The Digital Divide in East Asia

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The concept of a ‘digital divide’—inequality in access to modern information and communication technologies (ICTs) between industrialised and developing countries, and between urban and rural populations—has attracted much attention from policymakers, aid organisations, media and the general public. This paper places discussion of the digital divide in a broader economic context, linking it with the theory of economic growth and technological change. The network effects of diffusion of the Internet are related to the possibility of leap-frogging by latecomers. This is seen as a ‘digital opportunity’ presented to developing countries by the ‘new economy’. This paper discusses the appropriate policy environment for bridging the digital divide, and concludes that the East Asian region has much to gain from the complementarities of its economies, their openness to trade in ICT products, and policy cooperation.

Introduction

People are fascinated by technology. It pushes against the boundaries of the conceivable and expands human capability. Technology penetrates all aspects of human life and in recent years has connected people all over the globe through the World Wide Web. The speed of Internet expansion has been remarkable. While it took the telephone about 75 years to connect 50 million users, the World Wide Web has achieved the same numbers in four years (Pyramid Research 1999). Everything seems to be happening much faster today, but not for everyone. About one in three people in the world have never made a telephone call. Seventy per cent of the world’s poor, living in rural areas, do not have a reliable telecommunications infrastructure (DOT Force 2001). English, the language of less than 10 per cent of the world’s population, has become the main language of the Web, creating an effective barrier to access by many users from developing countries. The 20 per cent of the world’s inhabitants who live on a budget of less than US$1 per day, and those one in seven who suffer from chronic hunger, are obviously not among the happy Web surfers (Accenture, Markle Foundation and UNDP 2001:1).

The startling gap between information haves and have-nots has been called the ‘digital divide’. This divide has a number of dimensions. It refers to a widening gap between industrialised and developing countries in access to information and communication technologies (ICTs), that is, digital technology for processing information and delivering it via telecommunications. There is also significant heterogeneity within regions, with different developing countries within the same region catching up at different rates. Differences within national borders, according to location,
gender, disability or income, are also dimensions of the digital divide.\(^1\)

The concept of the digital divide assumes that ICTs play a special role in the modern economy. The dramatic increase in the speed of connections and the reduction in the price of telecommunications services have increased the international flow of information and accelerated the diffusion of knowledge. The view that knowledge is the main driver of growth, wealth creation and employment across all industries is a cornerstone of the concept of a ‘knowledge-based economy’ (APEC 2000). The concept of the new economy attributes sustainable long-term growth to the use of information networks through ICTs, and to a set of favourable policies encouraging innovation, entrepreneurship and human resource development (CEA 2001; OECD 2001).

In either view, knowledge and ICTs are interdependent drivers of economic growth. Rapid change in ICTs poses the question of whether lack of infrastructure to support information networks fixes an economy on a divergent path of development, or whether catch-up and therefore convergence are possible through natural processes or as a consequence of policy initiatives or both. And if policy is important, which policy?

The spectrum of views and attitudes towards the digital divide is wide. On one side are the World Bank, the United Nations Development Programme and other international institutions and regional fora actively working to close the divide. On the other side, there are the sceptics. What the poor need is a combination of basic education, basic mechanisation and infrastructure so they can let the full effect of market forces raise them to the next level. Closing the digital divide would be good, but right now most of Asia’s poor are still looking forward to home electricity (FEER 2001).

In the middle of the spectrum there is the view that while ICTs, through dissemination of knowledge, play a key role in growth, there is no economic reason to expect the divide to deepen over time. The disparities among the APEC economies in their telecommunications infrastructure could vanish at an accelerating rate (Choi 2000). Diffusion of ICTs could slow down in the industrialised countries and pick up in the developing world, narrowing the divide. The “[d]igital divide is an agenda driven by politics rather than by solid economics” (Choi 2000:30), with the implication that scarce economic resources might find better use elsewhere, for example, in strengthening the financial system or providing more education.\(^2\)

**Current situation in East Asia**

ICT infrastructure development varies widely within the East Asian region. According to the International Telecommunication Union (ITU) data for 1999,\(^3\) Internet penetration in East Asia stands at four hosts and 115 users per 10,000 population on average. But, there are countries such as Singapore, with 460 Internet hosts and more than 2,900 Internet users per 10,000 population. This is quite close to the corresponding numbers for Australia (576 Internet hosts and 3,172 users per 10,000 inhabitants). The Nielsen/NetRatings research data on Internet activity in the world suggest that the top four locations, in number of Web pages viewed per person, are South Korea (90 page views per person), Taiwan (76), Hong Kong (62) and Singapore (56) (Nairne 2001). The difference in computer stock between countries in the region is striking: there are 53 computers per 100 population in Singapore but only 18 in Korea, seven in Malaysia, two in the Philippines and 0.1 in Myanmar.

Figure 1 provides a snapshot of the relative positions of countries within the Asia Pacific region.\(^4\) The top three rays of the star indicate key economic variables, namely population

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1. See Lloyd et al. (2000) for a recent discussion of the digital divide in Australia.
2. In arriving to this conclusion, Choi uses the S-shaped diffusion curve proposed in Davies (1979), and Gort and Klepper (1982).
3. Even though ITU data for 2000 are available, 1999 data have been reported in this section to ensure time consistency with UNESCO data for education used to construct Figure 1.
4. See APEC (2000) for a more extensive discussion of indicators of the extent of the digital divide.
density, GDP per capita and the services share of GDP. On the right-hand side are telecommunications and IT indicators, including telecommunications penetration rates, and computer and Internet access. On the left-hand side are a series of population and education indicators, including adult literacy, teacher–pupil ratio in primary education, and the share of the urban population in the total. Higher scores for all these variables are expected to be associated with a greater capacity to make more effective use of ICTs. A ‘missing element’ in the star graph for the region visually suggests that this indicator is low in that economy compared to the average across the region.

The size of the shapes in Figure 1 indicate the degree of development of economies in terms of these indicators. The upper-left ray in the shapes indicates population density. Lack of this ray for Australia and New Zealand indicates their relatively low population density (two and 14 persons per square kilometre, respectively) compared to Singapore and Hong Kong. In the latter, population density is overwhelmingly higher, above 6,300 people per square km. The industrialised countries have a high share of urban population, which makes it more economical to extend network infrastructure (and raises the separate issue of an urban–rural divide).

Countries in the East Asian region are very different in terms of their income, telecommunications infrastructure and policy, information technology penetration and human development. Industrialised countries in the sample are followed by Hong Kong, Singapore, Korea, Malaysia and Brunei. Cambodia and Nepal are at the opposite extreme, with the lowest reported levels of all indicators. The relative strengths and weaknesses of different countries can be visually assessed on the diagram.

There are large deviations in access to telecommunications infrastructure and computer technology within the East Asian region (Figure 1). Lack of infrastructure creates the most obvious physical barrier to the use of technology networks. The cost of using telecommunications and accessing the Internet is another barrier. High illiteracy, low levels of educational attainment and lack of technical (computer)
skills may render it impossible for many people in the developing Asian economies to share the benefits of the new technology. How might all these differences affect future growth? The key links are those between the distribution of information and its contribution to the creation of knowledge and consequently, to growth.

**Information and communication technology, knowledge and growth**

A necessary, but not sufficient, condition for scientific discovery, and addition to knowledge, is the availability of ideas that can be combined in previously unknown ways. ICTs have two effects. One is the speed with which combinations of new ideas can be examined and tested; this is the basis of the biotech revolution, for instance. It also opens up new sources of information, both within and between economies. Sharing of information between economies, facilitated by ICTs, is beneficial for all participants, and expands the pool of available information and ideas.

The links between knowledge, its diffusion and growth are the subject of a large body of literature. Romer (1986, 1987, 1990) proposed a model of growth that used knowledge as an input in production. This model, with increasing returns in the creation of knowledge, suggested the possibility of larger countries always growing faster than small countries. It also found that, as with other public goods and externalities, competitive equilibrium was not socially optimal. Private firms spent too little on research and accumulation of knowledge. Government intervention, funded by socially optimal taxation, would improve economic welfare.

A key feature of models of growth in which technological change is endogenous is the role of increasing returns. Another key feature of ICT is the network effect, or network externalities. Network externalities occur if the value of the good to the consumer depends on the number of consumers using (purchasing) the same or similar good (see also Shapiro and Varian 1999). These effects are examples of increasing returns, although they occur on the demand side of the use of the technology rather than its development. However, they too, have the potential to contribute to a divergence in growth rates.

Creating a global information network requires its components to be compatible. Many complementary components are required to provide a typical network service. Costless combination of various network links and nodes make it possible to generate network externalities. Here adherence to technical standards becomes very important. Investment decisions by governments are also important: governments, including the research sector and education institutions, are relatively large users of ICTs, and their choices can influence standards in the rest of the economy, as well as make a significant contribution to connectivity.

ICTs have been classified as general purpose technologies (GPTs) that can be used in a large number of sectors, leading to drastic change in the modes of their operation (Helpman 1998). GPTs are often characterised as ‘enabling technologies’, opening up new opportunities and increasing the productivity of research and development (R&D) in downstream sectors, that is, involving ‘innovational complementarities’ (Bresnahan and Trajtenberg 1995). Essential features of GPTs include their initial scope for improvement, variety of users and potential applications in other sectors of the economy, and strong complementarities

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5 A distinction between the creation of knowledge and its diffusion was made by Schumpeter (1943). Arrow (1962) linked diffusion of knowledge and growth in the learning-by-doing model. Further research into the dynamics of the knowledge diffusion process and its relationship with growth and inequality was conducted by Davies (1979), Gort and Klepper (1982), and Jovanovic and Rob (1989). Grossman and Helpman (1991), Barro and Sala-i-Martin (1995), and Aghion and Howitt (1998) review the analysis of the origins of technological change from endogenous R&D decisions of firms, including the impact of increasing returns.

6 Liebowitz and Margolis (1994) distinguished between network effects and network externalities, questioning the validity of the latter concept.

7 See Economides (1996), Economides and Himmelberg (1995), and Shy (1996) for further discussion of network externalities.
with other technologies. Information and communication technologies are essential for coordination of all economic activities. More efficient coordination of those activities is a separate route by which ICTs may make a contribution to growth.

The debate, however, is about the significance of ICT as a new technology. Some economists claim that the modern digital revolution is as important an invention as writing, printing and the telegraph—the earlier examples of breakthrough technological innovations in communications. Others are more sceptical: Gordon (2000), for example, claims that the magnitude and relative importance of the growth of use of the Internet cannot be compared to the great inventions of the past. Shiller (2001:13) refers to “just another superhighway”, making the comparison with the interstate road system in the United States.

US experience suggests that the links between ICTs and growth are significant. Use of information technology (computer hardware, software and network infrastructure) accounted for about two-thirds of the acceleration in labour productivity for the non-farm business sector in the United States between the first and second halves of the 1990s (Oliner and Sichel 2000). While the share of information technology in US GDP was only about 8 per cent, it is associated with almost one-third of the growth of output between 1995 and 1999 (CEA 2001).

A positive relationship between the Internet, and telecommunications infrastructure and growth is also reported in Canning (1999a, 1999b, 1999c). A number of studies attributed rapid growth of the ‘Asian tigers’ (newly industrialising economies) to the increased use of inputs (labour force participation, education and investment) rather than to the total factor productivity growth (Krugman 1994; Young 1995; Collins and Bosworth 1996). Use of ICTs could trigger a productivity surge and ensure continuing growth in the new economy setting.

The degree to which ICTs contribute to growth depends on the depth of penetration, indicated, for example, by the proportion of computing equipment in total capital stock. The first stage of computerisation of the economy, with a low share of new ICT capital in the total stock, should not be expected to produce an immediate improvement in efficiency. In fact, a study using a model that included adjustment costs suggested that the contribution to growth of computers to the US economy was negative for the period 1974–84 (Kiley 1999). Pohjola (2000) arrives at a similar conclusion for the developing countries, finding no significant contribution of ICTs to GDP growth. The implication for developing countries is not to expect miraculous effects from the computerisation of the economy during the first phase of ‘bridging the digital divide’. The effects will be seen only in the medium or long run.

Jorgenson and Stiroh (2000) estimated that average labour productivity in the US grew at 2.4 per cent per annum during 1995–98. They found little evidence of spillovers from ICT production to users of the technology. More important are the direct effects among users, associated with the sharp decline in computer and semiconductor prices during 1995–98 (at about 28 per cent per annum), which led to price-induced substitution and rapid investment in ICT equipment and consequent ICT capital deepening (see also Gordon 2000). Thus, there has been a significant increase in total factor productivity (0.99 per cent per annum). ICT deepening was also the underlying economic mechanism behind the labour productivity surge in the United States in 1995–98. Baily and Lawrence (2001) found empirical evidence for this effect continuing in the second half of 2000, by the acceleration of

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8 Phillips (2000) draws an interesting historic parallel between the advent of the telegraph and the Internet.
9 The value of local production of ICT versus its application is illustrated in the Australian debate (Kelly 2001a, 2001b). It has been recognised in the Australian Treasury’s Budget paper, A More Productive Australia—policy and technology, that, historically, the benefits of the general purpose “technologies have come not from their production but from their use throughout the economy”. However, the Australian Labor Party Agenda for the Knowledge Nation sees producing the ICTs as more important than using them. It proposes measures to promote creation of new ICT and biotech industries, and increase state funding for R&D.
productivity in service industries using ICTs. They also noted that it takes time for the benefits of adjustment of business practices to show up in the statistics. The decline in ICT prices has been predicted to continue to be a stimulus to US growth in the immediate future (Jorgenson 2001).10, 11

These empirical results suggest that important implications for developing economies are the value of access to world markets for ICT products and thus to falling real costs of equipment, rather than an expectation of strong spillover effects from a policy targeted on the production of ICT items.

Harris (1998) has studied the effect of modern ICTs on factor markets. He focuses on the Internet and finds that internationalising communications networks creates a ‘virtual mobility’ of factors including skilled labour, and has a strong liberalising effect on cross-border trade in services. In this model, the effects of removal of a communications autarky might lead, initially, to a drop in skilled labour’s productivity and wages, followed by a long-run rise in productivity after the scale economy effects come into play. The model predicts converging productivity of skilled labour in the technology and services sectors, but also rising income inequality between skilled and unskilled labour within regions or countries. This result highlights another issue associated with the digital divide—the growth in the wage premium for skilled labour. This has important policy implications for investment in human capital and education.

The diffusion process
In a recent paper, Dudley (1999) revived a 50-year old hypothesis of the Canadian historian Harold Innis, who argued that there exist very long growth cycles generated by two-way interaction between a society’s production system and its communication technology. Innes proposed a three-phase theory of the relationship between communications and economic activity. The model, enhanced and tested by Dudley, concentrates on three aspects of information: storing, decoding and transmission. Based on the relative cost of these aspects, information network architecture develops.

A centralised network exists when transmission is cheaper than storage and decoding. A decentralised structure develops when the storage costs decrease. A drop in decoding costs leads to the creation of a distributed network, with any node capable of producing information directly usable by any other node.

Dudley (1999) used the directed-search hypothesis to explain the motive of innovation. According to this hypothesis, if the costs of any of three aspects of information—transmission, storage or decoding—are too high, bottlenecks occur, blocking the exchange of information. To relieve the most important impediment to the flow of information, specific research activity is undertaken leading to macro-inventions, the effect of which is further carried on through a series of micro-inventions. Three phases of economic development are innovation, diffusion and dominance. Growth is fastest at the diffusion stage, but growth staggers at the dominance phase when new combinations of existing ideas are exhausted.

Dudley’s paper was written in 1996, when productivity statistics did not show any signs of the impact from the new ICTs (the ‘Solow Paradox’). Dudley claimed that the 1970s and 1980s, characterised by a slowdown of economic growth, constituted the innovation phase of the new digital (and Internet-driven) technological cycle. During the first stage, the

10 The neo-classical explanation of Jorgenson and Stiroh (2000) is derived on the assumption of diminishing returns to capital: a relative price decline and input substitution leads to capital deepenings and an increase in labour productivity. Stiroh (2001) discussed neo-classical and new growth theoretical approaches to explain modern growth.
11 The price dynamics of the computers market are similar to the pattern for telecommunications, specifically facsimile machines (Economides and Himmelberg 1995). The price of fax machines dropped dramatically, by a factor of four between 1982 and 1985. At the beginning of the 1980s, demand for fax machines was at about 20 per cent per annum. After the drastic fall in price, demand doubled in 1987, and it more than doubled the year after. This explosive growth was attributed to the anticipated increase in the size of the installed base, leading to increased value to the consumer through the network externality effect.
new technologies were still not sufficiently affordable to replace techniques inherited from the previous dominance phase. The second stage—the diffusion phase—would be expected to bring about higher economic growth (Dudley 1999:617). Results of the econometric studies discussed in the previous section seem to be consistent with this story.

Continuing this line of reasoning, Brundenius (1996) agrees with Perez (1985) that the current ICT revolution might create a ‘window of opportunity’ for latecomers to leap-frog into the new technological phase, if the inertia of the previous paradigm is not too strong. Diffusion of the new technology may be conveyed in the most efficient way, bypassing inferior options. This claim has direct implications for the digital divide discussion. It is of paramount importance for the governments of the developing countries not to create the economic inertia artificially. On the other hand, being a latecomer is not necessarily a disadvantage.

### Link between human capital and ICTs

The diffusion process depends on a number of variables, including the capacity of people to absorb new technology and a supportive policy environment. The APEC framework on the knowledge-based economy identifies the innovation system, business environment, ICT infrastructure and human resource development as the key elements (Gera and Weir 2001).

Work on the impact of a growing stock of human knowledge on productivity started with the models of optimal quantity of investment in human capital developed by Becker (1967) and Ben-Porath (1967). A positive relationship between education (schooling) and growth of per capita GDP has been found in a number of cross-sectional studies including Barro and Sala-i-Martin (1995). Generally, the impact of schooling on growth explains about one-third of variations in cross-country data. However, a strong empirical relationship between schooling and growth could reflect omitted common factors (for example, better enforcement of property rights or greater openness of the economy). Reverse causality could also obtain, with schooling responding to the anticipated rate of growth for income.

Educational attainment levels, including literacy rates and enrolment ratios, are far lower in developing countries than in the industrialised world. Relatively scarce human capital yields high economic returns to investment in education. Private returns to human capital (education) in developing countries were estimated to be 20 per cent per year to primary education, approximately 15 per cent per year to secondary education, and 10 per cent per year of tertiary education (Patrinos 2000). Additional social returns to investment in human capital are due to its positive externalities, that is, the spillover effects of higher education.

A number of other factors have been found to affect the returns to time spent in education. Card and Krueger (1992) found that graduates of higher-quality schools (measured by pupil–teacher ratio) have higher returns to additional years of schooling. Education quality, measured by student cognitive performance on various international tests, has also been found to have an extremely strong effect on growth rates (Hanushek and Kimko 2000).

Analysing the 1984–89 US data, Krueger (1993) estimated that workers who used computers in their job earned 10–15 per cent higher wages, and expansion of computer use in the workplace accounted for an increase of 30–50 per cent in the rate of return to education.

The relationship between computer use and quality of education has yet to be determined. If use of ICTs for teaching improves the quality of basic education, then development of programs introducing computers to schools will add to the returns to education investment. Primary and secondary education, and teacher training, also present an opportunity to accelerate the adoption of new technology by introducing it to the next generation of the labour force.

Caselli and Coleman (2001) studied technology diffusion from industrialised to developing countries in the case of computers. Computers, like communications, represent an embodied technology, that is, a technology that cannot be adopted without physical installation of the required equipment. Using computer...
imports as the measure of investment in computing equipment at the early stages of technology transfer, Caselli and Coleman (2001) found that computer adoption is positively related to the level of human capital. Openness of manufacturing trade, protection of property rights, high rates of investment and a low share of agriculture in GDP were all found to be positively linked to the adoption of computers.

The link with human capital is interesting, and it supports a previously established phenomenon of complementarity between human capital and computers. If computer technology is skill-biased, then successful adoption of it depends on higher-level human capital. This has direct policy implications for developing countries: the digital divide must be tackled through investment in both ICT infrastructure and education.

Policy initiatives

Dealing with the digital divide has flooded the agendas of the multilateral organisations. A proposal for a Global Information Society was adopted at the Okinawa summit of the G-8 in July 2000. The key principles include

- promotion of competition in the ICT sectors
- protection of intellectual property
- facilitation of cross-border e-commerce using World Trade Organization/General Agreement on Trade in Services commitments
- consistent approach to taxation of e-commerce based on the principles of neutrality and equity
- moratorium on customs duties on electronic transactions
- promotion of technical standards to ensure interoperability
- building consumers’ confidence in e-commerce and ensuring protection of privacy
- facilitation of electronic security measures.12

The APEC leaders in their Brunei Declaration (November 2000) announced new strategies aimed at addressing the digital divide, including tripling the number of people within the region with individual and community-based access to the Internet by 2005, and ensuring universal access to the Internet in the region by 2010. In line with APEC principles, the leaders recognised that the pace of development and implementation of the appropriate policy framework will vary in each economy because of the diversity among members and the widely different levels at which information and communication technology is now integrated (URL http://www.apec2000.gov.bn/leaders.pdf).

The major initiatives complement those of the G-8—getting fundamentals right, creating stimulus for innovation, entrepreneurship, ICT infrastructure development and human capacity building.13

The latest OECD report on the new economy (OECD 2001) identified five broad but critical policy areas. They are strong economic and social fundamentals; use of ICT as enabling technology; innovative environment; human capital development; and entrepreneurship. Examples of initiatives within these policy areas are listed in Box 1.14

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12 A special taskforce, the Digital Opportunity Task Force, or DOT Force, was created at the Okinawa summit to tackle the digital divide. The final report of the DOT Force, including a proposal for a Genoa Plan of Action, was produced in May 2001 (DOT Force 2001).

13 APEC has established a number of activities to follow up the Brunei Declaration. Brunei Darussalam and the People’s Republic of China jointly hosted a high-level APEC meeting of business, government, trainers and educators in China in May 2001—New Economy, New Strategy: cooperation and innovation to build human capacity for common prosperity. Opportunities for further work to bridge the digital divide and expand the Internet access include technical assistance to the developing member economies, cooperative human capacity building projects, and developing policies aimed at access to and use of ICTs. Many of these ideas for capturing the benefits of the new economy are central to the APEC agenda for liberalisation of trade and investment, and market strengthening reform, including the development of well functioning capital markets, human capacity building, protection of intellectual property rights, and so on.

# Box 1

## Policy initiatives to tackle the digital divide

### Strong fundamentals

These policies include macroeconomic stability, openness, a well-functioning financial system, flexible labour markets, targeted social policies and labour programs. Incubation and diffusion of new technologies will not be possible without strong policy fundamentals. The success of the new economy in the US has been associated with more flexible labour markets, as compared to the European workforce (see de Masi (2001) for the international comparisons of labour productivity in industrial countries). Labour markets in East Asia are flexible, an advantage for accelerating the benefits from the introduction of ICTs.

### ICT as enabling technology

This group of policies focuses on using the ICT, increased competition in the telecommunications sector, private participation in the provision of infrastructure, lower barriers to trade in computer products and software, strengthening consumer and business confidence in using ICTs, and developing e-government applications.

### Innovative environment

The content of this group of policies includes investment in basic research, increased effectiveness of, and competitiveness for, government funding for innovation, achieving a balance in the intellectual property rights regime, and facilitating the flow of knowledge between public and private sectors and internationally.

### Human capital development

Relevant policies target early education and child care, basic and vocational education, ICT literacy, and better integration of higher education with job markets.

### Entrepreneurship

This group of policies includes access to financing (venture capital), facilitation of firm entry and exit, and encouraging an entrepreneurial spirit in society.
Access to ICTs alone is not a miraculous cure for developing countries. A large number of policies matter for development, as they will for the application of any new technology. Openness to trade and investment, financial soundness, investment in education, protection of property rights and an effective legal system are all necessary conditions for the successful diffusion of this new technology and its contribution to growth (Woodall 2000a, 2000b). This view is consistent with the work programs of APEC (2000) and OECD (2001).

Three areas of policies are especially relevant to the digital divide issues. Two of these have already been discussed. The first is the set of policies related to generating network externalities. The second is human capital development related to ICTs. The third is trade policy, particularly the terms on which developing economies have access to world markets for ICT products.

The Declaration on Trade in Information Technology Products (ITA), which came into effect in July 1997, provided for participants to eliminate duties on the products included in the agreement. Zero tariff levels and zero ‘other duties and charges’ on the agreed products were to be achieved by January 2000. In November 2000, there were 39 participants to the ITA, covering 54 WTO members and states or custom territories acceding to the WTO, and representing about 93 per cent of world trade in the products covered. India, Indonesia, Malaysia, Philippines, Singapore and Thailand are among the 28 countries that signed the ITA. Among the Asia Pacific countries, Singapore had the most liberal trade policy (zero tariffs for computers, network equipment, optical data storage devices and multimedia accessories). Malaysia and Indonesia eliminated their tariffs on ITA goods by 2000. Philippines and Thailand originally had higher tariffs (about 20–28 per cent), and India started with the most restrictive trade policy in such products in the sample of Asian countries committed to the ITA (the base tariff rate of 66.7 per cent scheduled to fade to zero by 2005).

Many East Asian economies are already highly competitive in world trade in ICT products. According to the WTO, in 1999 the share of office machines and telecommunications equipment in total merchandise trade in the Asian region was the highest in the world, accounting for 35.5 per cent of total exports and 30.9 per cent of imports (Australia, Japan and New Zealand excluded). Intra-Asia trade generated the highest volume of world exports of office and telecom equipment (US$162 billion), followed by intra-Western Europe (US$160 billion), and Asia to North America exports (US$114 billion). Asia accounted for 47 per cent (US$364 billion) of world trade in office machines and telecommunication equipment and supplied almost three-quarters of the US imports of IT goods.¹⁵

Liberalisation of trade in computer and telecommunications goods provides a good position from which the East Asian region can bridge the digital divide. However, important services are related to effective use of ICTs, and telecommunications is the obvious one. Openness in those sectors also matters.

The uneven distribution of the computer stock, as well as of skilled ICT labour, is an element of the digital divide but it also creates complementarities, including scope for peer-to-peer support within the region. Development assistance programs, as well as trade, can deliver the benefits of this complementarity. The Comprehensive Cooperation Package to Address the International Digital Divide, announced by Japan before the Kyushu-Okinawa Summit, refers to US$15 billion over five years.¹⁶ Australia has recently announced the Virtual Colombo Plan in partnership with the World Bank. This initiative is designed to use the opportunities embedded in ICTs to improve

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¹⁵ Export-oriented micro-electronics industries of NIEs have been recognised as a major source of growth in the region (see Hobday (2001) for a recent analysis of the electronics sector of the Asia Pacific).

¹⁶ Specific action areas include raising awareness of IT opportunities, contributing to policy and institution-building, human resources development, building IT infrastructure, and promoting the use of IT in development assistance. To develop specific projects, the Japanese government conducted consultations with senior officials in a number of regional economies including the Philippines, Thailand, Cambodia, Indonesia, Singapore, Vietnam and Malaysia.
education and access to knowledge in developing countries. Several APEC capacity-building programs are also focused on this area.

Not all these capacity-building initiatives are driven by the public sector alone. The private sector has strong commercial interests in those programs, as long as the policy environment allows private investors to capture some part of the returns in the longer run. Examples of recent public–private partnership initiatives include Hewlett-Packard launch of the World e-Inclusion program by setting up a number of Internet technology centres in Asia. Services to be offered by these centres include on-line microfinance services to help overseas workers remit their earnings back home; an ‘e-jobs’ program through the Internet (for example, software development and data processing); distance learning; and tele-medicine.

Conclusion

There is a gap in access to information and communications technology. A wide variation in the indicators of the information infrastructure and access to digital technology is evident in the East Asia region and also within economies.

This gap can affect growth and development, through its linkages with access to information and the creation of knowledge, and through its role as an enabling technology. Network effects add to the risks of divergences in growth. Important internal equity issues emerge as well, with the diffusion of the technology favouring skilled labour.

Lags and stages in the diffusion of ICTs should be expected. Natural dynamic processes can operate, and catch-up by the lagging economies is possible. There may even be an advantage for latecomers. While it is important to avoid inertia, the effects of new investments in ICTs may not be immediate.

However, policy still matters, given the range of market failures associated with ICTs and their applications. A key impact of ICTs are their role in the distribution of information that is part of the process of investment in the creation of knowledge. That investment is likely to be too low if left to the market because of the ‘public good’ nature of knowledge, and there are also increasing returns in its production process. Delivery systems for information are associated with network externalities, and achieving connectivity is critical for dealing with those externalities.

Discussion of the right policy environment to deal with the digital divide is often grouped into areas such as strong economic and social fundamentals; use of ICT as an enabling technology; the innovative environment; human capital development; and fostering entrepreneurship. More specifically, the policy set immediately relevant to the digital divide includes those initiatives that help capture the network externalities, that recognise the two-way connections with human capital development and provide access to world markets for ICT products and services.

The region shows variation in ICT conditions but it also has advantages in terms of the complementarities among economies, their current openness to trade in ICT products, and their evident competitiveness in world markets for those products. There is scope to gain not only from trade and investment, but also policy cooperation on capacity building. The sharing of ideas adds to the process of discovery and to knowledge, including knowledge about policy making.

References


