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Impacts of Information Technology on Society in the new Century

1 Introduction

In the past few decades there has been a revolution in computing and communications, and all indications are that technological progress and use of information technology will continue at a rapid pace. Accompanying and supporting the dramatic increases in the power and use of new information technologies has been the declining cost of communications as a result of both technological improvements and increased competition. According to Moore's law the processing power of microchips is doubling every 18 months. These advances present many significant opportunities but also pose major challenges. Today, innovations in information technology are having wide-ranging effects across numerous domains of society, and policy makers are acting on issues involving economic productivity, intellectual property rights, privacy protection, and affordability of and access to information. Choices made now will have long-lasting consequences, and attention must be paid to their social and economic impacts.

One of the most significant outcomes of the progress of information technology is probably electronic commerce over the Internet, a new way of conducting business. Though only a few years old, it may radically alter economic activities and the social environment. Already, it affects such large sectors as communications, finance and retail trade and might expand to areas such as education and health services. It implies the seamless application of information and communication technology along the entire value chain of a business that is conducted electronically.

The following sections will focus on the impacts of information technology and electronic commerce on business models, commerce, market structure, workplace, labour market, education, private life and society as a whole.

2 Business Models, Commerce and Market Structure

One important way in which information technology is affecting work is by reducing the importance of distance. In many industries, the geographic distribution of work is changing significantly. For instance, some software firms have found that they can overcome the tight local market for software engineers by sending projects to India or other nations where the wages are much lower. Furthermore, such arrangements can take advantage of the time differences so that critical projects can be worked on nearly around the clock. Firms can outsource their manufacturing to other nations and rely on telecommunications to keep marketing, R&D, and distribution teams in close contact with the manufacturing groups. Thus the technology can enable a finer division of labour among countries, which in turn affects the relative demand for various skills in each nation. The technology enables various types of work and employment to be decoupled from one another. Firms have greater freedom to locate their economic activities, creating greater competition among regions in infrastructure, labour, capital, and other

resource markets. It also opens the door for regulatory arbitrage : firms can increasingly choose which tax authority and other regulations apply.

Computers and communication technologies also promote more market-like forms of production and distribution. An infrastructure of computing and communication technology, providing 24-hour access at low cost to almost any kind of price and product information desired by buyers, will reduce the informational barriers to efficient market operation. This infrastructure might also provide the means for effecting real-time transactions and make intermediaries such as sales clerks, stock brokers and travel agents, whose function is to provide an essential information link between buyers and sellers, redundant. Removal of intermediaries would reduce the costs in the production and distribution value chain. The information technologies have facilitated the evolution of enhanced mail order retailing, in which goods can be ordered quickly by using telephones or computer networks and then dispatched by suppliers through integrated transport companies that rely extensively on computers and communication technologies to control their operations. Nonphysical goods, such as software, can be shipped electronically, eliminating the entire transport channel. Payments can be done in new ways. The result is disintermediation throughout the distribution channel, with cost reduction, lower end-consumer prices, and higher profit margins.

The impact of information technology on the firms' cost structure can be best illustrated on the electronic commerce example. The key areas of cost reduction when carrying out a sale via electronic commerce rather than in a traditional store involve physical establishment, order placement and execution, customer support, staffing, inventory carrying, and distribution. Although setting up and maintaining an e-commerce web site might be expensive, it is certainly less expensive to maintain such a storefront than a physical one because it is always open, can be accessed by millions around the globe, and has few variable costs, so that it can scale up to meet the demand. By maintaining one 'store' instead of several, duplicate inventory costs are eliminated. In addition, e-commerce is very effective at reducing the costs of attracting new customers, because advertising is typically cheaper than for other media and more targeted. Moreover, the electronic interface allows e-commerce merchants to check that an order is internally consistent and that the order, receipt, and invoice match. Through e-commerce, firms are able to move much of their customer support on line so that customers can access databases or manuals directly. This significantly cuts costs while generally improving the quality of service. E-commerce shops require far fewer, but high-skilled, employees. E-commerce also permits savings in inventory carrying costs. The faster the input can be ordered and delivered, the less the need for a large inventory. The impact on costs associated with decreased inventories is most pronounced in industries where the product has a limited shelf life (e.g. bananas), is subject to fast technological obsolescence or price declines (e.g. computers), or where there is a rapid flow of new products (e.g. books, music). Although shipping costs can increase the cost of many products purchased via electronic commerce and add substantially to the final price, distribution costs are significantly reduced for digital products such as financial services, software, and travel, which are important e-commerce segments.

Although electronic commerce causes the disintermediation of some intermediaries, it creates greater dependency on others and also some entirely new intermediary functions. Among the intermediary services that could add costs to e-commerce transactions are advertising, secure online payment, and delivery. The relative ease of becoming an e-commerce merchant and setting up stores results in such a huge number of offerings that consumers can easily be overwhelmed. This increases the importance of using advertising to establish a brand name and thus generate consumer familiarity and trust. For new e-commerce start-ups, this process can be expensive and represents a significant transaction cost. The openness, global reach, and lack of physical clues that are inherent characteristics of e-commerce also make it vulnerable

to fraud and thus increase certain costs for e-commerce merchants as compared to traditional stores. New techniques are being developed to protect the use of credit cards in e-commerce transactions, but the need for greater security and user verification leads to increased costs. A key feature of e-commerce is the convenience of having purchases delivered directly. In the case of tangibles, such as books, this incurs delivery costs, which cause prices to rise in most cases, thereby negating many of the savings associated with e-commerce and substantially adding to transaction costs.

With the Internet, e-commerce is rapidly expanding into a fast-moving, open global market with an ever-increasing number of participants. The open and global nature of e-commerce is likely to increase market size and change market structure, both in terms of the number and size of players and the way in which players compete on international markets. Digitized products can cross the border in real time, consumers can shop 24 hours a day, seven days a week, and firms are increasingly faced with international online competition. The Internet is helping to enlarge existing markets by cutting through many of the distribution and marketing barriers that can prevent firms from gaining access to foreign markets. E-commerce lowers information and transaction costs for operating on overseas markets and provides a cheap and efficient way to strengthen customer-supplier relations. It also encourages companies to develop innovative ways of advertising, delivering and supporting their product and services. While e-commerce on the Internet offers the potential for global markets, certain factors, such as language, transport costs, local reputation, as well as differences in the cost and ease of access to networks, attenuate this potential to a greater or lesser extent.

3 Workplace and Labour Market

Computers and communication technologies allow individuals to communicate with one another in ways complementary to traditional face-to-face, telephonic, and written modes. They enable collaborative work involving distributed communities of actors who seldom, if ever, meet physically. These technologies utilize communication infrastructures that are both global and always up, thus enabling 24-hour activity and asynchronous as well as synchronous interactions among individuals, groups, and organizations. Social interaction in organizations will be affected by use of computers and communication technologies. Peer-to-peer relations across department lines will be enhanced through sharing of information and coordination of activities. Interaction between superiors and subordinates will become more tense because of social control issues raised by the use of computerized monitoring systems, but on the other hand, the use of e-mail will lower the barriers to communications across different status levels, resulting in more uninhibited communications between supervisor and subordinates.

That the importance of distance will be reduced by computers and communication technology also favours telecommuting, and thus, has implications for the residence patterns of the citizens. As workers find that they can do most of their work at home rather than in a centralized workplace, the demand for homes in climatically and physically attractive regions would increase. The consequences of such a shift in employment from the suburbs to more remote areas would be profound. Property values would rise in the favoured destinations and fall in the suburbs. Rural, historical, or charming aspects of life and the environment in the newly attractive areas would be threatened. Since most telecommuters would be among the better educated and higher paid, the demand in these areas for high-income and high-status services like gourmet restaurants and clothing boutiques would increase. Also would there be an expansion of services of all types, creating and expanding job opportunities for the local population.

By reducing the fixed cost of employment, widespread telecommuting should make it easier for individuals to work on flexible schedules, to work part time, to share jobs, or to hold two or more jobs simultaneously. Since changing employers would not necessarily require changing one's place of residence, telecommuting should increase job mobility and speed career advancement. This increased flexibility might also reduce job stress and increase job satisfaction. Since job stress is a major factor governing health there may be additional benefits in the form of reduced health costs and mortality rates. On the other hand one might also argue that technologies, by expanding the number of different tasks that are expected of workers and the array of skills needed to perform these tasks, might speed up work and increase the level of stress and time pressure on workers.

A question that is more difficult to be answered is about the impacts that computers and communications might have on employment. The ability of computers and communications to perform routine tasks such as bookkeeping more rapidly than humans leads to concern that people will be replaced by computers and communications. The response to this argument is that even if computers and communications lead to the elimination of some workers, other jobs will be created, particularly for computer professionals, and that growth in output will increase overall employment. It is more likely that computers and communications will lead to changes in the types of workers needed for different occupations rather than to changes in total employment.

A number of industries are affected by electronic commerce. The distribution sector is directly affected, as e-commerce is a way of supplying and delivering goods and services. Other industries, indirectly affected, are those related to information and communication technology (the infrastructure that enables e-commerce), content-related industries (entertainment, software), transactions-related industries (financial sector, advertising, travel, transport). E-commerce might also create new markets or extend market reach beyond traditional borders. Enlarging the market will have a positive effect on jobs. Another important issue relates to interlinkages among activities affected by e-commerce. Expenditure for e-commerce-related intermediate goods and services will create jobs indirectly, on the basis of the volume of electronic transactions and their effect on prices, costs and productivity. The convergence of media, telecommunication and computing technologies is creating a new integrated supply chain for the production and delivery of multimedia and information content. Most of the employment related to e-commerce involves around the content industries and communication infrastructure such as the Internet.

Jobs are both created and destroyed by technology, trade, and organizational change. These processes also underlie changes in the skill composition of employment. Beyond the net employment gains or losses brought about by these factors, it is apparent that workers with different skill levels will be affected differently. E-commerce is certainly driving the demand for IT professionals but it also requires IT expertise to be coupled with strong business application skills, thereby generating demand for a flexible, multi-skilled work force. There is a growing need for increased integration of Internet front-end applications with enterprise operations, applications and back-end databases. Many of the IT skill requirements needed for Internet support can be met by low-paid IT workers who can deal with the organizational services needed for basic web page programming. However, wide area networks, competitive web sites, and complex network applications require much more skill than a platform-specific IT job. Since the skills required for e-commerce are rare and in high demand, e-commerce might accelerate the upskilling trend in many countries by requiring high-skilled computer scientists to replace low-skilled information clerks, cashiers and market salespersons.

4 Education

Advances in information technology will affect the craft of teaching by complementing rather than eliminating traditional classroom instruction. Indeed the effective instructor acts in a mixture of roles. In one role the instructor is a supplier of services to the students, who might be regarded as its customers. But the effective instructor occupies another role as well, as a supervisor of students, and plays a role in motivating, encouraging, evaluating, and developing students. For any topic there will always be a small percentage of students with the necessary background, motivation, and self-discipline to learn from self-paced workbooks or computer assisted instruction. For the majority of students, however, the presence of a live instructor will continue to be far more effective than a computer assisted counterpart in facilitating positive educational outcomes. The greatest potential for new information technology lies in improving the productivity of time spent outside the classroom. Making solutions to problem sets and assigned reading materials available on the Internet offers a lot of convenience. E-mail vastly simplifies communication between students and faculty and among students who may be engaged in group projects.

Although distance learning has existed for some time, the Internet makes possible an large expansion in coverage and better delivery of instruction. Text can be combined with audio/video, and students can interact in real time via e-mail and discussion groups. Such technical improvements coincide with a general demand for retraining and upskilling by those who, due to work and family demands, cannot attend traditional courses. Distance learning via the Internet is likely to complement existing schools for children and university students, but it could have more of a substitution effect for continuing education programmes. For some degree programmes, high-prestige institutions could use their reputation to attract students who would otherwise attend a local facility. Owing to the Internet's ease of access and convenience for distance learning, overall demand for such programmes will probably expand, leading to growth in this segment of e-commerce.

As shown in the previous section, high level skills are vital in a technology-based and knowledge-intensive economy. Changes associated with rapid technological advances in industry have made continual upgrading of professional skills an economic necessity. The goal of lifelong learning can only be accomplished by reinforcing and adapting existing systems of learning, both in public and private sectors. The demand for education and training concerns the full range of modern technology. Information technologies are uniquely capable of providing ways to meet this demand. Online training via the Internet ranges from accessing self-study courses to complete electronic classrooms. These computer-based training programmes provide flexibility in skills acquisition and are more affordable and relevant than more traditional seminars and courses.

5 Private Life and Society

Increasing representation of a wide variety of content in digital form results in easier and cheaper duplication and distribution of information. This has a mixed effect on the provision of content. On the one hand, content can be distributed at a lower unit cost. On the other hand, distribution of content outside of channels that respect intellectual property rights can reduce the incentives of creators and distributors to produce and make content available in the first place. Information technology raises a host of questions about intellectual property protection and new tools and regulations have to be developed in order to solve this problem.

Many issues also surround free speech and regulation of content on the Internet, and there

continue to be calls for mechanisms to control objectionable content. However it is very difficult to find a sensible solution. Dealing with indecent material involves understanding not only the views on such topics but also their evolution over time. Furthermore, the same technology that allows for content filtering with respect to decency can be used to filter political speech and to restrict access to political material. Thus, if censorship does not appear to be an option, a possible solution might be labeling. The idea is that consumers will be better informed in their decisions to avoid objectionable content.

The rapid increase in computing and communications power has raised considerable concern about privacy both in the public and private sector. Decreases in the cost of data storage and information processing make it likely that it will become practicable for both government and private data-mining enterprises to collect detailed dossiers on all citizens. Nobody knows who currently collects data about individuals, how this data is used and shared or how this data might be misused. These concerns lower the consumers' trust in online institutions and communication and, thus, inhibit the development of electronic commerce. A technological approach to protecting privacy might be cryptography although it might be claimed that cryptography presents a serious barrier to criminal investigations.

It is popular wisdom that people today suffer information overload. A lot of the information available on the Internet is incomplete and even incorrect. People spend more and more of their time absorbing irrelevant information just because it is available and they think they should know about it. Therefore, it must be studied how people assign credibility to the information they collect in order to invent and develop new credibility systems to help consumers to manage the information overload.

Technological progress inevitably creates dependence on technology. Indeed the creation of vital infrastructure ensures dependence on that infrastructure. As surely as the world is now dependent on its transport, telephone, and other infrastructures, it will be dependent on the emerging information infrastructure. Dependence on technology can bring risks. Failures in the technological infrastructure can cause the collapse of economic and social functionality. Black-outs of long-distance telephone service, credit data systems, electronic funds transfer systems, and other such vital communications and information processing services would undoubtedly cause widespread economic disruption. However, it is probably impossible to avoid technological dependence. Therefore, what must be considered is the exposure brought from dependence on technologies with a recognizable probability of failure, no workable substitute at hand, and high costs as a result of failure.

6 Conclusion

The ongoing computing and communications revolution has numerous economic and social impacts on modern society and requires serious social science investigation in order to manage its risks and dangers. Such work would be valuable for both social policy and technology design. Decisions have to be taken carefully. Many choices being made now will be costly or difficult to modify in the future.