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Human Resource Development: Where to Invest for the Future?*

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"In five years' time, all companies will be Internet companies, or they won't be companies at all."

Andy Grove, Chairman of Intel Corporation

1. INTRODUCTION

The new millennium will be the millennium of the 'information society,' where the economy is 'knowledge-based' and the main driving technology is Information and Communications Technology (ICT).[1] The technology has changed the way we lead our lives from the way we work, the way we learn, to the way we live at an unprecedented speed. It has also significantly changed the mix of skills which are demanded by the workplace. The aim of this article is to analyze the impact of ICT on the demand for skills in the context of Asian developing countries, and to draw some policy recommendations concerning human resource development for those countries.

This article is organized in five sections. The first section is the introduction. The second section discusses the impact of ICT on overall economic efficiency and productivity. Section 3 compares operations and human resource requirements between firms that aggressively use ICT to turn themselves into 'virtual firms' and their more traditional counterparts. Section 4 draws some implications of ICT for human resources in Asian developing countries. The last section draws some conclusions and provides recommendations on human resource development policy in preparation for the information society.

2. ICT AND THE 'NEW ECONOMY'

Rapid technological progress in ICT and its speedy proliferation among developed countries have led to speculation that the widespread adoption of ICT will lead to a 'frictionless' economy, i.e., one in which transaction costs gradually approach zero, barriers to entry disappear, markets respond instantaneously and productivity increases substantially. In such an economy, there would be stable economic growth and low inflation, or the so-called 'New Economy.'[2]

Currently, most speculation related to the 'New Economy' can be neither confirmed nor rejected. For example, the impact of ICT on overall productivity, the so-called 'productivity paradox,' is far from being conclusively understood. Economists are especially having difficulties explaining why the widespread adoption of ICT has not resulted in an increase in the official productivity index.

There are plenty of explanations for the productivity paradox. Some argued that the utility and usefulness of the existing ICT are rather limited due to poor design (Landauer 1995). Others have suggested that there is a redistribution effect whereby virtual firms compete away business from their traditional competitors, or that there is a significant time lag between ICT investment and return. Resource misallocation problems—i.e., firms over-allocating their resources toward the accumulation of hardware and software but under-allocating resources to training—is another alternative explanation. There are also macroeconomic explanations. Some have suggested that the amount of ICT capital stock contributes too small a share to the total capital stock in the economy to have any visible impact, while others believe that these are factors that mask ICT's contributions to overall economic growth. Interested readers should refer to Murakami 1998 and Brynjolfsson 1993.

While the impacts of ICT on economy-wide productivity is far from conclusive, there are preliminary results that show that the rate of return of ICT capital is higher than 50 percent. This figure overwhelms that of ordinary capital, which is approximately 30 percent. It must be noted, however, that ICT capital has a higher depreciation rate than does ordinary capital (Murakami 1998). There are also numerous case studies confirming that the use of ICT contributed significantly to higher productivity levels among firms. For example, it was shown that ICT helps to reduce production costs, speed up product life cycles, reduce inventories, marketing, and distribution costs, and provides better after-sales service to consumers at lower costs (see, for example, OECD 1999). The next section will discuss in greater detail how ICT improves the competitiveness of a firm and changes the types of skills in demand.

3. IMPACTS OF ICT ON BUSINESS MODELS AND SKILLS DEMANDED

The application of ICT to the world of commerce is best exemplified by the concept of electronic commerce (E-Commerce). Narrowly defined, E-Commerce is the conduct of business on-line, e.g., the selling and buying of products and services through Web store-fronts. The actual products traded may be physical products, such as used cars, or services, such as travel services, on-line medical consultation, or distance education. There is an increasing on-line presence of products that can be easily digitized, such as news, audio and video material, database information, software, and all sorts of knowledge-based products.

E-Commerce, however, is not limited to the selling of products on-line. Along with its customers, a virtual firm will also find its suppliers, accountants, methods of payment, government agencies, and competitors on-line. These on-line partners demand changes in the way in which business is done, from production to consumption. Through on-line selling, E-Commerce will lead to significant changes in the way products are customized, distributed, and exchanged, and the way in which consumers search for products and services. In short, the E-Commerce revolution is the revolution of processes. A process-oriented definition of E-Commerce offers a broader view of what E-Commerce represents. Intra-firm processes (e.g., manufacturing, inventory management, corporate financial management, operations), and inter-firm processes (e.g., supply-chain management, bidding) are affected by the same technology and networks as are business-to-consumer processes.

For example, General Electric (GE) has developed a Web-based link to its suppliers known as the Trade Process Network (TPN) in order to receive quick responses from suppliers to its call for bids. The system features an electronic catalog and accommodates electronic purchases, with the option of paying on-line using an electronic credit card. The adoption of the TPN has cut the average length of a procurement cycle in half, processing costs by a third, and the cost of goods purchased by anywhere from 5-50 percent. GE now conducts business worth over $1 billion on the Web annually. The total number of suppliers that it deals with has declined, but the remaining ones have proved more efficient.

To see the impacts of ICT on the way business is conducted, it is useful to compare some operating parameters of virtual and physical stores. Figure 1 and Table 1 compare basic operating statistics in 1997 for Amazon.Com, the most famous virtual bookstore, and its traditional rivals Barnes & Noble and Borders in terms of sales, inventory cost, employment, etc.[3] The rest of this section will analyze and compare operating costs, employment, and skill requirements in virtual and physical firms.

3.1 Operating Costs

Virtual firms in general operate on much lower gross margins than do their traditional counterparts. For example, Amazon's gross sales margin was only 19.5 percent in 1997, while Borders' was 26.6 percent (Figure 1). This is because the on-line bookstore offers steeper discounts to its customers. However, it is less expensive to maintain an on-line storefront than a traditional one because it does not require display space or storage space. Also, it never has to close, can be accessed by millions worldwide, has few variable costs, and can expand to meet increases in demand. Moreover, by maintaining a single store instead of thousands, inventory costs are minimized. With a smaller inventory and lower property and equipment costs, lower margins are possible.

3.2 Employment

Virtual firms usually employ fewer employees than their traditional counterparts with comparable sales volumes. For example, Amazon.Com, with a sales volume of $148 million, employed only 614 people in

1997 (4.2 employees per $1 million), while Barnes & Noble, with a sales volume of $2.8 billion, had 27,200 employees (9.7 employees per $1 million) (Table 1). The number of employees per sales unit can be much lower for virtual firms that sell high-value products. For example, NECX, a catalog turned E-Commerce seller of personal computers, generated $50 million from its on-line storefront in 1997, but employed only 39 people (0.78 employees per $1 million). Moreover, virtual firms can easily expand the scale of their operations with little increase in the number of employees. For example, during 1997-1998, Amazon.Com expanded its sales volume by 4.1 times while the number of employees increased only 3.4 times. Consequently, in 1998, every 3.44 employees generated $1 million of sales revenue. In comparison, Barnes & Noble could only afford a marginal cut in its workforce, mainly from the introduction of its on-line operations. In 1998, it took 9.65 Barnes & Noble employees to generate $1 million in sales revenue, a figure which is almost triple that of Amazon.Com.

Similar examples of labor savings associated with the use of ICT are abundant. For example, Federal Express reported that their on-line consumer service system saved them from hiring an additional 20,000 people, representing approximately 14 percent of their total labor force. Cisco, the leading U.S. communication equipment manufacturer, reported that it did not have to hire 1,000 new staff for its sales and support group, thanks to its use of E-Commerce. GE reported that its labor costs associated with procurement have declined by 30 percent. These cases suggest that reductions in personnel expenditures can be significant and represent a major cost savings associated with the use of ICT.[4]

3.3 Skill Composition of Workforce

Virtual firms require a very technically skilled workforce, while their traditional counterparts employ only few information technology specialists. Although information on the skill composition of the workforces of the three bookstores is unavailable, it is estimated that engineers and software developers may make up more than 25 percent of the workforce of virtual firms like Amazon.Com. For example, 'Portal' service companies like Yahoo!, Excite and Infoseek Corp. have, respectively, 19 percent, 35 percent and 26 percent of their workforces located in their research and development departments (see Table 2). About half of NECX employees are skilled technical support staff. Thus, one should consider these on-line companies not as ordinary retailers, but as ICT companies. Apart from the technical people, virtual firms also employ personnel with advanced business skills who understand ICT business models.

Table 3 exemplifies some highly paid jobs related to E-Commerce. It should be noted that not all jobs are technical or engineering jobs. In fact, many jobs require matching technological capabilities with business and marketing skills. Inter-personal communication skills are also deemed essential, as the people in charge of each area have to work together as a team.

4. IMPLICATION FOR ASIAN COUNTRIES

Examples from developed countries have clearly shown that ICT has brought about a more efficient means of conducting business and lower transaction costs to the overall economy, which serve to enhance the overall competitiveness of these countries. The pace of the adoption of E-Commerce in these countries is very fast. For example, GE expects to conduct its procurement almost entirely through the TPN bidding system within five years. Other large companies are moving in the same direction. Further adoption of ICT in developed countries will inevitably put increasing pressure on Asian companies, which trade extensively with these countries. Unless they join the electronic supply chain, Asian companies will lose their comparative advantage as suppliers of cheap but high quality parts and raw materials to those large multinational corporations that have fully automated their supply chain management. Recently, central and local governments of some OECD countries, e.g., Canada, have also decided to move their procurement process on-line.

It is conceivable that in a few years small and medium sized Asian companies that are currently supplying parts and raw materials to large companies in the U.S. and Europe will lose their markets unless they integrate themselves into their customers' electronic supply chains. Losses of market share will likely be most pronounced in those sectors that were early adopters of ICT-based trading, e.g., retail, pharmaceutical, automobile, and electronics industries. As the information era is fast approaching, Asian companies will have no choice but to upgrade their ICT capabilities and modify their business models accordingly.

For the above reason, Asian countries are competing intensively with one another to create their own ICT industries. Policy makers in most Asian countries desire to have all the ICT industries in their country—i.e., microelectronics, telecommunications, computer hardware, and software. Most ambitious perhaps is Malaysia's Multimedia Supercorridor (MSC) project that was started in 1997. The objective of this project is to attract ICT multinational corporations to the country. Fearful of falling behind, the Thai government has initiated the software park project to promote the establishment of a local software industry. Singapore, meanwhile, has declared in its E-Commerce master plan that E-Commerce will be central to Singapore's future competitiveness.

Early adoption of ICT in the conducting of business will be crucial to two aspects of the competitiveness of Asian firms. Firstly, as mentioned above, the adoption of ICT will help Asian companies maintain access to markets in developed countries and prepare themselves for new business opportunities. Secondly, as the adoption of ICT becomes widespread, the ICT industry will cease to be a separate industry and become instead the basic infrastructure of the information society. The adoption of ICT will be crucial to maintain the competitiveness of almost every industry, i.e., retail, finance, tourism, manufacturing, etc.

As the world moves forward into the information society, the availability of highly skilled workers will become increasingly important. With trade, investment and financial liberalization, goods, services, and capital can move across borders at lower costs. However, due to regulation, geography, and cultural differences, human resources will never be as mobile as other factors of production. Thus, human capital endowment will become one of the most important factors determining the relative competitiveness of a country in the same way that other non-tradable factors, such as physical infrastructures, are. In the future, a country with a well-educated and relatively cheap workforce skilled in ICT will most likely have a comparative advantage in the production of goods and services.

With this in mind, it is foreseeable that the major stumbling block to the successful adoption of ICT in Asian countries will be their limited ICT human resources. Some Asian countries have already experienced a shortage in ICT skills. India had a work force of approximately 160,000 high-skilled software professionals in 1996-97. Although it supplies graduates at a pace of about 55,000 a year, this may be insufficient to keep pace with its software industry which is growing by over 40 percent a year. At the moment, Malaysian universities are producing less than 6,000 ICT engineers a year, while demand is estimated at 10,000 or more.[5]

5. POLICY RECOMMENDATIONS

In the short term, Asian countries can cope with the problem of ICT labor shortages by changing their laws and regulations to allow greater cross-border labor mobility. For example, Singapore is attracting foreign skilled workers by lowering the cost of renting houses, providing tax deductions for employers who undertake overseas recruitment, and reviewing the criteria for eligibility of employment pass holders (CSC 1998). Similarly, the MSC status companies in Malaysia have been given full flexibility to recruit knowledge workers from abroad under the MSC's Bill of Guarantees (PriceWaterhouse 1998). The long-term solution for most countries, however, requires that skilled labor be homegrown.

5.1 Expansion of Tertiary Education

The expansion of tertiary education will be necessary for a country aiming to enter the information era. It will bring about not only more equity, but also more efficiency since it will provide a larger pool of talented people for the workplace to draw on. Currently, college enrollment ratios in most developing Asian countries are relatively low. In some countries, e.g., Thailand and Indonesia, this is due to low enrollment ratios at the secondary level. The draft National Education Act of Thailand, which mandates free universal education until 12^{th} grade, marked an important step forward. In the case of Malaysia, where enrollment ratios in secondary education are already high, the objective is to raise the enrollment ratio in tertiary educational institutions from the current 13 percent to 20 percent by the year 2000. However, it will not be sufficient just to increase the overall enrollment level. For long-term growth, increasing the proportion of students majoring in mathematics, science, and engineering will also be important (Murphy et al. 1991). Thus, the expansion of tertiary education in science and technology would yield high economic and social returns for some Asian countries, especially Thailand and the Philippines, where the current proportion of students majoring in these fields is relatively low.

5.2 Reform of Formal Education Curriculum

As was shown in section 3, those skills needed by the ICT industry will be considerably different from those currently provided by formal education. Thus, there is an urgent need to reform curriculums accordingly. The overall direction of the new curriculum should aim to reduce the traditional emphasis on the learning of factual knowledge and focus more instead on the learning of 'information-processing skills.' This is because memorized facts will be of little use in an age in which the volume of information doubles every two to three years, and becomes obsolete quickly. Moreover, we now have products of the new technology, e.g., CD-ROMs and the Internet, which can readily provide facts at a very low cost.[6]

Workforces of the future will need to be ICT literate so as to be able to access the information required for problem solving. They also need to learn information-processing skills in order to be able to utilize these facts. They will also be required to be information literate and capable of abstract thinking, systems thinking, presentation, inter-personal communication, and collaboration. Subjects tailored for such a curriculum would tend to be more 'meta-subjects'—i.e., subjects that are more concerned with learning how to learn rather than merely the learning of facts. To achieve this, radical and new ways of thinking are needed. For example, to stimulate collaboration among students, it may be necessary to evaluate students under a new incentive system that takes information production and information sharing into account.

5.3 Reform of Training Systems

To develop a new training system for ICT skills effectively, we need to take into consideration their unique characteristics. Firstly, most of them are 'tacit' rather than 'codified' forms of knowledge that require a lot of training and experience in order to operate efficiently. Secondly, because of the rapid pace of technological change, training and continuous re-training are necessary. Otherwise the accumulated skills will rapidly become obsolete. For example, within ten years most of the technology we operate today will be obsolete, and have been replaced by new technology. Thirdly, most ICT skills will be generic skills, some will be industry specific skills, and a few will be firm-specific skills. For example, the skills required to write computer programs could be employed in any firm or industry. Thus, there are potential spillovers when ICT personnel changes job. Also investment in ICT training can generate additional spillovers by enhancing the level of technical sophistication of the overall economy, thereby allowing it to operate more efficiently.

In short, while the accumulation of ICT skills requires extensive investments in training, externalities raise the questions of whether private investment alone will provide optimal returns, and whether there are rationales for government intervention in the marketplace. However, considering that skilled personnel will be highly paid, there should be incentives for workers to invest in training themselves. Thus, instead of fully subsidizing potential ICT and other skilled workers, the government should devise a scheme by which the cost of training is suitably allocated among workers, businesses, and the public. Incentive schemes that cover part of the training cost could be designed to encourage individuals and businesses to invest more in training in some cases, e.g., where training leads to certifiable and critical skills.

Institutional innovations will also be important. The government should encourage firms with many highly skilled workers to adopt new compensation schemes, e.g., performance-based variable pay, employee stock options (ESOPs), etc., to retain talented staff. Closer interaction between the workplace and educational institutes will also be necessary. Finally, special attention needs to be paid to the training of workers who cannot keep up with the changing technology to facilitate their transfer to other jobs.

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