size of these sectors as well as the gains in productivity made the IT-producing sectors extremely important to US productivity growth.

Furthermore, the products IT-producing firms created enabled a whole movement of managerial innovation. IT allowed firms within the top six sectors to take advantage of key elements in the business climate, including increased demand, as in the semiconductor sector; deregulation, as in the telecommunications and securities sectors; and high competition, as in the wholesale and retail sectors. It is clear that the integration of information technology was just one of many decisions that firms had to make in order to navigate through the sector.

So how were firms in the most productive sectors of the economy able to use information technology as a driving force for productivity growth? A study of the most productive sectors by McKinsey Global Institute revealed the following three characteristics of productive applications of information technology. Applications were

- Tailored to sector-specific business processes and linked to key performance levers
- Deployed in a sequence that built capabilities over time
- Co-evolved with managerial and technical innovation.

Applications that exhibited these characteristics were found to have had a profound impact on productivity. Having information technology tailored to the sector's key business processes means embedding information about the underlying business process within the particular installation of information technology. This underlying business process is strongly reflected in the company's performance levers, which are a key to a company's values and goals. There are eight productivity levers which have a bearing on the effectiveness of IT applications:

- Substituting capital for labor
- Deploying labor more effectively
- Reducing non-labor costs
- Increasing labor efficiency
- Increasing asset utilization
- Selling new value added goods and services
- Shifting to higher value added goods and services within the current portfolio

- Realizing more value from the existing goods and services

These levers provide an excellent framework with which to examine the impact of information technology. Effective IT applications hit upon at least one performance lever. The levers affected by information technology depended on market dynamics of the particular industry and thus varied across and within sectors (McKinsey). I will come back to this framework when I look at how information technology has affected individual sectors.

The second characteristic of successful information technology applications was that they were deployed in a sequence that built capabilities over time. This did not entail simply increasing investment in information technology, but also developing new systems within the business process to know what to do with that new functionality. For example, after first implementing automated data capture and storage, retailers used this data to enact new decision support capabilities in areas such as merchandise planning (McKinsey).

The third characteristic of productive information technology applications was that they co-evolved with managerial and technical innovation. To use another retail example, Wal-Mart developed new information technology capabilities at the same time it was working to simplify its relationship with suppliers and distributors. Improved data storage and merchandise planning allowed for stores with more customized inventory and shopping experiences. Information technology did not operate in a vacuum within any sector, but only in the context of other managerial decisions.

In-Depth Look

I would now like to take the company-level productivity lever framework that was mentioned in the previous section and use it to analyze the information technology decisions of industries within the service sector as well as in the manufacturing sector. Aside from discussing the specific instances of information technology and the levers they impact, I also will talk about the social implications for the labor market.

Retail

Retail is characterized by a highly competitive environment. As such, it is quite difficult to effectively differentiate oneself from the competition. Nevertheless, the retail space is dominated by industry giants such as Wal-Mart, Target and Amazon.com. Significant productivity gains have come primarily from the retailer's ability to more closely match customer preferences without raising prices to do so. For large general merchandise retailers like Wal-Mart, innovations came through the implementation of warehouse and transportation management systems, which led to reductions in inventory costs and frequent stock replenishment. Point-of-sale and electronic scanning allowed for more convenient tendering of transactions as customers no longer had to worry about bringing cash or waiting in line for a price check. These innovations also allowed for data tracking, which translated into better local supply-demand match-ups. Prices were kept low because of improved distribution logistics, which kept items in inventory for as least time as possible.

In apparel, vertically integrated stores such as the Gap employ vendor management systems. Such a system manages the relationship between the Gap and

clothing vendors, shortening time to market and improving production/sourcing in the process. High-end retailers such as Neiman Marcus or Nordstrom's rely on intimate knowledge of their customers to provide targeted promotions that are not only effective in getting customers to make a purchase according to their preferences, but are effective in getting customers to buy something traditionally out of their comfort zone. High-end retailers use customer data warehouses to cluster consumers together in order to package promotions.

Information technology applications in this sector impacted productivity levers through increased labor efficiency, increased asset utilization, and substituting capital for labor. Applications such as inventory handling reduced non-labor costs. Merchandise management programs allowed retailers to realize more value out of existing goods because they were more responsive to demand.

Here, human labor loses out to the computer in the area of inventory and vendor management. Before the advent of warehouse and transportation management systems, a human would have to receive the shipment of goods, verify the amount being delivered, then log the shipment, then find space in the warehouse for it and log that information, etc. Now with bar code tracking, that person is no longer necessary or at least, he can focus on other tasks. Aside from those areas with routinized tasks, human labor is mostly complemented by information technology, which is reflected in its impact on increased labor efficiency and increased asset utilization.

Banking

Retail banking is another sector that has been traditionally difficult for firms to differentiate themselves. Deregulation in this sector during the 1990s only served to

increase competition. Adoption of information technology was most effective when it focused on sector-specific business processes such as lending, credit card operations, and banking channel operations (McKinsey). Applications tended to focus on automation of tasks, development and support of alternate channels, and scale-enablement. Perhaps the biggest strides were made in the lending process. The development of credit scoring and underwriting software led to firms being able to process more loan applications more employee, improved quality and consistency of decisions, and a centralized credit officer review process based at a remote site instead of at each branch. Banks were thus able to offer new services while simultaneously realizing more value from their current portfolio. One senior executive claimed to have seen as much as an 80 percent reduction in paperwork (McKinsey).

Check imaging lowered some labor and storage costs. Voice Response Units/Integrated Voice Response (VRU/IVR) allowed firms to keep call center personnel costs in check as call volumes rose, deploying labor more effectively through automation. Standardization of core banking systems also led to a decrease in costs.

The applicable levers with the biggest impact were substituting capital for labor, deploying labor more effectively, increasing asset utilization, selling new goods and services, and shifting mix of services in current portfolio. Substituting capital for labor made the biggest impact as lending systems, check imaging and VRUs all made a big impact on this lever. However, the effect on labor is slightly different within the loan disbursement department than it is within the check processing department or call center.

This is because loan officers contain some form of sector-specific, expert knowledge. While educational training has some bearing on this knowledge, a lot of this

knowledge comes from intuition formed over years on the job. These individuals still have value to the company, particularly in deciding over matters that fall outside of the normal parameters of the software. So the firms have been able to use this labor for their shift to other services.

On the other hand, the labor force for check processing and call centers is one that is typically low-skill. Information technology will render some portion of this job force obsolete. Employees in these areas contain no specialized knowledge, and thus whether they stay or are fired depends only on the optimum mix of capital and labor.

Semiconductors (Manufacturing)

At 35 times the overall US growth rate, the semiconductor sector experienced one of the highest productivity growth rates of any sector during the 1990s. Though semiconductors are part of the information technology growth machine, I treat it here as an example of manufacturing. This sector is split up into two main subsectors, microprocessors and memory, which is only worth noting because they exhibit different characteristics and thus have different information technology needs.

The memory subsector is a commodity market with no product differentiation. Competitive advantage is gained through improved process capabilities, implying greater asset utilization and increased labor efficiency. Thus, the memory subsector's key information technology investments were process control systems, automation systems, and process diagnostic tools.

The microprocessor subsector represents a market that has many differentiated products. It is also forced to live by the law that processing speed doubles every 18 months. The emphasis for this subsector became how to provide consistently, high

quality products, which was highly valued by customers. Their information technology needs were design reuse methodology/tools, process control systems and process diagnostic tools.

Meeting these needs led to large gains in productivity, particularly through the channels of increased asset utilization, selling new value added goods, and increased labor efficiency. As with the employment of merchandise management in retail and lending systems in retail banking, the information technology investments in semiconductor manufacturing, especially microprocessors, have led to the ability to create new, specialized products. To illustrate the mechanism through which this is done in manufacturing, it is instructive to look briefly at a more detailed example.

Valve-Making

The manufacturing sector depends on its ability to put out high quality products consistently. This is especially true when you are making a small part of a much larger entity, as with a valve. There are three elements contributing to the operational efficiency in manufacturing a valve: the set-up time, or the time it takes to program the machine so that it will perform the right combination of tasks to produce the valve; the runtime of the machine to complete the valve, and the time it takes to inspect the valve for quality assurance (Bartel et al). Four advancements in manufacturing information technology affect these three elements directly.

One such advancement was the creation of computer numerically controlled machines (CNCs). Instead of having a highly skilled machinist hammer out the machine part, CNCs can automatically drill and chip the block of metal into the specified part, which is loaded into its operating system. The rise of 3-D computer-aided design (CAD)

has been another great step, as now machine operators can upload the design right into the CNC instead of having to program the machine, greatly reducing set-up time. Flexible manufacturing systems (FMS) coordinate actions across multiple CNCs, as it is much more common to need several machines to produce a valve. After the part is created, automated inspection machines use laser technology to ensure quality to 1/1000 of an inch.

Summarizing the benefits, CNCs and CAD drastically reduce setup time, which has the biggest impact on creating highly differentiated products. FMSs reduce runtime, making the production of any one part go much faster. Automated inspection systems intuitively speed up inspection. It then makes sense why U.S. manufacturers have moved into the area of making highly customized products because of their ability to do so cheaply. I will talk more about this in the next section.

Global Implications

Over the last few years, many people have become alarmed at the number of jobs that have gone overseas. Outsourcing has become the wave of the present as U.S. companies are increasingly sending non-core business over to developing countries such as India for processing. One estimate says over 315,000 jobs have been offshored as of 2003 (Baily and Lawrence). Most people attribute this number to unscrupulous multi-national corporations trying to avoid higher wage standards here in the U.S. by exploiting lower wage labor in developing countries.

However, the situation is more complicated than firms just trying to earn an extra buck. First of all, information technology offers little comparative advantage in the long run. As more and more firms within a given sector adopt IT applications, the more those

applications become the cost of doing business rather than a source of differentiation (McKinsey). Investments in information technology will only be differentiable if they are accompanied by changes in business process that are not easily copied. Various information technology services such as back-end programming and tax preparation are being outsourced because the work itself does not require specialized knowledge. Given the low transportation costs of information, the only other factor of production is the cost of labor, which countries like India clearly have the advantage in. Combined with the drop in domestic demand for information technology services, it makes sense for firms to focus on higher-end activities while outsourcing lower-end IT-enabled activities (Baily and Lawrence). The same dynamic exists in manufacturing where U.S. firms produce highly customized products whereas developing nations such as China are producing batch commodities.

However, the burning question becomes should developing nations be comfortable with this niche of performing low-end IT services and commodity manufacturing? Through examination of these sectors, it has become clear that information technology will enable a firm to excel if it is advanced in tandem with business innovation. Ultimately, companies in developing countries have the burden of innovation to bear to really become competitors in the global economy. However, Western firms are providing them with ample opportunity. It is projected that over 3.4 million IT jobs will be offshored by 2015 by the U.S. alone. Firms in developing countries will be well acquainted with the basics of IT services; one has to crawl before they can walk. With this investment in human capital, it is possible that these workers will go off and create their own Microsoft or Amazon.com. Let's hope so.

Works Cited

Baily, Martin N. and Robert Z. Lawrence. "What Happened to the Great U.S. Job Machine? The Role of Trade and Offshoring," **Brookings Panel on Economic Activity.** September 9, 2004.

Bartel, Ann, Casey Ichniowski and Kathryn Shaw. "The Strategic Investment in Information Technologies and New Human Resource Practices and Their Effects on Productivity," **An "Insider" Econometric Analysis.** October 21, 2004.

McKinsey and Company. "How IT Enables Productivity Growth," October 2002.