



Asia-Pacific Economic Cooperation

1. THE EMERGING NEW ECONOMY AND IMPLICATIONS FOR INNOVATION, DIGITAL DIVIDE AND POLICY

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2002

The New Economy in APEC:

Innovations, Digital Divide and Policy



APEC Economic Committee

ASEAN
Economic Community



The New
Economy
in APEC
Innovation, Growth
and Jobs

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FOREWORD

Over the past few years, there has been wide recognition of the increasing role of knowledge within the production process and the transformation of industrial economies into new, or knowledge-based, economies (KBEs).

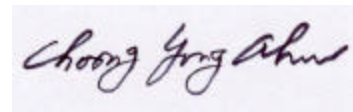
In 2000, the Economic Committee report *Towards Knowledge-Based Economies in APEC* noted that economic growth appears to be most sustainable for those economies which are closest to being KBEs, and made a first assessment of the extent to which these characteristics applied to a range of APEC economies.

The committee's 2001 report *The New Economy and APEC* (2001) went forward from the KBE report of 2000 to examine in greater depth what constitutes the "right policy environment" to yield the "higher productivity" of the "new style of economy".

This volume complements those earlier reports on the New Economy/KBE by examining in more detail some specific aspects of the KBE/New Economy. It brings together research contributions from Australia, Canada, Japan, and Chinese Taipei on the following important issues.

- What is the role of services in the new economy? Is policy sufficiently geared towards growth and innovation in service industries?
- How significant is the contribution of information and communications technology (ICTs) to productivity growth, particularly, in service industries?
- What is the importance of entrepreneurship in the new economy? What policies foster entrepreneurship?
- What are the implications of the "digital divide" both between economies and within economies?

My special thanks go to Dr Surendra Gera, vice chair of the Economic Committee and Dr Sangkyom Kim, who brought the various contributions together, and to all the contributing researchers. The section on service industries was drafted by a team from Australia, comprising Dr. Tony Weir, Oliver Harrop, Grant Keys, Chris Paterson, Bruce Sainsbury, Mike Edwards, and Meliha Handzic. The section on ICTs and productivity was drafted by a team from Canada comprising Dr. Someshwar Rao and Dr. Jianmin Tang. The section on entrepreneurship is the work of Dr. Shuhei Shiozawa and while the part on digital divide is by a team from Chinese Taipei comprising Tain-Jy Chen (coordinator), Gee San, Da-Nien Liu, Ying-Hua Ku, Shin-Hong Chen, Meng-Chun Liu, Jiann-Chyuan Wang, Holin Lin and Nieh-Hsuan Fang.



Choong Yong Ahn
Chair, APEC Economic Committee
Seoul, October 2002

CHAPTER ONE

THE EMERGING NEW ECONOMY IN APEC: IMPLICATIONS FOR INNOVATION, THE DIGITAL DIVIDE AND POLICY*

INTRODUCTION

Over the past few years, there has been wide recognition of the increasing role of knowledge within the production process and of the increasing transformation of industrial economies into knowledge-based economies. A knowledge-based economy (KBE) is an economy in which the production, distribution, and use of knowledge are the main drivers of growth, wealth creation and employment across all industries. In the KBE, the ability to create and exploit knowledge is critical to the success of all industries, including "high-tech" and "traditional" industries. In KBEs, it is this capacity to translate ideas into useful products and processes that is increasingly becoming the major source of firms' competitive advantage. Enterprises that cannot acquire and effectively use knowledge are in danger of losing market share to their more innovative rivals.

The Economic Committee (EC) report, *Towards Knowledge-Based Economies in APEC* (2000), analyzed the characteristics of a KBE in terms of four key dimensions: business environment, innovation system, human resource development (HRD), and information and communications technology (ICT) infrastructure. Noting that economic growth appears to be most sustainable for those economies that are closest to KBEs, the 2000 report made a first assessment of the extent to which these characteristics applied in a range of APEC economies. The report made a preliminary examination of some policies that APEC economies had adopted individually to help them become more knowledge-based economies, and also examined how further co-operation within APEC could help member economies to further develop as KBEs.

A closely inter-related new development is the emerging trend towards a new economy. In most recent years, the most developed and highest performing APEC economies have enjoyed robust growth, low unemployment, and low and stable inflation. A key factor in the remarkable performance of these economies has been an acceleration of labour and total factor productivity (TFP) growth. In the United States, for example, the strong productivity growth performance, in part, has been due to an increase in capital, especially ICT capital (Jorgenson, 2001). In addition, a rapidly increasing role for information technologies and the Internet has led to a surge in intangible capital investment, including the creation of new products and services, and the redesign of production processes and management (OECD, 2001a).

Conceptually, the term "new economy" has been defined in different ways. While some analysts would see it as essentially synonymous with the KBE, other studies associate the term "new economy" more directly with the association of non-inflationary, sustained growth with high investment in ICT and restructuring of the economy, as seen most dramatically in the US in the late 1990s (see, for example, OECD, 2000; Stiroh, 1999). These studies suggest that sources of growth are somewhat different in the new economy. Certain sectors of the new economy may benefit from increasing returns to scale, externalities, standards, and network economies. For example, in industries where network effects are present, such as telephone or Internet services, the more links the network has, the more valuable it is to each participant in the network. These spill-overs contribute to higher TFP growth.

The phrase "new economy" gives the impression that something fundamentally has changed and that the economy now works differently. The OECD both before and after the slow-down in the US economy maintains that in some ways, this is indeed the case (OECD 2000, 2001a). Innovation and technological change appear to have become more central to economic performance. Firms are finding new ways to reduce costs and risks of innovation. Networking, openness and collaboration are enhancing firms' internal abilities to innovate. Start-up firms are playing an important role in the innovation process. Market-based financing is now more important in funding innovation. Knowledge-intensive services, such as R&D, and computing and consulting services have experienced very rapid growth and are important sources of innovation. ICT—a new general-purpose technology—has significant potential to enhance the economy's productivity and make firms more efficient. ICT is raising productivity in many services industries, including transport, communications, wholesale and retail trade, and finance,

insurance, and business services, although measuring productivity remains difficult in many parts of the services sector. The Internet and e-commerce are having broad spill-over effects throughout a range of economic activities. Firms, industries and markets are undergoing profound restructuring to reap the potential benefits of ICT.

On this view, the KBE and the new economy have somewhat different, but closely inter-related focuses. The “new economy” focuses on the respective roles of ICT and restructuring in overall productivity growth, while the KBE emphasises the growing importance of knowledge in all economic activities. In any event, the “old economy” industries still remain important as they are being revitalized by the new technologies and new processes.

An Economic Committee report, *The New Economy and APEC* (2001), went forward from the KBE report (2000) to examine in much greater depth the “business environment” dimension. It asked what constitutes the “right policy environment” to yield the “higher productivity” of the “new style of economy”. The report addressed four main questions:

- What are the fundamental underpinnings of the “new economy”?
- What evidence is there, at the macro-economic level of the benefits to growth and at the micro-economic level of the challenges of transformation, which can assist in the domestic political discussion about policy reform and structural adjustment?
- What are the implications, particularly in terms of trade competitiveness and digital divides, of the different paces of policy reform in pursuit of the new economy?
- What conclusions and recommendations, both for economies and for the institution of APEC, should we draw from the foregoing discussion?

The report drew on macro-economic and micro-economic evidence (16 case studies from 12 APEC economies) to illustrate the benefits and challenges of pursuing structural policies, without which policies in other areas, such as ICT, human capital, innovation and entrepreneurship, will be ineffective in inducing the transformations necessary to take APEC economies forward into the global new economy.

A key conclusion of the report is that the most important driver of the benefits to be gained in the new economy is not ICT sales or ICT production, but how individuals, firms, markets and governments use those technologies, especially in a networked environment.

The main message of the 16 case studies is that the new economy is essentially about transformation and restructuring toward greater productivity, and that structural policy fundamentals are the key to that transformation. The case studies illustrated that the networked information technologies so characteristic of the new economy could not transform the productivity of organizations unless appropriate organizational and national policies were also in place.

The study offers recommendations in four policy domains that are crucial to creating an environment in which networked ICTs can transform the activities of firms, governments and individuals, yielding overall higher productivity growth and economic well-being. The specific recommendations are:

- Trade and cross-border investment liberalization: Productivity gains from the new economy come from global engagement, especially in services. The report recommends a new round of reform and liberalization, particularly of services and cross-border investment.
- Banking and financial policies: APEC member economies should give priority attention to liberalizing barriers to cross-border financial transactions. They should bring in foreign best practices and allow them to work.

- Pro-competitive market policy and legal environment: Appropriate and independent regulatory authorities, transparent and non-onerous business rules, flexible labour markets, and ease of entry and exit of firms (including through mergers and takeovers) are fundamental to creating the new economy environment characterized by innovation, quality infrastructure, and a hospitable business environment.
- Fiscal policy and fiscal activities of government: The new economy should change the activities of government. An efficient and effective fiscal policy and fiscal activities will direct public expenditures toward high-return activities and implement efficient, progressive, and broad-based tax regimes that support private sector incentives for growth.

Finally, the report analyzed the “digital divide” in terms of the broader concept of the productivity and growth gap among APEC economies. The results show that for some APEC economies, especially for Australia; Canada; Mexico; and the US, productivity growth in the last half of the 1990s exceeded that of the 1980s and the early 1990s, whilst other economies had lower productivity growth rates. The implication is that the productivity divide, and therefore the growth divide, is widening in APEC. The analysis points to a widening “productivity divide” within APEC coming from differences in improvement in productivity from ICTs, which are themselves due in large part to underlying structural conditions. A key conclusion is that the “digital divide” in this wider sense leads to other specific economic consequences such as “brain drain”, less training by firms, and lower revenues.

THE ISSUES

This volume complements the earlier reports on the new economy and the KBE by the APEC Economic Committee. It examines in more detail some specific aspects of the KBE and the new economy by focusing on a number of important issues, as outlined below.

What is the role of services in the new economy? Is policy sufficiently geared towards growth and innovation in service industries?

Services are sometimes perceived as labour intensive activities that are less conducive to higher levels of growth and innovation. But it is becoming increasingly clear that the service sector has experienced some of the most profound changes in the new knowledge-based economy. Many services have experienced rapid productivity growth, several are innovative and new jobs in the services sector increasingly require highly skilled workers.

The recent wave of innovation in computers and telecommunications had a huge impact on productivity in many service industries, including transport, communications, wholesale and retail trade, and finance and business services, although measurement of productivity change in services remains notoriously difficult (Pilat, 2000). Certain knowledge-intensive services such as consulting, training, R&D, and computing services are important sources of innovation. A key factor behind the performance of the services sector has been organizational innovations that have led to gains in efficiency and competitiveness; the most influential of these innovations have been the implementation of ICT in service delivery and the introduction of electronic commerce.

Services are also becoming more tradeable. In recent years, global international trade in services has been growing faster than trade in goods, and more than half of new foreign direct investment is in services industries (OECD, 2001b; Copeland, 2001). As a consequence, services are more exposed to competition, requiring that they innovate to improve the quality of service offered.

A central goal of the paper in this volume is to highlight the policies to enhance innovation and the economic performance of the services sector in the new economy.

How significant is the contribution of ICTs to productivity growth, particularly, in service industries?

There now seems to be a broad consensus that ICTs played a dominant role in the revival of US productivity growth in the 1990s, especially in the second half (Jorgensen, 2001; Oliner and Sichel, 2000). This renaissance of US productivity is commonly attributed to the new economy—a radical transformation of business strategies and production processes by the use of ICTs in both ICT-producing and ICT-using industries.

A paper in this volume examines the role of the services sector in the adoption of ICTs and examines the contribution of ICT investment to output and labour productivity growth in Canada and the US.

What is the importance of entrepreneurship in the new economy? What policies foster entrepreneurship?

Entrepreneurship, the ability to exploit new business opportunities, is a key to growth and innovation. One way to seize new market opportunities in the new global KBE is to start new enterprises. Start-up firms play an important role in the innovation process, as they are important sources of new ideas and innovations. In the new economy the changing innovation process has brought small start-up firms to the forefront, as they are exploring new opportunities in areas such as electronic commerce and genetic engineering and are developing specialized niche markets. However, many barriers to business start-ups exist.

A paper in this volume assesses the state of entrepreneurship in APEC member economies and explores possible explanations for diversity among them. Based on case studies from a number of APEC economies, the paper summarizes best practices and puts forward a menu of policy options designed to foster entrepreneurship.

What are the implications of the “digital divide” both between economies and within economies?

There is a great diversity among economies in terms of the ability to take advantage of, or adapt to, the newly emerged technologies, because of differences in capabilities in: information infrastructures, the availability of personal computers or Internet access, education levels, and human resources development. Even the language used may affect Internet usage. Economies that lack the capability to take advantage of, or adapt to, the information age may be left behind in terms of productivity growth and the ability to participate in the increasingly networked world market (APEC, 2001). Even within an economy, the ICT-modern regions and ICT-backward regions may see the gap between them widen with the advancement of ICT-based education, production, and trading. It is a similar picture for ICT-modern firms and ICT-lagging firms.

In an earlier (unpublished) paper for the APEC Economic Committee, a team from Chinese Taipei measured the degree of digital divide in the APEC region, using various indicators (Chinese Taipei, 2001). The general conclusion is that a digital divide between economies is serious and there is no hope for a quick turn-around. Bridging the divide calls for concrete actions by the government as well as the private sector. That paper also explored the factors that facilitate or inhibit the adoption of information technologies in the field of business-to-business (B2B) electronic commerce using several case studies of ICT-manufacturing firms and their supply chains. A key conclusion was that B2B is a global phenomenon and infrastructure-building is the key to the access to, and investment in, new technologies. Private initiatives seem to be more critical than government policies in this area.

The final paper in this volume complements the earlier paper by presenting a series of case studies of retailers in Chinese Taipei which cast light on the barriers and opportunities in business-to-

consumer (B2C) electronic commerce. The paper also examines the social factors that contribute to the digital divide within an economy, drawing on two governmental surveys of people's use (or non-use) of the Internet.

ORGANIZATION OF THE VOLUME AND OVERVIEW OF INDIVIDUAL PAPERS

Four papers are presented in this volume.

1. Innovation in Service Industries including E-Commerce

Following on from APEC (2000) and APEC (2001), the present study on "Innovation in Service Industries including E-Commerce" goes more thoroughly into the innovation dimension of the KBE/ new economy. Innovation is not confined to manufactured products, and is much more than research or mere invention (discovery). The study focuses on innovation in service industries, because much less analysis has been done in this area than in manufacturing, where innovation is easier to recognize and measure.

Service industries are one of the fastest growing sectors in developing economies. A key factor in this expansion has been the organizational innovations that have led to gains in efficiency and competitiveness; the most influential such innovation has been the introduction of electronic commerce (e-commerce). This study involves an analysis of several case studies involving e-commerce and other relevant innovations.

Part 2 of this chapter begins by reviewing the characteristics and importance of service industries, especially in APEC economies. Part 3 presents new case studies on innovation in service industries: global supply chains; knowledge management; and education services, and also re-examines from a different perspective many of the case studies from *The New Economy and APEC* (2001). Emerging themes include:

- The impact of international competition;
- The importance of supply chains, alliances and clusters in the new economy;
- Innovation in internal working patterns of organizations;
- The changing nature of services;
- Increased foreign investment in service industries as they become more open; and
- Managing the intellectual capital behind innovations.

Finally, Part 4 highlights some policy implications of the analysis for APEC economies. Policymakers should consider existing policies and programs and address any implicit biases against services in domestic R&D and innovation policies. If innovation in services is to be more effectively supported, a move away from the traditional emphasis on support for technical R&D to incorporate the range of innovation strategies that better reflect opportunities and developments in the modern economy will be necessary (OECD 2001). These strategies include, in particular, policies to encourage strategic alliances through networking and clustering.

The traditional boundaries between services and other sectors such as manufacturing, agriculture and resources are blurring. New product-service linkages may necessitate a shift in how statisticians and policymakers characterize both productive activity and competitive business structures and skills.

Knowledge management tools and processes are becoming increasingly important for service industries. They are now being taught in some institutions, and there may be scope for further diffusion of these skills through APEC channels.

It is not clear whether current intellectual property protection regimes constrain or facilitate innovation in services. The international transfer of intellectual property is an area that needs further study and debate, including in APEC forums. The scheduled review of the World Trade Organization's Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS) offers a framework for such discussion, but there are many contentious issues.

Technology is creating a borderless economy in many services. Electronic commerce, a hallmark of the "new economy", widens the scope of such trade. The e-APEC agenda, not least its emphasis on e-commerce readiness and on paperless trading, offers scope to increase trade and raise productivity across the APEC region.

More generally, trade in services is promoted by the 1995 General Agreement on Trade in Services (GATS) under which members of the World Trade Organization (WTO) are encouraged to undertake progressive opening of their service sectors at their own pace, and in accordance with their priorities and objectives. A further round of negotiations within the GATS framework is now underway, aimed at accelerating such liberalization. Related discussions continue within the APEC Committee on Trade and Investment (CTI) especially in its Group on Services. Capacity building is a priority for many APEC economies that intend to participate in the WTO negotiations on trade in services and are looking for ways to strengthen their participation in the multilateral trading system.

Innovation is fundamentally an organizational and managerial issue, because innovations are produced within organizations that transform knowledge. Capacity building across APEC, along the lines of the Beijing Initiative of May 2001, can help spread the necessary organizational and managerial skills.

In terms of policy, analysis by the APEC Economic Committee and the OECD has shown that innovation (and thus prosperity in the new economy), whilst it is encouraged by policies specifically on innovation, also requires complementary, strong policy support for human resource development. It also needs an ICT infrastructure, together with a business environment ("framework policies"), that is supportive of investment, including investment in innovative developments (APEC 2000, 2001). Through the "knowledge clearing house" and other mechanisms for sharing relevant experience and knowledge, APEC can collectively raise the capacity of policymakers to put such policies in place.

2. The Contribution of the Information and Communication Technology (ICT) Sector to Productivity Growth in Canada and the United States in the 1990s

In the 1990s, labour productivity and real incomes grew at a significantly slower pace in Canada than in the United States, its southern neighbour and largest trading partner. As a result the productivity and real income gaps between the two countries have widened.

The main objective of this paper is to analyze the contribution of ICTs to Canada's productivity growth in the 1990s and examine their role in the widening of the Canada-US productivity and real income gaps.

The study is organized as follows. In section 2, aggregate labour productivity growth in Canada, the United States and other OECD countries is analyzed. An analysis of the trends in the output and employment structure of ICT-producing industries in Canada and the US is provided in section 3. The contribution of the ICT-producing industries to aggregate labour productivity growth in the two economies in the 1990s is examined in section 4. Trends in machinery and equipment (M&E) and ICT investment, and productivity performance in ICT-using industries in the two economies are examined in section 5. Finally, section 6 summarizes the key findings and explores the medium-term prospects for productivity growth in Canada, and the Canada-US productivity and real income level gaps.

The empirical findings show that labour productivity in the ICT manufacturing industries in Canada increased at an annual rate of 13.7 percent during the second half of the 1990s, compared to 3.5 percent in the ICT services sector. In the United States, labour productivity in manufacturing increased by 42.5 percent per annum during this period. The study concludes that the large differences in the size and productivity growth of the ICT manufacturing sector between Canada and the US accounted for all of the widening of the manufacturing and economy-wide labour productivity level gaps between the two economies in the second half of the 1990s. Furthermore, in both economies, ICT and M&E investment per worker increased at a significantly faster pace in service industries in the latter half of the 1990s. But, the investment and productivity gains were significantly larger in the US than in Canada.

The study argues that the short- to medium-term outlook for productivity growth in Canada does not look very promising. This is because of the current economic slowdown in North America and elsewhere, particularly in the ICT-producing industries, and the large negative impact of the slowdown on M&E investment, especially ICT investment, in Canada.

3. The Renewed Importance of Entrepreneurship in the New Economy

APEC economies have shown a remarkable shift to the new KBE in the 1990s and the major accelerators have been information and communication technologies (ICTs) and innovation. This shift has opened up significant opportunities for new businesses. In the new economy, innovative ideas, individual initiatives, flexibility, and expeditious decision-making have led to a generation of new businesses, boosting employment and economic growth. In this environment, entrepreneurship has taken on renewed importance and there is a growing need to implement public policies to foster entrepreneurship.

According to the entrepreneurship index of the International Institute of Management Development (IMD) in 2002, the top three economies in APEC were Canada; Hong Kong, China; and the United States. The least active three economies were China; Japan; and Mexico.

As a follow-up to the previous report, *APEC Economies beyond the Asian Crisis?* which laid out a menu of possible options for public policies that foster entrepreneurship, this paper draws its conclusions and assesses policy implications after further research based on case studies of seven APEC economies.

The paper is organized as follows. First, it provides an overview of the state of entrepreneurship among APEC economies and analyzes its impact on the macro-economy. To identify how the state of entrepreneurship affects the macro-economy within the APEC region under the “new economy”, the paper conducts cross-country analyses using available indicators such as GDP growth, venture capital investment, firm start-up rate, and the unemployment rate.

Second, it provides a menu of successful public policies (best practices) for fostering entrepreneurship within the APEC region. Studies are conducted in a number of member economies including the United States; Republic of Korea; Chinese Taipei; Singapore; Malaysia; China; and Japan. Based on the best policy practices, the economies are grouped by taking into account both the economic development of each economy and its indigenous factors, such as economic/social systems. In addition, factors such as the economic and political background of the integration of the policy, the purpose of the policy, targeting of industry or social sector, the main body of the policy package, current situation of start-ups, and problems and future projections (strategies) are considered.

Finally, the paper concludes with lessons learned and best practices. Some of the key policies proposed to foster entrepreneurship include:

Establishing good business environments and framework conditions. All the APEC members with the higher entrepreneurship indexes have constructed and maintained good business environments and framework conditions. Among member economies, the United States may be equipped with the most developed and functioning financial, labour, and goods markets and legal systems.

Well-designed incentive system. The reduction of capital gain taxes for investors, especially the so-called “angel” investors is such an incentive. However, special tax treatments inevitably undermine the basic taxation principles of equity, neutrality, and simplicity and proposals for such incentives and their policy goals should be weighed against these principles. Second-tier markets with less stringent admission requirements facilitate initial public offerings, and give incentives for investors to buy equity in the ventures. At the same time, lowering the listing requirements must be accompanied with stringent rules for de-listing and tighter time requirements for disclosure.

Minimum and effective government intervention. In cases where the market mechanism causes sub-optimal provision of services, government may have to intervene to complement the market. Education to foster entrepreneurial spirit and ability is an important example of such a policy.

University/business cooperation. Technological innovations are the seeds of business start-ups. Innovative ideas can turn into successful ventures only when they are married with managerial skills and business know-how. Universities and research institutions can serve as the core of a clustering of venture businesses. Moreover, technology licensing organizations (TLOs) facilitate the transfer of technologies from universities to the private/business sector.

Development of private businesses that foster entrepreneurship. Assistance services for start-ups may become businesses themselves in many of the APEC economies that have high growth potential. While incubation, training and information services are still publicly supplied in most of the APEC members, it would be worthwhile for governments to create policies to encourage private businesses into this area.

4. Transforming the Digital Divide into Digital Opportunities

The “digital divide” between information technology (IT) “haves” and “have-nots” has been a topic of considerable academic and political discourse. Are the IT inequalities disappearing, continuing or widening?

In an earlier (unpublished) paper for the APEC Economic Committee, a team from Chinese Taipei measured the degree of digital divide in the APEC region, using various indicators. (Chinese Taipei, 2001). Their findings show that a digital divide does exist between APEC member economies and in fact has been widening over the years. Possible factors in the widening of the gap are:

- The more advanced economies liberalized their telecommunication markets in recent years which led to the growing supply of ICT services and a drastic cut in ICT costs, while many other APEC member economies were rather sluggish in reforming their telecommunication market; and
- The degree of economic openness affected ICT diffusion and applications. Foreign direct investment (FDI), in particular, frequently brought ICT technologies into the host economies and promoted the usage of such technologies in the local business community.

That paper also explored the factors that facilitate or inhibit the adoption of information technologies in the field of business-to-business (B2B) electronic commerce using several case studies of ICT-manufacturing firms and their supply chains. The paper’s general conclusion is that B2B is a global phenomenon and infrastructure-building is the key to the access to and

investment in new technologies. Private initiatives seem to be more critical than government policies in this area.

The current paper complements the earlier paper by presenting a series of case studies on retailers in Chinese Taipei which cast light on the barriers and opportunities in business-to-consumer (B2C) electronic commerce. The paper also examines the social factors that contribute to the digital divide within an economy, drawing on two governmental surveys of people's use (or non-use) of the Internet.

The paper suggests that market competition is essential to the increased penetration of the Internet. Consumers are sensitive to the price of Internet services, and market competition can drive down the price, encouraging access to the Internet. Market entry alone is probably insufficient to generate enough competition, because incumbents have established networks that are fully paid for through previous depreciation. The government may have to generate policies that actually favor new entrants for a short period before fair competition can be guaranteed. They may, for example, allow private operators open access to last-mile networks owned by the incumbents. The regulatory committee has to ensure a fair access fee to such networks in order for the new entrants to stage a real challenge to the long-time monopolist.

Of the social factors that contribute to the digital divide, the results of surveys in Chinese Taipei indicate that women, the less educated, the elderly, and non-working individuals are among the disadvantaged in terms of Internet access. The digital divide for women is particularly serious for married women without jobs, despite the fact that the computer penetration rate at home is fairly high. Low levels of education and old age are barriers to learning which can only be overcome by technical support facilities. The less-educated and older cohorts of the population have a better chance to access to the Internet if they are working. These conclusions are likely to apply in many other APEC economies.

Schools and workplaces provide the best technical support facilities, and are conducive to Internet penetration. In contrast, the home is not a good place for Internet learning, although this is a natural starting point for many women and the elderly. Social learning facilities provided by Internet cafés seem to be a good substitute for the home, however, the study indicates that the service pattern of the Internet café industry may be biased towards the technically capable population rather than the disadvantaged. In this regard, government policy may play a useful role.

Several online retailers ("electronic shops") were interviewed in the study and the pattern of e-commerce development and opportunities has been revealed. Interviewees include a travel agent and a bookstore owner who do all their business online, and a home improvement business owner who offers extensive customer service online. The results show that e-commerce can grow very rapidly and there are no apparent barriers to entry. The key to success seems to be the right products. Simply putting a conventional product online does not make a successful e-business. It takes some genuine innovations that offer a product or service that is distinctively different to get the business going. A low price is almost a necessity in e-commerce, but it is not a sufficient condition for success. Most people agree that they have only realized a very small fraction of the potential of Internet-based trading, and there is plenty of room for further development. The business models vary, but they all seem to point to the importance of alliances. (One of the case studies is a firm that specializes in payment collection and product delivery for other retailers.) A successful e-shop is usually narrowly specialized, hence it is a form suitable for small and medium-sized enterprises to start, but the e-shop needs to mobilize various kinds of external resources to offer an attractive product.

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CHAPTER 2

INNOVATION IN SERVICE INDUSTRIES INCLUDING E-COMMERCE

1. INTRODUCTION

This study on “Innovation in Service Industries including E-Commerce” constitutes one part of the APEC Economic Committee’s 2002 project on the new economy. The other parts deal with:

- Economic Growth In The Information Age (Canada);
- Importance Of Entrepreneurship In The New Economy (Japan); and
- Transforming Digital Divide Into Digital Opportunities (Chinese Taipei)

All four parts follow on from two overview reports by the Economic Committee: *Towards Knowledge-Based Economies in APEC* (2000) and *The New Economy and APEC* (2001).

The term “knowledge-based economy” (KBE) used in the 2000 report and the wide sense of “new economy” used in the 2001 report refer to essentially the same thing. A knowledge-based economy is an economy in which the production, distribution, and use of knowledge is the main driver of growth, wealth creation and employment across all industries. In this context, being a KBE means more than simply having a thriving “new economy” or “information economy” — somehow separate from a stagnant “old economy”. In a truly knowledge-based economy, all sectors have become knowledge-intensive, not just those usually called “high technology”.

The 2000 report analysed the characteristics of a knowledge-based economy (KBE) in terms of four key dimensions: innovation system, human resource development, information and communications technology infrastructure, and business environment. Noting that economic growth appears to be most sustainable for those economies which are closest to KBEs, the KBE report made a first assessment of the extent to which these characteristics applied in a range of APEC economies. The KBE report made a preliminary examination of some policies that APEC economies individually had adopted to help them become more knowledge-based economies, and also examined how further co-operation within APEC could help member economies to further develop as KBEs.

The 2001 report, *The New Economy and APEC*, went forward from the KBE report of 2000 to examine in much greater depth the business environment dimension, and in particular the structural policies that are the foundation required to build a ‘new economy’. The report drew on macroeconomic and microeconomic evidence (14 case studies from 9 member economies) to illustrate the benefits and challenges of pursuing such policies, without which policies in the other 3 dimensions will be ineffective in inducing the transformations necessary to take APEC economies forward into the global new economy. The case studies illustrated that the networked information technologies so characteristic of the new economy could not transform the productivity of organisations, unless appropriate organisational and national policies were also in place.

The four new studies in the 2002 report complement the earlier overviews, by examining in more detail some more specific aspects of the new, knowledge-based economy. In particular, the present study on “Innovation in Service Industries including E-Commerce” goes more thoroughly into the innovation dimension. *Innovation* has been defined by Maguire, Kazlauskas and Weir (1994) as:

“The application in any organisation of ideas new to it, whether they are embodied in products, processes, services, or in the systems of management and marketing through which the organisation operates.”

In an open market, and especially in the global markets of the new economy, there are always competitor firms striving for market dominance, or to create new products and markets. Foster

(1986) notes that: “Successful companies believe that as risky as innovation is, not innovating is even riskier.”

Thus, innovation is a central characteristic of a successful modern economy. Furthermore, innovation is intimately connected with knowledge. As OECD (1997) states:

“Innovation is the creative process through which additional economic value is extracted from knowledge; the additional economic value is obtained through the transformation of knowledge into new products, processes and services.”

As the above quotes make clear, innovation is not confined to manufactured products, and is much more than research or mere invention (discovery).

This study focuses on innovation in service industries, because much less analysis has been done in this area than in manufacturing, where innovation is easier to recognise and measure — a new product on the shelf is more visible than a new organisational process. It is no coincidence that many of the case studies in *The New Economy and APEC* concern service industries, since a notable feature of the new economy has been the expansion of the services sector (examined later).

Service industries now account for approximately 60 percent to 70 percent of business sector GDP in developed economies, and are one of the fastest growing sectors in developing economies. A key factor in this expansion has been organisational innovations that have led to gains in efficiency and competitiveness, and the most influential such innovation has been the introduction of electronic commerce (*e-commerce*). The interaction between innovation, the business environment, and ICT is strikingly exemplified in E-Commerce. It is one of the most visible features of the new economy and is emerging as one of the most important drivers of productivity growth in service industries.

Therefore, understanding the role of e-commerce in the innovation process driving productivity in service industries is increasingly important for the formation of effective public policy for the new economy. Accordingly, this study involves an analysis of several case studies involving e-commerce and other relevant innovations.

Part 2 of this study begins by reviewing the characteristics and importance of service industries, especially in APEC economies. It asks questions such as: What are the distinguishing characteristics of service industries, from an economic and policy perspective? How important are service industries in APEC economies, both in terms of domestic value and trade? What factors are driving their growth? Are there any constraints to growth and trade? And, what do these trends imply?

Part 3 presents some new case studies on innovation in service industries, global supply chains, knowledge management and education services and also re-examines from a different perspective many of the case studies from *The New Economy and APEC*. Emerging themes include:

- the impact of international competition;
- the importance of supply chains, alliances and clusters in the new economy;
- innovation in internal working patterns of organisations;
- the changing nature of services;
- increased foreign investment in service industries as they become more open; and
- managing the intellectual capital behind innovations.

Finally, Part 4 highlights some policy implications of the analysis for APEC economies.

Readers may wish to follow up this short study by reference to two larger multi-author works both devoted to innovation in services: *Innovation and productivity in services* (OECD 2001) and *Knowledge and innovation in the new service economy* (Andersen et al 2000).

ACKNOWLEDGMENTS

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2. CHARACTERISTICS AND IMPORTANCE OF SERVICE INDUSTRIES IN MODERN ECONOMIES

2.1 Services, Innovation and E-Commerce

Services

A recent definition of services (Allens, 1999) states that:

“Services deliver help, utility or care, and experience, information or other intellectual content – the majority of the value is intangible rather than residing in any physical product.”

The services sector is thus a highly diversified part of the economy. It ranges from technology and skills intensive sectors (such as software, computer and business services) to the low-technology and skill sectors comprising a large portion of convenience and personal services (Pilat, 2001). All sectors however are becoming increasingly intertwined.

Services are not directly associated with the manufacture of goods, mining or agriculture. They typically involve the provision of human value added in the form of labour, advice, managerial skill, entertainment, training, intermediation and the like (OECD, 2000). While differences between services and manufacturing exist, the extent of diversity within both sectors, and the growing overlap between them, makes generalisations about the characteristics of each sector limiting.

Nonetheless, services differ from other types of economic activities in a number of ways. Many, for example, cannot be inventoried and must be consumed at the point of production. This would include trips to the doctor, enjoying a meal at a restaurant, flying from Tokyo to Paris, or attending a concert. This is in marked contrast with manufactured products, whose tangible character allows them to be stored, distributed widely and consumed without direct interaction with the entity that produced the good.

Another distinguishing feature of services is the relatively high emphasis placed on intellectual capital, or “intangibles”, in many service activities. While difficult to measure, “intangibles” can hold the key to value creation. However, because, unlike a piece of equipment, they cannot be valued in a concrete way, and because they represent a weak form of collateral for the purpose of securing debt finance, their contribution to companies and their intrinsic worth often goes unrecognised. Ways of reporting and understanding the value of intangibles is still being developed (ISR 2001).

Despite the distinctions that exist between manufacturing and services, the two sectors work in a close symbiotic relationship. Without the demand for transport services, for example, the manufacture of trucks, planes and even cars, would collapse. The distinction between the two is increasingly blurring, and it is difficult to examine the role of services in isolation from that of manufacturing (Pilat, 2001).

Recent studies of “manufacturing” firms in Australia shows that manufacturers are increasingly incorporating services in their offerings to customers, both within the production process and at, or close to, point of sale. Service firms are taking products produced by others and adding value by bundling them with a vast array of services, and in turn, often stimulating the creation of new physical products. Project based firms are linking services and products to deliver entire projects. (AEGIS 2002). The increasing trend to bundling services with manufactured products was also noted by Andersen et al (2000) and Howells (2001) who refer to the ‘servicisation of the manufacturing industry’ as a major factor in innovation.

Some services are becoming more like manufacturing — increasingly standardised and suited for mass production. Franchising arrangements have enabled the rapid growth of services based on clearly articulated business processes.

Innovation

With an increasingly large proportion of GDP now sourced from services (see sec. 2.2) innovation in this sector is becoming crucial to economic growth, and is therefore of great importance for policymakers.

Innovation, in its broadest sense, is widespread in many service industries, but far less evident in others. As a result, it is sometimes difficult to pin down, since it encompasses a range of activities. Innovation in services takes many forms designed to offer new products to customers or to implement processes more efficiently. It usually involves organisational change such as new management practices, customised service, human capital and network alliances (supply chains). This innovation is often non-technical and may be called ‘soft technology’. Innovation in services may involve the introduction of new technologies and products produced through traditional R&D either developed ‘in house’ or contracted out. It may also involve the bringing together of existing technologies in new ways or to serve new purposes. Much innovation involves small changes and improvements to current products and processes. In general, product, process and organisational innovation occur together. The introduction of a new range of services or capital investment in a new facility or capability are often associated with major innovations. In short, the perception that services are not very innovative is a misunderstanding, fed largely by a lack of statistics and measurement indicators for services.

Governments themselves make major contributions to service innovation in continually improving the processes of government. In Australia, for example, governments have invested heavily in developing web sites to provide information and process transactions. Managing individual records handled by the taxation, social security and other departments is subject to constant improvement representing significant investment in software development.

Areas where innovation has lagged tend to be those where regulation has restricted competition, or those which have been protected by the need to be close to customers. New approaches to service exports through franchising and on-line delivery are providing a competitive challenge.

Among the principal elements of any innovation framework are policies to build an innovation culture. It is important to enhance technological diffusion throughout the economy, to promote networking and clustering, to better leverage R&D, to increase access to finance and venture capital and to strengthen the capacity of the innovation system to respond to globalisation. The key to innovation is a skilled workforce. The more competitive service firms become the more dependent they are on a skilled workforce.

Measurement of innovation in services is not as straightforward as in manufacturing. While research and development expenditures (an innovation indicator) tend to be relatively low, some service sectors are major buyers and users of advanced technology. This can have a pronounced effect on innovation as services that make use of technology also stimulate innovation in the sectors that supply the technology.

Similarly, patenting (another innovation indicator) is common in manufacturing, whereas service innovations often do not meet the criteria for patent approval. Innovation in services is more likely to be protected by copyright and trademark procedures which are not commonly captured in innovation statistics. Moreover, there are many “intangible” forms of innovation associated, for example, with processes and procedures which become a firm’s trade secrets or proprietary

knowledge, or with strategic alliances protected by confidentiality agreements. Patents for Business Schemes have recently been developed in a number of economies. In Australia, for example, a patent may be granted for a business scheme where there is a means for putting the scheme into effect. Any such scheme must also be new and inventive. The means of effect requires the interaction of a physical system or process with the scheme.

Innovation surveys have made it clear that expenditure on R&D is only one element of a firm's expenditure on innovation. For manufacturing, R&D generally amounts to about half of total investment in innovation, in services investment in R&D may be about one quarter of the total investment (Pilat 2001).

The challenge of identifying and measuring innovation performance is becoming an important priority for most developed economies and has resulted in a number of projects that have attempted to identify indicators of knowledge-based activities. The APEC report, *Towards Knowledge-based Economies in APEC* (2000), has made an important contribution to the provision of an analytical basis useful for promoting the effective use of knowledge, an important part of innovation process, and the creation and dissemination of knowledge among APEC economies.

Supply Chains

An increasing number of service firms are becoming more pro-active in the innovation process, often leading innovation amongst other groups of firms. Howells (2001) notes that "services have now become more innovative in both technological and non-technological terms". A recent Australian study *The Impact of the Internet on Global Supply Chains* (ITR 2002) and Howells (2001) both note that innovation is now undertaken more as a collaborative process involving bilateral or multilateral networks of both service and manufacturing firms — in particular, 'supply chains'.

The supply chain encompasses every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer. Firms are developing much more dynamic supply chain relationships in response to the challenges of globalisation and increased competition in rapidly changing markets. These partnerships include collaboration with higher education institutes or public research interests. They enable firms to better share risks, reduce costs, shorten response times to changes in demand, leverage global intellectual property and access global markets. Even seemingly simple supply chains involve a complex web of communications, payment streams and product movements involving paper, phone, fax, Electronic Data Interchange (EDI) and more recently the internet. Internet based e-commerce is the most significant technological innovation of late to contribute to global supply chains development by providing new growth opportunities and cost savings (e.g. new banking software and financial products available to customers).

E-Commerce

Electronic commerce using the internet is a new way of advertising, buying, selling, and in some cases, delivering goods and services. There has been much hype about the potential of the internet to transform supply chains and business processes. Despite the setbacks following the deflation of the 'dot.com bubble' in the United States and elsewhere, the internet is beginning a new phase of adoption (ITR, 2002). This means that businesses are moving from simply using e-mail, to developing websites, to providing transaction capability online, and to joint development of complex designs (e.g. in architecture and engineering).

It is already clear that e-commerce will bring significant changes to business, consumers, the government and the economy. Also clear is the potential for economic growth from business transformation that takes advantage of internet technologies.

Internet technologies are lowering the cost of communicating between firms and consumers and speeding the transfer of information, which is now virtually instantaneous. The greatest effects may be associated not with many of the impacts that command the most attention (e.g. customised products, the elimination of the middlemen) but with less visible, but potentially more pervasive effects on routine business activities (e.g. ordering office supplies, paying bills, and estimating demand) — i.e. on the way businesses interact with each other (OECD, 1999).

The internet can be used as a medium for quality control, faster market feedback and the facilitation of global sales and sourcing of goods and services. It has the potential to draw on the comparative advantage of local skills in each area to shorten product development and “to market” time by allowing design sharing 24 hours around the globe and outsourcing of manufacturing, administration or logistics functions. Similarly, online order entry and product configuration can eliminate paperwork and errors. Businesses will use the internet to conduct transactions and generate revenues among themselves (DITR, 2002). These concepts are further explored in the complementary APEC study, *Transforming Digital Divide into Digital Opportunity* produced by Chinese Taipei.¹

It is not innovation that creates wealth, but its use, particularly in transforming business processes. Whilst not the only such innovation, e-commerce stands out as the main factor driving the growth observed in service industries in the last decade and as such, comprises a large focus of this analysis.

2.2 Trends and observations in services

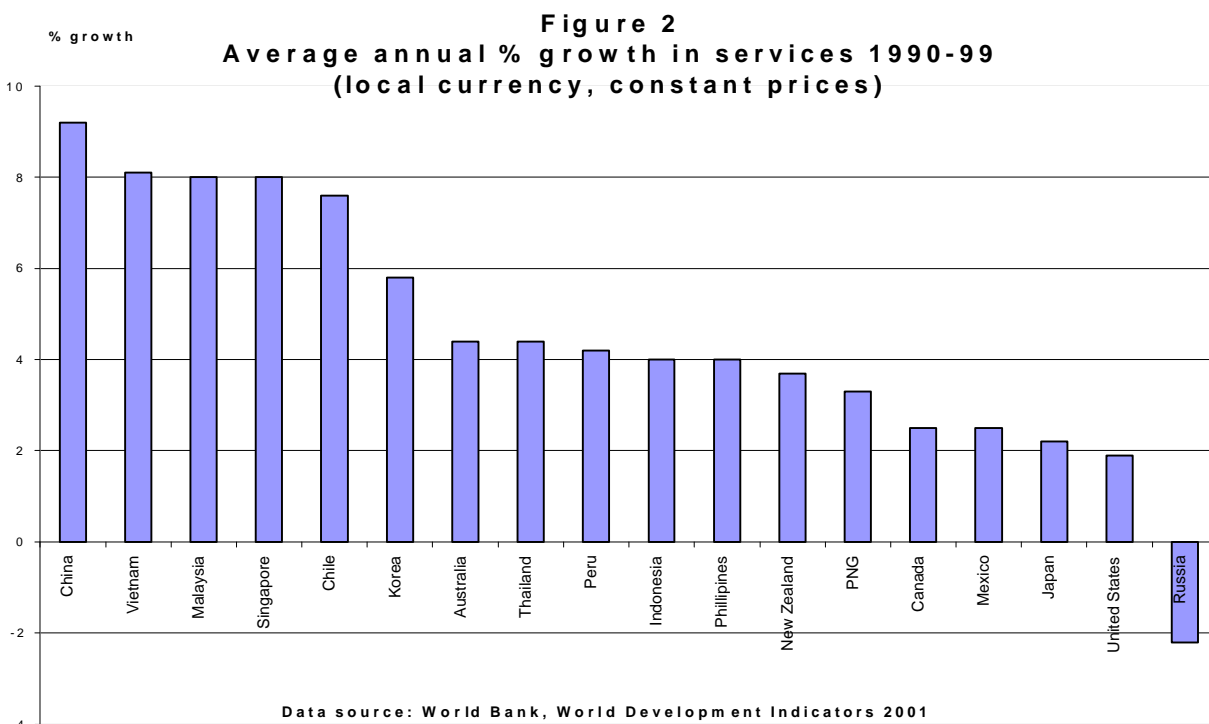
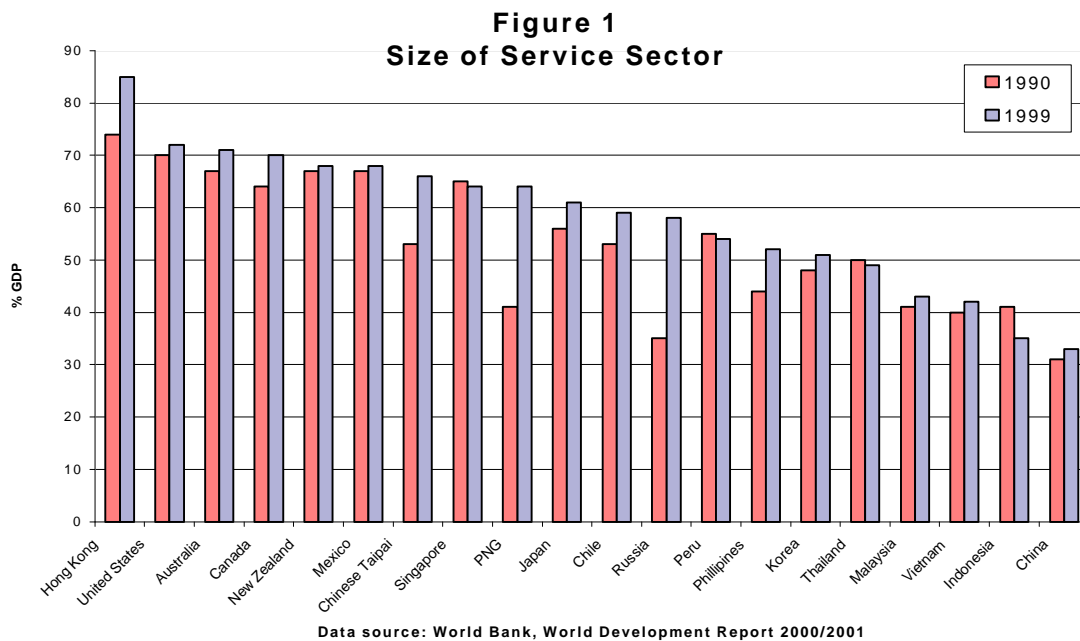
Growth Rates

Services contribution to economic growth is measured by the growth in value added by the sector. Value added is extrapolated from the base year using single volume indexes of outputs, or more rarely, inputs. Particularly in the service industries, including most of government, value added in constant prices is often imputed from labour inputs, such as real wages or the number of employees. However, the full range of value added activities that service industries employ is often unaccounted for. As an example, improvements to human capital including on-the-job training, and to the quality of output such as ‘better patient care’ in health services, are not considered when calculating value added. Likewise, some services such as household and personal services are traded in the black market and escape inclusion. In the absence of well-defined measures output, measurement of the growth of services remains difficult (World Bank, 2001: 197).

Figures 1 and 2 below have therefore been included to present two views on service sector growth. In doing so, we reveal much about the state of play in the services sector among the APEC member economies. Figure 1 gives a comparison between the 1990 and 1999 figures on the size of the service sector as a proportion of GDP in economies of the APEC region. Figure 2 is

¹ The evolving range of types of business that can be conducted over the internet is leading to an evolution of definitions. Thus the broad range of operations including not only financial transactions but also exchange of business information such as engineering designs and sales data is coming to be referred to as *e-business*, with the term e-commerce often used more specifically to refer to procurement/ money transactions. E-commerce is then divided into business-to business (B2B, which accounts for 90 percent of transactions by value) and business-to-consumer (B2C). However, in this report, we use e-commerce in the broader sense.

a more accurate representation of growth over the same period, determined by measuring the growth in value added of the service sector at constant prices. It shows the rate at which economies are expanding their service sector base.



The services sector is over 50 percent of GDP in most APEC economies, but ranges from 33 percent in China to 85 percent in Hong Kong, China. This correlates with a high 6.9 percent annual real rate of growth in Hong Kong, China from 1990–97. Part of the reason for the rapid

development of the service sector in Hong Kong, China was the mass relocation of manufacturing firms to the Chinese hinterland over the period. Other reasons included globalisation, rapid economic growth and integration within the Asia-Pacific region, and the opening of trade with China. Together, these changes have ushered in an unprecedented and extremely rapid structural transformation in the Hong Kong, China economy, from a manufacturing to service base.

At the other end of the scale, whilst the service sectors of China and Indonesia are the smallest as a percentage of GDP among the APEC economies, they are both showing high growth rates over the past decade with an average annual percentage growth of 9.2 percent and 4 percent respectively. This figure is especially positive for Indonesia after its services sector GDP contracted by over 13 percent in the aftermath of the Asian crisis (Niño, 2001).

The financial crisis in the region truncated the growth of the services sector in many of the economies which had grown since the early 1980s. While services in the early 1980s accounted for roughly 62 percent of the GDP in Korea, 57 percent in Thailand, 47 percent in Malaysia and the Philippines and just over 40 percent in Indonesia, they had since grown substantially beyond this, but by the end of the financial crisis the sector had fallen back to 1980 levels once again. This is particularly true of Korea, Indonesia, Thailand and Malaysia where growth in the services sector was most severely affected by the downturn (Niño, 2001). By observing the positive growth rates these economies have shown, and by comparing the size of the sectors against international levels, we can infer that the services sector in the ASEAN region economies has the potential for continued growth.

The only economy that has shown negative growth in its service sector over the past decade is Russia, reflecting the contraction of its GDP post 1991. Also of note, Mexico has been able to maintain a large service sector of around 68 percent of its economy over the last decade. This has come at an average annual growth rate of 2.5 percent which is encouraging in an economy that registered five years of steady growth at an annual average rate of no less than 5 percent—the highest rate for a similar period during the past 20 years. The higher pace of economic activity has been sustained upon the growing strength of exports and of private investment, both reaching record levels as a share of GDP (32.7 percent and 19.7 percent respectively).

Of the ten APEC economies with the largest service sectors, all except two have a GDP per capita of over US\$13,000 and are showing positive growth. This reflects the importance of the services sector in advanced modern economies.

Productivity

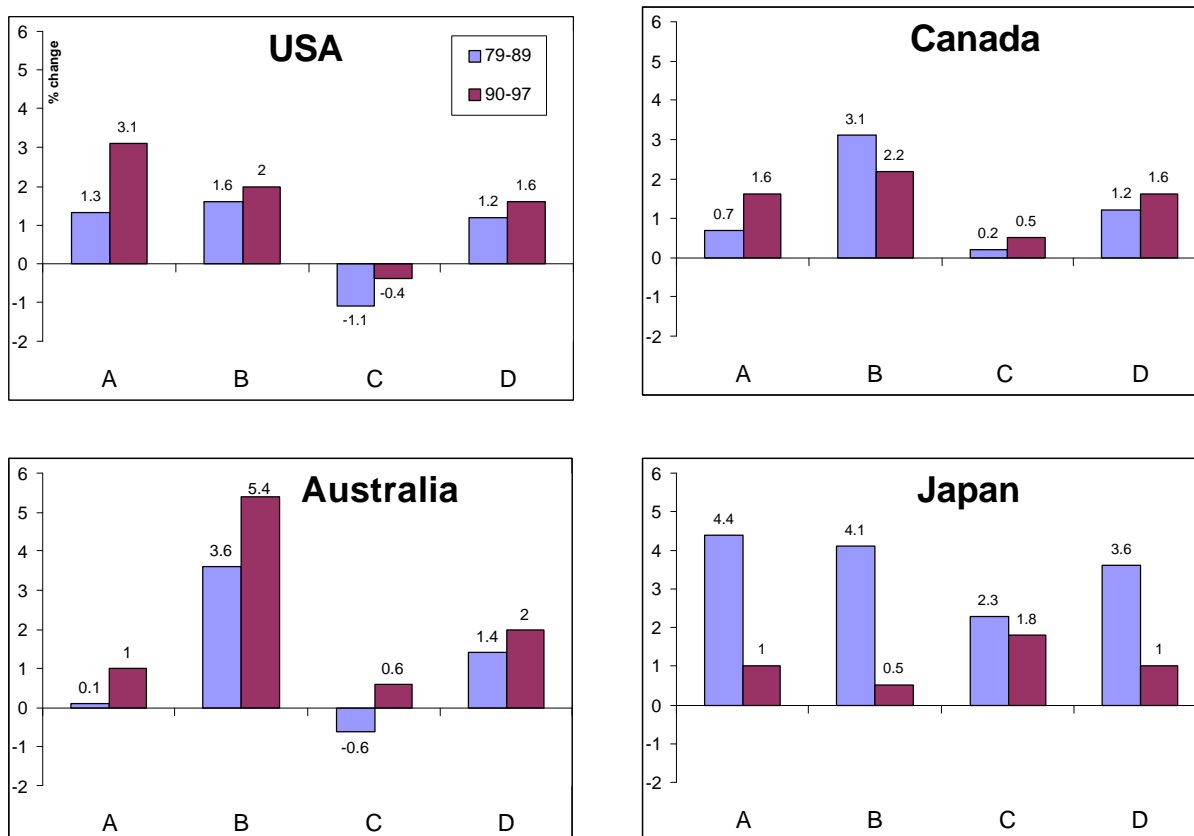
Productivity growth measures growth in output in excess of growth in inputs used over a specified period, and implies a more efficient allocation of resources. It may be due to more productive use of a single input, typically labour (labour productivity) or capital (capital productivity) or of several inputs (multifactor productivity).

In the services, productivity growth is hard to measure and difficult to interpret. For example, what is the output of banking services? Is it the number or value of all transactions? The figures must also be taken in context of movements within the sector in general. Growth may be influenced by activities in other sectors, and a change in classification or accounting procedures can produce significantly different results (e.g. utilities are no longer counted as 'government services'). Additionally, improvements in the quality of service provided or inputs used (e.g. human capital) are seldom included in the calculations. In services where output measured equals the sum of inputs (e.g. government), productivity by definition will remain unchanged.

Compared to its size, the services sector makes a relatively small contribution to overall productivity growth, although experiences differ widely within the sector.

For example, most social and community services such as health care may not be easily automated or improved by technological means, and some services may not be sold in the market (such as public services) reflecting in productivity statistics.

Figure 3 — Comparative Productivity Growth in Services (1979-97)



Data Source: Pilat (2001).

- A:** Wholesale & retail trade (inc restaurants & hotels)
- B:** Transport, storage and communications
- C:** Finance, insurance, real estate & business services
- D:** Total non-farm business sector

On the other hand, in services associated with recent innovation and ICT uptake—such as wholesale and retail trade; transport, storage and communications; and finance, property and business services—significant productivity gains have been observed in Australia, Canada, the USA and Japan. A four-economy comparison of the productivity growth in these services is shown in Figure 3. The figure shows that productivity growth has increased over the decade in all these economies except Japan, where growth has slowed (but still remains positive). One trend of note is that the largest improvements have typically been in transport, storage and communications; and in wholesale and retail trade. The fact that these services are generally seen as technology users rather than technology producers supports the general argument of APEC

(2001) and OECD (2001b) that use of technology, rather than production, is the most important factor in determining output growth. In this sense, services can be seen as drivers of growth, and uptake of technology, supported by complementary reforms and knowledge based initiatives (e.g training) would appear to provide the greatest growth benefits.

ICT Capital Contribution to Productivity Growth

Comparative international data outlining the contribution of ICT capital to productivity growth in services alone is not yet available. On the whole, services have experienced lower productivity growth than other sectors, although measurement difficulties (discussed earlier) may explain a large part of this. According to OECD and ABS data, between 1984 and 1998, services have seen positive productivity growth in Australia and the USA of 1.4 percent and 0.9 percent respectively².

Table 1 below shows the contribution to overall labour productivity growth in Australia due to capital intensity, ICT and other capital services. In the Australian market sector in general³, “capital deepening” particularly in IT and related infrastructure has made the greatest contribution to labour and (multifactor) productivity growth. During the 1990's, industries have invested in ICT in preference over other forms of capital, resulting in higher multifactor productivity growth. The implication is that increased investment in IT capital corresponds to increased efficiency and productivity from all inputs — at least in the market sector.

Table 1: Contributions to Growth Rates in Labour Productivity in the Market Sector

	1989–94	1994–2000	1984–1998	
			Australia*	USA
Output/hr (Labour prod)	2.0	3.0	1.4	0.9
Total capital intensity	1.3	1.1	-	
Information technology	0.7	0.8	-	
All other capital services	0.6	0.3	-	
Multifactor productivity	0.7	1.8	-	

Source: ABS, Australian National Accounts, September 2001
* Productivity Commission, 2001.

Given the size of the services sector (over 80 percent of GDP in some economies) the logical inference is that the same sources (namely ICT capital) are contributing to observed productivity growth in services as in the economy in general. Consequently, this paper focuses heavily on e-commerce as the most relevant business application to result from the increasing investment in ICT capital.

R&D

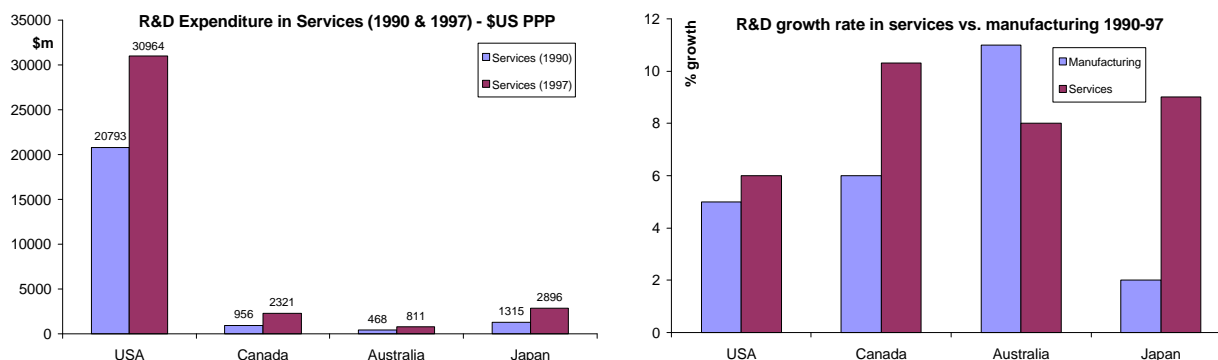
Generally, the R&D intensity of services appears lower than that of manufacturing, although R&D expenditure on services increasingly comprises a larger share of business R&D expenditure.

² Refer to Productivity Commission (2001) for an explanation of calculations.

³ Defined by the ABS as ANZSIC divisions A to K and P. Excludes Property and business services; Government administration and defence; Education; Health and community services; and Personal and other services.

Figure 4 compares growth and expenditure on R&D in services with manufacturing in four APEC economies– the US, Canada, Japan and Australia.

Figure 4: R&D Growth and Expenditure (1990 - 97)*



Services R&D as a percent of total BERD (1997)	Canada*	Australia	USA	Japan
	37	28	19	4

Source: Pilat, D. (OECD, 2001). * Canada measures use 1998.

In all economies shown in Fig.4, R&D expenditure has grown, and has been growing faster in services than manufacturing for all economies except Australia. It is likely that the greatest item of expenditure is on software development.

Much of the R&D conducted by service industries does not meet the conventional definition of R&D applied to manufacturing businesses and so may not be included in the statistics. R&D may be directed towards co-development with hardware and software suppliers of ways to apply technology, particularly information technology, to deliver services. It is also directed towards human factors, partnerships, psychology and design (Pilat, 2001).

Trade

An outward-orientated trade policy has long been seen as a centrepiece of East Asia's economic success. In recent decades, this export-orientated strategy has been the mainstay of the manufacturing industry, with services contributing only marginally to total exports.

Export of services includes those services delivered to overseas nationals within the host economy such as tourism and many education services. Services delivered in the destination economy require travel to that economy and usually the establishment of an agency or branch office from which the service can be delivered to customers. Measurements of trade in services, therefore, may be concealed in outward investment statistics.

New technologies are overcoming some of the problems of services delivery at a distance. Information and advice, for example, may be provided by email. The value of such services is difficult to measure and tends to be understated in measures of trade in services.

The export of services may require considerable effort to overcome language and cultural barriers. It is also subject to a wide range of regulatory requirements in most economies.

World exports of commercial services grew at an average annual rate of 6.4 percent between 1990 and 1998. Growth was highest in services, such as financial services, construction, computer and information services. (IMF 2001).

Trade is also increasingly occurring in services such as telecommunications (including call centres), transportation and back office functions (e.g. accounting) and the OECD report also notes that the increased use of ICT and electronic commerce is likely to facilitate trade in other services such as retailing, and travel. The APEC Economic Committee report, *The New Economy and APEC* (2001) offers a deeper analysis of the economic gains to APEC economies through trade liberalisation, particularly in services.

Recent trends show trade in services growing throughout the APEC region. As seen in Table 2, before the Asian Crisis had affected 1998 figures, exports in services had grown substantially across the region. The region appears to be returning to similar patterns once again.

Table 2: Service Exports (US\$ billion)

Economy	1990	2000	Economy	1990	2000
Australia	10	18	Mexico	8	14
Brunei	New Zealand	2	4
Canada	19	37	Papua New Guinea	0	0
Chile	2	4	Peru	1	1
China	6	30	Philippines	3	4
Hong Kong, China	18	42	Russian Federation	..	10
Indonesia	2	4	Singapore	13	30
Japan	41	68	Thailand	6	13
Korea	10	29	United States	145	274
Malaysia	4	13	Viet Nam	0	2

Source: World Bank (2000)

Note: Figures unavailable for Brunei and Chinese Taipei

2.3 Drivers of Growth in service industries

We have already seen that service industries comprise the largest sector in most developed economies and are showing both significant overall growth, and growth in productivity.

Figure 5: Relationship between Innovation, Demand, and Growth in Services

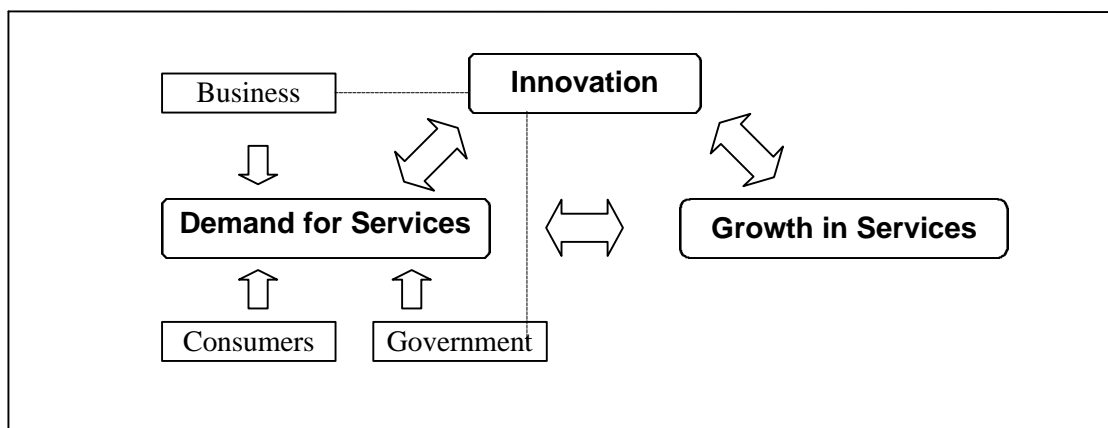


Figure 5 summarises the relation between these factors. In a broad sense, overall growth is driven by greater demand for the products of services. Demand for services comes from consumers, business or government (e.g. outsourcing). Although growth in services can sometimes occur without innovation (e.g. building more hospitals and schools to the current specification), the key message of this paper is that innovation is highly important to the demand for, and growth of, the service sector. This comes about as firms innovate in order to meet demand for a currently unavailable service, or in order to maintain competitiveness in a growing market—essentially demand, growth and innovation stimulate each other. Since innovation is primarily conducted by businesses and government (indicated by dotted lines), growth and demand for services will be much lower if the policy environment is not conducive to innovation.

The following sections address the underlying drivers of demand, which have in turn driven overall growth in services—namely, higher consumer demand for services, higher business demand for services (including government outsourcing and privatisation), and new opportunities and cost savings bought on by innovation itself.

Higher Consumer Demand for Services

Economists are quick to point out that as incomes rise, so too does demand for goods and services. The general rise in living standards, along with other factors, has been accompanied by higher spending on goods and services although debate continues in the literature over the extent of this ‘income elasticity of demand’. Additionally, lifestyles have changed to the extent that leisure activities now constitute a much higher proportion of household spending. In Australia, the Productivity Commission (2002) reports:

... While in 1960, almost 50 percent of the consumption expenditure of the average Australian household went towards food, clothing and consumer durables...by 2000 it had fallen to under 30 percent. Over the same period, the share of household income spent on services increased by the equivalent amount. The bulk of this increase was taken up by growth in spending on rent and household services, recreation and culture, insurance and financial services.

With rising standards of living, the demand for services has increased (e.g. takeaway food, cleaning, childcare). The growth in consumer demand however only partially explains the overall growth in services. In some sectors, such as property and business services, business demand has been much more important.

Higher Business Demand for Services

The general drive towards outsourcing, privatisation and use of business to business services (e.g. consultancy) has had a significant impact on some services, and sector growth in general.

Primarily, firms have been turning to outsourcing to reduce costs and improve efficiency in response to increased pressures to concentrate on areas of expertise. Outsourcing can improve productivity by providing access to a wider base of knowledge, skills and technology (Productivity Commission, 2002). Competition for tenders among providers typically results in the supply of services more efficiently than in-house provision, which does not face the same competitive pressure. Some functions are changing so rapidly and becoming increasingly specialised (eg IT, recruitment, marketing) to the extent that the costs involved in keeping up to date with private providers becomes prohibitive. Additionally, the potential exists for firms and public agencies to form strategic alliances and exploit the benefits of efficient global supply chains (e.g. the Philippines supplies back office functions to many global firms).

Similarly, the increased privatisation of government services including the outsourcing of entire services on a much larger scale, and has raised demand for some services. In conjunction with deregulation, some sectors in some economies (e.g. telecommunications) have become more efficient in response to increased competitive pressure in the private market.

While it is often said that outsourcing and privatisation have contributed to growth in the competitiveness, size and productivity of the services in some positive sense, the extent depends on which method is used to account for services formerly considered to be under a different classification — e.g. if the accounting area of a vehicle manufacturer is “spun out” to become a separate (specialised) accounting firm, this is conventionally recorded in national accounts as a decrease in employment in vehicle manufacturing and a corresponding increase in business services, even though the “real” change may be nil.

Innovation and Knowledge

Increasingly, firms and government realise the need to invest in knowledge and innovation to improve service delivery and develop new niche markets and a competitive edge. The rise in business services reflects a priority to remain competitive—hence investment by business in skills and human capital has led to a growth in services providing education and workplace training, especially consultancy. This reflects the general transition in society towards a knowledge-based economy. Consequently, knowledge based services such as ICT infrastructure and support have grown as a result of a greater desire by government and business to capitalise on investment in human capital with complementary innovation.

Innovation, such as the provision of online or flexible courses, is allowing more people to participate and take advantage of such opportunities and has led to a corresponding growth in education services. Another opportunity derived from innovation is provided by the tourism industry in which the introduction of Global Distribution Systems (GDSs) and more recently, online booking capability, has made travel available to more consumers at a lower cost. Two case studies in Part 3 examine these examples in more detail.

2.4 Impediments to Growth and Trade in Services

Barriers to growth and productivity still exist, and some services may never match the growth and productivity gains possible in parts of manufacturing, for example, a string quartet cannot cut players or time and still produce the same piece. Similarly, a medical service may be unable to make changes without affecting patient well-being. In those services that can grow and improve, impediments arise from natural and market barriers and from regulatory constraints, both domestic and international.

Natural and Market Barriers

Services are becoming increasingly tradeable on world markets compared with the past. In a globalised world, cross border exchanges should (in theory) be seamless and without restriction. In reality, problems like language and cultural differences, incomplete and imperfect information, and uncertainty over the stability and direction of the government and business environment create barriers which may discourage expansion into new markets — although as this paper emphasises that the internet is reducing these barriers.

In some industries, such as air transportation or credit card provision, start up costs may be so high or oligopolies so powerful as to prevent new entrants from establishing themselves. Alternatively, businesses (particularly small business) may be reluctant to adopt productivity enhancing technology if the benefits of doing so are not immediately apparent. There may indeed be no point in adopting such technology or making costly changes if the infrastructure is not in place or if complementary reforms are not undertaken to realise the benefits. Even when benefits are visible, it may be difficult to convince creditors to change tack or secure loans and foreign investment to implement service reform. Another common problem is that some innovations (particularly organisational practices) may not be patentable. Hence for customised service reasons they might be withheld from other firms in the industry, with growth suffering as a result.

Regulatory Constraints

Even if market conditions are conducive to growth of service industries, nationally and abroad, regulatory arrangements may negate growth potential. Historically, services have been highly regulated. This may be due to a desire to correct for market failure in some services, and to the influence of special interest groups. Many services impinge upon personal or social values and are regulated to protect individuals or communities. Regulatory barriers may also be used to help nations build up their own service providers especially in culturally sensitive areas. Despite recent international agreements such as GATS and separate arrangements between economies, some constraints still persist.

While regulatory barriers in goods may be easily identified, barriers in services are often less direct and more difficult to quantify. Nonetheless, most regulatory constraints to growth and competition centre around either complicated administrative requirements, trade and investment restrictions, or both.

The cost of excessive administrative requirements is felt across a range of service sectors to differing extents, and is typically a greater burden to small and medium enterprises. Complicated reporting and license issuing procedures, and inconsistency of standards within and between economies serve to restrict competition, adversely influence the entry and survival rates of new firms, and advantage larger businesses with greater market power (OECD, 2001).

Trade and investment barriers constitute the other main obstacle to growth and further globalisation of the services sector, and typically include limits on commercial presence, prohibition and censorship (e.g. health services) and foreign ownership restrictions.

Limitations on foreign investment and ownership constrain international expansion and reduce the available flow of funds necessary for new and existing ventures.

With the best of intentions, such limitations have further drawbacks, and serve to reinforce local parochialism, since domestic services not exposed to international competition have less incentive to innovate. In addition, they also discourage local firms from forming global networks and alliances, and insulate them from international knowledge transmission and managerial strategies that may enhance efficiency and better hedge against change. Faced with administrative difficulties and restrictive laws, local firms cannot hope to compete internationally. Investors will take their money elsewhere and benefits that could have been enjoyed locally will be foregone.

Nicoletti (in OECD, 2001) notes that in economies where competition enhancing regulatory reform is more advanced, the share of services, employment rates and the catch up in productivity growth have been higher. For the services, this has been accompanied by the modernisation of distribution systems. The costs of electricity, transport and communication have all fallen as a result. Nicoletti points to policy areas for which advances would be possible individually and multilaterally, including:

- A reduction in business administrative requirements, in particular small business
- The removal of restrictions to entry in some competitive industries (such as restrictions to large or foreign firms)
- Lifting of FDI restrictions in transport services, such as air travel and rail freight
- Promotion of competition in telecommunications services (e.g. access policies)
- Acceleration of reforms in the electricity supply industry, including unrestricted choice of suppliers for retail customers, enabling third party access to the grid, and vertical separation of generation and transmission.

There are many issues for policymakers to consider in opting for domestic reform; the above simply give an overview of some of the more common constraints hindering growth among APEC economies. It has become clear from several studies both in Australia and overseas, that (although difficult to quantify) with further reform of regulations in services, the payoffs in terms of growth and community welfare will be substantial (Productivity Commission, 2002).

2.5 Reducing barriers to trade in services: GATS and TRIPS

Although technological advancements have reduced the effectiveness of some barriers to service trade, there are some practical limits to the extent and pace that barriers and impediments to service trade can be reviewed and reformed. Social attitudes to issues such as protection of national sovereignty and cultural identity place understandable limits on reform agendas.

The World Trade Organisation (WTO) was established in 1995 at the conclusion of the Uruguay Round of multilateral trade negotiations, building on the earlier General Agreement on Tariffs and Trade (GATT) system. The WTO, under the direction of its 140 Members, administers a wide-ranging system of rules for international trade, aimed at liberalising and expanding trade under agreed and enforceable rules for reciprocal benefit.

GATS

In a landmark development for service trade, in 1995 WTO members (which included most APEC members) signed the first and only set of binding multilateral rules covering international trade in services—the General Agreement on Trade in Services (GATS). The GATS has two parts: a framework containing general rules and disciplines; and economy ‘schedules’ which list individual economies’ specific comments on access to their domestic markets by foreign suppliers. The GATS encourages member economies to undertake the progressive opening of their service sectors at their own pace and in accordance with their priorities and objectives. In principle, GATS covers all measures affecting trade in services, both present and in the future. However, in practice a number of measures either lie outside the GATS or are yet to be discussed. For example, services supplied by governments are not covered.

A formal review of the GATS has been under way since January 2000. However, the GATS negotiations received a significant impetus in November 2001, when world trade Ministers agreed to launch a new, comprehensive round of multilateral trade negotiations. The agreement, known as the Doha Declaration, gives a specific commitment to negotiations on a range of trade issues including services, agriculture, industrial products and intellectual property.

Further progress in removing impediments to trade in services is partly dependent upon gaining a better understanding of the nature and significance of these impediments. It is generally much more difficult to quantify the impact of barriers and impediments to trade in services than it is for goods. Many of the protective measures apply to goods—such as tariffs, bounties and subsidies—are both direct in their impact and visible, making their impacts comparatively easy to quantify. In contrast, most of the barriers and impediments to service trade are less direct, more discretionary in their application and therefore more difficult to quantify.

TRIPS

TRIPS — the Agreement on Trade-Related Aspects of Intellectual Property Rights — is another of the set of agreements making up the WTO system of trade rules.

TRIPS acknowledges that intellectual property protection is not an end in itself, but should “contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations”.

TRIPS is intended to maximise the contribution of intellectual property systems to economic growth through trade and investment by setting out:

- how WTO principles should be applied to intellectual property rights;
- how best to protect intellectual property rights;
- how to enforce the protection;
- how to settle disputes; and
- what should happen while the system is gradually being introduced.

TRIPS is not a static document, but has a ‘built-in’ review agenda. Although it was due to commence in 2000, the exact scope and purpose of the overall review of TRIPS is yet to be decided by WTO members. The review process could, in the meantime, promote greater understanding of how the existing Agreement operates in practice, allow for exchange of information about how best to achieve economic benefits from national TRIPS-consistent intellectual property systems, and help clarify some of the more complex or contentious issues in advance of future development or revision of TRIPS provisions.

2.6 Some implications of current trends

Trend growth in the overall size of services (as a percentage of GDP) is expected to continue, or even accelerate in most OECD economies (OECD, 2000). The faster growing service industries (e.g. communications) are likely to maintain high growth as new technologies such as broadband and third generation (3G) mobile phones come to fruition; and that lower growth services (such as defence and utilities) are expected to grow at rates below average and the economy in general (Pilat, 2001).

Productivity growth will continue, provided firms are able to translate investment in human capital and information technology to their benefit by effective management and organisational practices.

The growth in services is associated with the global trend towards knowledge based economies. Empirical research by the OECD and in many economies shows that “the average job in the services sector is not a low skilled job...much of the growth in service employment between the early 1980s and the early 1990s involved high-skilled workers...” (Pilat, 2001). This suggests that a skilled workforce must be available to meet this demand, and government policies need to foster skills development and training to this end.

Similar economic processes are driving growth in the services and other sectors. The trend towards the growing role of knowledge, innovation and information technology in the ‘new’ or ‘knowledge based’ economy shows no sign of abating. As the momentum for globalisation grows, and regulatory reform continues, barriers limiting this growth will begin to come down. Governments are increasingly pursuing policies in this direction.

3. CASE STUDIES OF INNOVATION IN SERVICE INDUSTRIES

3.1 Selection of case studies

Many readers may find it helpful to have some examples at the micro level of the somewhat abstract macro trends identified in Part 2.

The 12 case studies of innovation in service industries summarised in Table 3.1 come from 7 sectors and 8 economies plus two which are cross-border, one of which is also cross-sectoral. The selection has attempted to focus on sectors and issues which all APEC member economies can relate to. All the case studies are briefly described in the next section, which amplifies the entries in the Table. The columns in Table 3.1 indicate how each individual case study relates to some of the common themes which emerge. These themes include:

- *Innovation*, including technological innovation, necessarily involves organisational innovation (i.e. a change in the way the “business” is run). This means that innovation can succeed only when human factors are properly taken into account — the *Human resources* dimension of a KBE.
- The nature of services is changing, especially as ICT allows new ways of providing what the customer wants.
- Alliances between organisations are a pervasive feature of the new economy
- Intellectual capital and its management are becoming key to competitive advantage.
- The *business environment* has to be supportive of innovation, especially in relation to competition and investment.

Two of these case studies (those on management education and knowledge management) were specially compiled for this report ⁴; full descriptions are at Appendices A and B. Seven of the studies were published in APEC (2001) ⁵ but are reanalysed here from a different perspective, closer to that in the innovation studies literature. The others are based on reports in the open literature as cited in the footnotes.

⁴ By Meliha Handzic of the University of New South Wales, Australia

⁵ APEC Economic Committee (2001) *APEC and the New Economy*. Full descriptions of those case studies are in Appendix 4 of that report.

Table 3.1 Summary of Case Studies

Case Study	What is the innovation?	Organisational innovation/ human factors	Changing nature of services	Alliances	Managing intellectual capital	Bus. Envnt: competition and investment
Banking (Aust)	ICT/ e-commerce	Branch restructures; changing role of mgrs	ATMs etc	Mergers; jt ventures (incl with Indian IT)	Specialised programs and procedures	Liberalisation (Campbell rept etc) -> inward and outward investment
Financial Transactions (HK)	Electronic (scriptless) trading of securities	Less paper handling; quicker	For stockbrokers - less advising	Govt rules change "electronic transactions ordinance"	Rapid change (ure)	In principle open to customers from o/s (not noted in study)
Retail (Canada)	ICT/ e-commerce esp with suppliers (mainly EDI now but moving to I/N esp for "product flow info" - Coy C already there)	Better inventory mgmt	Some B2C (only Coy B, small). VCM as main comp edge; more customised products	Focus on supply chain mgmt, incl collaborative promotions; logistics important	Restricted access to systems (but incl suppliers)	"fierce competition"; border open too! Some suppliers competing directly with retailers (thro' B2C)
Retail (Korea) - Tesco/ Samsung	"Samsung-Tesco's critical success factor is mgt of the NE paradigm"	More global outlook -> more global std IT required; major cultural adjustments -> "shinbaration" (Tesco alone "too rational", Samsung "too emotional".	"glocalisation"!!	Merger of a Korean and U.K. business. Logistics an area needing attention.	Draws on Tesco's exp in Thailand. Adopted "battle tested" software base over 10 months. Extensive HRD (recruitment and in-house)	Opening for investment after financial crisis. Tesco (UK) took major stake in the retail operation of Samsung. Wal-Mart (US) is another competitor.
Education - "schoolnet" (Thailand)	"Schoolnet" - i.e. Connecting schools to internet	Collaborative projects across schools	Now includes online experiences	Some private sector (donor) input	Key role of govt agency (NECTEC)	N/a
Management Education (UNSW) - Australia	New curriculum and methods in teaching business mgt	Technology-mediated teaching and learning; conscious cross-cultural approach	Online delivery (though only on-campus)	N/A	Km as new skill	Faculty has 50 percent overseas students (50 nationalities!) -> cross-cultural issues
Medical (Viet Nam) "Great blessing polyclinic"	Internet advertising and some services of a health clinic	Sme	Planning an online health encyclopedia	ISPs etc	Caution re transactions because of lack of legal framework re web in vn	N/A

Table 3.1 (continued)

Case study	What is the innovation?	Organisational innovation/ human factors	Changing nature of services	Alliances	Managing intellectual capital	Bus. Eenvt: competition and investment
Hi-tech Hospital (Malaysia)	Super-computerised hospital	Fast unduplicated info transmission between depts; no paper files; "biggest challenge is changing the way doctors and nurses work"	Built (allegedly) to overcome shortage of doctors and nurses	Computer systems specially developed/ integrated - (allegedly the most advanced in world)	Confidentiality issues.	N/a
Tourism-computerised Reservation Systems	(1) 1970s: EDI systems world-wide; (2) late 1990s: internet (B2C) systems	Cut-back in back office; much faster higher capacity systems	Change in role of travel agent (esp. W B2C)	Heart of system: interlinked systems - airlines etc all feeding off each other	[to check]	Any economy left out doesn't get many bookings!
Building and Construction Hub (Australia "CITE")	Development of an industry e-business std	Business eff'y (better doc trail -> fewer disputes) and reduced doc handling costs	Not yet	11 major Aust constr have formed consortium; but system will be open to all users (cheaply)	B.O.O. by a software/ IT coy is sought, but consortium members committed to use	Similar initiatives have failed in other economies
Taiwan Semiconductor Manufacturing Company	B2B hub offering "virtual manufacture" (incl customer support in design, engineering, and logistics)	Separate (though integrated) service arm. Can include integration with customers mgt system	No longer offering fabrication alone, but also a customer-advisory service (and help with supply chain mgt)	Supply chain mgt, but including advice to customers and feedback to foundry. Also operates a "Design Service Alliance" (linked to 3rd party design libraries etc)	"silicon intellectual property"; "IP Alliance"	Strong competition between foundries in different economies.
Knowledge Management	Introduction of KM into business practice	Cultural change to sharing of info/ kn; "kn measurement"; not just IT	Examples given from several sectors: int'l business services, banking (Canada, Aust, USA), manufacturing (Japan X3), Telecom (Aust), insurance (Sweden)	Some with IT-suppliers	Core of the paper	Examples from several economies.

3.2 Description and analysis of the case studies

In this “new economy” report, the innovations described all involve a strong element of information and communications technology (ICT)—indeed “e-commerce” in some form or other. However the emphasis is on looking at them in a general framework of innovation in a knowledge-based economy (c.f. Dodgson 2000, Maguire et al 1994), because many of the themes listed above apply to any form of innovation in services. The following descriptions follow the order of Table 3.1, i.e. they are arranged by sector.

Financial services

The case study of an *Australian bank*⁶ embraces the parallel effects of policy “liberalisation” (especially the opening of the banking sector in Australia sector to greater competition, especially from overseas-owned banks) and of the growing use of ICT to its present pervasive place in banking. For this reason it spans a particularly long time frame from the early 1980s to the present.

Over that period, ICT has moved from being merely a “back-office” tool for reconciling accounts to being the artery of a nation-wide network over which customers can make “instantaneous” transactions without handling paper or entering a branch. Consequently the nature of the banking service has changed to one involving less personal interaction for routine transactions, with banks seeking their competitive advantage through the lower costs (to them) of electronic transactions compared to over-the-counter. They also compete more through personalised high value-added services (financial advice etc). All this has entailed substantial reduction in the number of bank staff, and a need for change in the skills of those who are left. Such organisational change and human adaptation typifies almost all innovation, including technological innovation. As TASC (1988) put it:

“Innovation is centrally an organisational and managerial issue because innovations are produced within organisations that transform ‘knowledge’. Thus the relationship between the nature and structure and values of an organisation and the innovations produced is a useful focus for analysis, and hence for the development of operational policies by managers and government”.

The case study of electronic *financial transactions in Hong Kong, China*⁷ focuses more on what government has to do to facilitate similar change to paperless trading of financial securities. This includes making sure that adequate infrastructure is in place, in particular high-speed communications links.⁸ An appropriate legal and regulatory framework is also important. In this case an Electronic Transactions Ordinance, which provides legal recognition and certification of electronic records and digital signatures. This addresses the four major concerns about electronic transactions — i.e. authentication, integrity, confidentiality and non-repudiation.

This illustrates, as does the Australian case study (though less explicitly) that innovation requires government to provide a supportive business environment.

⁶ “An Australian Bank adapts to deregulation and information technology”, case study by Tony Weir, published in Appendix 4 of APEC (2001).

⁷ “Electronic financial transactions in Hong Kong, China”, case study by the Financial Services Bureau of HK SAR, published in Appendix 4 of APEC (2001).

⁸ The telecommunications aspects of e-commerce in Hong Kong, China are discussed in more detail in the case study by John Ure in APEC, (2001).

Retail

The retail sector is a significant component of all market economies, because it relates directly to all households in the economy. In many APEC economies, e-commerce has already dramatically improved the productivity of the larger retailers, bringing lower prices to consumers and making the larger operations even more cost-competitive against “corner store” operations. In some other APEC economies these gains are yet to appear, in large part because regulation of the retail sector in those economies impedes firms from gaining the economic benefit from such innovation.

In *Australia* for example, wholesale and retail trade was the most significant contributor in the 1990s to productivity growth in the services sector, resulting in strong output growth throughout the 1990's at around 3.5 percent per year (Productivity Commission, 2001). Strong multi-factor productivity growth was a result of large reductions in labour and growth in capital, which encompassed technical improvements in efficiency such as barcode scanning and inventory management systems. In the retail sector, capital deepening (whereby each unit of labour has more capital to work with to produce output) was the main contributor to the observed growth in labour productivity. Other contributing factors to overall productivity included stronger competition, removal of regulatory barriers and innovation in retail practices (eg longer opening hours).

For the *chains of department stores examined in the Canadian case study*⁹, much of their improved productivity similarly stems from better management and integration of their supply chains, through the use of e-commerce:

“Each of the participating firms stated that e-commerce and Internet solutions have strengthened existing relationships with their suppliers. E-commerce improves the flow of information between the parties. The entire value chain makes better decisions collaboratively with the end result being vastly improved performance throughout the entire chain.”

More precisely, business-to-business (B2B) electronic commerce is a critical enabler for such processes as stock replenishment, product information, store planning, promotional planning, point of sale, shipping and billing, purchasing orders, planned order forecasts, inbound planning, invoices and point of sale data. Clearly for these firms, alliances — in particular alliances along their supply chains — are at the heart of these innovations.

An alliance of a different kind is at the heart of the *Korean case study*¹⁰, namely the merger in 1999 between Samsung Corporation (a Korean general retail chain) and the UK-based retailer Tesco. Samsung Corporation had earlier been devolved from the Samsung conglomerate (*chaebol*) but had been almost bankrupted by the financial crisis of 1998. Tesco brought to the venture not only substantial cash but also advanced management skills and an IT system already proven to work in their global supply chains. Bringing this IT system into Samsung was an innovation in the sense of it being new to Korea, but was relatively free of technical risk.

However, the organisational innovation — the human factor risk — required was considerably greater. It is relatively easy to adopt just the new hardware and train employees in the specific technical skills that are required by new technology. The harder part is the balancing of different culture (in this case, British and Korean).

Samsung-Tesco faced difficulties in 1999, right after the merger. The morale of the employees was quite low due to cultural differences brought out by the merger, language barriers, and

⁹ “The impact of e-business and e-commerce on the Canadian general merchandising retail sector” by P Richer and R le Page, published in Appendix 4 of APEC (2001).

¹⁰ “Case study of Samsung-Tesco, Korea” by Y Jang of KIEP, published in Appendix 4 of APEC (2001).

communication difficulties. The major conflict was that employees perceived the new management process of Samsung-Tesco to be too rational and lacking humanity, compared to the Korean culture of *shinbaram* where emotional reaction allows people to achieve more than their limit. A conscious effort was made by management to reconcile these by encouraging teamwork to create a working environment where employees can surpass their limit while not letting it develop into cronyism. Their approach was summed up in the slogan “glocalisation” (i.e. globalisation +localisation): the pursuit of global best practice respecting the local business environment.

Although it took nearly a year to bring the new IT system into use, the attention that Samsung-Tesco paid to human factors was critical to ensuring the success of their innovation — to the extent that Samsung-Tesco sales grew from US\$360 million in 1999 to US\$1200 million in 2001.

Education

In the 1980's, *Thailand* established a central agency, the National Electronics and Computer Technology Center (NECTEC), to develop Thailand's competitiveness in electronics and computers and to stimulate economic and social impact through R&D programs as well as providing R&D funding to universities.

The case study of *SchoolNet* illustrates the value of such a central agency in assisting schools to use information technology and access the internet.¹¹ Support is provided in training teachers, developing content and in moving to more advanced uses of the Internet. These include web site development and participation in international projects. For schools ready to run their own server, NECTEC provides training in Linux-SIS, a straightforward web-based server management tool which has excellent documentation in the Thai language. Many Thai schools including almost all secondary schools are now connected to the internet by SchoolNet and about 500 have their own web sites. In effect, government is able to apply economies of scale unavailable to individual schools, particularly in skills in developing and adapting internet applications into the Thai language and culture. Such adaptation to local conditions is an essential part of any effective innovation. For example in this case, if the technology were made available only in English, it would not have been taken up nearly so widely.

The University of New South Wales Faculty of Commerce and Economics in *Australia*, has recognised the new demands of the knowledge based economy on management.¹² It has changed both the content and the form of its teaching to better prepare its students of *business management* for the new management environment which they will face.

Key skills, which all students must develop, are computer literacy and information literacy and these basic skills are applied in all units of study. Multidisciplinary graduate programs of study in e-business management, knowledge management and the management of services businesses are now available. These programs recognise the challenges of management in businesses where the challenge is “making knowledge productive”.¹³ Special programs in e-business management provide multi-disciplinary perspectives on the conditions and drivers of e-business success. Knowledge management programs are designed to provide multidisciplinary perspectives on knowledge management as an emergent organisational phenomenon, and provide an orientation to working and managing in contexts where knowledge is a central capability and a driver of organisational success.

¹¹ A fuller description of the Schoolnet project is given in Appendix 4 of *APEC and the new economy* (APEC 2001).

¹² See Appendix B of this paper for a fuller description of this case study (by Meliha Handzic of the UNSW).

¹³ Drucker P, (1993) *Post Capitalist Society*

Special programs in services management are designed to provide multi-disciplinary perspectives on services management as a social and commercial phenomenon, provide an orientation to working and managing in service oriented environments and choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

Innovative methods of teaching and learning have also been introduced using technology to support learning strategies in three main modes. These are as an adjunct to face to face course work, as a replacement for some elements of traditional class interaction and online learning in which all the content and processes of interaction are supported by technology. Such strategies require the development of new courses, design and delivery standards, training in interactive media production and opportunities to share effective teaching strategies. Students need training in using the technology and technical assistance. New technical infrastructure is needed such as a local intranet, electronic security measures and ready access for staff and students on and off campus. The promotion of interactive teaching and learning reflects recent research into student learning, serves to build a community of practice which values and accommodates student diversity in learning and is likely to improve the quality of learning experiences and satisfaction with the outcomes.

This is particularly important because nearly half the students of the Faculty of Commerce and Economics at UNSW come from outside Australia: 2500 out of 6000, about half of them postgraduates. They represent over 50 different nationalities and almost 70 percent do not have English as their first language. This diversity represents a challenge to teaching but also an opportunity to enrich the learning experiences of students in preparing them for professional, management and policy positions in a diverse global environment.

It is a particularly strong example of one model of the internationalisation of (tertiary) education, namely the physical movement of students to overseas campuses. Within APEC, the proportion of overseas students is particularly high in the US and in Australia, where students are attracted by the internationally recognised qualifications and the chance to become more fluent in English (the international language of business). Australian universities are also attractive because they are relatively cheap, and some (like UNSW) extensively promote themselves in the sending economies (mainly in East Asia). For some students, though not for their governments, one attraction of studying overseas is the perceived potential to stay on after graduation in high-paid employment.

An alternative model of internationalisation is where a university from a more developed economy (or one which has particularly high prestige) sets up an offshore campus in a host economy. The MIT campus in Singapore is an example.

In yet another model, some institutions in more developed economies specialise in distance education methods, i.e. they offer their courses online, not only to students in its own economy but to all comers, including from overseas. Some Australian universities based outside the main cities, such as the University of New England or the University of Southern Queensland, have specialised in distance education from their foundation, in response to the vast distances in Australia and the relatively low numbers in their physical catchment area, and have moved seamlessly from the older correspondence methods to the use of online tools.

All of these models of international education put competitive pressure on the corresponding institutions in the students' home economy. Such competition is a strong encouragement to them to ensure that their standards are internationally competitive or they will lose (or not attract) the best students.

Health services

A private *health clinic* established in *Viet Nam* in September 2000 used its web site to promote its services.¹⁴ Initially it used a static web site giving information about the clinic but this was extended to include interactive features which enabled clients to arrange appointments, receive feedback and place orders. Future developments will include an on-line health encyclopaedia. The clinic was promoted successfully by advertisements on prominent Vietnamese web sites.

Although there have also been difficulties in attracting sufficiently skilled staff to develop and manage the web site, a more significant limitation on the use of the internet to promote this business has been the low speed of the local network and the lack of a legal framework for online transactions and of direct government support. Once again this emphasises the need for a supportive business environment. Nevertheless, this case study shows that even limited innovation in this field can be worthwhile.

A shortage of doctors and nurses was an incentive to the development of a paperless hospital, the *Selayang hospital in Malaysia*.¹⁵ This new hospital stores all information electronically including X-ray images. Patients are given barcodes which enable information about them to be readily retrieved. The objective of a paperless hospital posed major technical challenges which have been overcome by adapting and coordinating existing technologies to create a central computing capability with a high level of reliability and backup.

While establishing this innovative system was a major challenge, it was an even greater challenge to change the way in which the medical staff work and to help them feel comfortable with computers.

Tourism

The travel industry provides a large-scale example of how innovative use of information technology has led to improvements in efficiency and service delivery and changed the way customers and providers do business. The tremendous growth in online booking systems has added convenience and enabled global supply chain relationships to develop, offering a wider variety of travel services to more people at a much lower cost.¹⁶

The first *computerised reservations system* (CRS) was born in the USA in the 1950's out of a desire by American Airlines to find a more cost-effective way of taking bookings than by telephone. Called SABRE (Semi-Automated Business Research Environment), by the 1970s it had grown to link terminals in travel agents with the central office in the world's first fully automated booking system. This allowed the airline to reduce the number of staff employed to take bookings from agents and gave it a huge competitive advantage by allowing the sale of seats 24 hours a day. With the addition of hotels, car rental companies and other providers, the world's first Global Distributions Systems (GDSs) were born, with several major conglomerates vying for market share.

¹⁴ A fuller description of the "Great Blessing Polyclinic" is given by Dr Mai Anh, Secretary General of the Vietnam IT Association, in Appendix 4 of *APEC and the New Economy* (2001). The clinic's website (which is of course in Vietnamese) is accessible in Vietnam (though not in all other economies) at www.phongkhamhp.com.vn.

¹⁵ See article "high tech health check" in *Far Eastern Economic Review* of 28 March 2002. The Selayang hospital also maintains an extensive website at www.selayanghospital.gov.my.

¹⁶ This case study draws on Linsey McNeill, *Travel in the digital age*, Bowerdean, London 1997, with supplementary information from DiSabatino, J. "Airline Ticketing Systems React to Disaster", *Computerworld*, Framingham, Sept 24, 2001; Moorman, R.W. "Hidden Charges", *Aviation Week & Space Technology*, New York, March 26, 2001; Feldman, J. "Sabre Hones Its Edge", *Air Transport World*, Cleveland, April, 2001

By 1996 the four largest GDSs — SABRE, Galileo, Worldspan and Amadeus — displayed up to one million fares for up to 725 airlines, more than 30,000 rooms for over 200 hotel chains, and hire cars at 13,000 locations throughout the world as well as cruises, entertainment and even flowers. Ninety-five percent of travel agents in the US were connected to a GDS by the end of 1995, and handling up to 4,750 messages per second. This level of connectivity (with the US and overseas travel agents) has allowed Galileo to process some 350 million transactions annually, whilst Sabre reported 467 million bookings in 2000 with overall revenue at US\$2.6 billion.

These systems represent one of the most widely spread alliances in any industry. Their benefits of scale rest on the participation of large numbers of players from all segments of the travel industry, including airlines, other travel providers, hotels, resorts, attractions such as theme parks, and of course the travel agents who are the principal users. Without large numbers of all of these, a particular GDS will be non-competitive. Moreover because the services of a competing airline or resort area are available at the push of a button, these systems make tourism operators everywhere more open to international competition. Those resorts or other destinations which stay out of the GDS stand to lose a lot of business to those who participate, as it is harder for the agent both to discover and to book their services.

Actual growth in the number of people travelling (as opposed to persons making multiple bookings) is difficult to quantify. Whilst specific data in other APEC economies has been difficult to come by, the experience of frequent travellers such as members of the APEC Economic Committee suggests that travel to at least the major destinations in most APEC economies is usually booked through one or other of these computerised systems.

The arrival of the internet has provided the potential for even more cost effective means of marketing and distributing travel products and services, and may surpass GDS systems in terms of total bookings in the near future as consumers reap the benefits of cutting out the middle men.

US Airlines and their customers paid an estimated US\$1.7 billion in 2000 to GDSs like Galileo and Sabre, and booking fees have been steadily rising at around 7 percent per year over the last decade — averaging US\$3.54 per segment compared with US\$1.85 per segment in 1990. In most cases, commission formerly paid to agents or GDSs can be recovered by providing booking capability online via the airline or company's website, at a lower cost. As a result GDSs are moving to rapidly build online (Internet) capability.

Full service websites such as Microsoft's *Expedia.com* and SABRE's *Travelocity.com* allow airlines, hotels and partners to offer and promote packages almost instantly, and allow the customer to select their own arrangements with all the information at their fingertips. This transfers the hard work of looking and booking to the customer, and eliminates the need for an agent, except to provide personalised advice and to negotiate bulk deals with suppliers and provide support in special cases (e.g. group travel). Travelocity is now the largest single ticketing location in the US. In 2000, 21.3 million bookings (up 137 percent from 1999) were worth US\$2.5 billion, with 40–60 percent growth projected. Such growth of up to 60 percent per year on travel web sites appears to be a common trend in all APEC economies.

Similarly, innovative websites such as *priceline.com* and *hotwire.com* have arisen to target the niche market of heavily discounted last minute travel by exploiting the cost savings of electronic commerce and distribution.

Their business model relies on strategic partnerships with big name airlines and hotels and allows consumers to “name their own price” for last minute services. Consumers enter the basics of where they would like to fly to or stay and suggest a price, and in exchange are compelled to accept the arrangements should their price be agreed to (e.g. ‘red eye’ flights and multiple connections). By requiring consumers to be flexible with respect to brands, the system enables

sellers to generate incremental revenue without disrupting their existing distribution channels or retail pricing structures.

Construction¹⁷

The construction industry is conservative by nature and has been relatively slow to adopt information technology to business processes. (In Australia the industry is rated as the second slowest adopter behind the transport industry). Until very recently the use of IT was generally limited only to “back-office” or administrative and accounting systems.

Over the past five years American and, to a lesser extent, European software companies have been developing software to e-enable the construction industry. In the US, Canada and Great Britain as well as a number of European economies attempts were made within the respective construction industries for contractors to band together with the aim of collectively supporting particular software products and thus establishing an industry standard.

By early 2001 all of these attempts had failed—each for similar reasons. These included being poorly advised; having “blue sky” expectations; a lack of real understanding of how to implement IT (i.e. the cultural change requirement being 80 percent of the issue and technology 20 percent); and a fear by participants that their rival would capture disproportionate benefits.

The CITE consortium of 11 of the largest construction companies in Australia is in the throes of setting up a new industry e-commerce exchange which would cover the core functions of tendering on-line, web-based document management, and electronic procurement, thereby making savings and lessening disputes for all users. The consortium’s members hope that by using a different business model than has been used elsewhere, their exchange will prosper where earlier attempts have failed. In particular:

- The Exchange is to be available to all industry players (i.e. including small businesses, not just the original large proponents), with neutral ownership.
- The exchange should provide vertical integration and not be a horizontal buyers marketplace.
- The CITE members do not seek to be software owners and developers.
- The Exchange’s operation must be flexible to suit future industry development, provide easy interface with ‘backroom’ processes, and not interfere with competitive business processes.
- Fees are paid by those who issue tenders (mainly big businesses) but not by those who respond to them (mainly small businesses).

The proposal is that this will be achieved through a “build, own, operate” contract with an independent IT company, with the consortium members (who represent 33 percent by value of the Australian construction industry) committing to use the facility, thereby guaranteeing a customer base, especially as their subcontractors would share in the cost savings of its use. The exchange is planned to start operation in late 2002.

The lesson of this case study is the importance in the new economy of balancing cooperation with competition.

¹⁷ This case study is based on a paper presented by Mike Rollo of Leighton Holdings Ltd to ABARE’s Industry Outlook Conference, Canberra March 2002. See also Appendix 3 of *The internet’s Impact on global supply chains*, Dept of Industry Tourism and Resources, Canberra 2002.

Manufacturing-linked services

The case study of *Taiwan Semiconductor Manufacturing Corporation* (TSMC)¹⁸ illustrates the convergence of services and manufacturing referred to in Part 2.

TSMC was created to function as a dedicated foundry service provider, i.e. as a company which fabricates integrated circuits (silicon chips) but does not design them or assemble complete consumer products. Though founded only in 1987, TSMC currently employs 14,500 people worldwide, and posted annual sales of US\$5.3 billion in 2000.

Part of the reason for this success is TSMC's attention to customer service management, in the course of which it has come to offer many service functions to its customers, who come from around the world and range from start-up ventures to world-leading integrated device manufacturers. Electronic commerce has come to play a vital role in these services. Foundries such as TSMC have become part of the network of innovation of new IC designs, which entails close knowledge interactions between foundries and their customers.

For example, TSMC initiated the concept of the 'virtual fab' in 1996 in order to promote virtual integration with its customers by means of business-to-business (B2B) applications, with TSMC thereby becoming a facilitator of its customers' supply chain management. The system acts as an extension of customers' own internal systems enabling collaborative planning, tracking of work in progress, engineering data sharing, real-time order placement, confirmation and other important business control features. It includes a suite of Internet-based applications that provide TSMC's customers with real-time support in wafer design, engineering and logistics. It even offers a "design service alliance" through which TSMC's customers gain access to required technical services, leading edge process-specific technologies and documents on design requirements, including silicon-verified and production-proven foundry-specific intellectual property (IP), which are useful for designers in IP assembly.

In sum, whilst starting out as a stand-alone OEM foundry, TSMC has come to resemble a provider of integrated service packages covering a wide range of value chain management activities thanks to its extensive application of e-commerce. Basically, through its arms-length relationship with its customers, TSMC is not just a pure manufacturer; it has become the natural place to verify the manufacturability of its customers' designs and to ensure the quality and timely delivery of their finished wafers. The ability of the electronic Internet and e-commerce links to accelerate and broaden information transfer between TSMC and its customers not only helps to simplify their tasks of knowledge management and exchange, but also induces TSMC to widen the scope of its extended supply chain management activities.

In TSMC's B2B e-commerce model, goods and cash flows are secondary to *information* flows. As a pure-play foundry, its inventory costs for finished products are not an important issue, whereas in contrast, customer relationship management is regarded as central to TSMC's operations as a means of securing its rates of capacity utilisation and profitability. In addition, from their own view, B2B e-commerce is necessary for foundries to come to terms with the trend towards "system on a chip". Therefore, TSMC's e-commerce initiatives aim to meet the across-the-board needs of its customers, in order to enhance customer loyalty.

¹⁸ "Case study on business to business e-commerce at Taiwan Semiconductor Manufacturing Company" by S-H Chen, published in Appendix 4 of APEC (2001). The same case study features as "Company A" in the 2002 APEC Economic Committee paper "Turning digital divides into digital opportunities".

Cross sectoral

The management of knowledge has become a critical issue in the knowledge based economy. Systematic use of *knowledge management* tools and processes is an important organisational innovation in itself. In her paper¹⁹ Handzic provides an integrated knowledge management framework, together with several examples from around the APEC region of organisations successfully taking up these tools.

She points to the need for strong leadership in establishing a conducive organisational framework and a collaborative culture that encourages and facilitates knowledge sharing. Technology may provide a platform for knowledge capture or sharing and can be used to integrate knowledge management into business processes. The framework provides for continuous knowledge measurement where possible linked to the business' financial results.

Knowledge management is yet another example of an innovation that can succeed only when attention is paid to both the technical and the human factors.

4. CONCLUSIONS

In most APEC economies, service industries already dominate the economy — accounting for over 50 per cent of GDP. They are likely to become even more important in future. However, they do not command as much attention at the political level as they should: manufacturing still seems to attract most of the attention when it comes to designing tax, trade, and support policies. While this has not stopped the service sector from growing, the lack of attention has undoubtedly diminished the contribution that services could be making to our economies (OECD 2000). As both a consequence and a cause of this relative lack of attention, the availability and quality of data on services is inadequate in almost all APEC economies, especially in comparison with data on manufacturing, resources and agriculture.

Innovation—the transformation of knowledge into new products, processes and services—is the lifeblood of firms in the modern, globalised, knowledge-based economy. Without innovation, firms are overtaken by their competitors—often new competitors from outside. Innovation is much more widespread in service industries than would be suggested by traditional manufacturing-oriented measures such as formal R&D, patents, and numbers of physical artefacts.

The case studies presented in this report exhibit a range of such new service offerings, ranging from electronic banking, computerised travel reservation systems, to new ways of organising retail supply chains, and even to “knowledge management” within businesses. Some of the services in question are offered not to consumers directly but as “intermediate” services to other businesses. Indeed “business services” is one of the largest and fastest growing areas of many economies.

As is typical in the new economy, the innovations in the case studies all involve the application of information and communication technology (ICT) to produce new services or to streamline processes, and thus raise productivity and competitiveness. Such changes in the way an organisation does business are a significant form of innovation in services. Far-reaching organisational innovations, such as computerised reservation systems, can over time affect the way a whole industry functions.

¹⁹ M Handzic “knowledge management processes and enablers in innovative organisations: selected case studies”, Appendix A of this report.

The importance of human factors in getting innovation right is especially clear in organisational innovation. It is a recipe for failure to simply place a new computer system on workers' desks without adequate instruction on how to use it or explanation of why it will benefit them.

There is a case for more mutual capacity-building across APEC to help put the necessary managerial and technical skills in place to foster productive organisational innovation. Policymakers should consider existing policies and programs and address any implicit biases against services in domestic R&D and innovation policies—for example, in the definition of what “R&D” is eligible for assistance. If innovation in services is to be more effectively supported, a move away from the traditional emphasis on support for technical R&D, to incorporate the range of innovation strategies that better reflect opportunities and developments in the modern economy will be necessary (OECD 2001). Some such strategies are described in Part 2 of *Towards knowledge-based economies in APEC* (APEC 2000). In particular, they include policies to encourage strategic alliances through networking and clustering.

The traditional boundaries between services and other sectors such as manufacturing, agriculture and resources are blurring, as businesses are becoming increasingly interconnected in order to focus on customers' needs and thus remain competitive. Thus, a firm may take goods produced by other sectors and add value to them with a variety of services, often ending up with innovative new service-product packages. Examples include contract manufacturers (who also offer related engineering services (e.g. in the semiconductor industry) and service providers who bundle products (such as mobile phone companies who virtually give away the handsets in order to make money from the telecommunications). Such product-service linkages may necessitate a shift in how statisticians and policymakers characterise both productive activity and competitive business structures and skills.

It is not surprising that intellectual capital, i.e. knowledge, an intangible asset, is a key factor in service industries, dealing (as they often do) in intangible outputs. This is especially true in the more innovative organisations, as seen in the case studies. Inputs of intellectual capital are important in the strategic alliances that are such a feature of the new economy generally and of the case studies in particular. The alliance applies a multiplier to the effectiveness of the intellectual capital—by bringing together a variety of complementary skills and knowledge, more competitive products and services emerge. For example, software houses develop new (tailored) products to match the precise needs of users such as retailers and their supply chains. The using organisation develops additional intellectual capital in the form of new organisational processes to make effective use of the software. Although the ownership of the specific software may rest with either the customer or the supplier, in either case the skills needed to develop it remain with the software house as its intellectual capital, which can be applied to the problems of other customers.

Thus, knowledge management tools and processes are becoming increasingly important for service industries. They are now being taught in some institutions, and there may be scope for further diffusion of these skills through APEC channels. In addition, the effectiveness of current policies in protecting intellectual property rights is also an issue. Patents are little used by service industries, because they are designed primarily for tangible technical products. Service industries are more likely to use trademarks, copyright, protection of trade secrets, or simply a first-to-market strategy. It is not clear whether current intellectual property protection regimes constrain or facilitate innovation in services.

International trade in services is growing, which is increasing competition in service industries in all APEC economies. Official figures show that world exports of services in 2000 represented about 20 percent of total exports, and had grown at over 9 percent pa since 1985 (Productivity Commission 2002). Because of the diversity of ways in which services can be “exported” and the fact that they do not pass through customs points, these figures are almost certainly underestimates. (For example, an accounting firm setting up an affiliate in a foreign economy would probably be recorded as “foreign direct investment” rather than as an import [export] of

accounting services.) A major driver of the growth in services trade has been information and communications technology, which enables the activities of whole sectors of the economy — including banking, accounting and computer programming — to be carried out anywhere in the world and delivered to customers in a matter of seconds. Thus technology is creating a borderless economy in many services.

Electronic commerce, a hallmark of the “new economy”, widens the scope of such trade to many other sectors. The e-APEC agenda, not least its thrusts on e-commerce readiness and on paperless trading, offers scope to increase trade and raise productivity across the APEC region.

More generally, trade in services is promoted by the 1995 General Agreement on Trade in Services (GATS) under which members of WTO are encouraged to undertake progressive opening of their service sectors at their own pace and in accordance with their priorities and objectives. A further round of negotiations within the GATS framework is now underway, aimed at accelerating such liberalisation. Related discussions continue within the APEC Committee on Trade and Investment, and in particular its Group on Services.

The international transfer of intellectual property is an area that needs further study and debate, including in APEC forums. The scheduled review of TRIPS agreement of the WTO offers a framework for such discussion, but there are many contentious issues.

Capacity-building is a priority for many APEC economies intending to participate in the WTO negotiations on trade in services and looking for ways to strengthen their participation in the multilateral trading system. The importance of capacity-building was highlighted in the Doha Ministerial Declaration, in which WTO Members sought to place the priorities and interests of developing economies and least developed economies at the heart of the WTO’s work program. The WTO is already working closely with a number of organisations, such as global financial institutions and regional banks in the area of technical cooperation and capacity-building.

Trade liberalisation is not an end in itself. Rather it is improvement in overall community welfare that is the goal. This requires that better services — better in quality, cost or both — be available to business and consumers in all APEC economies. Better services and products come from innovation in service industries.

Innovation is centrally an organisational and managerial issue, because innovations are produced within organisations that transform knowledge. Capacity-building across APEC, along the lines of the Beijing Initiative of May 2001, can help spread the necessary organisational and managerial skills.

In terms of policy, analysis by the APEC Economic Committee and the OECD has shown that innovation (and thus prosperity in the new economy) is encouraged not only by policies specifically on innovation, but also requires complementary strong policy support for human resource development and ICT infrastructure, together with a business environment (“framework policies”) that is supportive of investment including investment in innovative developments (APEC 2000, 2001). Through the “knowledge clearing house” and other mechanisms for sharing relevant experience and knowledge, APEC can collectively raise the capacity of policymakers to put such policies in place.

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Appendix A

KNOWLEDGE MANAGEMENT IN INNOVATIVE ORGANISATIONS: SELECTED CASE STUDIES

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Introduction

Human society is experiencing a major transformation from an industry-based society to a knowledge-based society. With this transition, there is a growing recognition among academics and practitioners alike for the need to better understand the value of knowledge, what knowledge is, and how it should be managed.

In general, the management literature indicates a widespread recognition of the importance of knowledge with respect to the struggle for economic success, but little shared understanding of the construct itself (Drucker, 1993; Stewart, 1997). There are also differences among scholars in what constitutes useful knowledge and the ways in which it is created. Some theorists show more interest in codified repositories and information processing as enablers of 'explicit' objective and systematic knowledge. Others focus more on 'tacit' knowledge that people derive from their experiences and from social interaction with others (Nonaka and Takeuchi, 1995).

As organisations become more knowledge-based, their success will increasingly depend on how successful knowledge workers are at creating and applying new ideas productively and efficiently. The central task of those concerned with knowledge management is to determine ways to better cultivate, nurture and exploit knowledge at individual, and group levels.

An integrated model of knowledge management presented in Figure 1 illustrates the essential components of knowledge management and their relationships. The model (adapted from Handzic, 2001) suggests two types of organisational factors: *organisational environment* (eg. leadership, culture) and *technological infrastructure* (eg. I&CT) as major enablers that facilitate *knowledge processes* (eg. creation, transfer, utilisation) and foster the development of *organisational knowledge*. The model also suggests that organisational environment influences the choice of the technological infrastructure that supports knowledge processes. Finally, the model incorporates a feedback loop to suggest the need for continuous knowledge *measurement* and potential adjustment of strategies over time.

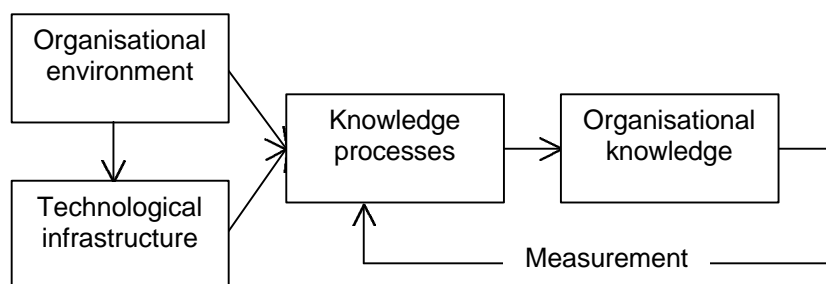


Figure 1. An Integrated Knowledge Management Framework

Knowledge management involves:

- appreciating differences in types of knowledge and ways of knowing, and their personal, public and cultural manifestations;
- understanding the underlying economics of knowledge development and use, including the effects of rapid dissemination and the possibility of increasing returns on knowledge resources;
- accessing forms of legal right and remedy that protect proprietary or user advantages in knowledge resources;
- appreciating the nature of ‘knowledge work’, and the needs and expectations of ‘knowledge workers’;
- appreciating relationships between knowledge, learning and innovation in, and by organisations;
- designing and negotiating systems for recognising and valuing the knowledge creation and utilisation capabilities of organisations;
- designing knowledge management architectures, systems and processes in organisations;
- impacting processes by which knowledge is mobilised, conserved, leveraged and enhanced within organisations;
- negotiating knowledge creation, diffusion and use within and across organisations and cultures, and in relationships with customers, suppliers and other stakeholders; and
- managing knowledge strategically, in generating new service offerings and enhanced organisational capabilities.

Given the current infancy of the knowledge management theory and practice, there is little empirical evidence regarding the actual penetration and impact of various knowledge management initiatives in the services sector. Therefore, the main purpose of this paper is to present a selected number of case studies from the literature (A.A. 1998, Rollo and Clarke 2001) as examples of the best international practices in knowledge management across financial, prudential, professional and business services.

Knowledge Processes

Our integrated knowledge management framework suggests that organisational knowledge is enhanced through a series of interrelated processes of knowledge creation, transfer and utilisation. Companies that implement these processes may exhibit some of the following characteristics: systematic identification of knowledge gaps and well-defined processes to close them, development of sophisticated and ethical intelligence-gathering mechanisms, involvement of all workforce in looking for ideas, formalising the process of capturing and transferring knowledge including documentation and lessons learnt, valuing and transferring tacit knowledge across organisation through encouraging experimentation and socialisation. The following case studies illustrate two most commonly used approaches, *codification* and *personalisation*, in financial and professional service organisations.

Bank of Montreal is one of the largest banks in Canada. Recognising the importance of better understanding the needs of their customers, this bank developed a sophisticated business intelligence system which the bank calls the customer knowledge database (CKDB). The CKDB consolidates detailed, business critical information such as the monthly profitability of customer accounts, profiles of individual customers, their demographic distribution, and the profitability of different market segments, regions and products. The database is further organised into several “datamarts” which serve different departments, such as loans, mortgage, credit cards, mutual funds, retail banking and on-line banking. The CKDB serves as an invaluable source of information helping the bank to identify innovative ways to retain customer loyalty, attract new customers, and maintain profitability.

Ernst & Young International is a global confederation of professional services in accounting, health care, personnel and information technology, with roughly 660 offices in more than 130 economies. To enable its employees to access and use knowledge content anywhere and anytime, the firm has established the Center for Business Knowledge (CBK). The CBK is a global network that consists of the firms' world-wide professionals. The key service provided by the CBK is the generation of timely proprietary research and analysis. The CBK is organised for each key domain of knowledge within the consulting practice, based on three areas of expertise: particular industries, specialist consulting approaches, and key areas of technology. Some regions have also knowledge focus groups on narrower topics. Each focus group meets occasionally face-to-face, and has on-line discussion and document database. The key to the success of the network is a group of facilitators who capture, edit and prune the discussion and document databases. The professionals in the network rotate in consultant and facilitator roles.

Organisational Environment

According to our framework, knowledge processes are facilitated by a conducive organisational environment, that is usually demonstrated in terms of a strong leadership support and a collaborative organisational culture. The examples of leadership support may include: recognition of the central importance of managing knowledge to organisational strategy, understanding and developing marketing and selling strategies that recognise the revenue-generating potential of the organisational knowledge assets, encouraging learning to support existing and create new competencies, developing human resources plans and reward schemes based on the contribution to the development of organisational knowledge. The evidence of a collaborative culture may include the environment that encourages and facilitates knowledge sharing, where a climate of openness and trust exists, where service value creation is the main objective of KM, where flexibility and a desire to innovate drive the learning process, and where employees take responsibility for their own learning. The following case study illustrates a good example of the knowledge conducive organisational environment.

McKinsey & Company is a global business consulting firm with 82 offices in 43 economies. The company has over 25 years of service in Greater China. Its reputation comes from a few basic ideals: the clients' interest come first, be discrete, be honest, do not overextend yourself. McKinsey's internal structure is supported by a collaborative culture reinforced by the fact that staff share part of the entire firm's profit irrespective of what economy they are employed in. The company is owned by partners which creates strong relationships and keeps the competence from leaving the firm. There is also emphasis on cultural socialisation. Partners are encouraged to move between client companies thereby sharing knowledge through personal relationships. Several policies are aimed at increasing competence of the firm and enabling knowledge flow from more to less senior people. The company recruits the top graduates, assigns them to teams with seniors and puts them through an up-or-out initiation. The company encourages knowledge flows by developing individual concepts, transferring tacit concepts and models that can be used by other staff, and sharing information on all projects. In terms of external structure the firm focuses on nurturing close relations with selected high image clients. The company also nurtures close relationships with universities because they recruit talent from them.

Canon, Honda and Matsushita, are three Japanese companies that all value tacit knowledge and its transfer across the organisation. Canon encourages frequent dialogue and communication among its groups of workers to elicit employees tacit knowledge. The company often uses a change of scenery and atmosphere to discuss problems and bring about free and fresh associations. This approach resulted in the development of Canon's breakthrough product - mini-copier. Honda, a Japanese car company, uses figurative language and metaphors as means to articulate and express tacit knowledge embedded in the organisation. The project team of the Honda City car coined a slogan Theory of Automobile Evolution to express the team's challenge to produce a car design concept different from anything else done before. The result was a

revolutionary product in car styling and engineering. Matsushita, an electric company based in Osaka, produced a record selling home bread-making machine through close study of the tacit knowledge of head bakers from the Osaka International Hotel, and by translating that knowledge into the product design specifications.

Technological Infrastructure

Our framework also suggests that technological infrastructure has the potential to enable or facilitate knowledge processes by providing a platform for knowledge capture or sharing. Some examples where technology has been successfully used to facilitate knowledge processes include: linking all members of the company to one another and to all relevant external publics, creating an institutional memory that is accessible to the entire organisation, linking organisation with its customers and partners, supporting collaboration among employees, fostering human-centered, real-time, integrated and smart systems. The following case studies present some organisations that use information technology *everywhere*.

Chase Manhattan Corporation is one of the largest banks in the United States, offering commercial, consumer and investment banking services. As Chase builds its brand identity and continues growing, the bank invests heavily in new technology to take them even further. Fundamentally, Chase uses information technology to improve *faster* than other megabanks in several important areas, including return on average assets, return on equity and efficiency. The essential bank technology of Chase is a corporate intranet that uses Lotus Notes groupware as an E-mail backbone. Chase also uses the web browser technology of Notes to provide its employees with Internet access and links to information such as human resources and benefits. Bank employees can use network computers to access the intranet and to perform routine tasks, such as opening accounts.

Westpac Institutional Bank ranks among top ten companies on the Australian Stock Exchange. Westpac has implemented knowledge management as a way of doing business. The bank boasts one of the largest centralised Oracle Financials systems in the world, and relies on an intranet and a web-enabled Oracle Financial Analyser to provide critical financial-performance information to its managers. Knowledge management is also intermingled with customer relationship management, because the bank wants to increase its knowledge of customers in order to better understand their needs. Westpac has taken advantage of the latest technology to develop a system known as Connect to record and store all of its core reports in a globally distributed database. Connect captures key contacts and automatically directs new information and news about customers to the relevant people in the bank. The benefit of the bank's knowledge management strategy is seen in high percentage of the Australian top companies' nominations of Westpac as a preferred banking partner.

Measurement

Finally, our framework suggests the need for continuous knowledge measurement in order to monitor and adjust an organisation's knowledge management strategy over time. Implementing good knowledge measurement practices is usually evidenced in finding ways to link knowledge management to financial results, developing specific sets of indicators to manage knowledge, including a balanced set of soft and hard, financial and non-financial indicators, as well as by allocating resources towards efforts that measurably increase organisational knowledge base. The following case studies introduce: a particular measurement practice of an organisation that created the world's first intellectual capital report, and one application of qualitative and quantitative methods to measuring the benefits of knowledge management.

Scandia Insurance is one of the leading companies in the world in Intellectual Capital accounts. Scandia's Intellectual Capital consists of human capital (personal values, competencies, potential relationships, attitudes) and structural capital, which includes customer capital (base, relationships, potential) and organisational capital (processes, culture, innovation assets). Scandia believes that their Intellectual Capital is at least as important as their financial capital in providing sustainable earnings. Scandia measures human capital by using indices such as an empowerment index (motivation, support, awareness and competence), training expenses per employee, employee turnover, average years of service, education levels. Scandia's structural capital is measured primarily in terms of its IT capacity and processing time. Scandia's core business measures consist of a set of indicators including financial (return-based efficiency and effectiveness metrics), customer (satisfaction and unit growth), process (efficiency and outputs/savings per employee), development (return business and future growth) and human (employee loyalty, skills and competencies). All metrics are tied to the company's strategic goals of generating value in financial and prudential services.

Telstra Corporation is the largest telecommunications company in Australia, and the most significant company in the high-technology sector in the Australian economy. The company has launched a number of successful "KnowHow" initiatives (iVelocity, iRadio, 2HoursofPower, WebLessons, WebLectures, iKnowAllQuiz) to increase sales of its products and services. The role of these technology-enabled initiatives is to rapidly build and transfer knowledge to the sales force about the company's emerging products, services, and business solutions. Telstra measures the success of KnowHow through a formal audit of its media, including both quantitative and qualitative research methods. The 2000/2001 audit feedback indicated varying levels of support for and use of the available tools. iRadio was found to be the most popular and 2HoursofPower the most effective tool. iStore document quality was perceived as excellent, while search facilities needed improvement. A large number of people were discouraged from using iKnowAllQuiz, due to perception problems. Feedback on WebLessons and WebLectures was scarce and hazy. The monetary value of KnowHow developed by the internal review indicated savings of millions of dollars per annum through finding quality information faster, minimising duplicate creation of sales tools, and avoiding duplicated training developments.

Conclusions

From the survey of selected practices presented in this paper, one may conclude that knowledge management represents one of the most significant management movements in the knowledge economy. If planned and implemented carefully in alignment with organisational objectives and core competencies, it may enable the release of the organisational knowledge resources that would bring the ultimate business success in the new economy.

Furthermore, the overview of the selected case studies together with its underlying knowledge management framework provides an important insight into how knowledge management may help to run business services more effectively. In particular, the findings indicate that technology may assist, but also emphasise the importance of the organisational cultural and structural context in which people are encouraged to develop and share their knowledge.

The overview also recognises the contingent nature of the knowledge management implementations. It suggests that different mix of strategies and processes may be needed to satisfy different business needs. The major challenge for organisations operating in the new economy will be to find the most appropriate mix to fit their business goals and strategy, technical expertise and culture, that would ultimately bring them success.

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Appendix B

BUSINESS EDUCATION FOR THE NEW ECONOMY AT UNSW

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Introduction

The changing economic landscape, particularly the growing importance of innovations for economic growth and competitive advantage in the New Economy, suggests the need for better management of professional knowledge of future knowledge workers. Workers in the new economy are expected to be skilled at creating, acquiring and transferring knowledge and modifying their behaviour accordingly (Garvin, 1998). They are anticipated to be capable of continually expanding their capacity to create desired results, nurture new thinking patterns, set free collective aspirations and learn how to learn together (Senge, 1990). It is also suggested that inventing new knowledge should be a modern worker's way of behaving or being (Nonaka, 1998).

Organisations' increasing demand for new skills and capabilities for future professionals and managerial knowledge workers, necessitates a corresponding response from the Education sector. In general, these demands have not been adequately addressed by Management Education (Seufert and Seufert, 1999).

Major criticisms are directed at content that has no base in reality and does not cultivate creativity and problem solving skills and instructional methods that largely impart knowledge rather than allow constructing it through experience.

This paper describes some major steps made by the University of New South Wales, Australia (UNSW) towards building an educational system that can meet the requirements of the Knowledge Economy. In particular, the paper describes innovations in the education services of the Faculty of Commerce and Economics (FCE), especially in curriculum and instructional/learning developments. Some of these innovations are in response to the very international mix of students at UNSW.

New Key Skills

Employers of graduates from the Faculty of Commerce and Economics expect them to be computer and information literate, i.e. they expect them to leave university with the strategies and skills necessary for locating, assessing, retrieving, validating, evaluating, managing and using information relevant to their fields of study. Moreover, in an age where information rapidly dates, where new technologies make information accessible in new ways, and where information itself is seen as a driving force of economic and societal change – computer and information literacy provide a means of personal empowerment and a platform for lifelong learning (FCE 2000a,b).

Computer Literacy

The Faculty of Commerce and Economics now lists as one of the key skills it expects of its graduates: *computer literacy* - the ability to use computer technologies and information systems, in acquiring and storing information, supporting and communicating applied research outcomes,

and supporting various modes of presentation. It is recognised that computer literacy relates more to an individual's ability to feel comfortable with using computing facilities, rather than any one specific hardware/software combination. Different students will have different starting points in relation to computer literacy, and provision needs to be made for this.

Accordingly, the Faculty provides a self-directed multi-media training program in its laboratories on common computer applications, which can be accessed by students on a 'needs' basis or used by staff as input to courses where they use specific computer technologies.

Information Literacy

Similarly for *information literacy* - Use information effectively by finding, accessing and marshalling it; evaluating its quality and relevance; and managing its deployment appropriately and responsibly. To this end, the Faculty has a two stage program: a generic information literacy course in 'workbook' form for all first year students in the Faculty at Undergraduate and Postgraduate levels, and integrating information literacy development into discipline based courses at later stages.

The Stage 1 program is supported by an Information Literacy Workbook, which is introduced to entering students in Induction Programs, referenced in Course Outlines, maintained on an accessible web-site, and used where appropriate in the first year courses. In Stage 2, discipline-specific Information Literacy Workbooks are: referenced on the Course Outline of disciplinary courses, maintained on an accessible web-site, used for assignments in at least one course in a disciplinary stream, and incorporated in relevant assessments relating to such assignments. The use and value of the Information Literacy resources is assessed through inputs from students, and by Faculty and library staff.

Novel Curriculum Developments

During 2000, a special working party consisting of representatives from all schools of the Faculty of Commerce and Economics developed a new stream of multidisciplinary graduate programmes of study. These programmes are articulated to provide a cross disciplinary perspective on E-Business Management, Knowledge Management and Services Management (FCE 2000c,d, 2001a).

E-Business Management

E-Business is about 'doing business electronically', and differently. It involves the use of electronic technologies and the internet together to design, produce, and deliver goods and services – at speed, and globally. It operates through new business models, where agility is the key to success and organisational strategies, processes, competencies and cultures are fundamentally changed. It blurs the distinction between organisations, customers and suppliers in value chains, and alters the meaning of working in, or for a business. Business success will flow from the design, use and redesign of appropriate and effective business models built around the use of e-technologies, and their management in the midst of profound change. Thus, technology, business models, and management are implicated together in creating successful and sustained E-Business outcomes.

The special programs in E-Business Management provide multi-disciplinary perspectives on the conditions and drivers of E-Business success. They explore: alterations to work, organisations and management to accommodate and capitalise on E-Business technologies; shifts in institutional frameworks which facilitate or condition E-Business—globalisation, communication and information technologies, and economic and legal institutions; transformations in the nature of

change, in terms of speed, space, time, interdependencies, and heightened levels of ambiguity; trends, social impacts, long-term effects related to E-Business, and progressive shifts in the nature of E-Business itself. The special programs in E-Business management are also designed to provide an orientation to working and managing in E-Business environments and to provide choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

Knowledge Management

Knowledge management is an emergent response to a ‘third wave’, digital, or *knowledge economy* that is replacing the industrial society that has prevailed for the last two hundred years or so. In a knowledge economy “the only thing that increasingly will matter in national as well as international economics is management’s performance in making knowledge productive” (Drucker, 1993). Organisations in the knowledge economy increasingly will inhabit environments that are said to be “chaotic” – where the link between cause and effect becomes difficult to discern, small changes can be amplified beyond comprehension, and the future eludes prediction. Thus, survival of an organisation depends on ceaseless innovation and a capability to find opportunities for the exercise of new strategies.

In the knowledge economy, service oriented organisations will be dominant, with the intellect or knowledge of people being the primary resource that is accumulated, developed and enhanced in the battle for competitive advantage. As explained in Appendix A²⁰, this makes *knowledge management* a vital tool for a successful businesses in the new economy.

FCE’s special programs in knowledge management are designed to: provide multi-disciplinary perspectives on knowledge management as an emergent organisational phenomenon; provide an orientation to working and managing in contexts where knowledge is a central capability and a driver of organisational success; and to provide choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

Services Management

As explained in Part 2, most products sold not only embody an implicit service (how they will be used); they also are accompanied by a range of ancillary services—to the point where the provision of goods or products is seen simply as part of the provision of services to customers. In this sense, most firms are in the services economy, competing through their differentiated service offerings.²¹ Services thus become the central focus of relationships between any organisation and its customers, and the central focus of organisational strategies and operations.

The critical issue for service oriented organisations is customer satisfaction and enrichment. Consequently, the capability of all those who come into contact with the customer directly or who affect customer experiences in manifold ‘moments of truth’ is critical to success. For most service-oriented organisations this involves the entire workforce. Therefore, the workforce needs to be empowered to represent the organisation in pursuing customer enrichment, and entrusted to secure customer satisfaction. It also needs to be enabled to pursue such outcomes, in terms of access to information and possession of requisite knowledge, skills and attitudes; such enablement will involve thinking as well as doing, ongoing learning, and capacities for innovation. The workforce needs to be seen as the vehicle through which the guiding strategic intelligence of the organisation is deployed and realised, as it focuses its endeavours in best representing the

²⁰. “Knowledge management in innovative organisations: selected case studies”, Appendix A of this paper [*Innovation in Services including e-commerce*, APEC Economic Committee, 2002]

²¹ Chapter 2 of this paper [*Innovation in Services including e-commerce*, APEC Economic Committee, 2002]

organisation. Thus, the workforce needs to understand and embrace the strategic intelligence which guides the organisation. While a capable workforce is critical to the success of service oriented organisations, it is also becoming progressively virtual—a resource that alters in construction as service offerings vary, and which is increasingly casualised, contract based and mobile.

With a capable workforce in place, the key role for management will be to leverage the value of the organisation, by creating and re-creating: a service-orientation; a capable workforce; a guiding form of strategic intelligence; and an organisation that is both virtual and agile. This will require new approaches to individual, organisational, and inter-organisational development—as well as new approaches to structuring work, securing commitment, and retaining control.

FCE's special programs in services management are designed to provide: multi-disciplinary perspectives on services management as a social and commercial phenomenon; an orientation to working and managing in service oriented environments; and choice in adapting study programs to academic or work backgrounds and career aspirations or needs.

Innovative teaching and learning

One of the major criticisms directed at current management education is that a large amount of knowledge is imparted to the learner without any attempt to base it in reality. Another noticeable weakness lies in the neglect of process oriented learning, that is, making the learning and thought process visible in order to develop the learners' metacognition (Joyce and Weil, 1986). FCE recognise that the quantity of material to be learnt by telling should be reduced to a minimum with lesson time instead mainly devoted to the cultivation of such qualities as problem-solving, decision making and creativity through self-directed and collaborative learning. The complexities of learning and the large number of interacting factors which affect individual and group learning present many challenges. The following sections briefly describe some innovative approaches developed and used at the UNSW's Faculty of Commerce and Economics (FCE 2001b,c,d)

Technology-Mediated Teaching and Learning

The design of quality learning draws on the full range of digital and analogue media for its purposes. Currently, the Internet and other networked technologies attract the most interest. We look to technology to provide mechanisms and media to support learning strategies in three main modes: *Adjunct* - in which the technology supplements a course of study offered principally face-to-face; *Mixed* – in which technology partly replaces elements of traditional class interaction; and *Online* – in which all the content and processes of interaction are supported by technology.

Using universal Internet standards, the student can access quality learning materials on demand, which are superior to those available or manageable in face-to-face settings. This is supported through the setting of tasks that may be published to the group or privately to the teacher via email or a student website. Other active engagement may be achieved through the development of pre-programmed interactive components or simulations that are made accessible through computer labs, face-to-face classrooms or online. Online discussion and dialogue (including with other students) may be held both synchronously through 'chat' sessions or more commonly through asynchronous discussions and bulletin boards. Online groups offer an achievable and retrievable record of class interactions as a forum for formative feedback. Individual and confidential feedback may be provided via private threads or email.

These processes within the Faculty are enabled through support for development and adequate infrastructure. For teachers, support includes: guidelines regarding minimum standards for course development, design, and delivery; processes and criteria by which learning materials are to be reviewed; workshops and individual support in educational design in response to the specific

needs of courses offered within a discipline or School; technical assistance for staff in content design and interactive media production. For students, support includes: specific information about the mediated learning and its use in each course; training and information to equitably access courseware and other UNSW online resources; access to technical assistance throughout the duration of a course/program; and opportunities to evaluate and comment on the teaching and learning process throughout a course.

The Faculty also provides necessary infrastructure for the mediated teaching and learning purposes. This infrastructure includes: electronic security measures (i.e., password protection, encryption, back-up); a local intranet; high-capacity local servers; high speed connection with the external internet and modem connections for students off campus; and technical support for commonly used computer platforms and software, which is reviewed annually in the light of new technologies.

Interactive Teaching and Learning

There are three main reasons to teach interactively. First, interactive teaching offers some insight into what students actually know. Second, interactive teaching is formative: the teacher seeks to direct students' cognitive processing along particular paths through conversations or dialogue to move them towards accepted conceptions of the topic within the discipline. Third, interactive teaching is motivational: e.g. when teachers ask students to work in small groups on a case study or problem, the resulting discussion not only serves to build new knowledge, it also serves to motivate students.

Interactive teaching methods can address each of these issues. Through well-designed learning processes, new material can be integrated into a student's existing set of knowledge constructs in a way that provides for a deeper level of understanding to occur.

In order to promote, maintain or develop these skill-sets by its academic staff, the Faculty provides: opportunities for staff to discuss and evaluate interactive teaching; regular dissemination of current developments related to interactive teaching of disciplines of the Faculty; technical resources, teaching spaces and infrastructure necessary for the conduct of a variety of desirable modes of active and interactive learning; staff development activities, such as workshops, seminars and individual coaching to build these skill-sets; and time release for the planning and coordination of interactive teaching strategies across Courses and Programs.

For students there are support mechanisms, both educational and social, to address skills deficits or other impediments to participation and learning; and mechanisms by which students can provide evaluative feedback to staff in order to improve the design of learning processes.

Cross-Cultural Teaching and Learning

Students and staff in the Faculty of Commerce and Economics have a range of cultural backgrounds and affiliations. Nearly half the students of the Faculty of Commerce and Economics at UNSW come from outside Australia: 2500 out of 6000, about half of them postgraduates. They represent over 50 different nationalities and almost seventy percent do not have English as their first language. This diversity represents a challenge to teaching but also an opportunity to enrich the learning experiences of students in preparing them for professional, management and policy positions in a diverse global environment.

The following eight principles help both teachers and students become more culturally aware of themselves and others, and to manage cultural diversity in the Faculty.

1. Be Consistent.
2. Provide information.

3. Encourage communication.
4. Avoid stereotyping.
5. Avoid ethnocentrism.
6. Involve others in your development.
7. Be an example.
8. Structure group work to manage diversity.

Conclusions

To prosper in the new economy, businesses need to be innovative. To meet the requirements of such organisations, management education has to itself be innovative, continually reviewing and reworking its products and services. This paper has briefly described some such innovations in curriculum and instructional methods made by one provider of business education, namely the Faculty of Commerce and Economics at the University of NSW. But that faculty, like similar providers of educational services elsewhere, has to continue to innovate or be left behind in the international competition for students that operates in the global new economy.

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CHAPTER THREE

THE CONTRIBUTION OF THE INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) SECTOR TO PRODUCTIVITY GROWTH IN CANADA AND THE UNITED STATES IN THE 1990S*

* This report was produced by Someshwar Rao and Jianmin Tang of Industry Canada, Ottawa, Canada. The authors would like to thank Andrew Sharpe for many useful comments and suggestions. They are also grateful to Renée St-Jacques for her encouragement and suggestions. The views expressed here are those of authors only and do not represent either Industry Canada or the Government of Canada. The recently launched joint research project between Harvard University, Industry Canada and Statistics Canada will develop more comparable sets of data on about 40 industries for Canada and the United States and undertake an in-depth analysis of the role of ICTs in economic growth in the two economies.

1. INTRODUCTION

In the 1990s, labour productivity and real incomes grew at a significantly slower pace in Canada than in the United States, its southern neighbour and largest trading partner. As a result, the productivity and real income level gaps between the two economies have widened. These trends are quite unexpected and worrisome, especially in view of the dramatic increase in Canada's outward orientation, partly due to FTA/NAFTA, and the implementation of a number of structural reforms.

Canada's relatively poor productivity performance has been blamed on many factors such as the widening of investment and innovation gaps, the weak Canadian dollar, slower adoption of information and communication technologies, relatively poor management strategies and practices, stronger labour unions, and heavier tax burdens. Although there is some empirical evidence to suggest that many of these factors might have contributed to Canada's relatively weak productivity performance, it is extremely difficult, if not impossible, to disentangle accurately the contribution of each factor to the productivity problem because they all interact and influence productivity in a complex manner.

There now seems to be a broad consensus that the information and communication technologies (ICTs) played a dominant role in the revival US productivity growth in the 1990s, especially in the second half [Jorgenson (2001), Jorgenson and Stiroh (2000), Oliner and Sichel (2000), and Lee and Pilat (2001)]. This renaissance of US productivity is commonly attributed to the New Economy—a radical transformation of business strategies and production processes by the use of ICTs in both ICT-producing and ICT-using industries. Muir and Robidoux (2001) and Macklem and Yetman (2001) examine the role of ICTs in the Canadian economy from two different perspectives: business cycles and inflation. The objective of this article is to analyse the contribution of ICTs to Canada's productivity growth in the 1990s and examine their role in the widening of the Canada-US productivity and real income level gaps. In addition, it will provide a short to medium-term perspective on Canada's productivity performance.

Our empirical results show that Canadian ICT-producing industries also experienced a large increase in productivity in the 1990s. But the contribution from this source to aggregate productivity growth was significantly smaller in Canada than in the United States, because the size of the ICT-producing sector, on average, is considerably smaller and its productivity grew at a significantly slower pace. Furthermore, productivity improvements in ICT-using industries were much smaller than in the United States. The short to medium term outlook for productivity growth in Canada does not look very promising because of the current economic slowdown in North America and elsewhere, particularly in ICT-producing industries, and the large negative impact of the slowdown on machinery and equipment (M&E) investment in Canada, especially ICT investment.

The article is organized in the following way. In section two, we analyse aggregate labour productivity growth in Canada, the United States and other OECD countries. An analysis of the trends in the output and employment structure of ICT-producing industries in Canada and the US is provided in section three. The contribution of ICT-producing industries to aggregate labour productivity growth in the two economies in the 1990s is examined in section four. Trends in M&E and ICT investment and productivity performance in ICT-using industries in the two economies are examined in section five. The last section summarizes the key findings and explores the medium-term prospects for productivity growth in Canada and the Canada-US productivity and real income level gaps.

2. AN OVERVIEW OF CANADA'S PRODUCTIVITY PERFORMANCE

Productivity growth is the fundamental determinant of growth in real incomes, and a key driver of economic well-being and quality of life in all economies. In addition, relative productivity performance is a key determinant of international competitiveness of a country in the medium term, especially for a small open economy such as Canada. In the post-1973, OECD countries have experienced slower productivity growth. This productivity growth slowdown has been being blamed for a number of economic problems, including sluggish economic growth, stagnant real wages, increased unemployment, budget deficits, and social unrest.

In this section, we will provide a brief overview of Canada's productivity growth in the past two decades and compare it with the performance of the United States and other OECD countries. This information will provide a useful background to our later analysis of the role of ICTs in both producing and using industries in Canada and the United States.

Canadian business sector labour productivity, measured as GDP per hour worked, increased at an annual rate of 1.7 percent during the second half of the 1990s²², compared to 1.5 percent in the first half. But labour productivity in the United States increased at a considerably faster pace than in Canada during the second half of the 1990s, accelerating 1.1 percentage points to 2.6 percent (Table 1). As a result of Canada's relatively weak productivity performance, the Canada-US aggregate labour productivity level gap increased from 15 percent in 1995 to 18 percent in 2000. And the per-capita income level gap remained more or less constant over this period (Chart 1). More importantly, in the 1990s, real personal disposable income in Canada increased by a mere 0.6 percent per year, compared to 1.7 percent in the United States.

Fortunately, Canada's productivity performance did not lag behind that of the United States in all industries.²³ As a matter of fact, in the 1990s, Canadian primary industries outperformed their US counterparts by a wide margin. Labour productivity in this sector in Canada increased at an average annual rate of 2.9 percent, compared to only 1.3 percent in the United States. In the construction industry, labour productivity actually declined marginally in both economies. On the other hand, Canada lagged badly behind the United States in the manufacturing sector. Labour productivity in the US manufacturing sector increased by 4.3 percent per year in the second half of the 1990s, more than three times the Canadian growth rate of 1.3 percent. (Table 2). As a result, the Canada-US manufacturing labour productivity level gap increased from 21 percent in 1995 to 35 percent in 2000 (Chart 1).

These broad productivity trends provide some general support for the thesis that Canada did not benefit from the production and use of ICTs as much as the United States in the second half of the 1990s. However, this situation is not unique to Canada. Labour productivity growth did not pick up significantly in the latter half of the 1990s in other OECD countries (Table 3). Instead, the growth rate actually declined in many economies. These trends are puzzling and worrisome and raise some important questions: Why did only the United States register a productivity revival in the second half of the 1990s? What accounts for the superior productivity performance of Canadian primary industries? What factors explain the relatively weak performance in Canada and other OECD economies?

²² It should be noted that the changes introduced by Statistics Canada in May 2001 in the methodology used to construct the national accounts, in particular the treatment of software purchases as investment and not intermediate inputs, have boosted the average annual rate of growth of business sector output per hour 0.5 percentage points from 1.2 percent to 1.7 percent over the 1995–2000 period. Consequently, labour productivity growth in the second half of the 1990s in Canada was significantly stronger than originally believed.

²³ Unlike the estimates for business sector productivity in Table 1, Statistics Canada has not yet incorporated the methodological change of treating software as part of investment into the productivity estimates by industry found in Table 2.

At least, seven explanations are possible for the relatively weak productivity performance in Canada and other OECD economies. These include: a smaller size of the ICT-producing sector; slower productivity growth in ICT-producing industries; weaker growth in ICT investment in ICT-using industries; a lag relative to the United States in the growth of ICT investment in ICT-using industries; a lagged and/or weaker productivity response to the increase in ICT investment in ICT-using industries; greater negative impact of other factors such as the business cycle and adverse supply shocks on productivity; and greater difficulties in measuring service sector output. In this article, we will examine in some detail the first five explanations for slower productivity growth in Canada and the widening of the Canada-US labour productivity level gap.

3. THE SIZE AND STRUCTURE OF THE ICT-PRODUCING SECTOR

In this section and the next we will examine the contribution of the ICT sector to Canada's productivity growth and its role in the widening of the manufacturing and the aggregate Canada-US labour productivity level gaps. In this article, we use the OECD definition of the ICT sector, which includes ICT manufacturing as well as ICT services industries.²⁴

A Profile of the Canadian ICT Sector

The ICT sector is a key and very dynamic sector of the Canadian economy. In 2000, the sector's contribution to GDP was \$52 billion (\$1992). In the second half of the 1990s, real output in the ICT sector grew at an average annual rate of 12 percent, compared to 3.8 percent for the overall economy. As a result, its share of real GDP increased from 3.7 percent in 1995 to 5.6 percent in 2000. The ICT sector is also a major employer. In 2000, about half a million persons worked in the sector, an increase of over 40 percent since 1990.

It is a high R&D intensity sector. In the 1990s, ICT sector nominal R&D spending increased by 10 percent per year, reaching \$4.9 billion in 2000. Currently, the ICT sector accounts for over 45 percent of total private sector R&D in Canada. Likewise, ICT-related Canadian patent applications granted in the United States increased at a considerably faster pace than all Canadian patent applications granted in the United States in the 1990s (Chart 2).

The ICT sector is also one of the most skill-intensive sectors. In both ICT manufacturing and services industries, the percentage of workers with university degree is significantly above the national average. For instance in the software and computer services industry, half of all employees have a university degree, over two and half times the national average. Similarly, employees in the ICT manufacturing are very well paid. In 2000, the average wage in the ICT sector was almost 50 percent higher than the average wage of all Canadian industries and this premium increased significantly in the 1990s (Chart 3).

Canada's trade in ICT goods also increased considerably in the 1990s. More than three quarters of ICT manufactured products are exported, reaching almost \$40 billion in 2000. They currently represent about 10 percent of Canada's total merchandise exports, compared to around 7 percent in 1990. Similarly, the share of ICT manufactured products in total merchandise imports increased from 15 percent in 1990 to 18 percent in 2000. This large and growing two-way trade in

²⁴ ICT manufacturing industries include computer, office machine, communication equipment, instruments, consumer electronics, and communications, energy wire and cable industries. However, in this study we exclude instruments due to data constraints. ICT services-producing industries include computer and related services, cable television, telecommunication carriers, and other telecommunication industries. Due to data constraints, cable television is replaced by a more broader sector: telecommunication-broadcasting industries.

ICT products implies increasing product specialization, bodes very well for continuation of a healthy productivity growth and dynamism in the Canadian ICT sector.

The Structure

The industrial structure of the ICT sector also changed dramatically in the 1990s. For instance, the share of office machines in real GDP of the ICT sector more than tripled, reaching 8.1 percent in 2000. Similarly, the share of computer services almost doubled. On the other hand, the importance of telecom services declined sharply. But they still represent 41 percent of the sector's output, compared to 51 percent in 1990. More importantly, ICT services industries still contribute close to 75 percent of the ICT sector output (Chart 4).

Similarly, the employment structure of the ICT sector has greatly changed. The share of computer services in the ICT sector employment more than doubled, reaching 38 percent in 2000. This increase came at the expense of telecom services. It is interesting to note that despite a three-fold increase in its real GDP share, the share of office machines in ICT sector employment in the 1990s declined somewhat to 4.2 percent, implying huge productivity improvements in this sector (Chart 5).

Unlike its small output and employment shares, ICT manufacturing accounts for close to 70 percent of the R&D undertaken by the ICT sector. However, telecommunication equipment manufacturers carry out almost 50 percent of all R&D done in ICT manufacturing. Computer equipment and other communication and electronic equipment producers contribute around 20 percent of the ICT sector R&D. Similarly, exports of telecommunication and computer equipment account for over 50 percent of all ICT manufactured exports. Electronic parts and components contribute another 20 percent to ICT goods exports.

Canada-US Comparisons

An analysis of the size, dynamism and the structure of the ICT sector in Canada and the United States can shed light on Canada's relatively weak productivity performance. The United States accounts for almost 50 percent of total ICT sector value added in OECD countries, compared to Canada's 2.9 percent, implying a much larger share of overall business sector GDP—8.7 percent versus 6.5 percent. Similarly, the ratio of value added to gross output is significantly smaller in Canada than in the United States (41 percent versus 49 percent), reflecting greater assembly of imported components. More importantly, labour productivity in the Canadian ICT sector is almost 40 percent below the US level. This explains why the ICT sector employment accounts for a larger share of business sector employment in Canada than in the United States. (4.6 percent versus 3.9 percent).

Like GDP, the United States accounts for over 50 percent of total ICT sector R&D in OECD countries, compared to Canada's 2.7 percent. Further, the proportion of R&D to value added is significantly lower in Canada than in the United States (8.9 percent versus 10.3 percent). Similarly, the shares of ICTs in total merchandise exports and imports are considerably lower in Canada. For instance, in 1997, ICT exports accounted for only 7.2 percent of Canadian merchandise exports, compared to 15.2 percent in the United States.

In summary, the ICT sector in Canada is significantly smaller, less innovative, less productive and less outward-oriented, suggesting that these factors might have played an important role in the recent widening of the Canada-US aggregate labour productivity gap.

In addition, differences and changes in the industrial structure of employment and output, and relative productivity levels within the ICT sector between the two economies could also contribute to the differences in productivity growth between the two economies. Here, we look at the structural changes in the ICT manufacturing sector in the two economies. Similar analysis

cannot be undertaken for the ICT services sector because comparable data do not exist for the United States.

ICT manufacturing accounts for a much larger share of the ICT sector in the United States than in Canada. In 1998, it accounted for 3 percent of aggregate GDP, more than double the share in Canada. Although the industrial structure of real value added in the ICT manufacturing sector was very similar between the two economies in 2000, the share of computers and office machines has more than tripled in Canada since 1989, reaching 31 percent in 2000, compared to a stable share of around 30 percent in the United States (Table 4).

The employment structure, however, is significantly different between the two economies. The communication equipment and other electronics industry accounted for 77 percent of employment in the ICT manufacturing sector in 2000, compared to only 68 percent in the United States. On the other hand, the computer equipment industry's share was 6 percentage points higher in the United States. As expected, the employment share of the ICT manufacturing sector in the total economy was considerably lower in Canada than in the US, 0.6 percent vs. 1.0 percent.

In 2000, the labour productivity level in Canadian ICT manufacturing industries, expressed in terms of 1992 dollars, was 2.5 times larger than the level for aggregate labour productivity, compared to a stunning ratio of 15.7 in the United States (also expressed in terms of 1992 dollars).²⁵ More importantly, this relative productivity advantage saw a 15-fold increase in the United States, compared to an increase of less than 150 percent in Canada.

In the two economies, computer equipment industry was more productive than communication equipment and other electronics industries in the 1990s, but the advantage was significantly greater in Canada than in the United States. In both economies, consumer electronics industry's productivity level in 2000 was less than 11 percent of the ICT manufacturing sector average and has steadily lost ground since 1989 (Table 6).

4. CONTRIBUTION OF THE ICT SECTOR TO ECONOMIC GROWTH

In this section, we will analyse the contribution of the ICT producing sector to output and labour productivity growth in Canada and the United States.

Output Growth

Between 1995–2000, the real GDP of the Canadian ICT manufacturing sector increased at an average annual rate of 17 percent per year, compared to 10.5 percent in ICT services. During this period, the real GDP increased by 3.8 percent per annum. Given that the ICT sector represented 5.6 percent of real output in 2000, the 12 percent annual growth rate for the sector imply that almost 14 percent of overall economic growth in the second half of the 1990s was directly attributable to the ICT sector.²⁶

²⁵ It should be noted that constant price labour productivity levels are very sensitive to both the base year and the use of hedonic techniques for quality adjustment. For example, the massive price declines in the computer sector based on these hedonic techniques resulted in very large increases in the real output of the sector and very high constant price productivity levels even though competitive forces keep the current price productivity level of the sector in line with those of other sectors. When the constant price output series are rebased, the constant price productivity levels in sectors with above average productivity gains fall towards their current price productivity levels and of course are identical in the new base year. Because of this situation, some productivity analysts believe labour productivity levels are most appropriately measured in terms of current prices.

²⁶ Note, however, that contribution figures are only approximation because industry real GDP numbers do not add up to total real GDP number, due to the use of Fisher Chain Price Index.

As pointed out earlier, data on U.S. ICT services industries are not available. But the data on ICT manufacturing sector in the two economies suggest that the ICT sector's contribution to economic growth during the second half of the 1990s was much larger in the United States than in Canada. During this period, real GDP of the ICT manufacturing sector grew at a remarkable 45 percent per year in the United States, implying that more than one-third of US economic growth in the latter half of the 1990s came from this source (Table 7).

Labour Productivity Growth

Labour productivity (GDP per worker) during this period increased at an average annual rate of 5.8 percent in the Canadian ICT sector, a slight increase from the first half average. During this period, total economy output per worker in Canada increased by only 1.7 percent per year, suggesting that more than a quarter of aggregate productivity growth was the direct result of a healthy productivity growth in the ICT sector. It is important to note that despite accounting for only 25 percent of the output of the ICT sector, ICT manufacturing accounted for more than 60 percent of the total contribution of the ICT sector to aggregate labour productivity growth because of its much superior productivity growth. Labour productivity in this component of the ICT sector increased at an annual rate of 13.7 percent, compared to 3.5 percent in the ICT services sector (Table 7).

In the United States, labour productivity in ICT manufacturing increased by 42.5 percent per annum during the second half of the 1990s, compared to a growth rate of 19.7 percent in the first half of the decade (Table 7). This superior performance accounted for more than 50 percent of the U.S. aggregate labour productivity annual growth rate of 2.5 percent in the second half of the 1990s.

The next important question is: what was the combined contribution of the larger size and faster productivity growth in the ICT manufacturing sector in the widening of the Canada-US manufacturing and aggregate and labour productivity gaps during the past five years? The productivity trends in the two economies imply that **all** of the difference in aggregate labour productivity growth between Canada and the United States, hence the widening of the aggregate labour productivity level gap during the second half of the last decade, was due to the large differences in the size and productivity growth of the ICT manufacturing sector in the two economies. The two factors contributed more or less equally to the widening of the aggregate labour productivity gap. Similarly, they were also entirely responsible for the dramatic widening of the Canada-U.S. manufacturing labour productivity gap during this period. As a matter of fact our results suggest that without the superior productivity performance in primary industries, the aggregate labour productivity level gap between Canada and the US would have widened even more.

5. PRODUCTIVITY PERFORMANCE IN ICT-USING INDUSTRIES

In the two previous sections we analysed the contribution of ICT producing industries to Canada's output and productivity growth in the 1990s and examined their role in the widening of the Canada-US aggregate economy and manufacturing labour productivity gaps. In this section, we will look at the investment and productivity performance of ICT-using industries in both Canada and the United States.

In the second half of the 1990s, the aggregate ratio of ICT investment to employment in Canada increased at an annual rate of 20.6 percent, compared to 11.7 percent in the first half of the 1990s and 8.8 percent in the 1980s. Further, the ICT investment intensity increased significantly across all major industries during the 1992–97 period (Table 8). The increase was particularly strong in service industries. For instance, in wholesale trade, retail trade and finance, insurance and real

estate industries, the ICT investment intensity increased at annual rate between 17 and 27 percent per annum.

In addition, ICT investment intensity is generally much higher in service-producing industries compared to goods-producing industries (Table 9). For instance, in finance, insurance and real estate, the ICT investment intensity in 1997 was twice that of the aggregate intensity, whereas in primary industries it was only 5.0 percent of the aggregate intensity. As expected, the ICT intensity was more than ten times that of the aggregate intensity in the communications industries.

Canadian Experience

The acceleration in ICT investment contributed to a large increase in the aggregate ratio of M&E to employment in the latter half of the 1990s. It increased at 9.3 percent per year, compared to meagre 0.7 percent in the first half of the 1990s. Like ICT investment, M&E investment intensity increased in the second half of the 1990s at a considerably faster pace in service-producing industries than in goods-producing industries. The M&E investment intensity of the aggregate manufacturing sector actually declined while the intensity of the communications industry increased by 23 percent per year during the 1995–99 period (Table 10).

The key question is: did the increase in ICT and M&E investment intensities translate into superior productivity performance in the latter half of the 1990s? As expected, labour productivity in service industries increased at a considerably faster pace in the second half of the 1990s compared to the first half — productivity growth averaged 1.5 percent per year during the 1995–99 period, compared to only 0.8 percent per year during the 1989–95 period. Furthermore, in wholesale and retail trade industries, labour productivity growth in the second half of the 1990s increased by over 3 percent per year, compared to only 1.3 percent in the manufacturing sector. Similarly, the communication sector, with the largest increase in ICT and M&E intensities, registered an extremely robust productivity growth of 7.6 percent per year over the same period (Table 2).

Canada-US Comparisons

In this sub-section, we will compare and contrast the investment and productivity performance of ICT using industries in Canada with those of the United States. In the 1990s, aggregate ICT investment intensity increased at a significantly faster pace in Canada than in the United States. However, the opposite is true for M&E investment, especially in the first half of the 1990s. During the 1989–95 period, the M&E investment intensity in Canada increased by a meagre 0.7 percent per year, compared to an increase of 9.3 percent per annum in the United States. As a result, the aggregate M&E investment gap between Canada and the US increased from 28 percent in 1987 to 41.5 percent in 1999. During the same period, ICT investment gap declined from 68 percent to 58 percent (Chart 6). The ICT investment intensity increased by more than 20 percent per year in all major US industries during the second half of the 1990s, except in primary industries and communication (Table 8).

The stronger ICT and M&E investment record, as expected, resulted in superior productivity performance in the United States in manufacturing and service industries. For instance, in the first half of the 1990s, productivity growth in service industries in the two economies increased by a mere 0.9 percent per year, but in the second half, service sector productivity increased by 2.3 percent per annum in the United States, compared to only 1.5 percent in Canada (Table 2). In addition, all major service industries registered a productivity growth of over 2 percent during this period in the United States. The productivity growth gap was even larger in the manufacturing sector: in Canada, labour productivity growth averaged only 1.3 percent per year while in the United States it averaged a healthy 4.3 percent. However, as mentioned in section four, almost all of the widening of the Canada-US labour productivity gap in manufacturing was due to the huge productivity growth gap in the ICT producing industries, represented here by the two machinery

industries: electrical and electronic equipment and non electrical machinery. During the second half of the 1990s, labour productivity in the U.S. electrical and electronic equipment industry increased by an annual rate of over 20 percent, almost two and half times faster than in Canada. Similarly, in the US non-electrical machinery industry, labour productivity increased by over 14 percent per year, while in Canada it declined by 2.6 percent per annum (Table 2).

In short, ICT and M&E investment intensities increased dramatically in service industries in both economies, resulting in increased productivity growth. But, the pickup in ICT and M&E investment intensities as well as productivity was significantly larger in the United States. However, the productivity growth deficit in service industries was offset somewhat by superior Canadian productivity performance in primary industries.

6. CONCLUSION

The main objective of this article has been to examine the contribution of ICTs to labour productivity growth in Canada in the 1990s and compare Canada's experience with the US record. Our analysis leads to three main conclusions:

- the ICT-producing sector in Canada registered a strong growth in output, employment and productivity in the 1990s, especially in the second half of the decade. It accounted for almost one quarter of aggregate labour productivity growth in the latter half of the 1990s;
- the contribution of ICT manufacturing industries to the US aggregate labour productivity growth during this period was more than double that in Canada. More importantly, the large differences in the size and productivity growth of ICT manufacturing between the two economies accounted for all of the widening of the manufacturing and economy-wide labour productivity level gaps between Canada and the United States; and
- in both economies, ICT and M&E investment intensities increased at a significantly faster pace in service industries in the latter half of the 1990s. Increased investments translated into higher productivity growth in these industries in the two economies. But, once again, the investment and productivity performance were significantly better in the United States than in Canada. Fortunately, Canada's superior productivity performance in primary industries offset somewhat the weaker productivity growth in service industries.

What are the implications of our findings for Canada's labour productivity growth and for the Canada-US labour productivity gap in the short to medium-term? The answer to this question is complicated. But, on balance, the medium-term outlook for Canada's productivity growth and the Canada-US productivity gap is not very rosy. This is due to the dramatic economic slowdown in the ICT-producing sector in the United States, Canada and other OECD economies and the negative impact of the current economic slowdown on ICT and M&E investment in both ICT-producing and ICT-using industries in Canada and other OECD countries.

In view of the sharp slowdown in economic activity and considerable excess capacity in ICT-producing industries, the contribution to Canada's aggregate labour productivity growth in the short-term is expected to be quite modest from this source. What about over next five years? In our view, even in the optimistic scenario, the contribution would be similar in magnitude to that experienced during second half of the 1990s. Given the persistence of a huge relative size advantage by the United States, even if Canada's ICT-producing industries experience similar productivity growth as their US counterparts, this source would likely contribute to the widening of the Canada-US labour productivity level gap in the short to medium term.

What about productivity growth in ICT-using industries? Primary industries in Canada will likely continue to register healthy productivity growth. Given the strong growth in ICT and M&E investment intensities in the second half of the 1990s, Canadian service industries should also enjoy reasonable productivity growth over the next five years, at least as good as in the last five years. But the current economic slowdown and its negative impact on capacity utilization and M&E investment could adversely impact labour productivity growth in these industries. For instance, ICT and M&E investment in the United States declined in the first two quarters of 2001 at annual rates of 17 percent and 10 percent respectively. In Canada, the decline was modest, but is likely to accelerate in the second half of the year. In view of weak economic growth and investment performance and low capacity utilization, labour productivity growth in service industries could average only around 1 percent per year over the course of the first half of this decade. For the same reasons, productivity growth in non-ICT manufacturing industries is also expected to be modest.

The United States, however, is likely to enjoy a productivity growth advantage in service industries. But, this advantage is likely, as in the second half of the 1990s, be offset by Canada's superior productivity performance in primary industries. On balance, however, the economy-wide Canada-US labour productivity gap is likely to widen further during the next five years because of the widening of the manufacturing labour productivity gap, primarily due to a relatively smaller contribution to aggregate productivity growth from ICT-producing industries in Canada.

In sum, Canada's labour productivity growth is expected to remain lacklustre in the first half of this decade. It could average as much as 1.5 percent per year. In addition, the economy-wide Canada-US aggregate labour productivity gap is expected to widen further during this period, but at a significantly slower pace than during the past five years. This sober medium-term perspective strongly implies that governments in Canada as well as the private sector should work with vigour on several fronts towards closing the innovation and investment gaps, improving the dynamism and flexibility of the Canadian economy, and raising Canada's productivity growth (Conference Board of Canada (2000); Rao et al.(2001)).

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Table 1: Labour Productivity* Growth in the Business Sector in Canada and the United States (average annual percent rate of change)

Canada			United States		
1981-1989	1989-1995	1995-2000	1981-1989	1989-1995	1995-2000
1.1	1.5	1.7	1.7	1.5	2.6

* Real GDP per hour worked.

Sources: Statistics Canada and U.S. Bureau of Labor Statistics

**Table 2: Labour Productivity* Growth by Industry in Canada and the United States
(average annual percent rate of change)**

Industry	Canada			United States		
	1989-95	1995-99	1989-99	1989-95	1995-99	1989-99
Primary industries	3.1	2.5	2.9	1.5	1.1	1.3
Construction	-0.8	0.5	-0.3	-0.1	-0.9	-0.4
Manufacturing (total)	3.2	1.3	2.4	3.2	4.3	3.6
Primary Metal	4.2	2.6	3.6	3.7	5.4	4.4
Paper & Allied	5.5	2.0	4.1	0.1	2.7	1.1
Lumber & Wood	-0.5	-0.4	-0.4	-2.7	-2.7	-2.7
Transportation Equipment	4.9	3.4	4.3	2.3	0.7	1.6
Stone, Clay & Glass	-0.8	4.7	1.4	2.9	1.5	2.4
Rubber & Plastics	6.9	1.7	4.8	3.5	2.9	3.3
Furniture & Fixtures	6.0	5.6	5.9	1.6	1.4	1.5
Food and Beverage	3.4	-1.5	1.4	2.8	-3.4	0.3
Chemicals	4.8	0.3	3.0	3.6	3.4	3.5
Tobacco	0.8	-2.4	-0.5	1.9	-15.5	-5.4
Misc. Manufacturing	4.3	4.2	4.2	-0.5	-0.7	-0.4
Leather	-4.2	-11.4	-7.1	4.6	1.2	3.3
Fabricated Metal	9.6	7.2	8.6	2.3	-0.1	1.3
Textiles**	3.7	-1.0	1.8	3.1	2.5	2.9
Printing & Publishing	-2.1	-1.0	-1.6	-2.9	-1.7	-2.4
Petroleum Refining	11.3	-4.0	4.9	0.3	9.4	3.8
Machinery Except Electrical***	4.1	-2.6	1.4	5.4	14.1	8.8
Electrical & Electronic Equip.***	8.9	8.4	8.7	13.1	20.4	15.9
Services	0.9	1.5	1.1	0.9	2.3	1.2
Transportation & Warehousing	2.0	1.3	1.7	2.5	1.7	2.2
Communications	3.0	7.6	4.8	5.1	2.7	4.1
Utilities	1.2	1.4	1.3	2.5	2.4	2.5
Wholesale trade	1.1	3.2	1.9	2.8	7.8	4.8
Retail trade	0.3	3.1	1.4	0.7	4.9	2.4
FIRE****	2.5	1.6	2.2	1.7	2.7	2.1
Total Economy	1.0	1.6	1.2	1.2	2.4	1.7

Notes: * Real GDP per worker

** Including primary textile mills, apparel and other textile products

*** Computer and office equipment are included in machinery for the US and in electrical and electronic equipment for Canada

**** Finance, insurance and real estate

Sources: Compilations based on data from Statistics Canada and US Bureau of Economic Analysis

**Table 3: Labour Productivity* Growth in Selected OECD Countries
(average annual percent rate of change)**

Economies	1979-89	1989-95**	1995-99***
Canada	0.7	1.0	0.9
Denmark	1.2	2.0	0.9
Finland	2.8	3.0	2.7
France	2.5	1.4	1.6
Germany	NA	2.3	2.3
Italy	1.7	1.9	0.7
Japan	3.2	1.2	0.8
Korea	4.8	5.0	2.7
Netherlands	1.5	1.2	0.7
UK	2.7	2.0	1.2
US	1.2	1.1	1.9

Notes: * Value added per person employed
 **1991-95 for Germany
 *** 1995-98 for France, Japan, Korea; 1995-97 for Germany
Source: Pilat, D and F.C. Lee (2001) "Productivity Growth in ICT-Producing Industries – A Source of Growth Differentials in the OECD?" DSTI/EAS/IND/SWP(2000)3/REV1, OECD STI Working Paper

**Table 4: Distribution of Real (\$1992) GDP in ICT Manufacturing Industries*
(Percent)**

Industry	Canada			United States		
	1989	1995	2000	1989	1995	2000
Computer and office machine	10.1	22.9	31.4	30.6	29.4	29.0
Consumer electronics	5.0	1.5	0.3	4.1	2.3	0.3
Communication and other electronics	85.0	75.6	68.3	65.3	68.3	70.8

*Excluding instruments
 Sources: Statistics Canada and US Federal Reserve

**Table 5: Distribution of Employment in ICT Manufacturing Industries*
(Percent)**

Industry	Canada			United States		
	1989	1995	2000	1989	1995	2000
Computer and office machine	20.3	18.1	20.4	32.9	28.0	26.2
Consumer electronics	7.8	3.1	2.4	6.2	6.7	5.8
Communication and other electronics	71.9	78.8	77.2	60.9	65.3	68.0

*Excluding instruments
 Sources: Statistics Canada and US Bureau of Labor Statistics

Table 6: Relative Labour Productivity Levels in ICT Manufacturing Industries*
(Aggregate ICT Manufacturing = 1.00)

Industry	Canada			United States		
	1989	1995	2000	1989	1995	2000
Computer and office machine	0.5	1.3	1.5	0.9	1.1	1.1
Consumer electronics	0.6	0.5	0.1	0.7	0.3	0.1
Communication and other electronics	1.2	1.0	0.9	1.1	1.1	1.0
ICT Manufacturing/Total Manufacturing	1.1	1.2	2.2	0.8	1.9	8.4

*Excluding instruments

Sources: Compilations based on data from Statistics Canada, US Bureau of Labour Statistics and Federal Reserve

Table 7: GDP and Labour Productivity (LP)* in the ICT Producing Sector in Canada and the United States (average annual percent rate of change)

	Canada		United States	
	1989-1995	1995-2000	1989-1995	1995-2000
Real GDP Growth in ICT Manufacturing	5.2	17.2	17.7	45.2
Real GDP Growth in ICT Services	5.6	10.5	NA	NA
Real GDP Growth in ICT Sector	5.5	12.0	NA	NA
Real GDP Growth for Total Economy	1.5	3.8	2.3	4.1
LP Growth in ICT Manufacturing	6.5	13.7	19.7	42.5
LP Growth in ICT Services	4.9	3.5	NA	NA
LP Growth in ICT Sector	5.3	5.8	NA	NA
LP Growth for Total Economy	1.0	1.7	1.2	2.5

*GDP per worker

Sources: Statistics Canada; US Bureau of Labor Statistics and Federal Reserve Board

**Table 8: ICT Investment*/Employment in Canadian and US Industries
(average annual percent rate of change)**

Industry	Canada	United States		
	1992-97	1992-97	1989-95	1995-99
Primary industries	19.3	12.7	12.2	9.9
Manufacturing	12.0	9.4	8.1	26.3
Construction	9.6	18.7	21.0	24.4
Transportations	21.8	19.0	14.1	20.1
Communications and other utilities	9.1	9.2	5.3	13.5
Wholesale	22.6	27.3	12.1	26.5
Retail	26.6	11.0	9.6	30.5
Finance, Insurance and real estate	16.8	18.3	6.7	26.0
Business services	2.6	15.5	-0.3	38.8
Business sector**	10.8	12.9	6.9	23.0

*Excluding software

**Excluding the service industries not listed in the table

Sources: Statistics Canada and US Bureau of Economic Analysis

**Table 9: Relative ICT Investment*/Employment Ratio in Canadian Industries in 1997
(Average=1.00)**

Industry	Relative ICT Investment /Employment
Primary industries	0.1
Manufacturing	0.4
Construction	0.1
Transportations	0.5
Communications and other utilities	10.7
Wholesale	0.7
Retail	0.2
Finance, Insurance and real estate	2.0
Business services	1.2

*Excluding software

Source: Statistics Canada

**Table 10: M&E Investment*/Employment in Canadian and U.S. Industries
(average annual percent rate of change)**

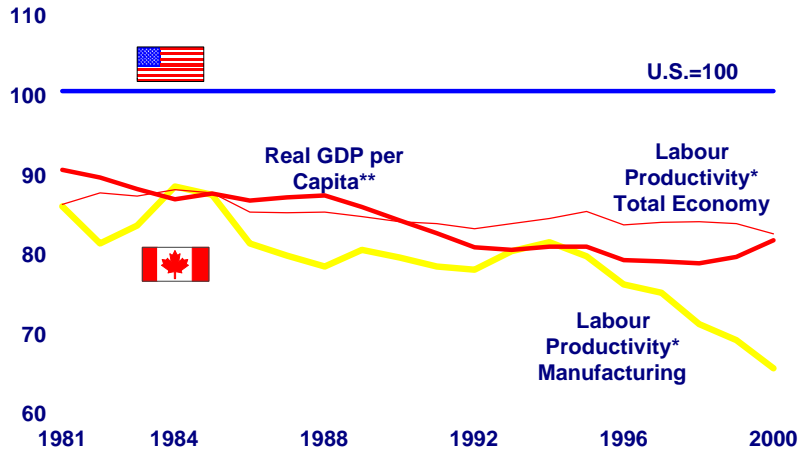
Industry	Canada		United States	
	1989-95	1995-99	1989-95	1995-99
Primary industries	1.8	1.6	4.7	2.8
Construction	3.5	2.6	3.5	7.7
Manufacturing	-1.6	-2.7	4.9	12.2
Transportation & Warehousing	6.8	11.5	8.1	13.4
Communications	1.4	23.0	6.8	11.2
Utilities	-7.1	-1.4	0.7	2.6
Wholesale trade	11.7	5.5	12.2	13.4
Retail trade	6.7	12.2	3.4	15.1
FIRE	-2.4	18.2	3.5	16.7
Business Sector**	-0.4	6.2	4.9	12.1

*Excluding software

**Excluding the service industries not listed in the table

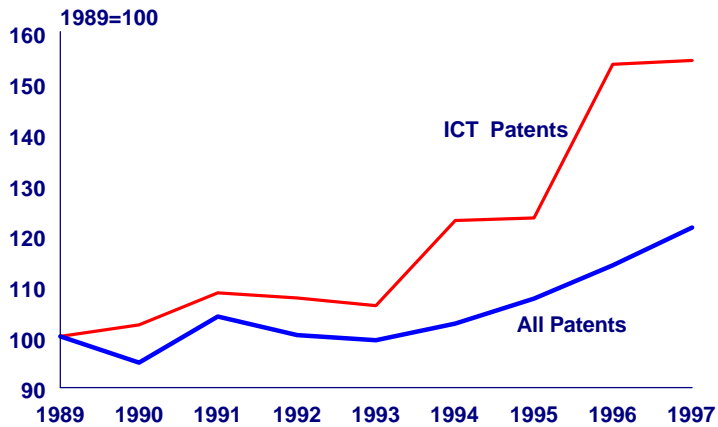
Sources: Statistics Canada and U.S. Bureau of Economic Analysis

Chart 1: Canada-U.S. Productivity and Real Income Gaps



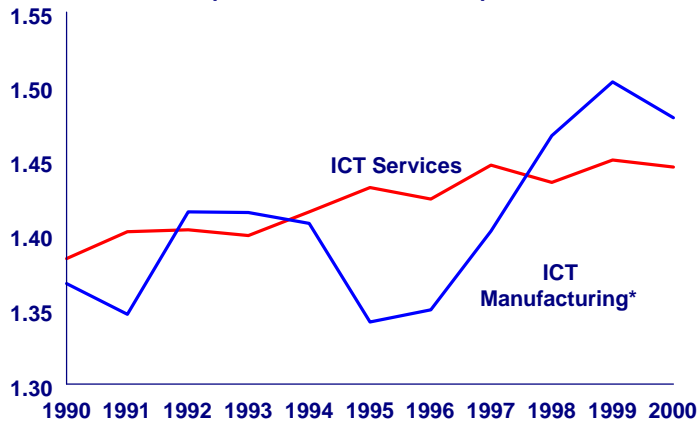
* Real GDP (in 2000 dollars) per hour worked
 *GDP per hour worked, based on the methodology of the Centre for the Study of Living Standards.
 Source: Statistics Canada, U.S. Bureau of Labour Statistics, and U.S. Bureau of Economic Analysis

Chart 2: Patents Granted for ICT Applications*



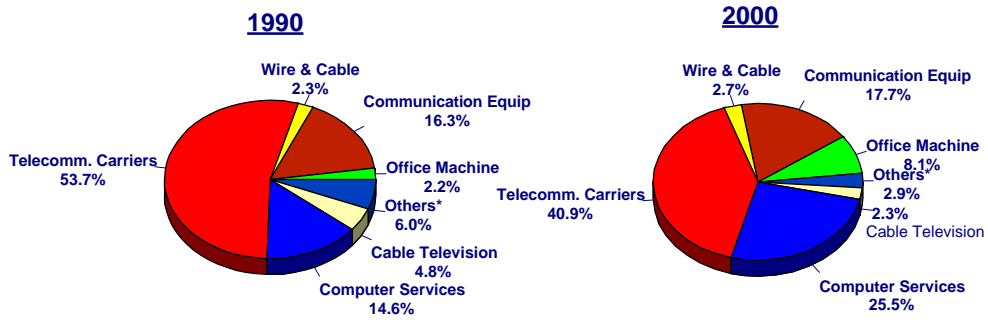
* Canadian patent applications granted in the U.S.
 Source: U.S. Patent and Trademark Office

**Chart 3: Weekly Earnings of ICT Sector Relative to All Industries
(All Industries = 1.00)**



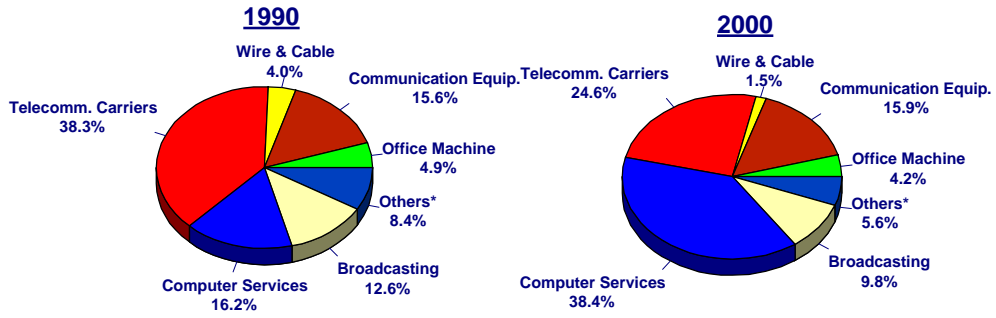
*Excluding record player, radio, TV receiver and instruments
Source: Statistics Canada

Chart 4: Real GDP Share of ICT Industries



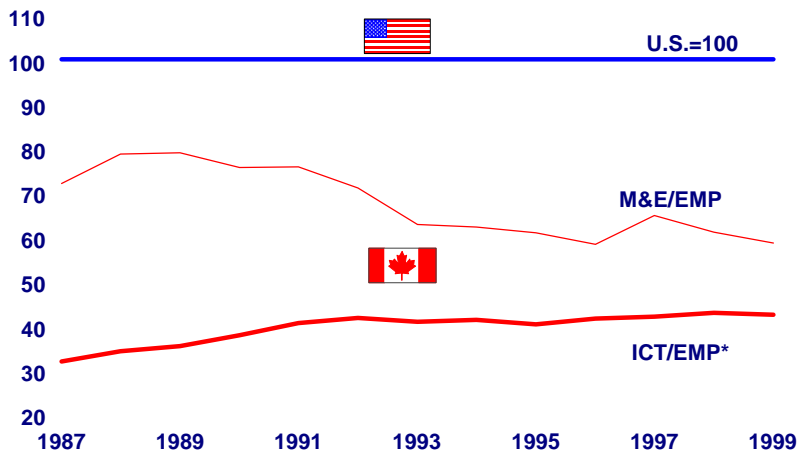
*Including consumer electronics and instruments industries
Source: Industry Canada estimation based on data from Statistics Canada

Chart 5: Employment Share of ICT Industries



*Including consumer electronics and instruments industries
 Source: Industry Canada estimation based on data from Statistics Canada

Chart 6: Canada-U.S. Investment Gaps



* U.S. Investment is converted into Canadian dollars using GDP PPP
 Source: Statistics Canada and U.S. Bureau of Economic Analysis

CHAPTER 4

THE RENEWED IMPORTANCE OF ENTREPRENEURSHIP IN THE NEW ECONOMY: CASE STUDIES OF SELECTED APEC ECONOMIES

In 2000, the APEC Economic Committee (EC) published a report entitled, *APEC Economies: Beyond the Asian Crisis*. The report contained a section that outlined a menu of options for public policies that attempt to foster entrepreneurship. The report was, however, based on an analysis of a limited number of economies in the APEC region, most of which were industrialized.

The Japanese research team has compiled this follow-up report. This volume focuses on the case studies of selected APEC economies, and takes a closer look at the diversified conditions and development stages among the members. Seven members have been selected for study: China; Korea; Japan; Malaysia; Singapore; Chinese Taipei; and the United States. EC's report provides a theoretical framework for categorizing the policies adopted by these members. Further efforts were made in this report to identify the economic rationales of the policies and to extract the "best practices" from them.

1. ENTREPRENEURSHIP IN THE APEC ECONOMIES

The State of Entrepreneurship

The state of entrepreneurship in the APEC economies seems quite mixed. According to the ranking based on the entrepreneurship index of International Institute for Management Development (IMD)²⁷, published in 2002, the highest-ranked member in the APEC in terms of entrepreneurship was the United States. The least entrepreneurial was Japan (Figure 1).²⁸ The score was between 9.11(US) and 3.80 (Japan). The scale was standardized at 10 points as the maximum and 0 as the minimum. While the index is compiled from both hard data and data from a survey of about 3,500 executives²⁹, and therefore tends to reflect the perceptions of the respondents, it indicates a general consensus on which economies are active in terms of entrepreneurship.

The most active five in APEC, besides the United States, were Hong Kong, China; Canada; Chinese Taipei; and Malaysia. The least active five, besides Japan, were China; Mexico; Indonesia; and Singapore. One may observe a generally positive correlation between the economic performances of the members and their ranking. Many of most active economies recorded robust growth during the crisis period, while some of the developing economies in the least active group suffered seriously from the economic difficulties.

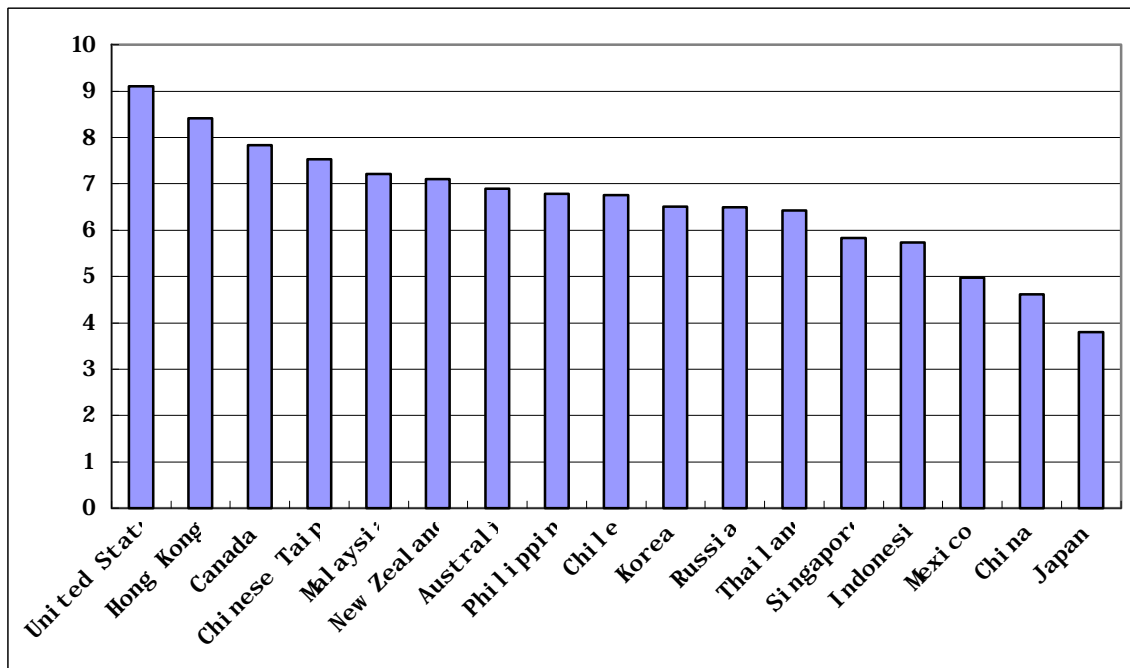
²⁷ The entrepreneurship index is a component of the IMD's competitiveness index. Based on the assumption that the competitiveness of both economies and companies are interdependent, the competitiveness index tries to measure and to compare the extent to which a economy provides an environment that fosters domestic and global competitiveness of the companies operating within its borders. Quantitative, hard data and qualitative, survey data are gathered. The two sets of data are then combined, aggregating the 243 criteria into various rankings. One of the criteria is entrepreneurship.

²⁸ The IMD did not publish the indice of Brunei, Papua New Guinea, Peru, and Viet Nam.

²⁹ The survey, Executive Opinion Survey, is undertaken by the IMD in 2002. This is an in-depth 106-item questionnaire sent to executives in top- and middle management in all of the economies covered by the survey. They were asked to evaluate the current and expected competitiveness conditions of the economy in which they work. The respondents represent a cross-section of the business community in their economies. They represent both domestic and international companies, as well as local and expatriate perspectives. Respondents ranked only the economy in which they work, thereby ensuring that the evaluations reflect an in-depth knowledge of a particular environment.

Figure 1: State of Entrepreneurship

(Source) International Institute for Management Development (IMD), *The World Competitiveness*



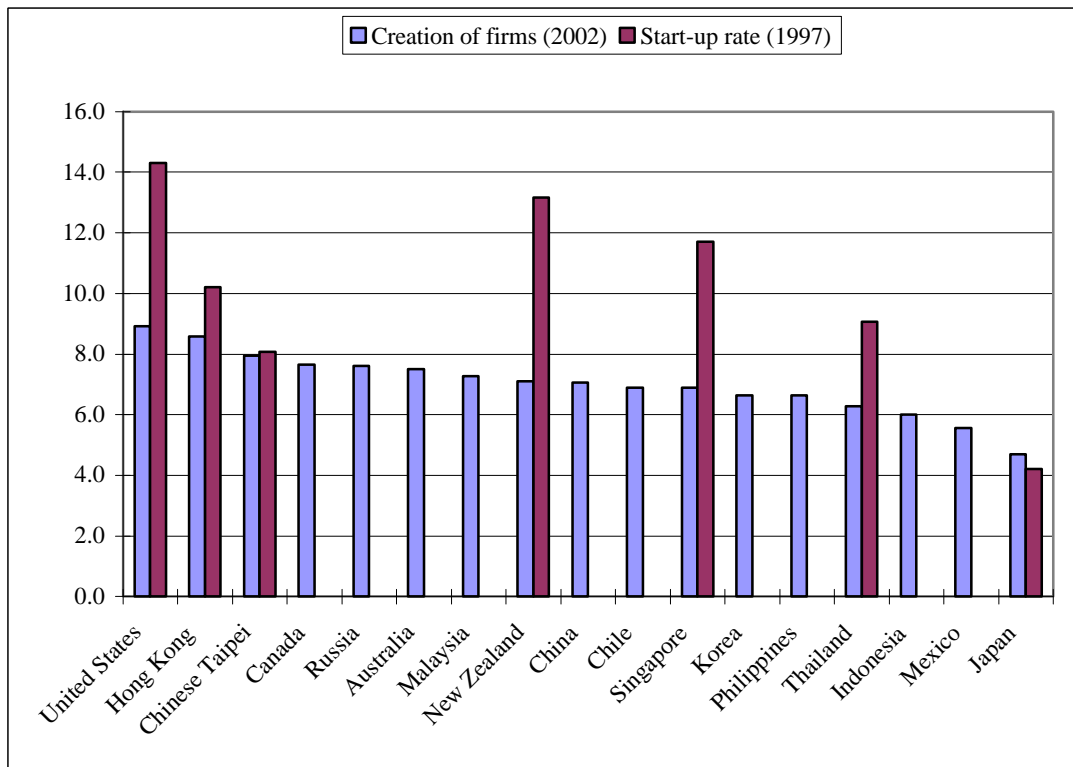
Yearbook 2002.

Firm Start-ups

The IMD entrepreneurship index is categorized under “corporate culture.” A related index is “creation of firms” under “management efficiency.” Entrepreneurship often takes the form of, among other things, the creation of new companies. The ranking of the APEC members in terms of the “creation of firms” is shown in Figure 2 below. The ranking looks like that of the entrepreneurship index. Indeed, the Spearman correlation between the two sets of data is 0.73, showing a high correlation.

While the IMD “creation of firms” index is based on a survey, real data on the ratio of firm start-ups are also available in some economies (Figure 2). Among APEC members, there is a common tendency between the rankings of “creation of firms” indices, and the firms start-up ratios. The exceptions are Hong Kong, China, and Chinese Taipei whose start-up ratios are lower than would be expected from the survey data. The discrepancy in the definitions of the start-up ratio in the different economies may have caused this.

Figure 2: Creation of Firms Indices and Start-up Rates



Source: International Institute for Management Development (IMD), *The World Competitiveness Yearbook 2002*. Companies Registry, Hong Kong; Registry of Companies, Malaysia; Companies Office, New Zealand; Singapore Department of Statistics, Registry of Companies and Businesses, Singapore; Ministry of Labor and Social Welfare, Thailand; MOEA, Republic of China; Small and Medium Enterprise Agency, *White Paper on Small and Medium Enterprises in Japan 2001*

What Accounts for the Diversity within APEC?

What accounts for the diversity of entrepreneurship among the APEC members? A wide range of macro-economic, micro-economic, institutional, and social factors should affect entrepreneurship.³⁰ A stable macro-economic environment is essential for new investment. Sustained growth with low inflation will secure the rates of return on investment and ventures and reduce future investment risks. A properly designed competition policy, at the micro-economic level, will help avoid entry barriers for new firms. At the institutional level, without organizations to provide a range of supporting services to fill the information and technology gaps, the level of business activities might be less than optimal. Social factors, such as mistrust among business counterparts, may hinder entrepreneurial initiatives.

Among APEC members, it appears convincing that the members with higher entrepreneurship indexes tend to have a better mix of the macro-economic, micro-economic, institutional, and social conditions. Hong Kong, China; the United States and Chinese Taipei have achieved higher growth with low inflation, maintain free and open markets, and foster good institutional and social environments for entrepreneurs. The diversity within APEC seems to reflect such basic factors. These determining factors, in turn, should have been affected by the combination of policies and programs within these economies, although public policies are by no means solely responsible for

³⁰ See pp.36 in OECD (1998) for the detailed analysis of the various factors. This study emphasizes the multifaceted nature of public policies that affect various aspects of entrepreneurship.

the results. In the next section, some cases of public policies introduced to foster entrepreneurship are introduced, in line with the menu of policy options, organized in APEC (2000). This will help understanding of the diversity within APEC.

2. POLICIES FOSTERING ENTREPRENEURSHIP IN APEC

Multifaceted Objectives of the Policies

Entrepreneurship is a key to economic growth. Entrepreneurs play a role in mobilizing resources to new, often innovative areas. This mechanism not only leads to more efficient use of resources—it also promotes the expansion of sectors with a larger growth potential. This conduit function is important, particularly when significant innovation, such as the application of new information technology, is taking place. Entrepreneurship is also expected to promote the creation of new jobs. As such, entrepreneurship provides policymakers with attractive option that is expected to improve both productivity and employment.

Nevertheless, many of the real policies in APEC have objectives that are not directly oriented toward growth and employment. Rather, the policies are aimed at somewhat intermediate targets, although such targets, once met, do lead to growth and employment. Policies in many economies are specifically targeted to small- and medium-sized enterprises. Promotional measures for starting up firms sometimes rest under umbrella programs, such as a racial policy (Malaysia), a structural adjustment package aimed at resolving the economic crisis (Korea), and small business development schemes (Japan, the United States, and many others). Recently, many measures in APEC aim at utilizing information technology in the area of venture promotion and firm creation.

Role of the Public Sector

It is usually the private sector that decides to start up new firms, taking account of returns from and risks of the investment. While the decision rests solely on the private sector, governments appear to be very interested in intervening to foster entrepreneurship. This interest may come mostly from the desire to sustain growth and secure employment. For the policymakers, entrepreneurship is supposed to be a formula for strengthening the supply side of the economy. For example, the “Basic Policies for Economic and Fiscal Policy Management and Structural Reform of the Japanese Economy” and the “Basic Policies for Economic and Fiscal Policy Management and Structural Reform of the Japanese Economy 2002”, set out by the Japanese government in June 2001 and in June 2002 respectively, include several measures to foster entrepreneurship in Japan. It should, however, be noted that this macro-economic rationale to support growth and employment should be carefully reviewed in light of cost-benefit balances and the principal roles of the government.

Overall, establishing good business environments and conducive framework conditions are crucial for governments to promote entrepreneurship. Such conditions may include healthy fiscal conditions, stable monetary policies; free, fair, open and transparent markets; functioning legal infrastructures, minimum regulations; and stable financial institutions. Governments need to address market failures. Positive externalities may give governments a rationale for playing a complementary role for granting incentives to entrepreneurs in innovative industries. Such examples include provision of incubation services and education, where the market mechanism alone cannot lead to optimal levels of activities within innovative industries.

Menu of Policy Options

In 2000 APEC put forward a menu of policy options to foster entrepreneurship. Based on the menu, this report will organize its analysis as follows:

- 1) Expanding Access to Finance
 - a. Equity Investment by “Angels” and Venture Capitalists
 - b. Tapping Stock Markets
 - c. Financing by Public Financing Institutions
- 2) Mobilizing Human Resources for New Business
 - a. Flexible Labor Markets
 - b. Education and Training
- 3) Expanding Access to Technologies and Information
- 4) Developing Legal Infrastructures

In addition to this list, healthy fiscal conditions, stable monetary policy, deregulation, and trade/investment liberalization are of particular importance. This report skips these policies to concentrate on the specific issue of entrepreneurship. This report will review the policies taken in selected APEC economies, following the menu above. The selected economies are: China; Japan; Korea; Malaysia; Singapore; Chinese Taipei; and the United States. As the selection is by no means exhaustive, the conclusion and lessons learned may not be automatically applicable to the other APEC economies.

2.1 Expanding Access to Finance

a. Equity Investment by “Angels” and Venture Capitalists

Risks and the Role of Equity Finance

Investment in start-ups involves potentially high returns and high risks. The high risks tend to hinder their access to bank loans and other bank lending. So, for starting up such ventures, equity funding may provide a better source of finance. Successful ventures will bring more rewards to the equity holders, compared to debt holders. Equity finance will offer a chance to those investors who prefer higher expected returns and accept more risks, and accordingly expand access to finance for the ventures.

At the early stage of venture firms, i.e. the leading-up and start-up stages, the entrepreneurs need a relatively small amount of funds, but the investors must accept a higher risk. In the United States, “angels” and venture capitalists have played an important role in funding the ventures at the early stages. Angels, who are usually wealthy individuals, provide new ventures with equity funds. Venture capitalists are financial intermediaries that pool risk-enduring funds from investors and make equity investments in young firms. Once the firm is successfully brought up through its late “mezzanine” stage to the initial public offering (IPO) stage, investment banks come to play a significant role in financing the firms.

Taxation to Expand Equity Funding in APEC

One policy measure to foster equity funding to new business concerns income taxation on “angels” (individuals investing in new businesses.) Since “angels” earn most profits in the form of capital gains through IPOs and mergers and acquisitions (M&A), their income from investment carries high risks. Reducing tax on the capital gains of “angels” may have a positive effect on their behavior towards risk taking.

Another taxation measure that might be helpful in fostering new businesses pertains to loss carryover in corporate income taxation. A newly-created company usually does not make profits in its first few years. Some innovative start-ups, profitable as they may be in the long run, could be discouraged if corporate income taxation on an annual basis lowers its profitability. Thus, loss carryover provision during the early years of operation for new ventures may encourage the creation of new innovative firms.

Among the APEC economies, the financial system for entrepreneurs in the United States apparently leads the other economies with respect to the width and depth of the financial markets. Regarding taxation, the United States rather early introduced “angel” taxation, before and in 1997. A study concluded that the 1997 tax reduction had the effect to increasing the attractiveness of these investments to investors and raised the market value of their shares.³¹

Following the United States, other APEC economies, such as Australia, Japan, Korea, New Zealand and Singapore, also undertook taxation policies to make venture capital and equity finance markets more amenable to new ventures. In particular, many members, such as Canada; Japan; Korea; and Singapore, introduced “angel taxation.” Such taxation includes a wide range of capital gain deductions from corporate income tax and private income tax for venture capitalists and “angels”. Some members reduced corporate income tax for start-ups. It is noteworthy that, in many industrialized economies, the cuts in capital gains tax were financed by broadening the tax base.

b. Tapping Stock Markets

Developing Second-tier Markets for Ventures

In many economies, stock markets specific to new companies have been opened and developed. Such stock markets help young companies to raise equity funds from a wide variety of investors. They are also important as “exit channels” for angels and venture capitalists to harvest their investments and move on to new opportunities.

IPOs on stock markets give an important opportunity to “angels” and venture capitalists to exit from their investments, reaping the capital gains and reinvesting in other budding companies. To this end, it is important for new, promising companies to be able to achieve IPOs within reasonably short periods of time. In the United States, it takes only about six years, on average, after its establishment for a new company to make an IPO. Given this relative ease of making IPOs, investors in the United States can exit earlier, even before the IPO, by selling their investments to other parties by way of M&A. Developing second-tier markets would provide easier access to public securities markets through less-stringent admission requirements.

Tapping Stock Markets in APEC

The best-known second-tier market is the NASDAQ (National Association of Securities Dealers Automated Quotation System) in the United States, established in 1971. Over the last few years, new stock markets for new companies have started operations in APEC economies as well. Major examples include the KOSDAQ (Korean Association of Securities Dealers Automated Quotation System) in 1996; the MOTHERS (Market of the High-Growth and Emerging Stocks) in 1999 and NASDAQ-JAPAN in 2000, both in Japan; the GEM (Growth Enterprise Markets) in 1999 in Hong Kong, China; MESDAQ in 1999 in Malaysia (Malaysian Association of Securities Dealers Automated Quotation System), SESDAQ in Singapore, and the TIGER (Taiwan Innovative Growing Entrepreneurs) in 2000 in Chinese Taipei.

³¹ Mark H. Lang and Douglas A. Shackelford. “Capitalization of Capital Gains Taxes: Evidence from Stock Price Reactions to the 1997 Rate Reduction.” *National Bureau of Economic Research*, Working Paper 6885, January 1999.

The recent opening of these new stock markets for new small companies in the APEC region is a welcome development in fostering entrepreneurship. It appears, however, that some of the markets have performed poorly. For example, MESDAQ in Malaysia listed only three companies as of February 2001 and was taken over by the Kuala Lumpur Stock Exchange (KLSE) in March 2002. This may reflect the slump in the investment market because of the flight of foreign investors. Chinese Taipei's TIGER listed only 12 companies at the end of 2000, and the liquidity of the listed stocks is still low. Effective 2 January 2002, a mechanism for the trading of emerging (unlisted) shares began operations. Such a mechanism is considered a funding alternative to the companies which are not listed on the stock market or over-the-counter markets. Some APEC members combine taxation policy with the development of new stock markets. Korea, for example, introduced the inclusion of 50 percent of the corporate tax in deductible expense for KOSDAQ-listed companies. Further, Korea has established a third-tier stock market to promote investments to non-listed small companies.

The performance, measured by the number of listed companies, depends on the prevailing economic conditions, as well as the function and attractiveness of the new market. It is, however, essential to gather investors and to attract companies to list to secure the liquidity. Making the markets open to foreign investors would be helpful, particularly for developing economies. At the same time, lowering listing requirements to facilitate new listings must be accompanied by stringent rules for de-listing and tighter time requirements for disclosure. These conditions would enable investors to make informed decisions at their own risk.

In many industrialized economies, financial institutions like pension funds and insurance companies are subject to various restrictions on their portfolios, including caps on equity investments, with the aim of helping maintain prudence in investment. Such restrictions may need to be reviewed with the view to the need for enhancing equity finance for new businesses. In this regard, it is worth noting that in the early 1970s the United States government relaxed the regulations on pension funds regarding equity investment in non-listed companies, leading the way to the subsequent rapid development of the venture capital industry in the United States.

c. Financing by Public Financial Institutions

Public Finance to Complement Private Seed Funds

Equity finance, important as it is, cannot satisfy all the financing needs of new companies. Bank loans (and loans from other financial intermediaries) are also an important source of finance for new companies. However, as mentioned earlier, there are some difficulties for who banks want to extend loans to new companies; higher credit risks, lack of collateral, and limited cash flows.

In many industrialized economies, most start-up entrepreneurs obtain their finance through informal sources, such as their own savings or those of their families. External formal equity financing, in fact, is used by only a small proportion of new entrepreneurs. In an effort to complement the seed funds financed by the private sector, governments often make loans or equity funds available for new firms through public financial institutions. In other cases, governments provide lenders of loans with guarantees.

Financing by Public Financial Institutions in APEC

Virtually all the selected APEC economies have a variety of programs to finance start-ups by public financial institutions. These include lending on preferential terms, co-financing with private banks ('pump priming' by public institutions), loan guaranty, and indirect equity investment through privately managed investment/venture funds.

However, the public financing schemes in APEC are often designed to serve specific objectives rather than merely fostering entrepreneurship. Most frequently, the funding is limited to small- and

medium-sized enterprises. As a successful example, the United States government undertakes a program called Small Business Investment Companies (SBICs), which refers to privately managed venture capital funds which are partly provided by the federal government's Small Business Administration (SBA). Playing a complementary role to private venture capitalists, SBICs are important where the availability of private venture capital is low. Japan maintains a similar system. The objectives of other selected APEC members include: to attract foreign capital (Malaysia, Singapore), to target industries with growth potential such as those related to information technology (China, Korea, Malaysia, Singapore, Chinese Taipei), and to fill ethnic gaps (Malaysia).

2.2 Mobilizing Human Resources for New Businesses

Flexible Labor Markets

Flexible labor markets are important in fostering entrepreneurship, insofar as they enable new firms to secure competent workers and professionals and to respond quickly to changes in circumstances. Deregulation in labor markets is important for enhancing the efficiency of the economy at large, and is vital for underpinning entrepreneurial activities.

The pension system, taxation, and other arrangements may inhibit labor mobility. For example, when company pensions are not portable, workers may be discouraged from leaving their present jobs. Defined-contribution pension plans with individualized accounts have less distortion on worker decisions. Likewise, if companies provide generous fringe benefits such as low-cost housing as part of wage compensation and such fringe benefits are not taxed, workers may be discouraged from starting their own new businesses. Thus, it is important to review the various economic and social arrangements pertaining to labor mobility, with a view to restoring neutrality in worker decisions about continuing or leaving their present jobs.

Compensation flexibility is also important among start-up companies, particularly in high-technology industries, which frequently turn to stock-based compensation plans to attract and motivate employees while conserving cash and generating capital. Stock options enable emerging companies to compete for talent with larger, established companies. Stock options provide a useful means for new businesses to remunerate investors and managers, as cash flows and profits are very limited when new businesses start their operations. When new companies are successful and thus boost their market values, stock options may confer huge profits to their holders, giving strong incentives for executives, and workers to help grow their companies. Furthermore, in the United States for example, the attractiveness of stock options is raised by postponing capital gains taxation until after the options are exercised. In light of the importance of stock options in fostering new businesses, corporate laws and taxation regarding stock options need to be revised as appropriate.

Education and Training

There is little doubt that the level of entrepreneurship in a society hinges on cultural factors regarding the emphasis placed on the independence of individuals and on respect for entrepreneurs starting their own businesses. Entrepreneurial activities tend to be sluggish when educational systems do not embrace the needs of a competitive economy. Education plays a critical role in creating entrepreneurs for future business start-ups. Education fostering entrepreneurial spirit and ability can be implemented by strengthening the interaction between industry and schools/academia, by promoting internships to expose students to real businesses, and by expanding life-long learning programs.

Training for start-ups should be practically designed and should provide concrete support for establishing new business. The impediments to starting a business are greater for some groups than for others. Young people, women, and specific ethnic groups may face discrimination, difficult access to capital, and a dearth of managerial experience. To better respond to these difficulties, the

provision of services is most effective when they are specifically targeted. When targeted and limited, these assistance policies may have a rationale in addressing social issues. Well-targeted assistance in such fields as the assessment of business ideas, the provision of technical information, marketing, and other business and managerial skills allows the better tailoring of services to needs.

Mobilizing Human Resources for New Businesses in APEC

In the industrialized economies in APEC, making labor markets more flexible has been a challenging macro-economic, structural adjustment policy issue since the early 1980s. Labor market reforms are still ongoing. For example, in 1999, the Japanese government deregulated tight restrictions on the operation of employment placement projects and worker.

A growing number of universities teach entrepreneurship. In the United States more than 500 entrepreneurial training courses have been established in universities and graduate schools, contributing to the active creation of new businesses. In some APEC economies, there appears to be a change in the tendency of university graduates to seek employment in established companies. In Korea, the economic crisis destroyed the “no fall” myth of conglomerates. Now, it is not uncommon for university graduates to join venture firms or to start businesses by themselves. The same change has appeared in Japan, after a slump in the economy.

All the selected APEC members have training programs and assistance services. Most of the programs are specifically targeted. In the United States, the SBA operates business centers, including “one-stop-shops” to provide managerial guidance and information for small business owners and entrepreneurs. In Japan; Korea; Malaysia; Singapore; and Chinese Taipei, many of the counseling and advisory services are targeted toward small- and medium-sized start-ups. The governments often emphasize the promotion of selected industries, such as high-tech industries that center around information technology, and on research and development. Malaysia provides training and other services for start-ups by a specific ethnic group.³²

2.3 Expanding Access to Technologies and Information

Technological innovations are the seeds of business start-ups. Innovative ideas can turn into successful ventures only when they are married with managerial skills and business know-how. Information regarding technological innovations, business opportunities, and business skills is key to linking up these crucial ingredients of new businesses. Thus, access to technologies and information is of great importance.

University–Company Cooperation and High-tech Clusters in APEC

Cooperation between universities and companies enhances their access to each other technologies and information. The significance of university-company cooperation in fostering new businesses in high-tech areas is well underscored by Silicon Valley, in the United States, where Stanford University has played an eminent role. Other such “hot spots” of entrepreneurial activities include Gladstone in Australia, the Valencia region of Spain, and the Hsinchu Science-based Industrial Park in Chinese Taipei. These examples point to the significance of the spatial concentration of business activities, concentration which are sometimes called “clusters”. Clusters of high-tech business activities have been formed in other APEC economies. Universities and research institutions can serve as the core of a cluster of venture businesses.

In APEC economies, policy measures have proven useful in facilitating the matching of new technologies developed in universities with business expertise. In the United States, “technology licensing organizations” (TLOs) were introduced in 1980 to facilitate the transfer of technologies

³² In addition, the Special Scheme for Women Entrepreneurs in Malaysia subsidizes small- and medium-sized enterprises managed or owned by women.

from universities to the private/business sector. TLOs excavate new technologies that are developed in universities and have potential for commercialization, and confer licenses for the use of such technologies on private companies. Part of the revenue from licensing fees is reinvested in further research.

Japan has recently been keen to promote university-company cooperation and has emulated the US model of TLOs, introducing new legislation in 1998. Ten TLOs have already been established and they are expected to boost the transfer of technologies from universities to the private/business sector. 2.2 billion yen was provided in FY2002 to promote R&D on the application of study results in universities to industry. The government has also relaxed restrictions on professors and research staff of national universities pursuing business interests in commercializing their own scientific findings. Korea, Malaysia, and Chinese Taipei have followed with respect to the formation of TLOs.

Foreign Direct Investment for Entrepreneurship in APEC

For APEC's developing economies, new technologies and innovations will become increasingly important as a source of economic growth. As economic development progresses, capital stock and labor contribute less to boosting economic growth as the law of diminishing returns sets in. To sustain growth and promote higher living standards, technical progress needs to be made by introducing new technologies.

Foreign direct investment (FDI) is an effective way to introduce and disseminate new technologies that are not available domestically. Foreign direct investment stimulates competition, and generates new business opportunities as foreign subsidiaries procure domestically some of the supplies they need. This opens the way for new businesses to expand. Many studies identified a positive relationship between FDI inflow and technical progress because of the dissemination of technology through various routes.

Thus, further investment liberalization is called for to introduce new technologies and stimulate entrepreneurship. This is of particular importance for many APEC developing members who have achieved a stronger economic growth and arrived at middle-income status, and accordingly need to seek further sources of growth. Protection of intellectual property rights is important in enticing high-tech industries to developing economies, where violation of intellectual property rights is rampant.

Business Incubation Scheme in APEC

The public and private/business sectors provide business incubation services that assist entrepreneurs in starting and managing new businesses. They typically provide workspaces equipped with utilities and some facilities for new companies on preferential and flexible terms. In addition, they often provide various advisory services including business management, finance and accounting services, access to business networks, and legal services. Private companies providing business incubation services can recoup expenses and make profits by sharing in the future profits of successful new businesses.

Business incubation itself has become a new business opportunity, as the number of new businesses is rising particularly in the IT-related industries. However, many governments are also involved in business incubation in one way or another. The underlying idea is that markets undersupply business incubation services in view of the need for promoting new businesses and employment, so that governments need either to undertake business incubation activities or to assist them through subsidies and other means.

It is important to note that however important promoting entrepreneurship is, the need for public intervention in incubation activities should be weighed carefully. Generally, the existence of an "externality" merits public intervention. Namely, public intervention can be justified when business

incubation generates greater returns to society than all the returns accrued to incubation operators and as a result the private sector supplies fewer incubation services than is socially optimal. In this regard, policy objectives such as balanced regional development may make the case for government measures. While applying this general rule in the real world is a difficult task, governments need to carefully balance the costs and benefits of public assistance to business incubation.

In APEC, most members are more or less involved in providing incubation services. China, for example, has created more than 100 business incubation centers, most of which are located in high-tech parks and urban areas. Korea has established such incubation facilities in 230 locations, and Chinese Taipei has 55. The governments heavily subsidize these incubation centers. Considering that the subsidized incubation services should play a complementary role to private activities, it would be desirable to develop an industry for incubation and for such centers to sustain themselves as businesses.

2.4 Developing Legal Infrastructures

A fair, stable and open legal system provides an essential infrastructure for entrepreneurship. Corporate law needs to be reviewed and revised as necessary, with a view toward promoting entrepreneurship. When bankruptcy laws exert excessively harsh penalties on failed business owners, they discourage people from starting their own businesses and make it difficult for bankrupt individuals to try again. Likewise, when bankruptcy laws do not allow failed companies under receivership to restructure and to start all over again with relative ease, they have dampening effects on entrepreneurship. An appropriate balance needs to be struck between the rights of creditors and the future prospects of failed companies/owners.

Some provisions in corporate law may make the use of stock options unwieldy for new companies. Since stock options are an effective means of fostering new businesses, such corporate laws regarding stock options need to be revised as appropriate.

As the new economy dictates speed and flexibility, many firms, new and old alike, have reorganized corporate structures into more decentralized ones, and have adopted performance-based compensation for managers and workers. Corporate laws and taxation should not inhibit flexible corporate restructuring. For example, until recently the prohibition against establishing holding companies was a stumbling block for corporate restructuring in Japan.

Among APEC members, the United States has the most functional legal infrastructure for fostering entrepreneurship. The other members have more or less followed the US model. In efforts to promote entrepreneurship and to facilitate flexible corporate restructuring, Japan has recently introduced a number of measures. In 1999, the Diet introduced new legislative measures to allow start-up companies to offer stock options to a wider group of stakeholders. Bankruptcy laws were also revised to streamline procedures to enable firms in distress to get back on their feet quickly, and a more comprehensive review of bankruptcy laws is now underway.

3. LESSONS LEARNED AND BEST PRACTICES

To sum up, the case studies here provide the following lessons to governments and policymakers, together with best practices to foster entrepreneurship:

Establishing Good Business Environments and Framework Conditions

First, the case studies indicate the importance of establishing the good business environments and framework conditions that are essential infrastructural elements for entrepreneurship. All the APEC members with higher entrepreneurship indices invariably have constructed and maintained such an infrastructure. Among the members, the United States may be equipped with the most developed

and functioning stock, labor, and goods markets and legal systems. For example, a functioning financial market significantly facilitates entrepreneurs' access to financing. The United States has the most developed stock market that is friendly to equity finance. Governments should consider the improvement of such business environments to foster entrepreneurship.

Well-designed Incentive System

Second, it proved effective in many APEC members to intervene in the entrepreneur markets with well-designed incentive systems. The reduction of capital gain taxes for investors, e.g., "angel" taxation, represents such an incentive system. Stock options will accord the employees a strong incentive to help grow their companies. The revisions of taxation and corporate law certainly fostered entrepreneurship. While the United States and other industrialized member economies preceded the other members in terms of the incorporation of such incentive systems, many APEC members are catching up.

While the utilization of incentive systems is effective in fostering entrepreneurship, the systems should be designed to make the incentive work effectively, and not to cause undesirable by-products. The conflict between tax reduction to cause incentives and the maintenance of a healthy fiscal balance can sometimes become an issue. In addition, special tax treatment inevitably undermines the basic taxation principles of equity, neutrality and simplicity and therefore they should be weighed carefully to determine whether they are achieving their policy goals. It is noteworthy that in many cases in the industrialized economies, income tax cuts from capital gains were financed by broadening the tax base. Another example is the creation of second-tier stock markets. Following the establishment of the NASDAQ, many APEC economies have established a second-tier markets for listing new small companies. These second-tier markets with less stringent admission requirements facilitate IPOs, and therefore give incentives for investors to buy equities of the ventures. At the same time, lowering the listing requirements must be accompanied with stringent rules for de-listing and tighter time requirements for disclosure. These conditions would enable investors, including foreign investors, to make informed decisions of their level of risk. Korea, for example, recently introduced strict rules for investing in companies to avoid moral hazards and to protect other investors.

Minimal and Effective Government Intervention

Third, government intervention in private markets should be minimal and effective. The role of government should be, in principle, complementary when the market mechanism causes sub-optimal provision of services. In this regard, education to foster entrepreneurial spirit and ability represents a case of a need for government policies.

Many APEC economies supply public training and information services for start-ups. In most of the cases, services are targeted toward sub-groups of the economy, such as small- and medium-sized enterprises, youth, women, and specific ethnic groups. When targeted and limited, these assistance policies may have a role in addressing social issues. Well-targeted assistance allows the better tailoring of services to needs.

University/business Cooperation

Fourth, university/business cooperation has proved effective and useful in fostering entrepreneurship. Universities and research institutions can serve as the core of a clustering of venture businesses. The most famous cluster in any APEC economy is Silicon Valley in the United States, where Stanford University has played (and continues to play) an eminent role. Other clusters in APEC economies include, Gladstone in Australia and Hsinchu Science-based Industrial Park in Chinese Taipei. In addition, TLOs facilitate the transfer of technologies from universities to private/business sectors.

Development of Private Business to Foster Entrepreneurship

Finally, it would be worthwhile for governments to create policies to develop private business, ability to foster entrepreneurship. Assistance services for start-ups may themselves become businesses in APEC economies that have a high growth potential. In the United States many of the incubation services are run by the private sector. While incubation, training and information services are still publicly supplied in most APEC economies, privatization would open up many new business opportunities.

CHINA (continued)		
	<u>Purpose/Outline of program (Budget amount)</u>	Key results
<p>Managerial guidance</p> <p>-Expanding access to technologies and information</p> <p style="padding-left: 20px;">University-company cooperation</p> <p style="padding-left: 20px;">Foreign direct investment</p> <p style="padding-left: 20px;">Business incubation</p> <p>Others</p> <p>-Developing legal infrastructure</p>	<p>[1] The Department of Small and Medium-sized Enterprises under the State Economic and Trade Commission has begun to organize experts to prepare educational and training materials for smaller businesses.</p> <p>[2] Since 1999, existing business administration institutes and training centers around the economy have been utilized in a planned manner to provide training for smaller businesses.</p> <p>The state encourages the transfer of technology between R&D institutions or institutions of higher education and businesses.</p> <p>[1] China has over 100 business incubation centers, most of them located in high-tech parks and urban areas. Approved enterprises receive corporate tax reduction or exemption, etc. The government has invested about Y240 million in incubation funds for the incubation centers.</p> <p>[2] Centers have been established to support entrepreneurship by those who have returned to China after studying abroad.</p> <p>[1] The Central Committee of the Communist Party of China and the State Council are emphasizing the construction of national high-tech parks and are providing support in terms of finances, taxation, and loans.</p> <p>[2] Technological transfer is approved as a form of investment in business (35% of registered capital). Also, compensation above a certain rate is approved for persons contributing to technological development at state-run enterprises and research institutions.</p> <p>[3] There is a program for seconding engineers from state-owned research institutions and institutions of higher education to private businesses (usually for up to two years).</p> <p>[4] Government provides information to SMEs through an on-line system located at SETC (www.chinasmb.gov.cn). It provides policy information, training courses, market information, etc. The system has branches nationwide.</p> <p>Encourage various types of investors in the society to invest in establishing small and medium-sized enterprises with production factors such as technologies. The pricing amount of production factors can be up 35% of the registered capital.</p>	<p>(Not yet observed)</p> <p>(Not yet observed)</p> <p>(Not yet observed)</p> <p>[1] 53 high-tech parks had been established in China and 13,700 enterprises had been set up. These enterprises are mainly in the field of electronic, bio-medical and new materials fields and so on. They are offering about 17,649 important export items.</p> <p>[2] (Not yet observed)</p> <p>[3] (Not yet observed)</p> <p>(Not yet observed)</p>
5. Situation of business start-ups	<p>With the reforms and greater openness, as China's manufacturing industry grew from 348,000 to 532,000 companies nationwide over the period from 1978 to 1994, about 99% of these were small and medium enterprises. In contrast with state-owned and public enterprises, there have been annual increases in the number of employees at privately operated businesses corresponding to the private sector, companies affiliated with foreign economies including Chinese Taipei, and individual enterprises. The growth rate for individual enterprises has been particularly high, reflecting dynamic entrepreneurial activity on the part of individuals in recent years.</p>	
6. Problems and future direction (Perspective for policy improvement)	<p>Related legislation and support programs have been established at quite a rapid pace in recent years. Taking the venture capital industry as an example, although it has already entered the developmental stage, some problems still remain. These include problems with the legislative framework. The fact that most venture capital is still publicly funded, and the issues of scale expansion and specialized training for administrators and managers.</p>	

JAPAN		
1. Background for introducing policies	In the venture boom which has continued since the collapse of the economic bubble, and against the backdrop of the long economic recession, high expectations are being placed on new industries, primarily computer network businesses, to prevent the hollowing out of industry and provide jobs. There are particularly high expectations for entrepreneurship. Public support programs for venture business have been rapidly put into place since the late 1990s, based on these kinds of expectations for venture business.	
2. Objective of policies	Smaller businesses are considered to be the source of dynamism in the Japanese economy, and the policy aim is to nurture and develop diverse, dynamic small and medium enterprises. In particular, existing small and medium enterprises which branch out into new areas of business and introduce innovations in management, along with newly founded businesses which use original new technologies and expertise, are the subject of active support they are seen as a driving force to reform and revitalize Japan's economic structures.	
3. Target / Industry / Social sector	New business areas and industrial areas requiring new technologies and expertise	
4. Main programs -Expanding access to finance Equity finance Taxation Stock market	<u>Purpose/Outline of program (Budget amount)</u> [1] Small and Medium Business Investment Consultation Companies (established by central government, regional governments and bank) invest in venture companies. [2] Japan Small and Medium Enterprise Corporation and Industrial Structure Improvement Fund invest in private venture capital associations (amounting 10.3 billion yen). Improving Corporation Income Tax (basic tax rate and reduction rate for SMEs), reduction in Individual Income Tax of individual enterprise, and taxes for "angel" investment, Introduction of Stock Option System etc. After enforcement of the law for improving financial system, markets for new business as "MOTHERS" "NASDAQ-JAPAN" were open. In August 2002, the NASDAQ announced that it would withdraw from Japan in October 2002 but the market continue its business.	<u>Key results</u> At the end of March 1999, 380 companies have received investment totalling 17.7 billion yen from Small and Medium Business Investment Consultation Company. Number of listed companies on MOTHERS and the NASDAQ-JAPAN was 36 and 97 respectively as at the end of July 2002.

JAPAN (continued)		
Public finance	<p>[1] Japan Finance Corporation for Small Business and National Life Finance Corporation provide loans for developing new business and loans for supporting new companies.</p> <p>[2] Credit Guarantee Corporation underwrites guarantee related to new business and new companies.</p> <p>[3] Venture Enterprise Center underwrites guarantee for long time without collateral in favor of new business and venture companies.</p>	<p>In FY2001 188billion yen was provided to 25,516 companies by the National life Finance Corporation. The number of cases that borrowed under the New Startup Finance Scheme, which does not require either collateral or guarantors (began in January 2002), was 327 borrowing a total of 980 million yen.</p> <p>The Credit Guarantee Corporation underwrote guarantees relating to 806 new business (a total of 4,562 million yen) and 2,240 new companies (a total of 11,873 million yen) from April 2001 to February 2002. Outstanding loans extended to entrepreneurs pre or within 1 year after establishment is 189.7 billion yen and 25,379 entities as at 1999 (plus 58.2%, 31.7% respectively compared to 1994)</p>
<p>-Education and training Education and training</p> <p>Managerial guidance</p> <p>-Expanding access to technologies and information University-company cooperation</p> <p>Foreign direct investment</p>	<p><u>Purpose/Outline of program (Budget amount)</u></p> <p>[1] New High-Tech Venture Development Foundation provides subsidy for training researchers to entrepreneurs within 10 years after their foundation.</p> <p>[2] Venture Enterprise Center provides opportunity for communication among entrepreneurs by opening "Entrepreneurship Seminar".</p> <p>[3] Small and Medium Business Investment Consultation Company organizes seminar for staff in charge of finance and/or auditing in companies in which they invest.</p> <p>[4] MEXT (Ministry of Education, Culture, Sports, Science and Technology) promotes internship programs at colleges of technology and universities and universities, and enriches career guidance including promoting internships in high schools.</p> <p>[1] Council for Supporting Entrepreneurs is to be established, of key figures or people with experience in start-ups, in order to deliver programs for fostering entrepreneurship. (349 million yen), centers in prefectures and regional centers advise and consult entrepreneurs on starting-up (1,095 million yen).</p> <p>[3] Japan Small and Medium Enterprise Corporation provides training to entrepreneurs who have realizable ideas and plans and intend to start a business.</p> <p>Law promoting transfer of technology by universities is encouraging establishment of TLO aiming at seeking, evaluating and selecting results of R&D done by universities, acquiring, maintaining and preserving patents, and at providing information on technologies.</p> <p>Subsidies are also provided to TLOs which promote industrialization by private companies (2.2 billion yen)</p>	<p><u>Key results</u></p> <p>(Not yet observed)</p> <p>[1] Number of consultations by Consulting and Advisory Centers in Japan Small and Medium Enterprise Corporation, by centers in prefectures and by regional centers is about 5,000, 60,000 and 30,000 respectively.</p> <p>Approved 17TLO established (in March 2001).</p>

JAPAN (continued)		
<p>Business incubation</p> <p>Others</p> <p>-Developing legal infrastructure</p>	<p>[1] Japan Small and Medium Enterprise Corporation provides subsidy for newly establishing companies, assists improving incubation centers.</p> <p>[2] Japan Regional Development Corporation invests in semipublic corporation who improves and manages incubation centers (investment of 4,100 million yen).</p> <p>[1] Related 6 agencies including Ministry of Economy, Trade and Industry assist SMEs who develop new technology to create new industry (Small Business Innovation Research)</p> <p>[2] New High-Tech Venture Development Foundation provides with subsidy for R&D to entrepreneurs within 10 years after their foundation..</p> <p>Legal reform has been conducted to facilitate establishing associations, and to which the tax deduction/exemption system is applied. Investment associations with limited responsibility now permitted to establish. Exchanging Stocks System to promote M&A has established. Law on Promoting Creative Activities of Small and Medium Enterprises provides a package supporting R&D and new businesses.</p>	<p>Number of public incubators is 90, that of private incubators is 23 as on February 1, 2002.</p> <p>Number of tenants is 1,763, that of public incubators is 1,356 and that of private incubators is 407.</p> <p>[2] New High-Tech Venture Development Foundation has supported 240 projects from FY1984 to FY2000, amounting 668 million yen.</p> <p>8,977 of companies have been approved under Law on Promoting Creative activities of Small and Medium Enterprises is (at the end of May 2002)</p>
5. Situation of business start-ups	<p>The rate of new business opening has been on the decline for a long period of time, and has been exceeded by the closure rate. (From 1996 to 1999, the rate of new business opening was 3.5% while the closure rate was 5.6%.) In recent years, there has been a decline in “spin-off” startups in fields unrelated to the former jobs of their entrepreneurs, while the number of businesses operated alone by their entrepreneurs, most of them women, has been increasing. The age of the entrepreneur at the time of the start-up has been rising, and the number of entrepreneurs in their fifties and sixties has been increasing while the number of young entrepreneurs (under 29 or in their thirties) has been decreasing.</p>	
6. Problems and future direction (Perspective for policy improvement)	<p>A considerable number of people are interested in starting businesses, but it is pointed out that there still are difficulties in funding and human resources.</p> <p>The Japanese government has advanced structural reforms, starting with “Basic Policies for Economic and Fiscal Policy Management and Structural Reform of the Japanese Economy” in June 2001, which includes ‘The “Support Challengers” Program’. The government is considering systems, including the tax system, to facilitate a shift from the emphasis on savings to an emphasis on equity investments; promote competition policy; utilize the application of a free market process; and promote a revolution in information technology.</p> <p>The government subsequently adopted the “Basic Policy for Economic and Fiscal Policy Management and Structural Reform of the Japanese Economy 2002” (June 2002). The “Strategy for Strengthening Management Potential” focuses on removing obstacles and lowering risks concerning start-ups through various measures such as improving personal security systems and the protocol for company formation. It also comes out with improvement of direct financial market which provides risk money.</p> <p>The government is implementing a set of policies regarding funding issue and human resource development, in order to double the number of start-ups within five years.</p>	

KOREA		
1. Background for introducing policies	Although Korea achieved the “miracle of Hangang” with financing led by sources other than the government, backed by the myth that its large financial groups could not fail, support for venture enterprises emerged as one of the few remaining options when the economy's economy and currency experienced a crisis. The Korean government had strengthened and expanded support policies for venture enterprises after the crisis, leading to what has been called a boom in venture business.	
2. Objective of policies	In the early 1990s, based on the need to improve international competitiveness and coordinate the industrial structure, the government began to focus on nurturing venture enterprises with new, sophisticated technological capabilities. After the currency crisis, attention turned to venture business rather than large financial groups as the main core of the industrial structure.	
3. Target / Industry / Social sector		
4. Main programs	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
-Expanding access to finance Equity finance	[1] Hosting of Investment Mart for the “Angel” Club (31 bodies), and the establishment and operation of the “Angel Investment Support System” consisting of specialist members. [2] Guarantee of debentures of investment companies (5,000 million won per company) and partial guarantee of COB upon issuance. [3] If investment companies form investment associations to attract funds at home or from overseas, up to 30% of the total amount of the capital is furnished by the government. [4] Establishment of Tasan Venture Co., Ltd. (public-private co-investment company) [5] With the capital provided 50:50 by the government and overseas investors, KVF (Korean Venture Fund) is founded to finance investment associations. [6] Launch of the registration system of investment associations and the introduction and operation of the limited liability system.	(Not yet observed)
Taxation	[1] Deduction of income tax (of 30% of the investment in capital by individuals for venture enterprises, investment companies, etc.), tax exemption on capital gains from the transfer of stocks of new investment companies. [2] Deduction of 50% of tax on capital gains from swaps of new stocks and stock investment for encouraging M&A between venture businesses. [3] Introduction of stock option system to venture companies, and its expansion to research institutes	(Not yet observed)
Stock markets	[1] Relaxation of registration requirements for the KOSDAQ market especially for venture enterprises. For KOSDAQ-listed companies, the inclusion of 50% of the corporate tax in deductible expenses is authorized. [2] Establishment of the third stock market to promote investment in non-listed small firms. Promotion of lending of venture entrepreneurship funds (200,000 million Won for FY2000)	(Not yet observed)
Public finance		(Not yet observed)
-Education and training Education and training	[1] “Entrepreneurship Support Course” in over 100 public agencies and universities. [2] Establishment of a Capitalist Training Center in the “South Korea Venture Capital Association” to provide new employees with re-education (biannual).	(Not yet observed)

KOREA (continued)		
	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
Education and training	[3] Special measure for military service for those engaging in venture business, and the staffing of science and technology researchers in venture enterprises on a priority basis.	(Not yet observed)
Managerial guidance	[4] Establishment of the "International Venture Promotion Foundation" to carry out the overseas training of venture specialists, joint projects with overseas venture enterprises. "Legal Council for Venture Enterprises" established to support legal affairs relating to small to medium businesses and venture enterprises, etc.	(Not yet observed)
-Expanding access to technologies and information		
University-company cooperation	Establishment of the "South Korea Technological Investment Center" for the brokerage of trades of technologies among companies and the promotion of transfer of technologies owned by research institutes.	(Not yet observed)
Foreign direct investment		
Business incubation	[1] Establishment of Incubation Centers to support entrepreneurship (230 centers as of October 2000). Establishment and operation of National Incubation Center Conference. [2] Permission for the use of laboratories of universities and research institutes (337 laboratories as of October 2000) [3] Public facilities in large cities are specified as "venture-concentrated facilities," and their building owners can enjoy some tax incentives.	(Not yet observed)
Others	[1] Shift of 5% of the technological development budget for ten government sections and eight public research institutes to technological development support for small to medium businesses (KOSBIR, 407,200 million won in FY1999) [2] Implementation of individual technological development projects and technological counseling projects by the Small to Medium Businesses Agency. [3] Establishment of a support center for venture enterprises (the Korea Venture Center) in Washington D.C., US with the aims to furnish local information, support in their entry into the local market, cooperate with universities, research institutes, etc. [4] Business areas which came into being spontaneously are designated as the "Venture Enterprises Promotion Area," and then support is given, on a priority basis, to the construction of information networks and the provision of equipment for joint testing.	(Not yet observed)
-Developing legal infrastructure	[1] Based on the Law on Special Measures for Venture Business Incubation, four types of venture companies are established. Minimum amount of set-up capital for venture companies was reduced to 20 million won. [2] Simplification of procedures for factory construction of new businesses (one-stop filing). "Spin-off" from large companies are recognized as new foundations.	As of May 2001, a total of 10,762 companies have been registered as venture businesses under the law.
5. Situation of business start-ups	The number of authorized venture businesses grew (to 10,762 companies as of May 2001) after the Law on Special Measures for Venture Business Incubation was enacted in 1997. The average venture enterprise has 37 employees; the entrepreneur is a male between the ages of 30 and 40; and the enterprise is a "spin-out" from private business. Seventy percent of them are concentrated around the capital, Seoul, and around Ninsen, and Kyoki.	
6. Problems and future direction (Perspective for policy improvement)	Unknown	

MALAYSIA

1. Background for introducing policies	Two background factors are the special measures for citizens of Malay ethnicity and supplementary measures for the introduction of foreign capital. The special measures for the Malays come under the Bumiputra policy designed to correct the economic gap between citizens of Malay and Chinese ethnicity. The supplementary measures for the introduction of foreign capital began with nurturing the domestic subcontractor manufacturing industry in order to actively attract foreign capital and to promote the development of export-led manufacturing businesses, and efforts have been made to gradually shift the focus to high value-added parts and services.	
2. Objective of policies	On the one hand, to further improve the economic status of the Malay people, incentives are being provided for entrepreneurship, whether large or small in scale, and efforts are being made to support household industry. On the other hand, the government is emphasizing the knowledge-based economy with the objectives of shedding dependence on labor-intensive manufacturing and achieving a high value-added economy, and is working to nurture businesses that are involved in R&D related to the information industry.	
3. Target / Industry / Social sector	The subject is primarily made up of a wide range of electric and electronics related materials and parts industries and the automobile related industry, but is gradually being expanded to include IT related, and other industries. Malay citizens	
4. Main programs -Expanding access to finance Equity finance Taxation Stock markets Public finance -Education and training Education and training	<p style="text-align: center;"><u>Purpose/Outline of program (Budget amount)</u></p> <p>[1] Multimedia Development Corporation (hereafter, MDC) has established MSCVC to support companies involved in R&D for information technology (Total fund about RM120million).</p> <p>[2] MTDC has established MiDAS to develop ventures engaged in biotechnology, advanced electronics and IT.</p> <p>Companies who send workers for technology training are able to receive a grant and claim training fee funded by payroll levy. Stock options are available for venture companies.</p> <p>The MESDAQ was established in 1999.</p> <p>[1] Bank Pembangunan and commercial banks provide loans for project financing and working capital to Bumiputra companies who participate in the Vender Development Program promoted by MED and MOF (New Entrepreneur Fund, amount approved RM1.45billion)</p> <p>[2] Bank Pembangunan and MIDF provide loans to Bumiputra companies for acquisition of machinery and equipment, working capital (Bumiputera Industrial Fund, amount approved RM99 million).</p> <p>[3] Credit Guarantee Corporation guarantees New Entrepreneur Fund.</p> <p>SMIDEC, in collaboration with existing training and technical institutions, industry associations and larger companies, upgrades knowledge and enhances technical and management skills among SMEs in critical area such as electronics, IT, industrial design, and TQM. (Skill Development & Upgrading)</p>	<p style="text-align: center;"><u>Key results</u></p> <p>Total amount invested by venture capital companies is RM117 million (for year 2000)</p> <p>(Not yet observed)</p> <p>3 companies listed 2001 Taken over by KLSE (Kuala Lumpur Stock Exchange) in March 2002</p> <p>[1] Outstanding balance RM750 million (2001/05)</p> <p>[2] Outstanding balance RM69 million (2001/05)</p> <p>[3] Outstanding balance RM10 million (1999/12)</p> <p>408 companies used as at the end of 1998.</p>

MALAYSIA (continued)		
Managerial guidance	Purpose/Outline of program (Budget amount)	Key results
-Expanding access to technologies and information	[1] SMIDEC provides various advice including on financing to SMEs (Business Clinic) [2] MED promote education and training for Bumiputra entrepreneurs to encourage entrepreneurship and develop management skills. (Entrepreneurship Training Programme)	[1] 257 companies attended Business Clinic sessions (1999).
University-company corporation	The Ministry of Science & Technology is to increase private sector R&D and promote closer cooperation between the private sector and public research institutions/universities through collaborative linkage. (Industrial Research and Development Grant Scheme, RM100million)	(Not yet observed)
Foreign direct investment	[1] Industrial Linkage Program by SMIDEC and Vender Development Program by MED, mainly in favor of Bumiputra companies, aim at developing SMEs and promoting technology transfer to them [2] MDC help MSC-status Companies (Multimedia Super Corridor Status) to develop R&D products(RM100 million) etc.	[1] Number of participants: ILP 122 companies, VDP 256 companies [2] No. of MSC-status Companies is 495 (including big business and foreign companies)
Business incubation	SMIDEC supports development of industrial estates with incubation facilities in cooperation with state governments. (Infrastructure Development Programme, RM100 million)	No. of employees increased by 7,000 at the end of 2000 7 of 10 projects have been completed and 54.8% units have been taken up (1999/12)
Others		
-Developing legal infrastructure	[1] Small and Medium Industries Development Corporation Act, 1995 [2] 6 Acts related to Multimedia Super Corridor (alias, CYBERLAWS)	SMEs policy (mainly for manufacturers) started.
5. Situation of business start-ups	The business-founding situation is unclear. Looking at general trends for entrepreneurs, a large proportion are in their late thirties to early forties, and a gradual shift is occurring from restaurants toward manufacturing. The educational of entrepreneurs has been rising, and an increasing number have earned college or graduate degrees. The promotion of an early retirement scheme by the government since the early 1990s, led a large number of government employees to become entrepreneurs. In terms of ethnic background, there are many production or “spin-out” enterprises by people of Chinese or Indian ethnicity	
6. Problems and future direction (Perspective for policy improvement)	Although many government agencies are involved in training entrepreneurs, there is not really any government office that has comprehensive authority. Even the Chambers of Commerce are divided according to three ethnic backgrounds, so it is not possible to determine the overall picture. Therefore, it is not easy for the effects of government policies to penetrate in a thorough manner, and there is very low utilization of government support policies. The following are pressing issues which need to be dealt with in the future. <ul style="list-style-type: none"> ▪ Consolidation and unified management and analysis of data on entrepreneurship. ▪ Development of precise means of informing entrepreneurs with regard to government measures. ▪ Business administrator education. 	

SINGAPORE											
1. Background for introducing policies	Against the backdrop of rising operating costs and intense competition from regional countries, Singapore has to position itself as a compelling hub for business and investment to stay competitive and enhance its economic growth. However, Singapore has been surpassed by Thailand, Malaysia, and Indonesia in some areas of labor-intensive industry through the active introduction of foreign capital, and it has become necessary for Singapore to go beyond achieve further industrial sophistication. In 1999, the Technopreneurship 21 initiative was launched to create a conducive environment that fosters innovation and technopreneurship. The commitment of the US\$1 billion Technopreneurship Investment Fund (TIF) has since boosted the local venture capital industry and accelerated several start-up activities.										
2. Objective of policies	The key for Singapore is to bring about a diverse, vibrant and self-sustaining enterprise environment for large and small enterprises to thrive. The development of an indigenous enterprise sector will serve as a complementary growth engine to the MNCs and large companies.										
3. Target / Industry / Social sector	Knowledge-intensive industry such as biomedical science, semiconductors, info-communications and exportable services (education and healthcare)										
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SINGAPORE (continued)		
	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
<p>-Education and training Education and training</p>	<p>[1] A*STAR (former National Science & Technology Board) supports personnel upgrading by providing trainees with an opportunity of internship at research institutes (RIs), by supporting corporate employees taking advanced training, and by facilitating capability improvement of scientists at graduate schools and overseas universities. (“Young Aspiring Scientist Programme” and “National Science Scholarships”) [2] EDB helps all industries develop new technology, carry out R&D, and develop human resources related to application and R&D of new technologies. (“Initiative in New Technology Scheme”). [3] SPRING Singapore supports small businesses providing high-tech training to their employees or training related to IT investment. (“Training Assistance Scheme, IT Training Assistance Scheme, IT Training Assistance Scheme”)</p>	<p>Through the Skills Development Fund, 111,231 SME training places were supported in FY2000 and 3,303 companies applied to the SDF in FY2000 for their first time compared to 3,180 in FY1999.</p>
<p>-Expanding Access to Technologies and Information University-company Cooperation</p>	<p>The NUS Centre for Entrepreneurship has started a consulting-professorship scheme, which will recruit well known entrepreneurs and venture capitalists to teach technopreneurship courses at NUS.</p>	<p>The NUS Center for Entrepreneurship and Incubators@Work!, the intra-preneurship arm of Singapore Technologies (ST) have established a joint-partnership to promote entrepreneurial culture and technology spin-offs.</p>
<p>Foreign direct investment</p>	<p>A*STAR offers the Temasek Professor (TP) Programme to attract world-renowned leaders/professors from overseas to lead and engage in leading-edge research projects in Singapore.</p>	<p>(Not yet observed)</p>
<p>Business incubation</p>	<p>[1] Jurong Town Corporation (JTC) offers assistance to newly set-up manufacturing firms or existing firms venturing into new products /processes.(New Business Creation Incentive) [2] With the strengthening of its capability to offer business networks to business and investments based here, Singapore has emerged as a hub of global enterprise incubators.</p>	<p>(Not yet observed)</p> <p>In 2001, there were 38 incubators based in Singapore. Examples include SuntecLabs, Phase Z, Ro and K-Incubator. The Japan Business Support Centre was also set up to facilitate start-ups and emerging companies from Japan to establish and grow their operations in Singapore.</p> <p>New industries being incubated generate S\$130 million investments, 600 employment and value-added of S\$900 million in 2001.</p>
<p>-Developing legal infrastructure</p>	<p>The EDB works closely with the Ministry of Law, the Intellectual Property Office of Singapore (IPOS) and other agencies to enhance Singapore’s environment for creating and exploiting intellectual property.</p>	<p>Patents filed in Singapore from around the world increased by 11%, up from 7,720 in 2000 to 8,594 in 2001.</p>

SINGAPORE (continued)

5. Situation of business start-ups	In 2001, 3459 high-tech companies were registered with the Registry of Companies and Businesses (RCB)-fewer than the peak of 5,087 in the Internet boom year of 2000, but more than the 2,521 in 1998 before the technopreneurship drive was launched. Of the high-tech companies incorporated in 2001, 450 commenced operations within the year, generating about 2,970 jobs with expected revenue of S\$210 million. In 2000, 659 start-ups commenced operations, generating 6,065 jobs and S\$341 million revenue.
6. Problems and future direction (Perspective for policy improvement)	The government is nurturing a more risk-taking culture through the relaxation of bankruptcy rules enabling earlier discharge of bankrupt businesses, and the establishment of the Phoenix Award to recognize entrepreneurs who persevered and became successful despite previous business failures.

CHINESE TAIPEI	
1. Background for introducing policies	Chinese Taipei's manufacturing industry is facing various problems, including decreased export competitiveness resulting from rising labor costs and appreciation of the New Taiwan dollar since the late 1980s, the high cost of major parts procurement for basic industries, and the lack of sufficient funding for research and development. For these reasons, in 1991 the Chinese Taipei authority announced development strategies and measures for the Ten Emerging Industries and commenced strong authority support and revisions in the tax system, leading to a startup boom for high-tech enterprises.
2. Objective of policies	The objectives of the support policies were to nurture small and medium enterprises (SMEs) as the driving force to adjust the industrial structure and improve international competitiveness, so these policies took the form of support for emerging venture enterprises.
3. Target / Industry	<p>Manufacturing industries: 3C (computers, communications, and consumer electronics); precision electronic parts and components; precision machinery; aerospace; biotechnology, pharmaceuticals, and specialty chemicals; green technology, and advanced materials.</p> <p>Technical services: Internet software of content, internet services, high-level IC design, automation or digitization engineering services, general contractor engineering services for electrical power systems, product engineering services, environmental protection engineering and technical services, technical biotechnology and pharmaceutical services, engineering and technical services for reducing greenhouse-gas emissions by metal processing industries, engineering and technical services for energy conservation or the use of new and clean energy sources, intellectual property technical services, and R&D services.</p>
/ Social sector	
4. Main programs	
-Expanding access to finance	
Equity finance	In addition to support measures such as preferential taxation on investment and financing for venture capital companies involved in emerging industries, the authority has directly invested NT\$800 million of public funds as venture capital. It also provides loans and financial assistance to priority industries.
Taxation	The preferential tax programs for venture capital companies include preferential treatment for investment in R&D (30% from their corporate income tax) and for investment in R&D that exceeds the average R&D expenditure (50% from their corporate income tax), no taxation of transfer profit or distributions, etc.
Stock markets	There are stock option systems by private companies in Chinese Taipei; related systems for the trading of unlisted securities are planning to be started by 2002. [1] There are stock option systems by private companies in Chinese Taipei; related systems for the trading of unlisted securities are planning to be started by 2002. [2] In April 2000, trading commenced on the Tiger Board for Type 2 stocks, with simpler conditions for market listing than over-the-counter stocks.
	<u>Key results</u>
	By 2000, at least NT\$120 billion of venture capital had been invested in high tech industries and had created at least NT\$ 900 billion of investment effect.
	(Not yet observed)
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	[2] By the end of 2000, only 12 companies have been listed on this exchange, liquidity is low.
Public finance	<u>Purpose/Outline of program (Budget amount)</u> [1] The National Youth Commission provides support for new business founding (loans for start-up funds and information on starting a business). [2] By means of new product development incentives for private companies, the MOEA provides businesses with interest-free loans for new product. [3] Customs duty is waived on equipment needed for R&D if there are no import substitutions. Accelerated depreciation is permitted in a period of two years.
	<u>Key results</u>
	[1] Founded in 1966, it has provided support to 14,528 companies and over 20,000 entrepreneurs as of 2001, creating jobs for about 110,000 persons. By April 2001, about NT\$ 18.7 billion of the loan projects have practiced.

CHINESE TAIPEI (continued)

<p>-Education and training Education and training</p>	<p>[1] Based on the SME Development Statute, the Small and Medium Enterprise Administration (SMEA) holds education and training programs for business administrators, executives, and engineers in alliance with universities and other institutions. [2] The National Youth Commission and the vocational training bureau (EVTA) of the Council of Labor Affairs also conduct education and training programs for persons with higher education and the general public, respectively. [3] Under tax law, from 15% to 20-30% of expenditures for training human resources can be deducted from corporate income tax. In addition, companies may deduct 50% of the amount of their investment in personnel training costs that exceeds the average personnel training costs of the previous two years from their corporate income tax for the current year.</p>	<p>(Not yet observed)</p>
<p>Managerial guidance</p>	<p>[1] The China Productivity Center promotes TQC and provides administrative guidance for small and medium businesses under contract with the authority and private companies. [2] The National Youth Commission provides guidance in business administration after a company has been established, in addition to support prior to start-up in the form of funding.</p>	<p>(Not yet observed)</p>
<p>-Expanding access to technologies and information</p>		
<p>University-company cooperation</p>	<p>To promote academic research institutions to establish mechanisms for technology transfer or licensing, so as to facilitate technology dissemination, the National Science Council will prescribe the regulatory procedures for Technology Transfer Centers and will accept application from various organizations. The budget for the year 2001 is NT\$27.9 million (US\$0.85 million).</p>	<p>In 2001, seven institutions were approved for subsidies to establish their respective technology transfer centers. They were: Taiwan University, Cheng Kung University, Chiao Tung University, Tsing Hua University, Feng Chia University, Kaohsiung Medical University, and Academia Sinica.</p>
<p>Foreign direct investment</p>		
<p>Business incubation</p>	<p>As of the end of June 2001, assistance and guidance efforts have been made to establish 55 incubation centers of small to medium enterprises. Industries involved include information and electronics, machine automation, multimedia, medical and health care, biotechnology, environmental protection, aerospace, and marine transportation. The government will arrange a budget of NT\$1.83 billion (US\$55.8 million) from 2001 to 2005 to continue enhancing the incubatory effects on innovation of small to medium enterprises.</p>	<p>Currently, about 700 SMEs are supported by these Centers.</p>
<p>Others</p>	<p>[1] The Basic Science and Technology Law was enacted in December 1998, clarifying the role of authority and removing the restrictions on the results of technological development under the National Property Law. [2] The Department of Industrial Technology (MOEA) and the Industrial Technology Research Institute (ITRI) develop new industrial technologies and license the results of such development. The ITRI also provides consulting on technological alliances and transfers between domestic and foreign companies.</p>	<p>[2] The authority budget for 1999 is about NT\$ 1,460 million, 98 projects have been licenced</p>

CHINESE TAIPEI (continued)		
Others	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
-Developing legal infrastructure	<p>[3] The Institute for Information Industry was commissioned by the authority to establish a technological service center and engage in the development and licensing of technology, primarily industrial software.</p> <p>There is a Bankruptcy Law, in which the regulations of company resuscitation and composition are quite similar to those of Japan.</p>	(Not yet observed)
5. Situation of business start-ups	The rate of new business founding peaked in 1992 and has been declining since then.	
6. Problems and future direction (Perspective for policy improvement)	The rate of business closure topped that of new business founding for the first time in 2000. The main reasons for this change were relocation of factories into China or elsewhere, and the recession caused by economic and currency crises around Asia. Since many newly established businesses are small- and medium-sized IT related companies, the rise and fall of the IT industry certainly influenced the whole economic development.	

USA		
1. Background for introducing policies	Widely supported ideas of the “American dream,” anti-monopolism and the desire to become one’s own master have made small entrepreneurs and Congress to recognize the problems that result from monopolies by large companies. Great strides in productivity at large companies during WWII led to decreased competitiveness for small businesses, resulting in awareness that support was needed for small businesses. In 1953, after the added impetus of the Korean War, the Small Business Act was enacted and the Small Business Agency (SBA) was established for its implementation.	
2. Objective of policies	The Small Business Act declares that the government should aid, counsel, assist, and protect the interests of small business concerns in order to preserve free competitive enterprise, to ensure that a fair proportion of the total purchases and contracts or subcontracts for property and service for the government be placed with small business enterprises, to ensure that a fair proportion of the total sales of government property be made to such enterprises, and to maintain and strengthen the overall economy of the nation.	
3. Target / Industry / Social sector	(Females, socially and economically disadvantaged individuals)	
4. Main programs	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
<ul style="list-style-type: none"> -Expanding access to finance <li style="padding-left: 20px;">Equity finance <li style="padding-left: 20px;">Taxation <li style="padding-left: 20px;">Stock markets <li style="padding-left: 20px;">Public finance <li style="padding-left: 20px;">-Education and training <li style="padding-left: 40px;">Education and training <li style="padding-left: 40px;">Managerial guidance 	<p>SBIC/SSBIC is a licensed small business investment company funded by local investors. They finance by issuing bonds guaranteed by the SBA and participating securities.</p> <p>Capital gains/loss tax relief for small business founders, venture capitalists, and “angels”. Corporate tax reduction for small business. Several types of incentives to shareholders, such as Stock Option 401(k).</p> <p>The NASDAQ was established in 1971 to facilitate capital formation by developing, operating and regulating the most liquid, efficient, and fair securities.</p> <p>Many types of loan guarantee programs are provided by the SBA. It also provides a micro-loan program, through which the SBA makes funds available to nonprofit community-based lenders.</p> <p>Online and offline entrepreneurship training by the SBA (workshops, seminars, etc.)</p> <p>The SBA operates business centers (including one-stop shop) to provide managerial guidance and information for small business owners and entrepreneurs, all over the US. The SBA also supports Service Corps of Retired Executives, which gives managerial counseling to small business owners.</p>	<p>Program expanded in the mid-1960s, mid-1980s, and over the last several years. Quite famous venture companies have appeared through the program. Encouraged investment for start-up companies.</p> <p>Became the largest stock market in the US by dollar volume</p> <p>Increased number and value amount of guaranteed loan (180% in number, 134% in value during 1990-96)</p> <p>(Not yet observed)</p> <p>Small Business Development Centers have counseled more than eight million entrepreneurs since 1980.</p>

USA (continued)		
	<u>Purpose/Outline of program (Budget amount)</u>	<u>Key results</u>
<p>-Expanding access to technologies and information</p> <p style="padding-left: 20px;">University-company cooperation</p> <p style="padding-left: 20px;">Foreign direct investment</p> <p style="padding-left: 20px;">Business incubation</p> <p style="padding-left: 20px;">Others</p> <p>-Developing legal infrastructure</p>	<p>Bayh-Dole Act promotes technology transfer from universities to industry through TLOs.</p> <p>Federal/state governments establish business incubation centers to increase jobs, diversify the economy, and expand the tax base.</p> <p>SBIC/STTR is a program in which federal government bodies reserve a specific percentage of R&D funds for small business, and encourage the commercialization of the technology, product or services.</p> <p>Pass-through taxation is applied on certain types of business organizations. Bankruptcy law allows failed companies to keep minimum assets to restart business.</p>	<p>Increased number of patents and start-ups of/by universities. 1,493 companies have been established through technology transfer from TLOs in various universities since 1980.</p> <p>Have created numbers of companies still in business, and jobs.</p> <p>Resulted in more than US\$7.7 billion in research awards to small firms.</p> <p>Encouraged investment for star-up companies.</p>
5. Situation of business start-ups	<p>“The 4th venture boom” in 1990s.</p> <p>High birth rate (14.3%) and high death rate (12.0%). (1997)</p> <p>Main entrepreneurs are male, white, non-Hispanic, and 35-54 years old, while the number of female, non-white, and Hispanic entrepreneurs increased in the 1990s.</p>	
6. Problems and future direction (Perspective for policy improvement)	<p>The SBA recognizes that performance monitoring and program evaluation are core features of their efforts. In this context, they plan to systemically review those programs that offer the most financial risk to the government, as leveraging venture capital market programs and business loan programs.</p>	

CHAPTER 5

TRANSFORMING DIGITAL DIVIDES INTO DIGITAL OPPORTUNITIES

1. INTRODUCTION

1.1 Background of Research

In recent years, both productivity growth and GDP growth in the US have accelerated while unemployment and inflation rates have declined, a phenomenon referred to as the “new economy”. It is generally believed that the application of information and telecommunication technologies (ICT), manifested by the diffusion of Internet services and electronics-based transactions, has contributed significantly to the emergence of the new economy. The application of ICT has enabled faster and wider access to information, which in turn, has improved productivity and efficiency. A recent report by the US Department of Commerce (2000a) confirmed that the production and use of ICT contributed half or more of the acceleration in US productivity growth in the second half of the 1990s. This has occurred despite the fact that ICT capital accounts for only 6.0 percent of private business investment. However, there is a great diversity among economies, in terms of their ability to take advantage of or to adapt to the newly emerged technologies. This is because of the differences in their capabilities in include information infrastructures, the availability of personal computers or internet access; education level; human resources development; or even the language. Economies that lack the capability to take advantage of, or to adapt to, the information age may be left behind in terms of productivity growth and the ability to participate in the increasingly networked world market. Said former Philippines president Fidel Ramos, “What this global gap represents is the shift from the old economy, which was protective in character, heavily dependent on capital, labor, and national resources as inputs and dominated by large companies facing limited competition to a new economy, which was global, knowledge, and information-driven and fired by the ever-growing number of entrepreneurial companies whose competitive edge lies in their ability to move quickly and innovatively.”

There is a great concern that the current developing economies may be also the ICT-backward economies that stand to lose from the ‘new order’ of the market and hence will see their income discrepancy with the developed economies further increased. Even within an economy, the ICT-modern regions and ICT-backward regions may see their gaps between them widen with the advancement of ICT-based education, production, and trading. It is well understood that the construction of hardware facilities is not sufficient to provide a competitive information infrastructure; the construction of “softwares,” including legal infrastructures and human resources development is equally important. As APEC is a very diverse region, it is critical for economies’ leaders to understand the possible impacts of the digital divide on the regional economies before we can prescribe any solutions to the problem.

The purpose of this research project is three-fold: (1) to assess the degree of the digital divide in the APEC region, (2) to understand the implications and consequences of the digital divide, and (3) to explore the possibilities for member economies to cooperate in narrowing the gaps and turning them into opportunities.

1.1.1 Issues to be addressed

To solve the digital divide problem, there are several issues to be examined and discussed in this project. They are:

1. How serious is the digital divide in the APEC region?
2. What are the impacts of digital divides on the division of labor, the organization of production, and the rise and the fall of industries across the APEC region?
3. What are the effects of ICT applications on economic performances at the firm and the industry levels?
4. What contributes to digital divides and what are the solutions?
5. Where are the opportunities for APEC members to cooperate in narrowing the digital

divides and create new opportunities in the information age.

1.2 Literature Review

Many indicators have pointed to the seriousness of the digital divide among economies. The OECD (2001) reports that in October 2000, there were just over 94 million Internet hosts in the world, with 95.6 percent in OECD area and only 4.4 percent outside the OECD area. Among the non-OECD economies, Chinese Taipei; Singapore; Hong Kong, China; and Israel account for 52 percent of all Internet hosts, and Argentina, Brazil, Malaysia and South Africa account for a further 24 percent. This implies that there are very few hosts in the rest of the developing economies. Another indicator of a digital divide is the number of secure servers used for electronic commerce. In October 2000, there were more than 110,000 secure servers worldwide, of which some 95 percent were located in the OECD area. The establishment of websites also points to the same direction. By July 2000, there were 19.8 million websites in the world, of which some 97 percent were hosted in OECD economies. Within the OECD area, a digital divide is also apparent, although it is less serious. For example, access to personal computers varies between 65 percent and 21 percent, and access to the Internet varies between 50 percent and 8 percent.

Within an economy digital divide can also exist along the lines of region, race, industry, firm size, and educational attainment, etc. In OECD economies, Internet access in urban areas is everywhere greater than in rural areas, and socially disadvantaged groups are always in the short side of the digital divide. For example, in the US, there is a 6 to 8 percentage point gap between telephone subscription in households with a white head and those headed by a black or Hispanic, and much of that gap may be attributed to income differences. Similarly, as of 1998, while 46.6 percent of white households in the US had a computer, only 23.2 percent of black households and 25.5 percent of Hispanic households had one. Among white households, 26.7 percent had access to Internet at home, as against only 9.2 percent of black households and 8.7 percent of Hispanic households despite the fact that Internet was available in the US for only about US\$15-US\$20 a month (Crandall 2001). This digital divide along the lines of region and race tends to aggravate the old patterns of social inequality, bringing new problems for governments as well as international organizations.

A digital divide also exists between industries and between firms of different sizes. Information-intensive service sectors such as business and property services; communications; finance and insurance; and the public sector such as education, public administration and health care, usually have the highest Internet penetration rates. Transport and storage, the retail trade, and accommodation and food services generally have the lowest penetration rates, with manufacturing sectors approximately in the middle (OECD 2001). In terms of firm size, large firms are usually more capable than small firms of acquiring and taking advantage of ICT technologies. The implications of the digital divide at the industry and firm levels can be found in at least three dimensions:

First, “digital readiness” in terms of infrastructure (such as a national information infrastructure), human resources development and government policies is an important facilitator for the development of information-intensive sectors. Instead of the traditional concept of comparative advantage based on the endowment of labor, capital and natural resources, international competition in the new economy may be determined by “digital readiness”. Economies that lag behind in building information infrastructures, among other things, will also likely lose comparative advantages in the information-intensive sectors.

Second, to the extent that ICT technologies are the dominant driving force for productivity growth, ICT-related production and services will gain disproportionately in employment and wage growth in the new economy. Take the US as an example, the average annual wage for workers in the ICT-producing industries was US\$58,000 in 1998, or 85 percent higher than the US\$31,400

average wage for all private-sector workers. Since 1992, wages paid by ICT-producing industries have grown by 5.8 percent per year, compared with the private-industry average wage growth of 3.6 percent annually (US Department of Commerce 2000). But despite the rapid growth in ICT-related wages, the beneficiaries may be mainly young workers. Many information technologies have short life cycles and employers intent on getting a product or service to the market quickly often prefer to hire workers skilled in the new technologies rather than retrain their current workers (Meares and Sergeant 1999). This spells a serious problem for the workers who are locked in the “old” technologies.

Third, computing and communications technologies have lowered barriers to market entry, especially to markets that provide information technologies and other services. New technologies provide small businesses with size and resource advantages that were previously available only to larger and more established firms (Tapscott 1997). By using the Internet, even small firms can compete outside local markets. But small firms are also those that are unable to invest in information capital or to master the use of information technologies. ICT therefore presents both an opportunity and a threat to small businesses. Small firms lying on the wrong side of the digital divide stand to lose not only in international competition, but also in local markets.

Because of the serious foreseeable consequences of the digital divide, several steps have been taken by international organizations and major economies to narrow the gap. The primary objective is to increase access to the Internet. For example, under the APEC initiative, the Information Technology Agreement (ITA) adopted by the WTO, has eliminated the tariffs on information products such as computers, semiconductors, and telecommunications equipment. The ITA brought down the prices of information products, enabling more access to the Internet by poorer sections of the population. The Basic Telecommunications Agreement, provided under the purviews of the WTO, also stipulates that a pro-competitive principle be adopted by the regulators in the signatory economies. The US, in particular, was engaged in talks with several APEC members to dismantle the domestic monopoly structure in the telecommunications service markets (Barshefsky 2001). But the key to narrowing digital divide in the APEC region, and in the rest of the world for that matter is a sustained commitment to technical assistance and capacity building by all the governments concerned. Technical assistance should cover human resources development and legal infrastructures, as well as hardware-embodied technologies, as human resources and legal frameworks are as important as hardware facilities in preparing an economy for “digital readiness”.

It is increasingly recognized by experts that some of the aims of capacity building can be accomplished by business/private-sector efforts. For example, the proliferation of Internet-cafes, village phones, and other forms of shared access to communication technologies, have had a great effect in reducing the digital divide. Therefore, a bottom-to-top process of developing “digital readiness” may be preferable over the traditional top-to-bottom approach in economic development (Hammond 2001). The fact that the private sector may play a role as important as the government implies that digital divides can be turned into opportunities for trade and growth which will eventually bring equity to the economies involved. Cooperation and assistance, therefore, will both find themselves centre stage in the process of narrowing the digital divide.

1.3 Research Agenda and Research Method

1.3.1 Research Agenda

1. We will use secondary data and solicit extra data from member economies to assess the extent of the digital divide in the APEC region. A host of indicators, such as diffusion of e-commerce, teledensity, Internet adoption, client platforms, media infrastructure, financial and human resources, etc., will be included in the survey to construct some overall digital divide index for.
2. We will prepare case studies at the firm level within the information and retail industries to

examine the application of IT and its impact on productivity and the organization of production within firms and across the region. In this regard, we will focus on Chinese Taipei but will welcome members of APEC to do joint research on their respective economies.

3. We will provide policy recommendations for the APEC members so as to cooperate in alleviating the digital divides and transform them into digital opportunities.

1.3.2 Research Methods

1. Measurement of the Digital Divide

The degree of the digital divide will be measured across the APEC members. Three main constructs will be used to measure the digital divide, with each construct encompassing several indicators. These constructs are information infrastructure, human resources development, and government policies. Information infrastructure includes the following indicators: teledensity, Internet access, patterns of Internet usage, personal computer availability, multi-media equipment availability, Internet penetration, business-to-business (B2B) readiness, etc. Human resources development includes two major indicators: general educational attainment and ICT-related skills. The government policy construct includes three main indicators: liberalization of telecommunications industry, the legal framework, and policies pertinent to electronics-based communication and commerce. Each indicator, in turn, will consist of several sub-indicators. Data on these sub-indicators will be obtained mainly from secondary data sources, such as OECD and APEC reports, publications by Net Value, IDC, ITU, and other private data-servicing companies. Supplemental data will be obtained through collaboration with APEC members.

The measurement of the digital divide within an economy will have to rely on data provided by APEC members. Intra-economy digital divides will be measured across regions, ethnic groups, age cohorts, industries, and firm sizes. Several APEC economies have published reports on the intra-economy digital divide, which will be collected and synthesized to construct a standard format for further data entry. Additional data will then be sought from the other APEC members through collaboration.

2. Firm-level Case Study

This portion of the study will explore individual company cases to understand how information technology has changed the organization, specialization, and performance of firms. A study of US firms has indicated that average productivity was highest among firms that were high in both ICT investment and decentralized organization but it was lowest among firms that were high in ICT investment but low in decentralization (Brynjolfsson and Hitt 2000). This suggests that the application of information technology has to be accommodated by organization restructuring. This relationship may be unique to US firms or it may be universal, a question to be researched. We will study individual firms which mainly serve as international subcontractors. Five firms, each from the information and retail industries, will be interviewed to find the answer. Organization-related issues to be explored include enterprise resources planning (ERP); hierarchical control; relationships with the buyers and suppliers; specialization-related issues to be explored include value-chain positioning, division of labor between the headquarters and the subsidiaries; and performance measures including costs, market share, profitability, innovation, etc. Collaboration from the other members of APEC is most needed in this area.

2. MEASUREMENT OF THE DIGITAL DIVIDE

2.1 Knowledge-Based Economy and the Digital Divide

The knowledge-based economy (KBE) differs from a material or capital-based economy in that it recognizes knowledge as the core of competitiveness and the driving force for long-term growth. The rules of the game in the knowledge-based economy are speed, flexibility and innovation. In the KBE, newly starting and rapidly growing companies are, almost from their inception, selling to global markets, and thus the established companies are forced to reinvent their operations in order to stay competitive in the new game. The KBE has brought major changes to the organization of production, market structures, occupational choices, and so on, challenging traditional ideas of national comparative advantage based on the endowment of basic resources of land, capital and labor. In the KBE, the most important kinds of capital are human capital and organizational capital, as opposed to financial capital, and the pace of innovation is now driving the evolution of the industry with a speed unimaginable in the past.

The challenges brought about by the KBE have also greatly affected the role of government. Instead of managing business cycles, the policy focus of the government has shifted to fostering innovation. The crucial infrastructure for industrial competition today does not comprise of roads, ports, and public utilities, but ‘information super-highways’ that facilitate the transmission of information. Technological advances in personal computers, telecommunications and the Internet have laid the foundations for this kind of infrastructure, thus the adequacy of public infrastructure is no longer measured by the length of highways and railroads, but by the penetration of broadband networks, and the like. And no longer is television or automobile ownership an appropriate indicator of the state of economic development, the Internet access rate is now probably more fitted to that purpose.

This section addresses the implications of the knowledge-based economy on the organization of world production, and the problems caused by the digital divide, with a focus on Chinese Taipei. The innovation-driven, time-based competition of the knowledge-based economy has greatly changed the roles of Chinese Taipei manufacturers and their working relationships with other players in the market. We show that the knowledge-based economy is much more than just high-technology manufacturing.

2.1.1 Restructuring of Worldwide Production Systems

The greatest impact of the knowledge-based economy has been the reorganization of world production. In a knowledge-based economy, a firm is seen as a producer, repository and user of knowledge, producing or acquiring knowledge and putting it to use in the most efficient way. A firm’s stock of knowledge underlies its competitive advantage, and all firms are likely to be heterogeneous because they possess idiosyncratic knowledge. A firm engages in those production activities where the knowledge it possesses provides it with a competitive advantage, and a transaction of products implies an exchange of knowledge. In comparison with the rare and uneven distribution of knowledge, non-knowledge inputs to production, which include labor and capital, are available to all firms almost on equal terms. Non-knowledge inputs may even have lost their economy specificity, as capital markets have become globalized, and, although wage differentials remain, cheap labor is accessible through foreign direct investment. Thus, a firm’s sustainable competitive advantage has to be built on its possession of knowledge rather than on primary inputs.

In a knowledge-based economy, the separation between innovation and production becomes the norm. This is because innovation and production are only slightly correlated. Although knowledge used in inventing a product can be useful in the manufacturing of the product, and

vice versa, it does not pay an innovator to invest in the manufacturing capacity unless it is unable to realize the value of its innovation through outsourcing. In fact, contract manufacturers can perform the production function at a lower cost than the innovators themselves because they exploit economies of scale through sharing their manufacturing capacity among multiple clients.

In order to make a perfect product, the innovator usually needs to share some knowledge with manufacturers, and conversely, some of the manufacturer's knowledge can aid in product innovation. However, the sharing of knowledge is best arranged in a cooperative relationship, because knowledge is intangible and sharing entails organizational learning. Therefore, alliances have become an important form of business organization in the knowledge-based economy, and an important source of learning and innovation (Powell, Kogut and Smith-Doerr 1996). Sharing knowledge with someone may be more efficient than accumulating such knowledge internally because of the 'non-rival' nature of knowledge, which allows the one who partakes of the knowledge to pay only a small marginal cost to compensate the owner. Acquisition of knowledge through exchange or alliance may also be more efficient than acquiring the firm that owns the knowledge because when acquiring the firm, one also acquires non-essential assets. In sum, a knowledge-based economy is characterized by alliance capitalism.

Product innovation entails different types of knowledge that are relevant to the various stages of production. Knowledge applied to manufacturing, marketing and customer services is complementary to the knowledge used in product innovation. However, vertical integration in the value chain is only justified if the internalization of such activities is the best way to acquire relevant knowledge, which is often not the case. As product innovation caters to the needs of customers, knowledge obtained from interactions with the customers, i.e., marketing, is most valuable to product innovation. Therefore, a combination of product innovation and marketing may be the optimal mix of services to be offered by a firm. Merchandisers such as Nike, Reebok and Calvin Klein are typical examples of an innovator-marketer combination in the traditional industries of footwear and apparel. Even in the high-technology industries, we have observed the trend towards making innovation and marketing the core functions of the firm. Integrated Device Makers (IDMs) in the information industry such as Apple, Compaq, Dell and Motorola, have each partitioned themselves from manufacturing and delegated such activities to contract manufacturers. Even in the semiconductor industries, 'fabless' designers have been the driving force of product innovation, working closely with the providers of foundry services.

Meanwhile, we increasingly observe that contract manufacturers are required to perform customer service functions in addition to making and delivering the products. So-called global logistics has prevailed in knowledge-based economy mainly because the knowledge of the organization of production is also useful in the arrangement of shipping and warehousing, and the knowledge of making products is also useful in fixing the products. Therefore, we observe a new division of labor in the knowledge-based economy where firms endowed with heterogeneous knowledge perform production activities in line with the knowledge-content of production; economy-specific advantages become secondary factors in the determination of the production pattern.

As a manifestation of this thesis, we have observed a resurgence of manufacturing activities in the US taking the form of consigned production (Sturgeon 2000). The contract manufacturers that maintain global production facilities divide their labor within the firm in line with the location-specific advantages. Similarly, R&D is also globalized (OECD, 1997). Foreign investment has become an increasingly important source of innovation (Zender, 1999), and the new division of labor has boosted the role of contract manufacturers. In the electronics industry, for example, the revenue of the world's largest 20 contract manufactures grew at an annual rate of 30.7 percent in 1988–92, and at an even higher annual rate of 46.4 percent in 1992–95 (Sturgeon 2000).

2.1.2 Market Structure in a Knowledge-Based Economy

As early as 1942, Schumpeter observed that productivity increases in the US economy were largely attributable to innovation delivered by the R&D laboratories of large American firms in an environment of high barriers to market entry. Schumpeter argued that large firms enjoying stable profits in an oligopolistic market structure have the financial resources to build up the knowledge base required to apply scientific principles to ever more complex innovations. This argument implies that 'a market structure involving large firms with a considerable degree of market power is the price that a society must pay for rapid technological advancement' (Nelson and Winter 1982, p.278). Two major building blocks of Schumpeter's argument have been broken down by the new economy, however. First of all, financial resources to support innovation do not have to come from the innovators themselves, as new financial developments, such as venture capital, can provide the mechanism to support innovative activities. Secondly, market power is not necessarily correlated to firm size, especially if a firm's size is measured by its scale of production. Instead, it is knowledge that forms the cornerstone of market power.

The breakdown of the Schumpeterian innovation manifests itself in the increasingly important role played by small firms in product innovation. A start-up company with good innovative ideas has the capacity to attract both financial and human resources to become a large company within a short span of time. In fact, even monopoly power created by innovation is often short-lived because it will soon be nullified by further new innovations. There is, therefore, no effective way for a monopoly firm to erect entry barriers without the assistance of the government. Market power can only be maintained with continuous innovation, as exemplified in the case of personal computers (PC) central processing units (CPU).

On the other hand, there seems to be increasing concentration in the manufacturing stage of production. Our explanation of this phenomenon is that large manufacturing firms enjoy economies of scale, economies of scope, and economies of speed in the application of knowledge. Such benefits do not exist at the innovation stage. The knowledge needed for manufacturing includes product engineering, processing technologies, tooling, quality control, the organization of production, and so on. This kind of knowledge can be applied to the same product with different designs, and to different production locations. Therefore, we have observed that a contract manufacturer may work for multiple designers and produce similar products in various locations around the world.

For a manufacturer, the advantage of being large increases with the knowledge content of manufacturing. Knowledge can be thought of as a sunk fixed input. The more costly this knowledge is, the greater the advantage that can be gained from a larger scale of production. Therefore, manufacture of newly-invented products tends to be more concentrated than the manufacturing of mature products. Thus small firms without the requisite knowledge endowment to engage in the production of innovative products can only participate in mature product markets. But even there, the prospects for small firms remain bleak in a knowledge-based economy because large firms still enjoy economies of scope in applying their superior knowledge.

Small firms, therefore, can only retreat to those niche markets that are immune from the dominance of economies of scale and economies of scope by these large firms. The large firms also enjoy the benefits of globalized production from the common governance of knowledge application in various locations, and from being able to deliver products to consumers at a higher speed than the small firms that cannot afford multinational production. Increasingly, speed has become more important than cost in global competition.

2.1.3 The Digital Divide in a Knowledge-based Economy

The digital divide, defined as the difference in the ability to access, exchange, and process information through digital devices, will have important consequences in a knowledge-based economy. In terms of information flow, the world will be networked, and economies that lag behind the world average in terms of information access, exchange, and processing bear a high risk of being left out of global production. They will then have to retreat to the production of standard products that require little coordination with the rest of the world in terms of acquiring inputs or selling final products, such as agricultural products or common-purpose materials. Because they are unable to keep up with the cycles of non-standardized products, they will be insulated from the diffusion of new technologies, and hence be unable to enjoy productivity growth driven by new technologies. If their per capita income is to grow, it has to come from capital accumulation, which is only possible through foreign direct investment as indigenous firms will be unable to penetrate the export markets to capture enough demand to support their investment expansions. The old view of dependency economy and the pessimism toward the export-driven growth model will probably regain popularity in the knowledge-based economy.

The digital divide allows multinational firms to play an ever-increasing role in the allocation of production, and may become a “necessary evil” for developing economies to benefit from the externalities of new knowledge. Even so, economies lying on the wrong side of the digital divide, will likely come to resent the rapid growth of the advanced economies that lead the drive towards digital revolution. The recent resurgence of anti-globalization movements sends a warning signal regarding this potentially catastrophic development. The digital divide also has a tendency to draw human resources from the digitally-backward economies to the digitally-advanced economies, further worsening the gap between the two sides. Worse yet, if a digitally-backward economy wishes to close its digital gap, it probably has to offer extremely attractive incentives to foreign investors or the elites of its society, with the result that social equity will be grossly sacrificed.

In a knowledge-based economy, production is increasingly disintegrated, but the scope for a horizontal division of labor seems to have been squeezed. This is because information-processing capability of the firm allows it to enjoy economies of scope in offering multiple products. Product differentiation can be achieved through variation of parts and design at a certain stage of production without sacrificing scale economies. The practice of configuration to order (CTO) in the PC industry is a typical example of economies of scope, which allows little room for horizontal differentiation of the product between firms. The so-called market niche becomes increasingly difficult to protect unless it is guarded by some proprietary knowledge. In fact, in a knowledge-based economy, even proprietary knowledge may have to be shared with some collaborators in vertically disintegrated production process in order to offer a competitive product in the market. In the end, the product is not a niche product any more, but a part of a range of differentiated products offered by a set of producers working collaboratively. The shrinkage of the space for a horizontal division of labor will make market entry increasingly difficult for digitally-backward economies. What we will observe is an increasing concentration of the manufacturing of certain products in certain economies, organized by certain multinational firms.

The digital divide will not only affect the allocation of industry between economies, but also the allocation of production between different sized firms. Large firms have an apparent advantage in processing information, if not in accessing and exchanging information, and therefore enjoy more economies of scope than small firms. It can therefore be expected that large firms will account for an increasing share of industry output. The advantage is more apparent in an industry where innovations are changing the nature of the products quickly, and where information-sharing is crucial to the organization of production.

Within an economy, the digital divide will also affect the regional location of industry. The information infrastructure such as telecommunication and Internet facilities is essential to the ability to access and exchange information. Hence, regional differences in the readiness of the information infrastructure will affect the location of industry. The agglomeration effect is not diluted in the knowledge-based economy, even if not reinforced. For one thing, in vertically disintegrated production, the availability of shipping services, such as those provided by UPS or Federal Express, is essential to the movement of products to integrate the commodity chains across borders. The shipping service itself has an obvious agglomeration effect. Therefore, we may also expect production to be concentrated in certain locations within an economy.

With the increasing availability of information, the value of information will naturally decrease. In the knowledge-based economy, knowing something is not enough to secure a competitive edge. It is the ability to respond to an influx of new information more quickly than the competitors that will create a competitive edge. This implies that the structure of the organization has to be flexible and nimble enough to respond to new information in order to excel in the knowledge-based economy. The traditional hierarchical organization with centralized control is facing a tremendous challenge in this new ballgame. Alliance capitalism will be prevalent in a knowledge-based economy where firms combine and re-combine themselves to respond to ever-changing market needs. Between the alliance members, constant exchange of information is a requisite and the development of some routine practices to process information will form the core strength of the alliance. The digital divide makes a difference to whether a group of collaborative firms can act together as an efficient processor of information. This collaboration requires something beyond the hard facilities such as the electronic networks that tie firms together, as the group needs to develop its ability to respond to new information quickly and effectively to beat the competition. It requires product design capability, manufacturing capacity, and marketing channels. When these capabilities are successfully developed, which takes time and money, the network itself presents an entry to other firms, and becomes a foundation for competitive advantage. Networking, therefore, is a key word in knowledge-based economy, and ICT technology serves as the backbone of networking.

A digital divide also makes a difference to a organizational structure of the company. A traditional company has a structure in which all information flows to the top hierarchy and decisions are made by the top managers who have access to best information. In a knowledge-based economy, information is supposed to be diffused throughout the organization. Therefore, decisions are to be decentralized so that those who have access to private information can combine with “publicly” available information to make quick decisions and act upon them effectively. A decentralized-decision organization tends to be more effective than a centralized one. It is well understood now that organizational reform is as important as digitalization *per se* in a knowledge-based economy.

2.1.4 Some Preliminary Evidence

In this subsection, we look at the trade and production statistics of the information industry to compare them against the theoretical assertions that we have drawn in the earlier discussion. First, looking at the concentration of production in certain economies and regions, we examine the exports of information products to the US market as a proxy for global production. The relevant data is calculated and listed in Table 2.1. It can be seen that Asian economies dominate the exports of information products to the US market. In 1998, Asian economies accounted for 77.0 percent of the information products that the US imported from the rest of the world. That commanding market share remained robust in 1999 and 2000, although it declined slightly. Aside from the Asian economies, only Mexico has played a significant role in the exports of information products, largely attributable to the direct investment induced by NAFTA. There

has been some rotation of production sites within Asia in the 1990s, mainly from ASEAN economies and Chinese Taipei to China as a result of rising labor costs in the former group.

Despite a high concentration of production in Asia, most Asian exports are produced by contract manufacturing and are owned by firms originating outside Asia. Except for Japan and Korea, which have some major brand name electronics firms, local firms in Asia own only a small fraction of the exports to the US. Within Asia, production has been concentrated in China, Chinese Taipei, and the ASEAN economies of Malaysia, Thailand and Singapore, in addition to Korea and Japan. There have been very small contributions made by economies such as Hong Kong, China; or Indonesia. The barrier of information technology and networked production has made new entry to the industry an almost insurmountable hurdle.

Table 2.1: Exports of Information Products to the US by Economy

	1998		1999		2000	
	Value (million \$)	Share (%)	Value (million \$)	Share (%)	Value (million \$)	Share (%)
China	5,159	7.3	7,216	9.1	10,015	11.4
Chinese Taipei	9,402	13.3	9,474	11.9	10,439	11.9
ASEAN Economies	23,524	33.2	24,329	30.5	24,079	27.3
Japan	13,163	18.6	13,625	17.1	14,437	16.4
Korea	3,371	4.8	5,410	6.8	7,717	8.8
Asia	54,619	77.0	60,054	75.3	66,687	75.7
Mexico	5,268	7.4	7,012	8.8	8,769	10.0
Others	11,070	15.6	12,659	15.9	12,614	14.3
Total	70,957	100.0	79,725	100.0	88,070	100.0

Note: 1. ASEAN refers to Singapore, Thailand, Malaysia, Philippines, Indonesia and Vietnam; Asia refers to Asian economies listed in the table.

2. Information products refer to HS8471 and HS8473.

Source: Calculated from US Trade Data Tape.

We may also look at the concentration of production within an economy, taking Chinese Taipei as an example. Table 2.2 shows the four-firm concentration ratio of some PC-related products in Chinese Taipei's PC industry.

Table 2.2: Four-firm concentration ratio of PC-related products

Product	Unit: %				
	1992	1993	1994	1995	1997
Desktop PC	63.30	62.34	74.17	91.23	81.69
Notebook PC	48.72	41.93	64.06	50.31	61.94
Mouse	69.55	73.58	75.63	84.97	71.04
Motherboard	37.78	42.54	56.02	40.73	44.33
Color monitor	-	44.79	50.81	52.92	45.15

Note: Concentration ratio is measured in terms of quantity produced by top-four firm

Source: Census of Manufactures, various years, Ministry of Economic Affairs, Chinese Taipei.

In terms of desk-top PCs, for example, the ratio was 63.3 percent in 1992, but rose to 81.69 percent in 1997. For notebook computers, the concentration ratio rose from 48.72 percent in 1992 to 61.94 percent in 1997, and although there have been some fluctuations, the trend is clear. This concentration ratio, together with Chinese Taipei's dominant share of the world PC

market, indicates a high degree of concentration of worldwide production. Note that the figures presented in Table 2.2 only count production in Chinese Taipei. Most of these manufacturers also own offshore production facilities and warehouses in order to provide global logistic services to their clients. For example, the world's largest SPS producer, Delta, owns factories in China, Thailand, Mexico and Chinese Taipei, and operates 27 warehouses around the world. For major clients, who include the world's top ten PC and top five cellular phone handset producers, products are shipped from their warehouses to their assembly lines twice a day in a typical 'just in time' fashion. Preliminary data, therefore, points toward the concentration of the production of information products within a small number of economies, and within a few firms within those economies.

2.2 The Digital Divide in APEC

This section will focus on how serious the digital divide problem is among APEC member economies. This important issue can be examined by comparing differences in the application of ICT among APEC member economies with different levels of GDP. To facilitate the comparison, we have grouped APEC's economies into four groups by member economy's GDP *per capita* statistics. Our grouping result shows that there are five member economies in the first tier group, each with a *per capita* GDP above US\$21,000. The second tier consists of four member economies each with *per capita* GDP ranging from US\$21,000 to US\$8,000. There are five member economies, each with a *per capita* GDP between US\$8,000 and US\$1,000, in the third tier group, and all the other APEC member economies are classified in the fourth tier group. Figure 2.1 and Figure 2.2, respectively, present the average Internet user intensities per 1000 persons and the average Internet host intensities per 1000 persons for the above four groups between 1992 and 1999.

Internet user intensity is another important indicators which can be used to examine digital divide problem among APEC member economies. The statistics as show in Figure 2.1 suggest that the total number of Internet users increases between 1992 and 1999. However, the increases in Internet user intensity mainly appear in the first and second tier group member economies. More specifically, the statistics show in 1999 (1992) the Internet users per 1000 persons accounted for 28.97 percent (0.82 percent) in the first tier and 20.3 percent (0.6 percent) in the second tier group member economies respectively. In contrast, the Internet user intensities in the third and fourth tier group member economies are still remaining at a relatively primitive stage even in 1999.

Figure 2.2 shows the growth trend of Internet host intensity for APEC member economies. As shown from the Figure, in 1999 (1992), on average, there was one host server for every 15.5 (770) persons in the first tier group member economies and for every 29.4 (909) persons in the second tier group member economies. Obviously, both first tier and second tier groups member economies have enjoyed considerable ICT application advantages in the past decade. In contrast, however, for those member economies in the third tier and fourth tier groups have rather limited progress in adopting ICT. More specifically, the ITU statistics show, on average in 1999, there were merely 0.21 (0.02) Internet host servers for every one hundred persons in the third tier and fourth tier member economies. Clearly a significant digital divide problem does emerge among APEC member economies and the problem is rapidly worsened.

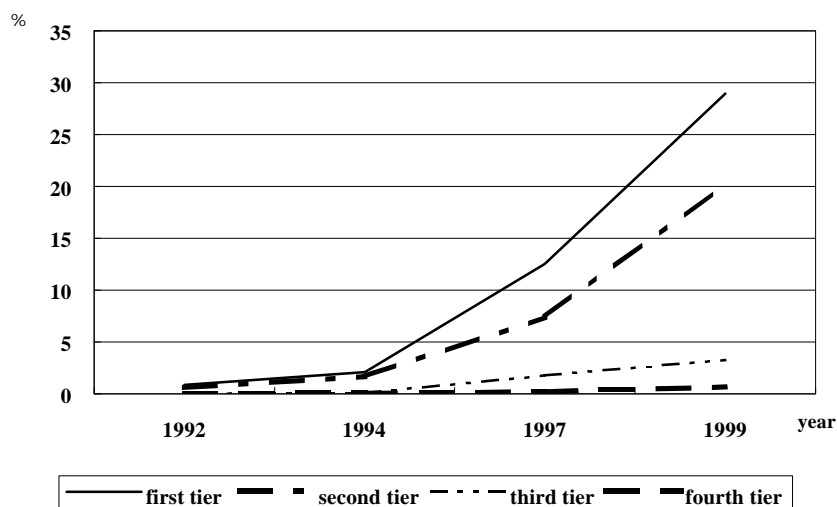


Figure 2.1: Internet User Intensity

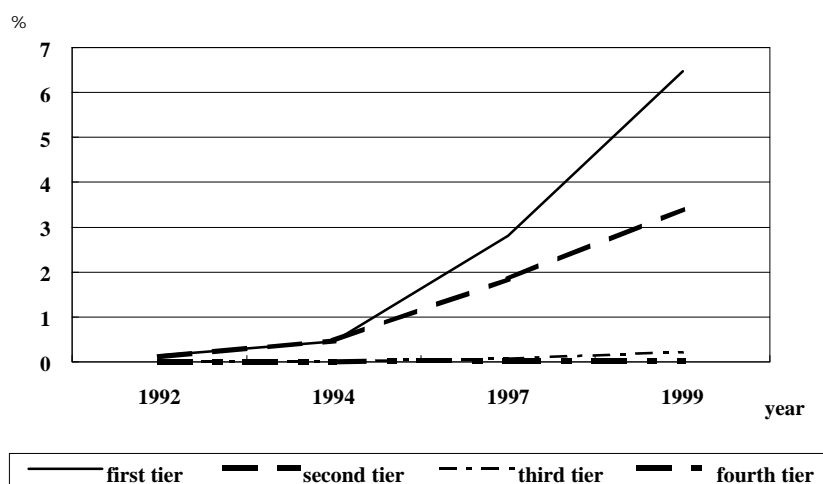


Figure 2.2: Internet host intensity

It is important to note that the widening digital divide gap among APEC member economies is not a unique phenomenon. It is also widely observed among other economies and among other organizational members. For instance, the OECD (2001) reports that a digital divide between OECD members and non-OECD member economies is emerging. The report asserts that the elimination of monopoly market structures, new market entry, and keen competition in OECD economies all contribute to the stimulation of new investments and new innovations which leads to a even stronger demand for communications access and services. The report also stresses that the liberalization of the telecommunication market in OECD member economies is another major contributing factor to the widening gap between OECD and non-OECD members.

Along with the liberalization of telecommunication and its related sectors, overall government policies are also critical in narrowing the digital divide. For instance, policies toward foreign direct investments (FDIs) and international trade are some of the key policies. Many studies show that beside capital and foreign exchanges, FDI does introduce managerial capabilities,

business organizational knowledge, and stimulate innovations in products and production processes in the host economies. Moreover, FDI can also have a strong demonstration effect in using ICT and multinational firms frequently urge their subcontractors to adopt such technologies to enhance business linkages.

Furthermore, international trade is another important driving force in diffusing ICT particularly in developing economies. In the recent decades, as the integration progress of global markets become intensified, the production process is, however, becoming more disintegrated. Nowadays, more and more manufacturing or service activities are conducted abroad which are then combined with those performed at home. The internationalization of production networks under the wave of globalization has thus become a common business practice (Feenstra, 1998). However, the operation of this international production network is heavily reliant on low coordination costs. The application of ICT both in developing and in developed economies becomes inevitable. Clearly for less developed economies, it becomes essential for them to tap into the international production network through various government policies.

2.2.1 Conclusion

This study utilizes average Internet host intensity and Internet user intensity indices to examine the digital divide problem among APEC member economies. The study found that the digital divide does exist in APEC member economies and that the gap is widening over the years. These are two possible contributing factors for the widening gap problem: first, the more advanced economies liberalized their telecommunication markets in recent years which led to the growing supply of ICT service and drastic cuts in ICT costs, while many other APEC member economies are rather sluggish in reforming their telecommunications market. Secondly, the openness of an economy also affects the ICT diffusion and application. FDI frequently brings ICT into the host economies and promotes the usage of such technologies in the local business community. In addition, multinational firms frequently urge their local subcontractors to apply ICT to enhance mutual business linkages which certainly helps local business communities effectively tap into the international production network.

International trade is another important mechanism for promoting the diffusion of ICT. Domestic business communities can then be channeled directly to engage in the international division of labor and the comparative advantage of the domestic economies can then be fully explored.

Table 2.3: Information technology Indicators across APEC members

Unit: per 1,000 people

	Telephone mainlines intensity				Internet host intensity				Estimated Internet user intensity			
	1992	1994	1997	1999	1992	1994	1997	1999	1992	1994	1997	1999
Japan	463.48	484.83	521.00	557.53	0.18	0.77	9.27	20.85	0.96	7.98	91.55	213.90
United States	561.28	588.82	644.00	664.41	3.69	12.19	76.98	192.51	17.62	32.61	149.31	268.27
Hong Kong, China	486.12	521.78	556.00	575.66	0.52	1.98	10.36	17.11	8.62	28.16	102.83	361.55
Singapore	367.84	395.95	451.00	482.02	0.44	1.57	15.41	38.06	4.72	11.89	133.80	243.97
Canada	577.73	594.09	622.00	654.52	1.88	6.44	27.98	54.77	9.25	23.76	150.07	360.76
Australia	472.04	495.65	513.00	519.69	3.49	9.01	35.90	57.47	17.72	22.40	86.37	316.34
New Zealand	440.42	462.99	486.00	495.67	0.57	8.65	44.60	71.11	2.87	32.11	145.16	183.68
Chinese Taipei	356.58	401.50	499.60	545.17	0.19	0.70	8.14	27.02	2.40	8.49	68.99	205.50
Brunei Darussalam	179.50	220.86	250.00	245.61	na	na	0.67	4.34	na	na	32.57	77.64
Korea	354.22	393.43	444.00	437.88	0.09	0.40	2.85	9.84	0.98	3.08	35.53	231.76
Mexico	75.43	91.83	96.90	112.23	0.01	0.08	0.44	4.16	0.17	0.42	6.24	18.71
Chile	94.76	113.43	184.00	207.00	na	0.02	1.23	2.66	0.37	1.43	10.74	46.61
Malaysia	111.51	145.67	195.00	202.98	0.00	0.08	1.49	2.70	0.01	1.02	27.69	68.71
Peru	27.35	33.10	67.50	66.93	na	0.01	0.14	0.37	na	0.09	41.04	15.85
Thailand	31.24	46.85	80.19	85.71	0.00	0.03	0.24	0.66	0.00	0.34	2.49	13.15
Russia	154.06	162.85	192.00	210.26	0.00	0.04	1.04	0.62	0.01	0.54	4.75	18.34
Philippines	10.37	16.57	28.60	38.84	na	0.00	0.06	0.17	na	0.06	1.38	6.72
Viet Nam	2.20	6.09	17.39	26.76	na	na	na	0.00	na	na	0.04	1.27
China	9.69	22.58	56.20	85.82	na	0.00	0.01	0.06	na	0.01	0.32	7.03
Indonesia	8.98	12.96	24.70	29.06	na	0.00	0.05	0.10	na	0.01	1.24	4.30
Papua New Guinea	9.47	10.00	12.50	12.71	na	na	0.01	0.07	na	na	na	0.43

Source: Calculated from ITU (2001).

2.3 ICT and Labor Productivity

It is well known that the emergence of a higher overall non-inflationary productivity growth in the US, regarded as the “new economy,” is partly driven by the popular application of information technologies. The US’ experience suggests that some “new factors” exist behind this growth performance and pose new challenges to policy makers. These new factors relating to information technologies may highlight two important meanings concerning the knowledge-based economy: the diffusion of knowledge and the improvement of coordination among economic agents.

Distinct from the accumulation of knowledge, the diffusion of knowledge is the main driving force for recent economic growth. Jovanovic and Rob (1989) apply a general equilibrium model to examine the impact of reducing communication costs on economic growth. In their model, they assumed that knowledge is distributed across human beings but the distribution mechanism is heterogeneous in its properties and the knowledge stock itself is uneven. They showed that the improvement in communication efficiency not only benefits the diffusion of knowledge, but also creates knowledge through the conscience of heterogeneous knowledge across people. In the same context, Antonelli (1997,1998) argues that the new information and communication technologies system profoundly affects the diffusion as well as the growth of knowledge-intensive business services (KBS). In practice, technical consultancy firms, software design houses, and other hardware and software engineering consulting companies can be regarded as KBS. KBS firms now play a critical role in this emerging market, serving as a dynamic source of “quasi-generic” knowledge and an interface between a firm’s own proprietary knowledge and the generic knowledge available in the economy as a whole. The application of new information and communication technologies (ICT) improves connectivity and receptivity of an economy through the growth of the KBS industry. By using ICT it enables firms to take advantage of new knowledge which, in turn, improves productive efficiency for the economy as a whole.

In addition, one may regard information technology as a typical transactional technology instead of a traditional factor input, such as labor or capital. Yang (1928) argues that the information technologies will enable economies to cut down their transaction costs, and expand the scale of production networks across domestic and international producers in achieving higher economic efficiency. Shi and Yang (1995) suggest that when transaction efficiency improves sufficiently, both the variety in inputs and the length of the production chain will increase so as to achieve higher economic efficiency. Kelly (1997) argues that a significant reduction in transaction costs will enable an economy to enjoy economic growth through expanding its market size. All these studies have clearly shown that the development of information technology will lead to fundamental changes in production and transactions which will ultimately enhance economic efficiency and growth.

One may examine the importance of information technology efficiency from another perspective. An economy which fails to use information technology efficiency will surely weaken its producer’s market linkages. As such, the differential application of information technologies may actually split an economy into several isolated and rather localized markets which will, in turn, limit the scope for specialization. Clearly, one of the main challenges faced by policy makers is how to apply information technology widely to an economy so as to bridge the digital divide within it and to cope with international society. The OECD (2001) defines the “digital divide” as the gap that exists between geographic areas or individuals at different socio-economic levels with respect to their opportunities to access information and communication technologies. The OECD’s study found that the gap not only exists within an economy, but also exists widely across international communities. APEC member economies are no exception. The digital divide among APEC member economies is an emerging issue that needs to be addressed in this 21st digital, century.

The purpose of this section is to empirically examine how information technology affects labor productivity. Our study shows that in addition to the traditional factors, such as physical capital

and human capital, information technology, measured by Internet host intensity and Internet user intensity, is critical in improving labor productivity for an economy. In addition, by using the latest available data in 1999, this study also found that APEC member economies are adopting ICT quite differently. We found that economies with higher *per capita* income generally enjoy a higher degree of ICT application than their counterparts with low *per capita* income. In addition, by examining relevant statistics from 1992 to 1999, this study found that the digital divide across APEC members to be widening.

In the next subsection, we present a simple empirical model to examine explicitly the effect of information technology on labor productivity. Some preliminary concluding remarks are made in subsection 2.

2.3.1 An Empirical Model of Labor Productivity and ICT Application

Information technology has been widely argued as the major driving force behind the emerging paradigm shifts, but relevant empirical research remains sparse (Antonelli, 1998). Inspired by this, this study wishes to explicitly examine the impact of the application of ICT on changes in labor productivity. As such, we are given the task of estimating labor productivity by considering factors such as capital stock, labor force, and various information technology indices for the latest available data period, i.e. 1997. A total of 92 economies with relevant statistics from the IMF's IFS statistics data bank as well as from the World Bank are employed in this study. We wish to examine how a difference in the information technology index, together with capital-labor ratios as well as adult literacy ratios, affects labor productivity. A labor productivity function for all these factors is specified as follows:

$$LP = F(KL, HC, ICT) \text{ ----- (1)}$$

LP in equation (1) refers to labor productivity, defined as the ration of an economy's GDP to its labor force. A higher LP indicates that the economy enjoys a higher labor productivity in its economic performance. In IFS statistics, GDP is measured in US\$ millions and the labor force is measured in millions of workers.

KL in equation (1) represents the capital-labor ratio, which is measured as the ratio of fixed capital to number in the labor force. As in Harrigan (1997), the capital stock is defined as a function of previous investment flow. The choice of function is somehow arbitrary because it is difficult to have information on the utilization duration and depreciation patterns of assets in all economies. This paper constructs the capital stock as a distributed lag of investment flows for the period of 1988 to 1997. More specifically, capital stock (K_c) in 1997 for economy C, is defined as:

$$k_c = \sum_{t=1988}^{1997} (1-d)^{1997-t} I_{ct} \text{ ----- (2)}$$

In equation (2), d denotes the discount factor, $d \in (0,1)$, and I_{ct} is the real fixed capital formation of economy c in year t. The capital stock contents all the previous investment flow from 1988 to 1997, and the depreciation ratio is set at $d=0.15$ per annum. In addition, we apply GDP price indices to deflate nominal fixed capital formation to obtain the real capital stock for 1997. However, for those economies such as Germany, Poland and Qatar which have not review their GDP deflator statistics to the IFS, we use their consumer price indexes in stead. In this study we expect KL to have a positive effect on labor productivity.

HC in equation (1) denotes the human capital for an economy. Many studies of economic growth have confirmed the importance of no-material investment in explaining the residual difference

between the rate of increase in output and the rate of increase in physical capital and labor. Romer (1990) has argued that the quality of labor force is one of the basic driving forces behind an economy's growth. Therefore, the quality of the labor force should be included in the labor productivity equation. In this paper, after examining 92 economies' relevant statistics, we decided to use the adult literacy ratio as the proxy for quality of labor. Since the improvement in adult literacy ratios relies heavily on the investment in education, we expect the adult literacy ratio (HC) to have a significant positive effect on labor productivity. It should be noted that the adult literacy ratio statistics are adopted from *World Development Indicators* published by the World Bank (2001).

ICT in equation (1) refers to the application of new information and communication technologies in an economy and can be measured by indices such as Internet host intensity (Ihost) and Internet user intensity (Iuser). Ihost and Iuser are measured respectively, by the ratio of total number of Internet hosts and total numbers of Internet users to population and their relevant statistics are taken from ITU (2001). In light of the discussion on information and efficiency, we expect that a high ICT performance is reflected either in terms of high Ihost or Iuser and should have a significant and positive impact on labor productivity.

Equation (1) can be explicitly expressed as the following production function:

$$LP = e^a e^{bHC} e^{cICT} (KL)^d \text{ ----- (3)}$$

Where equation (3) suggests that besides labor and physical capital which directly contribute to the growth of labor productivity (LP), LP can also be enhanced indirectly through improvement in HC and ICTs. Now we transform equation (3) in the natural logarithms to convert it into an empirical model of equation (4). The OLS estimation on equation (4) is made, and our empirical results are presented in Table 2.4.

$$\ln(LP) = a + bHC + cICT + d \ln(KL) . \text{ ----- (4)}$$

In equation (4), the coefficients *b* and *c* respectively denote the influence of HC and ICT on the growth of labor productivity, and the coefficient *d* is the labor productivity elasticity of capital-labor ratio. There are 92 economies' data examined in equation (4), therefore, the total number of observations for our empirical model is 92 (n=92). As we can see from Table 2.4, the R² statistics in both models are quite high which suggest that the goodness of fit for both models are reasonably well. A couple of interesting observations can also be made from the empirical results in Table 2.4.

Table 2.4: Determinants of labor productivity, 1997

	(1)	(2)
Constant	4.28 (9.74)**	4.02 (9.25)**
Ln(KL)	0.11 (2.57)*	0.13 (2.83)**
HC	0.04 (7.45)**	0.04 (8.05)**
Iuser	0.09 (5.52)**	--
Ihost	--	0.25 (4.42)**
Adjusted R ²	0.71	0.69
F-value	70.74**	67.57**
Number of Observation (n)	88	91

Notes: Numbers in parentheses are *t*-statistics; ** and * indicate significance at the 1 and 5 percent level, respectively.

Firstly, the labor productivity elasticity for the capital-labor ratio is significantly positive. The empirical results of this study support the traditional arguments that the accumulation of both physical and human capitals is driving economic development. In addition, the coefficient of variable *HC* is also significantly positive, indicating that human capital does matter in improving labor productivity. These empirical results are also consistent with our prediction.

In our empirical model, we apply two different variables, namely, Internet host intensity (*Ihost*) and Internet user intensity (*Iuser*), to examine the impact of the application of ICT for labor productivity. The empirical results as shown in Table 2.1 indicate that coefficients of both *Iuser* and *Ihost* are positive and highly significant. Clearly the empirical evidence confirms that the application of ICT positively and significantly contributes to labor productivity. Instead of interpreting this positive effect as localized technological change and national innovation system as asserted by Antonelli (1997, 1998), we consider this positive effect as mainly due to the application of the ICT which significantly reduces the knowledge-sharing cost, enhances economic efficiency in both transactions and production, and promotes labor productivity and economic growth.

It is also important to note that the above empirical results are based on the analysis of statistics from 91 economies in the world. These 91 economies cover developed, developing and underdeveloped economies. Clearly, the above empirical results do apply to all economies regardless of their current level of development.

2.3.2 Concluding Remarks

In this section, we investigated 92 economies' statistics in 1997, and found that the application of ICT, either measured by Internet host intensity or by Internet user intensity, has had a significant and positive impact on labor productivity. This empirical result suggests that the development of ICT infrastructure and the diffusion of ICT are critical for developing economies to narrow their digital divide between themselves and more developed economies. This empirical evidence is based on an econometric model analysis of 92 economies' relevant economic statistics, which cover a broad range of economic development status for the sampled economies. Our empirical evidence suggests the application of ICT is not merely a policy option but a top policy agenda that needs to be carried out forcefully in order to meet the globalization of the world economy.

2.4 Social Conditions and the Digital Divide

In this section, we investigate the social conditions that may underlie digital divide between economies. Within an economy, a digital divide is often found between races, regions, age cohorts, genders, etc. Those on the wrong side of digital divide are usually minorities, people living in rural and remote areas, the older generation, and sometimes, women and girls. The situation may differ from economy to economy, but due to increasing external benefits generated by an expanding digital network, there is a tendency for a digital divide within an economy to shrink over time. For example, the gender gap is closing in the US (US Department of Commerce, 2000b) and in Chinese Taipei, although females were behind males in terms of Internet access in the early years. In contrast, the digital divide between economies may be widening instead of narrowing because of the network economies that favor large and dense networks.

We consider several social factors that may affect an economy's digital readiness, which is represented by the Internet penetration ratio. The first factor is political freedom. The Internet is seen as a conductor of information flow and a new media that is very difficult to censor. The government of an economy without political freedom may take measures to discourage the diffusion of the Internet, and the information provided by the private sector to the Internet will also be constrained because of the fear of government censorship.

The second factor is *per capita* income. As with other services, the consumption of Internet services naturally rises with a person's income level. Given that computer is a relatively expensive item to own, Internet usage may even be categorized as a luxury good. Many developing economies have made the Internet accessible through publicly available facilities such as Internet telephones and Internet Cafés, hence overcoming the need for individuals to own computers. Nevertheless, the tendency to consume Internet services is likely to remain sensitive to *per capita* income.

The third factor is urbanization. It seems common across economies that the Internet penetration ratio is higher in urban areas than in rural and remote areas. Urban populations are blessed with better telecommunication infrastructures that enable Internet access. They are also attracted to the Internet by the benefits of networking because friends and colleagues are often on the Net.

The fourth factor is literacy. It goes without saying that information is valuable only if you can read it. In fact, the most-common language used on Internet is English, followed by Spanish, and Chinese represents only a small fraction of Internet users. Literacy in a foreign language may therefore be an important determinant of Internet access. In the case of Chinese Taipei, for example, Internet penetration is most thorough among the college-educated population who have a good command of English.

In addition to these four social factors, we also consider two economic factors that may affect Internet penetration. One is the price of Internet access, the other is the proportion of the service sector in the economy. The inclusion of a price variable is self-explanatory. The service sector has a higher tendency to adopt Internet-based trading and information exchanges than the manufacturing sector, therefore a service-oriented economy is expected to be more Internet-penetrated.

We employ the aforementioned six variables to explain the Internet penetration ratio, which is estimated by the number of Internet users divided by the total population, with a regression analysis. The result is as follows:

$$\begin{aligned}
 INTERNET = & \quad -1208 - 38.8 \text{ CHARGE} - 24.1 \text{ POLITICAL} \\
 & (82.1) \quad (11.1) \quad (6.6) \\
 & + 3.9 \text{ INCOME} + 1.9 \text{ URBAN} + 2.7 \text{ LITERACY} \\
 & (1.5) \quad (0.8) \quad (0.8) \\
 & + 3.5 \text{ SERVICE} \\
 & (1.3)
 \end{aligned}$$

The dependent variable, INTERNET, is the Internet penetration ratio. CHARGE is the Internet access fee, measured by the average charge of a local telephone call for three minutes, divided by *per capita* income. In essence, CHARGE measures the affordability of Internet service, using telephone charges as a proxy. POLITICAL measures the degree of political freedom, with a scale from one to seven with one representing total political freedom and seven, no freedom. INCOME is *per capita* income at the 1995 price, in US dollars. URBAN is the proportion of the population that is urban, measured as a percentage. LITERACY is the adult (age over 15) literacy ratio. SERVICE is the proportion of service value-added in GNP, measured as a percentage. All data are taken from *World Development Index* published by the World Bank, except for the political freedom variable, which is taken from Freedom House, and the Internet penetration ratio, taken from ITU.

The numbers in the parentheses underneath the coefficient estimates of explanatory variables are standard errors, which indicate that all explanatory variables are significant at the 5-percent level.

The results confirm our prior expectation that the lack of political freedom thwarts Internet access, while increased income level, urbanization, and literacy ratio, all contribute to Internet penetration. The price of Internet access also has a significant effect on Internet usage, suggesting that cutting the access fee is a useful inducement to higher Internet penetration. SERVICE also yields a positive coefficient, suggesting that a service-oriented economy is more conducive to Internet use.

The policy implications of this simple regression analysis are many. Despite differences in social conditions, price remains an effective factor in determining Internet access. Therefore, an economy interested in promoting Internet use should strive to lower the cost of access. It has been demonstrated in many cases that liberalization of the telecommunications market is an effective means of lowering the price. State-owned monopolies often charge excess fees to discourage Internet usage.

Second, literacy is an important factor in determining Internet access. Economies that lag behind in Internet penetration, particularly for non-English-speaking economies, may have to take the literacy problem seriously. After all, literacy is also an important determinant for economic growth. With the proliferation of the Internet, low-literacy economies may fall even further behind advanced economies because of the inability to benefit from the new technology. Nevertheless, the Internet also presents a new opportunity for enhancing literacy, as it has been proven to be a useful educational tool.

Third, as urbanization is a factor contributing positively to Internet usage, the emergence of the Internet may give populous economies or city states a new advantage in international competition. Singapore, for example, has taken advantage of this new opportunity to promote Internet-based trade. Of course, this advantage can only be realized by an open and culturally internationalized society. Information services can now be more easily traded because of the diffusion of the Internet.

3. THE DIGITAL DIVIDE IN E-COMMERCE

3.1 The Digital Divide in Business-to-Business (B2B) E-commerce

Having provided five in-depth case studies on the application of IT by Chinese Taipei firms in the preceding sections, this section goes further to present a synthesis discussion in the context of globalization, or more specifically, global production networks.

3.1.1 Globalization and Market Structure

It is well documented that a characteristic feature of Chinese Taipei's information industry is its local industrial clustering (Hobday, 1995; Kim and Tunzelmann, 1998; Kraemer, et al., 1996). Recent developments, however, have called into question the extent to which local agglomeration adequately encapsulates the dynamics of Chinese Taipei's information industry. In fact, Chinese Taipei's achievements in high-tech production now can be better understood by the ability of local firms to leverage and align local and international networks. The industrial structure of the island's IT sector is characterized by vertical disintegration but with strong linkages between local firms and multinational companies. The agglomeration effect of industrial clusters helps to create the momentum for the development of local industries in Chinese Taipei and, to the extent that the local networks become part of the global network, the local industries are given additional ammunition for development. The use of IT technologies has helped these Chinese Taipei firms to closely integrate themselves into the global production networks.

This phenomenon has something to do with the trend toward globalization, which has resulted in the reshaping of the industrial competition landscape. One outcome of globalization over the last

few decades has been the increasing disintegration of capabilities in production, and even innovation, across economies. (Feenstra, 1998). Driven by this disintegration, the outreach of multinationals not only takes the form of direct investment, but also of outsourcing of production, and even of knowledge. As a result, boundaries between firms have become blurred on an international scale, which has eroded the basis for the formation of traditional oligopolies (Delapierre and Mytelka, 1998). Industrial rivalry now tends to occur amongst industrial networks comprising of a multiplicity of firms linked up with different knowledge bases. Although well-established firms in the advanced economies tend to occupy the driving seat in these networks, firms in economies such as Chinese Taipei also play an important role.

Against this background, offshore sourcing is increasingly being embraced by many American firms—and more recently by Japanese firms—in their efforts to come to terms with the new global industrial dynamics (Chen and Ku, 2002; Kotabe, 1996; Swamidass and Kotabe, 1993; Venkatesan, 1992). Many brand marketers thus tend to concentrate their core competencies on brand name resources and R&D, whilst outsourcing the remaining production activities. As a result, former vertically integrated multinationals are increasingly becoming hollowed-out corporations (Kotabe, 1989).

On the other hand, a new breed of multinationals has emerged, such as Contract Electronics Manufacturers (CEMs), to assume the outsourcing activities. CEM companies such as Solectron or Flextronics, unlike the more traditional manufacturers and multinationals, do not make their own brand name products, instead deploying global networks with fast-response capabilities to provide production and other (mainly logistics) services to brand marketers. Chinese Taipei's firms have to compete with CEMs in the subcontracting business.

3.1.2 The Role of Information Network

With the advancement of ICT, the PC industry's drive to reduce the lead-time to market, along with lower production and inventory costs has brought about a profound change in the manufacturing system and inter-firm competition within the industry. It is now commonplace for components to be sourced from a global network of suppliers and for final assembly to be undertaken near the end-market (Angel and Engstrom, 1995; Borrus and Borrus, 1997). More specifically, major brand marketers moved to adopt outsourcing and order-based production, which greatly rationalized their global supply chain, thus altering their contractual relationships with firms in Chinese Taipei.

Such contractual arrangements with global leaders in the PC industry have enabled Chinese Taipei's IT firms to upgrade their position within the global production system and they have subsequently taken on the essential functions of coordinating the global supply chain for their OEM customers. For example, Compaq now outsources every element of the value chain, with the exception of marketing, to Chinese Taipei subcontractors. By so doing, the company completely hands over its inventory costs to these subcontractors, who are also required to produce and deliver sub-system products on tight schedules and in tune with the vagaries of market demand. The Chinese Taipei firms have to ensure that everything is synchronised up and down the supply chain. In order to do this they have to participate in cross-border supply-chain management, logistics operations, and after-sales services, coordinating all of these functions through the formation of a fast-response global production and logistics network or 'global logistics' (Chen and Liu 1999). The cases of Mitac, BenQ, and Compal, discussed above, provide a useful illustration of these points.

Global production networks have had similar implications for the IC industry. By disintegrating the IC value chain, the initial emergence of foundry services in Chinese Taipei facilitated the proliferation of small- and medium-sized firms engaged in other market segments, such as IC design, testing, and packaging, giving rise to a vertically disintegrated industrial structure. Moreover, the emergence of system-on-a-chip (SOC) technology has induced the modularization

of various design technologies, or silicon intellectual properties (SIPs), which can be used repetitively as the main building block for SOC designs. This trend has given rise to 'chipless' IC firms, acting as pure providers of SIP without owning a fab, or even a chip, leading to further disintegration of the industry. As a result, IC design and production has come to resemble a modular process utilizing SIP modules as the building blocks.

Although most SIPs are owned by integrated device manufacturers (IDMs), fabless firms – and increasingly, chipless foundry service providers – are the natural places to verify the value and 'fabricability' of SIP designs. Therefore, in order to go through the entire value chain, the industry is required to bring together a variety of industry players, including chipless firms, design service providers, IC designers, electronic design aided (EDA) tool providers, and foundry and packaging firms, who are likely to be located in a number of different economies. Production networks in the industry are thus global, or at least international, in nature.

In the above-mentioned context of globalization, one can encapsulate the way in which application of ICT facilitates the transformation of the Chinese Taipei's industries. In a sense, ICT has been used to facilitate Chinese Taipei firms' participation in global production networks and strengthen their position within these networks. The PC industry, although widely regarded as high value-added; tends to be vulnerable to increased competition and narrowing profit margins even before it reaches the mature stage of the product life cycle because of rapid changes in technology. As a result, firms and economies that rely heavily upon PC hardware manufacturing can be easily caught by deteriorating terms of trade. In addition, most of Chinese Taipei's IT firms undertake OEM/ODM contract works without any strong ability to control, or even gain direct access to, the final market. Their outreach, by means of moving elements of their manufacturing and/or assembly functions overseas, implies that they have to generate additional profits through the widening of their value chains. In the case of global logistics, they have begun to shoulder service functions such as the coordination of cross-border supply chain and logistics, in addition to their initial manufacturing function. It is therefore arguable that they have looked beyond manufacturing profits to seek profits from the services they provide to brand-name marketers. Moreover, central to global logistics is the subcontractors' ability to weave together the cross-national constituent elements of the value chain into a competitive, effective, and rapidly responsive system. Competitive advantage in the PC industry derives not only from lower costs, but also from rapid response capabilities and flexibility. The use of ICT in conjunction with the change of business models can help Taiwanese firms not only effectively coordinate multi-national and -organizational operations but also achieve speed and flexibility that is required.

Likewise, ICT has become essential to the development of the IC industry. Generally speaking, industrial networking as exists in Chinese Taipei's IC industry has also benefited from recent innovations in ICT. Firstly, by reducing the uncertainty and transaction costs involved in purchasing from outside suppliers, ICT reduces large firms' advantages of centralized purchasing and in-house suppliers. Secondly, technological changes have resulted in smaller production runs, increasing the feasibility of product changes and allowing small, specialized firms to exploit fragmented product markets on the basis of their flexible response. In addition, the IC industry is following the PC industry in moving rapidly towards order-based production. Leading IC firms in Chinese Taipei are championing the concept of the 'virtual factory' by deploying the Internet and extranet to electronically link with their customers and suppliers. More specifically, thanks to the emergence of SOC, foundries such as the TSMC have become an essential node of the innovation network of new IC designs, which entails close interactions of knowledge and information between foundries and their customers. As a result, the TSMC initiated the concept of the 'virtual fab' in order to promote virtual integration with its customers by means of business-to-business (B2B) applications, thus rendering the TSMC the facilitator of its customers' supply chain management. Virtual integration is therefore achieved in the industry characterized by vertical disintegration.

3.1.3 Goods Flow and Information Flow

However, the two cases of Mitac and the TSMC differ in a couple of aspects. Firstly, in the case of Mitac, the brand marketers, such as Compaq, took the initiative in shaping the global production network and in deploying IT integration within it. In contrast, TSMC appeared to play a more active role in this respect, since the company considered virtual integration as an evitable response to the emerging call for SOC. Secondly, in terms of inter-organizational and cross-border supply-chain integration, goods flows are no less important than information flows in the case of Mitac, and for the PC industry in general. However, for TSMC, such goods flows are secondary to information flows. This helps to explain why TSMC chose to take part in managing global production and knowledge networks, even though its production function is currently concentrated in Chinese Taipei.

Nonetheless, the two organizations do have some things in common. First of all, both have evolved from stand-alone OEM manufacturers towards providers of integrated service packages encompassing a wider range of value-chain activities other than manufacturing. By fine-tuning its international operations in a global logistics way and aided by ICT application, Mitac has begun to shoulder service functions such as the coordination of cross-border supply chains and logistics. Similarly, TSMC exploits its unique position in the IC industry to act as a portal providing comprehensive support for its customers' major operational tasks, ranging from design, prototyping, and engineering, to logistics.

Of equal importance is the formation of the global production networks that have resulted in new rules of the game for the two industries, towards which both Mitac and the TSMC have contributed in part. Central to global logistics is the subcontractors' ability to weave together the cross-national constituent elements of the value chain into a competitively effective and responsive production and logistics system. As a result, industrial competition within the PC industry relies not just on low costs, but also on rapid response and flexibility. In the case of TSMC, emphasis is placed on the tailored services packages provided to its customers, which include design support, cell library, SIP, quality/reliability, as well as process technology and wafer capacity. TSMC has thus dictated the new rules of the game, that foundry must go beyond manufacturing strength to become an essential platform for its customers to gain access to across-the-board competencies. In light of all these factors, the essence of ICT application is to facilitate networked firms' participation in setting the rules of the game for industrial competition, and those which provide more services improve their market position.

Compared to Mitac, which has placed logistics as the priority in its business operations, Compal still placed its core competence in manufacturing capability. Supply chain management based on new ICT technologies is seen by Compal as an instrument to strengthen its manufacturing capability rather than a basis for developing new competitiveness. Compal was more or less forced to adopt the new production method by brand-marketers who threatened to terminate orders if Compal refused to play by the rules of the game set by the brand-marketers. The new method of division of labor has turned Chinese Taipei subcontractors to manufacture service providers. In making the transition, some Chinese Taipei subcontractors place more emphasis on manufacturing such as Compal, some place more emphasis on service such as Mitac. For those emphasizing manufacturing, supply-chain management is the focus and the information network is mainly used for the coordination of production activities. For those emphasizing service, customer relationship is the focus whereby information network is mainly used for distribution and customer service. ICT seems to have given the players who are closest to consumers the highest power in the network. This is so because consumer information remains proprietary while other information has become open knowledge. It was a pure power play in the industry where the more powerful player in the network forced the less powerful players to absorb the costs and risks under the new production methods. In the case of Compal, these costs and risks were trickled down to upstream suppliers who are even less powerful than itself. It turns out that the longer the supply chain, the more capable the players in the system as a whole can absorb the risks, which

manifest mainly in terms of demand fluctuations. The ICT is particularly important in coordinating production activities along a long supply chain to reduce such risks. The Chinese Taipei experience points out the important role of small and medium enterprises (SMEs) which are likely to be on the short side of the digital divide. SMEs not only lack capital to invest in new information technologies, but are also short of human resources to manage new technologies once they are adopted. Nevertheless, they are also under pressure to catch up with the new technologies, otherwise they will be excluded from the networks.

3.1.4 Struggles in the Network

New production methods precipitated by the ICT have led to a more concentrated market in the relevant industries. Scale economies become even more important in market competition. Brand-marketers struggle to gain market share by pressing for low-cost, speedy, and fast production from their subcontractors. Chief subcontractors like Mitac or Compal also strive to increase production capacity to secure their position in global production networks. Small suppliers, while having no choice but to adopt new technologies, can only strengthen their bargaining power in the network with superior technologies. Being able to innovate and to continuously improve production efficiency is essential to the survival of SMEs in the information age.

The case of Epoch exemplifies the importance of innovation for SMEs in the new games. There is no guarantee that SMEs can always do this. A system of support for R&D by SMEs is therefore an important factor in the success of the industry. In addition to venture capital, which can turn innovations into business ventures, a supporting system to aid the existing SMEs in R&D endeavor is also important. The competitiveness of an economy's SMEs is likely to make a difference in global competition.

As to the case of BenQ, a hybrid of subcontractor and own-brand marketer, ICT offers an important opportunity to capitalize on economies of scope. On the one hand, the company is wired to international brand-marketers, and on the other hand, to upstream suppliers. Being a node in the network enables the company to access information flowing from both sides of the industry. Market information coming from the brand-marketers allows it to develop new products to meet consumption trends, whereas production-related information coming from the supplier side allows it to calibrate production costs and seize the opportunity opened by new technologies. In the meantime, continuous innovation within its own organization allows BenQ to attenuate the potential conflicts between OEM and own-brand operations. New innovations can supply both the own-brand and international buyers with appropriate product differentiation. The case of BenQ therefore exemplifies the value of information in the IT age.

BenQ's case also indicates that being able to build an information chain linking to the end-consumer is useful to the improvement of competitiveness. Information from the end-consumer illuminates the opportunities for process improvements and product innovations. This information also allows a manufacturer to serve its customers better, and that has become more important than the cost advantage in winning orders.

In sum, ICT can be considered as an innovation of 'transaction' technology, which can facilitate intra- and inter-organizational value chain management in a real-time and in a cost effective manner (Economist Intelligence Unit, 2000). The use of ICT in conjunction with new business models can help firms to achieve speed and flexibility in an industry where time to market is critical (Kraemer, *et al.*, 2000). In this regard, ICT is more than a transaction facilitator, and in fact, is promoted as being an enabling technology for collaborative commerce amongst firms, involving not only inter-organizational coordination of the supply chain but also cooperation in product definition, design and R&D (Berryman and Heck, 2001). In this way, production networks in the 'bricks and mortar' world may be transformed into virtual supply networks and collaborative communities. This is not to suggest that industrial advantages derived from the

physical world will become dispensable, but rather that they can go hand in hand with ICT applications to bolster the competitive edges of the firms involved.

3.1.5 The Role of Global Production Networks

OEM/ODM subcontractors in Chinese Taipei were forced to adopt a digital information network to organize their global production and service activities to serve brand-marketers who were striving to gain market shares by reducing costs and reducing time-to-market. New information technologies have allowed brand-marketers to engage in global marketing and they have found that organizing a competitive global marketing network is the best strategy for competition. The key is market share. A larger market share enables a brand-marketer to bargain for a better deal from the suppliers and the subcontractors, which in turn, allows it to gain even more market share. Therefore they have retreated from other segments of the value chain, including manufacturing and after-sales services, and even product design. Chinese Taipei's OEM/ODM subcontractors are therefore given the responsibility of providing these services. As brand-marketers operate a global marketing strategy, an OEM/ODM subcontractor will make a better partner if it maintains a global production and service capacity. This is because the contracting and coordination costs increase exponentially with the number of partners in a globally synchronized network striving to serve diversified local demands. For example, in the case of build-to-order marketing, subcontractors are required to deliver subassemblies to the final assembly lines near the markets in a just-in-time fashion. The subcontractors have to either own a production facility or a warehouse near these assembly lines. Because the pace of production, the level of inventory, and the shipping schedule have to be accurately coordinated, a digital network linking the subcontractor to the brand-marketer is a prerequisite for a successful partnership. In addition, the internal work routines of both parties have to be coordinated to prevent supply disruptions. All these require substantial investments and once these investments are made they become an exit barrier for the partnership. Therefore, the brand-marketers are very careful in choosing their subcontracting partners and the partners are more than willing to invest in the information network to seal the partnership once they are chosen. There is no incentive problem on the part of subcontractors. As a result, the development of global production networks has an effect of increasing market concentration, not only in the case of brands, but also in the case of subcontractors. The concentration ratio of Chinese Taipei's PC industry has been increasing since 1990 (Chen, Chen and Liu 2001), so has the ratio for contract manufactures in the US, e.g. Solectron, SCI, Flextronis.

The development of information networks does not appear to do away with the importance of agglomeration, however, which tends to be a local phenomenon. In fact, the information network may have made agglomeration an even stronger advantage in global competition. Although OEM/ODM subcontractors are offering a global manufacturing "service", their manufacturing activities are concentrated in a few locations. In the case of Chinese Taipei's subcontractors, the manufacturing activities are increasingly concentrated in China and Southeast Asia. Moreover, the choice of manufacturing location continues to be dictated by the cost of production in the traditional sense; Internet readiness does not appear to play a significant role in the location decision. Taking PC manufacturing as an example, China, Malaysia, and Thailand were by no means the most Internet-ready economies. in the Asia Pacific, but they were the locus of manufacturers. Likewise, Ireland and Eastern Europe are by no means the most Internet-ready economies. in Europe. In the case of software industry, Bangalore in India did not attract foreign investors by its digital infrastructure. Instead, it is the labor cost, labor quality, and language skills that are crucial in the choice of location for production activities. Once the production activities are located in the region, then the needs to build an interface with the rest of the world will facilitate the infrastructure development, often with aid from the host-economy government and multinationals. This is because the production activities per se are often coordinated by intranets of the company rather than the Internet, and bottlenecks to the establishment of intranets can be overcome relatively easily when compared to the Internet. On the other hand, these economies that have advanced information infrastructure may end up serving as a call center for brand-

marketers, providing technical support and customer services. Singapore and the United Kingdom are primary examples of these.

Logistics have proven to be critical to the choice of location in global production. In a global production network, the inbound shipment of materials and outbound shipment of products have to be carefully timed and managed. A logistics system plagued by uncertainty and inefficiency is unfit for global production. For example, inefficient transportation facilities and non-transparent customs procedures can be the demise of supply chain coordination and break down the global marketing system. Although information infrastructure is important to logistics, transportation and government regulations are far more influential.

There are two contrasting models in PC manufacturing: one is to decompose production into several modules and have them shipped to a final assembly line for configuration, the other is to have the product finalized in one place and shipped directly to the market. In both cases, there is a tendency for production to be concentrated in a few locations, although the degree of concentration tends to be higher in the case of “direct shipment” model. In the “decomposition” model, production of modules can be dispersed as standardization has allowed these modules to be made independently, but again production only takes place in a few economies.

It is puzzling why new information technologies do not help disperse global production as the cost of communication has been substantially lowered. The answer lies with the critical importance of time-to-market. As speed of delivery is critical to competitiveness, producers can not afford to spread out production too much as dispersion increases the cost of coordination. Nowadays, as components and parts suppliers are required to deliver their products to the production line in a just-in-time fashion, they inevitably have to be located near the final producers. In other words, although information technology allows production to be located far away from the market, it does not allow production to be too much dispersed. This implies that competition among economies for industrial location will become more intense in the information age and the agglomeration effect is likely to sharpen the comparative advantage of an economy.

Nevertheless, the working of the product life cycle will still move PC production from developed economies to developing economies as the industry matures. As Table 3.1 indicates, in 1985, 68.1 percent of PC hardware was produced in the US and Japan, and in 2000, the combined share of the US and Japan had dropped to 42.4 percent. In their place, Brazil, Mexico, China, Malaysia, Thailand, and Ireland had played a more important role. Although more economies are involved in producing PCs today than was the case 15 years ago when the industry began manufacturing remains concentrated in few economies. More importantly, the sales have increasingly concentrated in the hands of a few vendors. ICT has allowed a higher degree of horizontal integration and vertical disintegration than before. With the digital information network, these vendors coordinate works along the supply chain to serve a vast global market with diverse and ever-changing demands. These vendors outsource most manufacturing activities and focus their business operations on serving consumers. Dell has resorted to direct marketing to win the loyalty of consumers while IBM and HP-Compaq have marketed “solutions” as the main products rather than the hardware itself (Jason Dedrick and Kenneth Kraemer, 2002). This strategy makes economies of scale harder to realize because “customized” products or services are emphasized. This suggests that collaboration with local service providers is a possible solution, which in turn, implies business opportunities for local firms.

**Table 3.1: Leading computer producing economies, 1985, 1990, 1995, 2000
(hardware production in US\$ millions and share of total global production)**

	1985		1990		1995		2000		Global Rank
	Value	Share	Value	Share	Value	Share	Value	Share	
Americas									
US	47,122	49.2%	48,559	27.0%	76,284	26.5%	88,489	26.1%	1
Brazil	2,725	2.8%	4,634	2.6%	6,500	2.3%	9,084	2.7%	11
Mexico	n.a.	n.a.	1,161	0.6%	3,110	1.1%	10,281	3.0%	9
Asia-Pacific									
Japan	18,096	18.9%	52,428	29.2%	72,678	25.2%	55,340	16.3%	2
Singapore	1,194	1.2%	6,974	3.9%	21,127	7.3%	25,797	7.6%	3
Chinese Taipei	989	1.0%	5,886	3.3%	16,007	5.6%	22,157	6.5%	5
China	n.a.	n.a.	645	0.4%	5,600	1.9%	23,075	6.8%	4
Malaysia	42	0.1%	381	0.2%	5,280	1.8%	10,638	3.1%	8
Thailand	56	0.1%	1,586	0.9%	5,440	1.9%	8,731	2.6%	12
S. Korea	579	0.6%	3,073	1.7%	6,795	2.4%	7,681	2.3%	13
EMEA									
UK	4,416	4.6%	9,121	5.1%	13,460	4.7%	16,167	4.8%	6
Germany	5,445	5.7%	10,161	5.6%	8,054	2.8%	12,001	3.5%	7
Ireland	1,447	1.5%	3,817	2.1%	6,452	2.2%	10,013	3.0%	10
France	3,692	3.9%	7,550	4.2%	7,836	2.7%	7,135	2.1%	14
Italy	3,137	3.3%	6,863	3.8%	6,748	2.3%	5,754	1.7%	15

Source: Reed Electronics Research, Yearbook of World Electronics Data.

3.1.6 The Role of SMEs

One characteristic of digital information network is that its success depends on the collaboration of related firms in the network. Although large subcontractors have a strong incentive to link with brand-marketers, small components and parts suppliers may not sign on with the system automatically. Without the incorporation of these suppliers, the economic benefits of e-business can not be realized. There are many barriers for SMEs getting online, including:

- (1) lack of awareness or the urgency to link to the information network,
- (2) limited cash flow and access to capital resources to finance e-business investments,
- (3) a perception of insignificant cost savings as a result of small scale of operations, and
- (4) limited access to information technology resources.

(Source: Department of Industry, Tourism and Resources, Australia 2001, *The Internet's Impact on Global Supply Chains*).

However, there is urgency on the part of large assemblers to bring small components and parts suppliers online because without them the supply chain cannot achieve the efficiency required to meet the external demand. Therefore it is often the assembler who coerces the small suppliers to establish the relevant hardware facilities and software applications necessary to enter the information network. The assembler often offers guaranteed orders as an incentive. In fact, because of their competitors' lack of awareness and urgency, SMEs who answer to this call from large assemblers gain an immediate market advantage. Once brought into the information network, the demand for its product is transparent and production schedules can be arranged accordingly. Although SMEs lack technological, human, and financial resources to build the information infrastructure, the investment required is not totally out of reach because all they need is a local network linked to the assembler. As the information industry matures, external resources can be employed to overcome the shortages of internal technological and human resources. As to

the financial resources, linkages to the information network centered around a reputable assembly firm, which in turn, is linked to globally renowned multinationals, provide a financial leverage for small suppliers. Because semi-finished goods in the production process or accounts receivable become transparent in the information network, they can be used as a mortgage against loans. In fact, some assemblers in Chinese Taipei have purposefully incorporate a bank in their digital information network such that the invoicing and payment mechanisms can be integrated into the system along with the flow of goods and services. The bank in the system also provides credit to all parties involved, taking advantage of the information available in the system. The system eliminates the need for creditworthiness surveys and provides basis of risk management.

The aim of integrating SME suppliers into the digital information system is to remove warehouses from the supply chain. Ownership remains in the hands of suppliers until the components are put onto the production lines. The suppliers bear the inventory costs even after the components have been delivered to the factory. It is in their own interest to keep the inventory at the lowest level. The pressure to reduce inventory costs also forces small components and parts suppliers to adopt e-commerce. Again, competitive pressure trickles down from global production networks to local supply chains. The supply chains that are most successful in achieving productivity gains are most successful in the international market.

Inertia is a significant barrier to SMEs adopting e-commerce as many SMEs consider e-commerce to be only suitable for large enterprises. The demonstration effect is therefore very important. When some SMEs have succeeded in adopting e-commerce and have indeed benefited from it, other SMEs will be encouraged to do the same. There are also network economies in the adoption of e-commerce. The more the number of suppliers are linked to the digital information network, the higher the marginal return from additional investment on the network, and therefore it is easier to persuade the “non-convert” to sign on.

The data collected and revealed in the digital information network is also valuable information for quality control. By participating in the digital information network, a supplier will know quickly what problems have arisen in their products and they can fix them before more damage is done. The information network contains data from the beginning of production to the after-sales service and it helps identify problems quickly and find the solutions. Because each product is traceable in each step of production, and even the operator who performs the work can be identified, the origin of defects can be more easily located and fixed. Participation in the global production networks also allows SMEs to outsource knowledge from the network partners, particularly that owned by the “flagship” company (Ernst 2000).

In a global production network, complementarity of capabilities is central to the collaboration between network partners. With cut-throat competition, there is no room for buffer stocks or recourse for mistakes. Each node in the supply chain has to perform its duty perfectly. The flagship company that controls critical resources and capabilities must broaden its knowledge transfer to individual nodes to ensure a systemic, good performance. A global production network therefore acts as a conduit for knowledge transfer and a catalyst for knowledge creation and capability development in the participating firms. In the PC industry, the product life cycle has been cut to the point where only those firms succeeding in shipping new products first, and those introducing them simultaneously in all major markets will survive. Ramping-up production to a such speed is only possible if key design information is shared between the flagship company and its suppliers (Ernst 2000). Of course, it also implies that SMEs that fail to learn quickly will be expelled from the network.

The digital information network designed for the supply chain can be extrapolated to perform other functions to enhance the collective competitiveness of the system. For example, some of Chinese Taipei’s supply chain networks have been further developed to incorporate R&D functions. In other words, the system incorporates a design-in mechanism whereby components and parts suppliers are invited to participate in the design of the product at the time a product is

conceived. The information network provides feedback intelligence from the consumers, allowing components and parts suppliers to improve their products or make innovations. In fact, the “reverse” logistics process, in which defective products are returned to the original suppliers “backwards” down the supply chain always provides an opportunity for improvements of quality. SMEs who are left out of the system run the risks of devoiding the valuable information needed for product improvements and innovations.

3.1.7 Digital Opportunities

1. New Business Models

The emergence of ICT provides opportunities for a new kind of business. In the PC industry, enterprises that are capable of leveraging global resources have proven to be most competitive. Dell Computer is a prime example. Established in 1980 with a new concept of direct marketing, Dell has become the world’s leading PC vendor. Operating in 34 economies, with 35,000 employees, Dell has leveraged on global resources for its stunning success. It coordinates a global production network that spans the Americas, Europe, and Asia, combining in-house final assembly with heavy reliance on outside suppliers and contract manufactures. It also relies on outside partners for services such as system integration, installation, on-site repairs and consulting (Kraemer and Dedrick 2002). “Alliance capitalism” is the key to its success and information technology is the underlying force that drives Dell’s business model. With this model, Dell can tailor the products closer to the consumer’s desires and at the lowest cost. Alongside the rise of Dell, its major subcontractors such as Quanta and Arima, also emerged as two of the largest manufacturers of PCs in the world. Dell and its associates did not invent ICT, neither did they possess the most advanced ICT. Rather, Dell is innovative enough to take best advantage of ICT and turn it into a successful business model. In other words, it is the application of technologies that creates winners, just as it is in the “old” economy.

2. One-point Connectivity

To seize the opportunities in the information society, an economy must build a linkage to the global production network. It is apparent that digital opportunities will not be available without participation in the digital networks. Nevertheless, a digital-backward economy should not feel hopeless because linkage only means a one-point connection rather than a fully-blown integration. An economy can build a strong point to facilitate the linkage, which in turn, will set in motion a fuller integration process by mobilizing the resources of multinational firms. India and China are good examples. India devoted substantial resources to developing an optical-fiber-cable based telecommunication infrastructure in Bangalore which enabled it to participate in the global software industry. Once they are in the global production network, multinational firms invest automatically to facilitate further integration. Of course, a digital divide remains between Bangalore and the rest of India, but the problem is manageable because ICT diffusion is already taking place. An economy needs to accumulate a critical mass such that technology diffusion will take place and linkage to the global production network is the best way, if not the only way, to build such a critical mass. China is another example the Chinese government adopted an unbalanced development strategy to amass a viable manufacturing sector of information products along its coastal provinces, despite the general backwardness of its telecommunications infrastructure. Today, this industry has gained enough power to propel a self-sustained infrastructure building process.

3. Consumer-oriented Services

In the information society, the power of consumers increases as almost all production is driven by consumer demand. The old concept of dichotomy between demand-driven and supply-driven commodity chain is tilted towards the predominance of demand-driven ones. As a result of increasing consumer power, the ability to provide consumer services is still important in

determining the marketing success. Although production may be concentrated in a few locations far away from the market, consumer services are offered on the market. This implies that information network is indispensable wherever the market exists. Multinational firms offering global services have to extend their information networks to regions where the telecommunication infrastructure is inadequate. This means that there is a dependable force pushing for infrastructure investments, as long as the market exists. With the right government policies, such as a competitive telecommunications market and allowance for foreign participation, foreign investment can easily solve the problems of infrastructure bottlenecks. Once the infrastructure problems are resolved, the technological problems can also be resolved because technological advances will itself make ICT more user-friendly. The ability to use ICT in an innovative and productive way would still require adequate human resources, however, which can not be substituted for. The recent formation of a private group under the G8's Digital Opportunity Task Force to offer financial and technical assistance to developing economies wishing to bridge the digital divide indicates a genuine private interest in expanding the boundary of the information society.

3.2 Digital Divide in B2C E-commerce

Infrastructures are critically important in the development of business-to-consumer (B2C) e-Commerce since consumers need access to the Internet and providers need a secure server to conduct online trade. However, there is a great divide between economies in terms of both Internet access and the availability of servers. In addition, trading environment components such as online security and legal protection for consumers are also important facilitators of B2C E-commerce and are also areas of grave digital divide. Without a build-up of the basic infrastructures, and a friendly environment, B2C e-commerce can not take place. Fortunately, B2C E-Commerce appears to be a local phenomenon and hence digital divide does not create a great risk of foreign dominance in online trade. An economy lacking the infrastructures for B2C E-Commerce presents a barrier to online trade to domestic as well as foreign firms. It is almost like saying an economy without a seaport should not worry about the penetration of foreign goods. In fact, even without the protection of tariffs, cross-border e-commerce faces a greater trade barrier than traditional trade because logistics plays such a crucial role in Internet-based trade.

Logistics services that accommodate e-commerce, or e-logistics for short, have proved to be indispensable for e-commerce to fulfill its potential. E-logistics include the management of supply chains, inventory, and delivery, and this is the major difference between e-commerce and conventional trade. In conventional trade, logistics services are segmented between the chain to market and the chain to consumers. In e-commerce there is no segmentation and logistics have to respond directly to consumers. There is no "shock absorber" in between. The existing e-logistic problems arise largely from the fact that e-commerce and the related logistics services have outgrown the development of new facilities. Some e-retailers, for example, in the United States, failed to fulfill orders during peak demand periods and there is reluctance by some sellers to engage in international e-commerce because of the inability to solve the complex e-logistics problems. E-logistics requires developments in hardware facilities as well as software applications. It is inevitable that such developments have to be based on the foundations of conventional trade facilities instead of creating something completely new. Therefore e-logistics also tends to be a local phenomenon and it is very hard for the practices in one economy to be transplanted intact to the other economy. There is a serious interface problem when two e-logistics systems are to be combined and to function properly. In fact, even within an economy, there is a general lack of integration between the various applications used in different logistics functions. For example, there may be disparate documentation requirements in different transactions, e.g., government documents and commercial documents, that need to be harmonized. Without integration, economies of scale in logistics services such as shipping and distribution can not be realized.

At the present time, e-commerce only accounts for a small fraction of trade. Even in the most IT-savvy economy, the United States, e-commerce accounted for only 1.63 percent of GNP as of 2000, of which only a quarter is B2C transactions. The small percentage of B2C e-commerce in overall trade can be attributable to a lack of the right products. The experience of the short history of e-commerce is that e-commerce means more than trading commodities or services in an electronic way. Successful e-commerce requires right products or services and ones which offer some value that is nonexistent in conventional trade. This often implies that innovations are a prerequisite for successful e-marketing. The bursting of the dotcom bubble suggests that putting “old economy” products on the web does make good business. It takes some innovations to transform “old economy” products into “new economy” products. A typical example is Dell Computer. Dell’s success is not because it sells computers on the website, but because it sells computers according to the demands of consumers. It is a new kind of products, rather than a new kind of marketing, that creates value for e-commerce. Because innovations are often location-specific, e-commerce is also likely to be a local phenomenon.

If B2C e-commerce is a local phenomenon, then a digital divide between economies may give rise to different paths of development rather than subject the digitally-backward economies to the dominance of digitally-advanced economies. Although the building-up of infrastructures and human resources remains indispensable for the development of e-commerce, e-commerce presents a new opportunity for digital-backward economies as well as digital-weak firms. If B2C e-commerce is a local phenomenon, then a backward economy can develop its own digital industry without applying trade protection measures. One prime example is the culture-based Internet content industry. Many varieties of products in this category have proven to be viable, including electronic books, online music, online games, fortune-telling, and the like. A “killer” product, such as online games invented in Korea, can also be a vehicle to accelerate the Internet penetration and speed-up infrastructure development helping to close the digital divide.

It is encouraging to note that there are multiple routes to Internet access. Although computer terminals connected by fixed lines are most effective means of Internet access, cellular phones are a viable alternative. The establishment of cellular networks can be jump-started where technology leapfrogging is possible. China is a prime example which demonstrates the possibility of building a cellular network within a short span of time. B2C e-commerce based on a cellular network has also proved to be a vibrant business in Japan. In other words, it is entirely feasible for a digitally-backward economy to develop e-commerce without first beefing up computer ownership.

Compared to conventional trade, e-commerce can best serve the products whose consumers are not very numerous and who are dispersed throughout the economy. Products from remote regions may belong to this category. E-commerce may put these remote regions in the national spotlight and therefore entice investment in digital infrastructures to close the digital divide with the urban areas.

E-commerce may also provide an opportunity for digital-weak firms to compete with digital-sophisticated firms. As online trading reduces the transaction costs and the barriers to entry, small firms can compete with large firms based on products rather than production scale. In fact, e-commerce brings more focus to the strength of the products rather than the scale of production. If a small firm tries to match a large multinational enterprise by making a large investment in modern and powerful equipment for its website, it probably will never recover the costs. Scale matters in e-logistics (such as shipping and distribution) as well as in other platforms that facilitate trade. The dominance of FedEx and UPS in the e-commerce related shipping service in the United States is evident. According to a study by Jupiter Media Matrix (UNCTAD 2001), the number of companies that provide the time Internet users in the US spend online went from 11 in March 1999 to only four in March 2000. The first in the rankings, AOL Time Warner Network, accounted for 32 percent of online time. This strongly suggests the existence of scale economies in Internet service provider (ISP). While the distribution channels and platforms for trade tend to become concentrated over time, the product variety offered online has continued to increase.

Many small firms can offer their products online, riding on existing distribution channels and trading platforms. The Internet may even allow SMEs to implement a new strategy for building brand names or product images, one that was unfeasible in the old economy.

4. SOCIAL FACTORS FOR DIGITAL DIVIDE

The “digital divide” between information and technology “haves” and “have-nots” has been a topic of considerable academic and political discourse. Are the information technology inequalities disappearing, continuing, or widening? This chapter first examines existing gaps and the general trends of the digital divide in Chinese Taipei, and then assesses some social factors that contribute to it. Finally, some strategies and policies that could help reduce information technology inequalities are proposed.

4.1 Reconceptualizing the Digital Divide

4.1.1 Definition of the Digital Divide

Why does the digital divide (or the gap) matter? According to Bohland, *et al.*, (2000), there are several reasons that go beyond the acquisition of timely information. First, the digital divide has important consequences because of the broader social need for a well-educated, well-trained workforce. The second, concerns equality of opportunity. As the content of the Internet has become substantially enriched, the non-users of the Internet are deprived of its information, and resources, and even of their own identity as disconnection comes to mean nonexistence.

A narrow definition of the digital divide focuses on access to computers and the Internet. But access alone does not bridge the technology gap. To realize the potential of today’s information tools, people need the skills to explore, operate, and make the most out of the technologies to improve their lives and the health of their communities. The ability to create and share community-relevant information is part of that equation (Digital Beat, 2000). As Lazarus, the co-founder of the Children's Partnership (TCP), puts it, ‘there's been so much focus on the boxes and wires to connect to the Internet that we almost forgot to ask what people are getting once they connect.’ The report of TCP’s project is released in March 2000 and it examines a key element of the digital divide that is often ignored in the debates about access to information technologies. During five years of work to bridge the digital divide, TCP has found that it is as important to create useful content on the Internet—material and applications that serve the needs and interests of millions of low-income and underserved Internet users—as it is to provide computers and Internet connections.

It has been recognized that the concept of the digital divide is much more complex than a simple differentiation between those who are connected and those who are not. In addition to the usually understood division of Internet users and non-users (the first divide), non-users are not a homogenous group. They can be clearly classified into two broad groups, which constitute the second divide. Together, the user and the segmented non-user groups form a ‘dual digital divide.’ (Reddick, *et al.*, 2000)

In the paper ‘Creating the Cybersouth’, the digital divide is defined as having four distinct dimensions—access to information technology (IT), computer literacy, information literacy and appropriate informational content. At issue is the ability of citizens to participate fully in the new information age in ways that ensure equality of opportunity in social, educational, political, and economic systems (Bohland, *et al.*, 2000).

For Americans at risk of being left behind, useful information content in the Internet includes: (1) employment, education, business development and other information; (2) information that can be

clearly understood by limited-literacy users; (3) information in multiple languages; and (4) opportunities to create content and interact with it so that it is culturally appropriate. What do people want? What are the content-related barriers (lack of information, literacy barriers, language barriers, lack of cultural diversity)? People in different areas may have different concerns regarding the design of Internet content. The four dimensions mentioned above serve as a yardstick.

Wilkins and Waters (2000) reviewed 40 development projects gathered from published institutional documentation about the development communication projects using computer technologies implemented since 1992. According to the documents, in most of the development projects participation seems to be less about resistance, and more about integrating groups into existing economic and organizational structures. Regarding the role for communication technology in the process of social change, the discourse revealed that computer technologies are the tools for transmission, participation or resistance.

As computer technologies are adopted as channels for the transmission of information, the content and the context of the communication process is not addressed in most of the reports; it is believed that technologies per se will empower the information-poor and instill knowledge in them regardless of the context of the application of the technologies. Policy makers and social activists develop different discourses on the idea of participation and development. Discourse is defined here as an articulation of knowledge and power through the construction of social problems and institutional interventions (Crush, 1995, Escobar, 1995). Policy makers and activists provide different discourses to justify their actions. Regardless of what kind of discourse or justification it provides for use and non-use, the existing digital divide—in some areas, the widening divide—needs to be examined from various perspectives.

4.1.2 Adoption-Oriented and Access to the E-Marketplace

As an extension of the classic definition of digital divide, this perspective highlights the importance of presence in the emerging e-marketplace and the identity of an eligible consumer. As mentioned, the narrowing of the digital divide will help to provide the infrastructure for people to pursue education, to build community, to engage in public discourse, and to purchase goods and services. Failure in the adoption and use of information technologies results in isolation from the increasingly predominant means of commerce and communication. The Internet serves as the platform for all kinds of communications, disconnection from the Net leads to perceived isolation.

The so-called 'rural-penalty' is believed to reduce the opportunities available to nonmetropolitan communities. Due to geographical isolation, residents in remote areas will have limited retail choices and information sources. 'Wired' residents are different, they can access all information sources. More important, the creation of a telecommunications infrastructure in a community can help diversify the local economy and provide jobs for displaced farmers. As for local business, rural companies serve as 'out-source' suppliers that deliver component parts to the center firms located in metropolitan areas.

The picture is not as rosy as the theory predicts. The newly emerged 'out-source' suppliers now have to compete with similar suppliers from all over the world – with the aid of the net, geographic distance is no longer the issue when it comes to the matter of information transmission; as to the shipping of manufactured goods, the transportation between rural firms and metropolitan centers may not overcome the 'tyranny of geography'.

Hindman's (2000) research focuses on the effect of the telecommunications infrastructure in overcoming the barrier of geographic distance and encouraging the behavior of online consumption. It is hypothesized that the adoption and use of the net will eliminate the distinction between metropolitan and non-metropolitan experiences and answer the needs of all citizens. He attributes delays in the implementation of telecommunications infrastructure to the rural residents'

resistance to new ideas. Hindman hypothesizes that metropolitan residence will be positively associated with the use of information technologies, therefore new technologies are thought to support, not challenge, existing inequalities. Over time, metropolitan residence becomes even more associated with the use of information technologies. The hypotheses were tested based on an analysis of the secondary data from comprehensive survey in 1995 and 1998. The results show that the gap between metropolitan and non-metropolitan area residents appeared to be narrowing in terms of having a personal computer at home. However, for all of the other behaviors, such as adoption and use of various information technologies (e.g., going online to read the news or to purchase goods and services), “the gap was nearly twice as large in 1998 than in 1995” (Hindman, 2000, p. 555).

Therefore, the emergence of e-commerce will not generate a brand new model of participation. In the process of converting capital into digital information for the sake of efficient transmission of funds and effective management of business, private business and economic elites will not be left out. After the convergence of networks and the mergers among telecommunications corporations have taken place, new cadre of elites have a stake in the digital marketplace also. The technologies do not remove the structural inequalities associated with previous eras. Hindman’s findings support the idea that the ‘mass society’ era persists as corporations merge in preparation for the convergence of commerce and digital communication. For those who are economically deprived and live in remote areas, they continue to have limited access and resources to new media.

4.1.3 Continuation-Oriented and Focus Shifting to Internet Dropout

Many discussions and analyses have revolved around questions regarding adoption of the Internet. As for the changes taking place in the process of interacting with the new technologies, little research has been devoted to the people giving up these technologies. Former Internet users, or “Internet dropouts”, are the ones who withdrew from participating in cyberspace and stayed offline. Delving into this phenomenon, researchers have revealed barriers and disincentives to Internet participation. Even though the size of this population may be small, it is imperative to capture the stories of dropouts in order to bridge the digital divide effectively.

In terms of the development and implementation of communication technologies, many have experienced a rise and fall of technology use in their own lives. The rate of telephone use declined where in the 1930s due to economic depression. Among people who have purchased cellular phones, a telecommunication report showed that many no longer have active service subscription for the phones. There are studies focusing on the non-adoption of communication technologies, but in terms of the social aspects of communication technology – the discontinuation of the use – it is a neglected topic needs in-depth analysis and exploration.

In 1999, among all Internet users, 870,000 have quit going online (Commonwealth.). Half of all ‘dropouts’ began to use the Internet no earlier than 1998. The major reasons for quitting the Internet include: no time, low speed of transmission, and the difficulty of setting up the online environment. Net dropouts formed about 23.1 percent of the online population in 1999, decreasing from the 34.6 percent of the online population in 1998.

The Pew Internet and American Life Project (2000) shows that of the Americans who dropped out, the reasons given included the lack of computer, changes of job, high Internet access fee, the lack of usefulness of the Internet content, and worry of the intrusion of privacy. In Chinese Taipei, the poor infrastructure, users' insufficient media literacy, and life style deter people from exploring the Internet.

To their great surprise, Aspden and Katz(1998) found in their 1995 comprehensive survey that there were 8 percent respondents were self-claimed as Internet former users. The figure went up to 11 percent in 1996 survey. In their analysis, most of the former users in the age group below

20 had been connected to the Net less than six months. Former users and current users shared the similar background while for the age group above 20 years old, dropouts were demographically distinctive from users – the former users were younger, less affluent, less educated, and less likely to be married. Aspden and Katz mentioned in their study that there are four groups of people with regard to the Internet (non-use): those who are not aware of the Internet at all; those who know of the Internet but do not adopt the net, those who are aware of it, adopt the net, and currently use the Net, and the ones who discontinue to use the Net now. According to the findings, teenage users appear more likely to become dropouts, and this finding goes against the common belief that older people lag behind all others because of their often reduced capacity to adopt new technologies and absorb new knowledge. Young people do drop out, and the lack of systematic education and support systems explain the Internet discontinuation.

The phenomenon of reducing participation in the cyberworld challenges the assumptions of technological determinism. As many are still fascinated with the changes the net brings to us and some are puzzled over problem of the digital divide, the data on Internet dropouts points out the inadequacy of service, both provision online and off line.

4.2 Mapping the Gaps

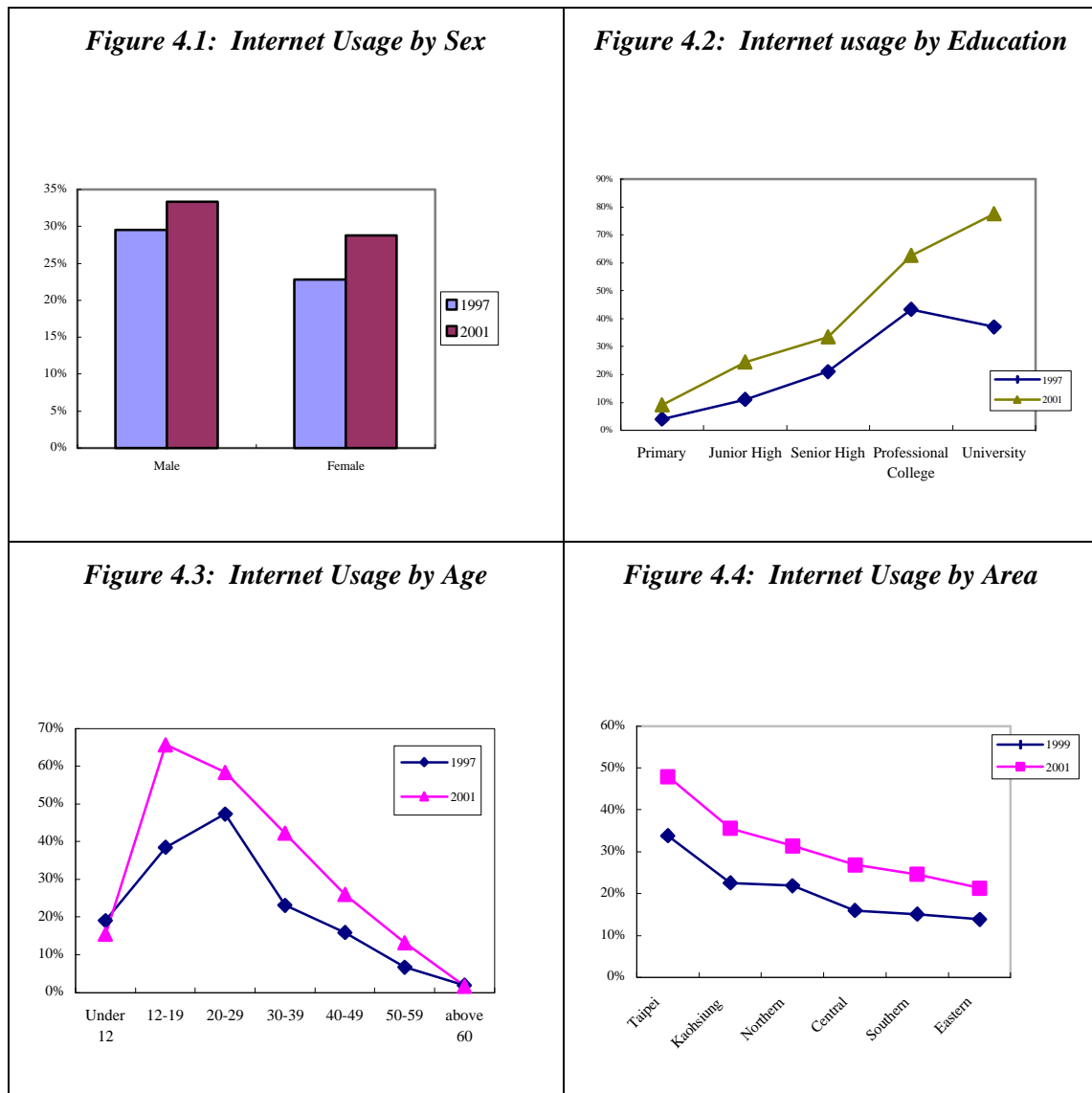
In the following sections, major trends and the current conditions of the digital divide in Chinese Taipei are briefly discussed, and then, based on the survey data and interviews, some of the social causes of the digital divide are identified.

The tables and figures that follow draw upon two comprehensive random surveys: (1) “A Survey on People’s Internet Usage in Chinese Taipei Area” (hereafter, PIU), conducted by the Department of Statistics, the Ministry of Transportation and Communications undertaken in 1997, 1999, and 2001;³³ (2) “A Survey on the Internet Society” (hereafter, IS), conducted by Institute of Sociology and the Office of Survey Data, Academic Sinica, in 1999. PIU survey data across years are used to depict the trends of the demographic shift of information inequality in contemporary Chinese Taipei, and is further analyzed, in more detail to provide updated snapshots of the digital divide in Chinese Taipei. The IS survey is used as supplementary data for the analysis on some key variables which are not available in the PIU surveys. Three categories of respondents are identified in our analysis: non-users, former users (dropouts), and current users.

4.2.1 General Trends

Over the past few years, the number of Internet users has increased rapidly in Chinese Taipei. The PIU survey shows that 36.1 percent of respondents have access to the Internet in 2001. This is an approximately 10 percentage points increase compared to 1997 (26.1 percent). While the total population of Internet users has expanded, it is to no one’s surprise that the spread of digital technology and information service is uneven among different groups of people. As the data reveals, a digital divide that is similar to those found in many other economies is still evident in Chinese Taipei. Compared to non-users, the Internet users are more likely to be male, generally younger, living in big cities, and more educated.

³³ A brief report for the 1999 survey and a more detailed report for the year of 2001 survey can be found at <http://www.motc.gov.tw/service/>, and <http://www.motc.gov.tw/service/survey/90www.doc>.



Figures 4.1 to 4.4 roughly depict the changes of direction in some major demographical aspects of Internet use. The gender gap and geographical inequalities in Internet access have narrowed over the past few years. However, the digital divides associated with age cohorts and educational achievement have widened. Highly educated people have always had better chances of accessing the Internet, and as a group, they gain access to the Internet at a faster rate than the lower educated. The Internet access rate for the least educated group of people (primary school or less) was 4 percent in 1997, and this figure has increased to 9.1 percent in 2001. However, the Internet access rate for the most educated group (university and beyond) rose from 37.1 percent in 1997 to 77.6 percent in 2001.

As to the Internet access rate by age cohort, the distribution is clearly skewed toward the younger generations, which is even more apparent in 2001 than in 1997 (see Figure 4.3). In 2001, 65.7 percent of teenagers in the survey sample claimed access to Internet, and for young adults (20 to 29 age cohort) the figure was 58.4 percent. In contrast, the proportion of the elderly (60 and above) with access to the Internet was less than 2.0 percent in both years.

4.2.2 A Closer Look: Demographics of Users, Non-users, and Dropouts

Reports of the digital divide in many economies show that some key demographic variables, such

as sex, age, race/ethnicity, family income, education, and urban residence are important determinants of information inequality. However, since neither the PIU survey nor the IS survey data contain information on respondents' ethnic background and family income,³⁴ the effects of class and ethnicity on the Internet usage was thus absent from the analysis. The 2001 PIU survey data reveal that the digital divide between the information rich and the information poor persisted. About 31 percent (31.2 percent) of the random sample reported were Internet users, while 4.9 percent were former users (dropouts). In total, 36.1 percent of the respondents reported having used the Internet, while non-users accounted for 63.9 percent of total respondents (see Table 4.1).

The 2001 survey indicates that Internet users are likely to be male (33.3 percent of males are current users compared to 28.8 percent of females), belong to younger generations (from teenagers up to the thirties), be well-educated (the higher the respondent's education level, the larger the proportion of group to be current Internet users), and living in a metropolitan city (47.9 percent of respondents in Taipei are Internet users, and 35.6 percent in Kaohsiung City, while only 21.3 percent of respondents in the Eastern part, the least urbanized area, of the island access the Internet).

The non-users are more likely to be female, have a lower education level, be very young or the older generation, or live in a less urbanized area of the island. Although not having access to the Internet at all and failing to retain Internet access are two distinct barriers to information equality, we found that the profiles of the latter group, namely the dropouts, are very similar to those of the non-users. This finding suggests that the digital divide is not just a matter of a lack of computers, Internet connection, and related facilities. Even when people have access to Internet, they might not want to, or be able to stay connected. This suggests that the solutions for shortening the digital divide should not rely upon the provision of hardware facilities alone. Further discussion on the Internet dropouts will be presented in the later section.

³⁴ The IS survey has information on the respondent's personal income. However, since a large proportion of Internet users belong to young generations who often have not entered the job market yet, this variable cannot serve as a proxy indicator for family economic condition.

Table 4.1: Internet Usage by Sex, Education, Age, and Area

	Current User	Former User	Non-User	Dropout Rate	Total
Sex					
Male	33.3%	4.8%	61.8%	12.6%	3215
Female	28.8%	4.9%	66.3%	14.6%	2856
Education					
Primary	9.1%	1.8%	89%	16.8%	2327
Junior High	24.5%	5.6%	69.9%	18.6%	895
Senior High	33.4%	7.5%	59.1%	18.3%	1482
Professional College	62.6%	8.8%	29.0%	11.8%	620
University and up	77.6%	5.4%	1.7%	6.5%	747
Age					
Under 12	15.4%	3.2%	81.4%	17.3%	748
12-19	65.7%	10.4%	23.9%	13.7%	808
20-29	58.4%	8.4%	33.1%	12.6%	888
30-39	42.2%	5.5%	52.2%	11.6%	919
40-49	26%	3.0%	71.0%	10.4%	897
50-59	13.2%	3.1%	83.7%	19.3%	668
above 60	1.7%	1.2%	97%	4.1%	1143
Area					
Taipei City	47.9%	5.4%	46.6%	10.2%	826
Kaohsiung City	35.6%	3.6%	60.8%	9.1%	444
Northern Area	31.4%	5.1%	63.5%	13.9%	1928
Central Area	26.9%	5.3%	67.7%	16.5%	1389
Southern Area	24.6%	4.2%	71.2%	14.4%	1324
Eastern Area	21.3%	5.0%	73.8%	19.0%	160
Total	cases				
(% of total)	1,894	296	3,881		6,071
	(31.2%)	(4.9%)	(63.9%)		(100%)

Source: The Ministry of Transportation and Communications, Department of Statistics, 2001.

Table 4.2 gives the results of a logistic regression model³⁵ aiming at predicting Internet usage as a function of basic demographic factors of individuals. The dependent variable for Model 1 is the log-odds of accessing Internet in the past, and the dependent variable for Model 2 is the log-odds of dropping out among Internet users. Both models use the PIU survey data to examine the effects of gender, age, education, and geographical differences on Internet access and dropout behavior.

³⁵ All independent variables used in the logistic regressions here are effect-coded, not dummy coded; therefore, the comparing values for all log-odds are the average values, not the reference group being left out from the model.

Table 4.2: Logistic Regression of Internet Users and Dropouts (PIU)

Independent	Model 1 User=1/ Nonuser=0		Model 2 Dropout=1/ Current user=0	
	b	exp.(b)	b	exp.(b)
Sex	---	---	---	---
Male	.124 ***	1.132	-.111 †	.895
Female	-.124 ***	.884	.111 †	1.117
Age	---	---	---	---
Under 12	.927 ***	2.527	-.439	.645
12-19	2.715 ***	15.105	-.759 ***	.468
20-29	.543 ***	1.721	-.076	.927
30-39	-.034	.966	-.206	.814
40-49	-.564 ***	.569	-.341 †	.711
50-59	-.970 ***	.379	.406 †	1.501
60 and up	-2.616 ***	.073	1.415 ***	4.118
Education	---	---	---	---
Primary	-2.250 ***	.105	.594 *	1.810
Junior high	-1.618 ***	.198	.789 ***	2.200
Senior high	-.561 ***	.571	.502 ***	1.653
College/univ.	1.509 ***	4.521	-.487 **	.614
Graduate	2.921 ***	18.550	-1.397 ***	.247
Area	---	---	---	---
Northern	.032	1.032	.053	1.054
Southern	-.140	.869	.020	1.021
Eastern	-.381 *	.684	.253	1.287
Big cities	.489 ***	1.631	-.326 *	.722
Constant	-.264		-1.641	
Model ²		3285.645		91.341
N		6071		2190
Pseudo R ²		.351		.04

† p<.10, * p<.05, **p<.01, ***p<.001.

pseudo R² = C/(C+N), C is the Model ².

Source: The Ministry of Transportation and Communications, 2001.

The result of Model 1 in Table 4.2 shows that all four basic demographic variables have statistically significant effect on respondents' chance of using Internet, after the influences of other variables are controlled. Being male, younger, with more education, or living in a more urbanized area, significantly increases the odds of using Internet, controlling for other variables in the model. The odds of using Internet are 1.132 times higher for men than the average for all respondents. As to the effects of age and education, Model 1 clearly demonstrates the consistent positive effects of both variables. After other variables are controlled, the digital disadvantage of the youngest age cohort (under 12) disappears, while the disadvantage of the elderly becomes evident. The odds of using the Internet for the youngest age cohort are 2.527 times higher, and for teenagers 15.105 times higher than the odds for the average respondents. The higher the respondent's education level, the more likely is the respondent to access the Internet. Respondents with a graduate school education enjoy 18.55 times higher odds of using the Internet than the average. Urbanization also appears to be an important determinant of individuals' Internet usage. The odds of using the Internet for the most urbanized respondents living in Taipei and Kaohsiung are 1.631 times higher than average, and the odds for residents in the least developed area (Eastern Chinese Taipei) are the lowest among all areas.

With regard to the behavior of Internet dropouts (see Model 2), as expected, the probability of discontinuing Internet usage is slightly higher for women than the average, and the result is statistically significant at the 10 percent level. Among the current Internet users, the chances of

dropping out for older generations, lower educational achievers, and people who live in less urbanized regions are also higher than the average. The probability of ending Internet use is particularly high among the eldest generation (4.118 times higher than the average).

Table 4.3: Internet Dropout Rate by Sex and Marital Status (IS)

Column pct (Count)	Single		Married	
	Male	Female	Male	Female
Current User (1)	48.8%	46.6%	20.5%	13.5%
Former User (2)	6.2%	7.4%	2.2%	3.4%
Nonuser	45.0%	46.0%	77.3%	83.1%
Dropout Rate (3) (3)=(2/1+2)%	11.3%	9.7%	13.7%	20.3%
Total	(547)	(541)	(815)	(1017)
Chi-Square	.905		17.69	
P-value	.636		.000	

Source: Institute of Sociology, and the Office of Survey Data, Academia Sinica, 1999.

In addition to the effects of these demographic factors suggested by the statistical data, our in-depth interviews suggest that family role and marital status are also important factors in determining an individual's Internet usage. Since the PIU surveys do not contain such information, the IS survey was analyzed to check the relationship between marital status and Internet usage.³⁶ The pattern revealed in Table 4.3 confirms our speculation of a negative effect of marriage on the respondent's Internet usage. Moreover, being married seems to have different effects on men and women. Taking the dropout rate as an example, single females show the lowest dropout rate (9.7 percent) followed by single males (11.3 percent), while married females have the highest (20.3 percent) among all four categories, much higher than the married males (13.7 percent).

To examine whether such differences in dropout rate resulted from other factors, further logistic regressions of Internet usage using the IS survey data were conducted. The result confirms the previous findings (Table 4.4). Other things being equal, marriage reduces the odds of accessing the Internet for both men and women. The odds of using the Internet for married women are 0.749 times of the average, the lowest group among all. The possible negative impact of marriage on women's Internet usage does not end here. If a married woman chooses to be a housewife, her chance of using the Internet falls to about half of that of the average (0.506 times). All variables are statistically significant at the 10 percent level. The unique, disadvantaged position of housewives in accessing digital information is made clearer in the model for the dropout (Table 4.4, Model 2). When other factors are controlled, being a housewife increases the odds of quitting using the Internet to almost 3 times (2.943 times) the average.

³⁶ Unlike the PIU surveys which applied a comprehensive stratified random sampling method, the IS survey used cluster sampling method to collect data in urban areas only. Therefore, geographic area is not included as an independent variable in the model.

Table 4.4: Effects of Marital Status and Occupation (IS)

Independent variables	Model 1 User=1/ Nonuser=0		Model 2 Dropout=1/ Current user=0	
	b	exp.(b)	b	exp.(b)
Age	---	---	---	---
15-19	1.228 ***	3.413	.598	1.818
20-29	.996 ***	2.706	.280	1.323
30-39	.284 †	1.328	.363	1.437
40-49	-.079	.924	.156	1.169
50-59	-.534 *	.587	1.240	3.455
60 and up	-1.895 **	.150	-2.637	.072
Education	---	---	---	---
Primary	-4.113	.016	---	---
Junior high	-.947	.388	.552	1.737
Senior high	.144	1.155	.586 †	1.797
College/univ.	1.755 *	5.782	.416	1.517
Graduate	3.162 ***	23.614	-1.555 *	.211
Occupation†	---	---	---	---
Professional	.563 ***	1.756	-.422 †	.655
Service	.063	1.065	.277	1.319
Manual	-.734 ***	.480	-.395	.674
Housewife	-.682 ***	.506	1.080 **	2.943
Student	.790 ***	2.203	-.539 †	.583
Sex × Marital Status	---	---	---	---
Married male	.381 ***	1.463	-.062	.940
Single male	-.175	.839	-.302	.739
Married female	.085	1.088	.149	1.161
Single female	-.290	.749	.215	1.239
Constant	-1.897		-2.600	
Model ²	962.832		41.093	
N	2923		953	
Pseudo R ²	.248		.041	

† p<.10, * p<.05, **p<.01, ***p<.001.

pseudo R² = C/(C+N), C is the Model ².

† The occupations are coded as: “1=professional, managerial”, “2=technical, service work”, “3=manual labor and manufacturing”, and the rest is the same as titled.

Source: Institute of Sociology, and the Office of Survey Research, Academia Sinica, 1999.

4.3 Social Factors for Digital Divide

We have identified four social factors that may deepen the existing digital divide in Chinese Taipei. They are: unfriendly technology, psychological barriers, irrelevant content, and physical access to ICT. Any attempt to address the digital divide problem in Chinese Taipei must take these factors into consideration.

4.3.1 The Interface as the Barrier to Access and Continual Use

1. Unfriendly Technology

This is the major barrier to Internet usage. Even experienced computer users find it difficult to get started in some Internet functions, e.g., the BBS discussion. Our study confirms the same finding.

2. The Importance of a Support Network

Since neither using a computer nor going online is an easy matter, a support network which offers the necessary help when it is needed becomes an important determinant of Internet usage; this is especially true for beginners. In order to test the effect of a support network on different groups of Internet users, four logistic regression models designed to estimate how people learn to use Internet were specified, and the results are presented in Table 4.5. Based on the ways people learn to use Internet, four dependent variables are created for analysis: (1) "Self-learned": including learning it by self-exploration or from private computer/Internet educational programs; (2) "From school": including learning it in the class, from teachers or from classmates; (3) "From work": including learning it at the workplace or from the computer programs offered in workplace; (4) "From family": including learning it from any family members, relatives, and other personal networks.

There were several findings. First, those who enjoy an advantageous position in digital access are also those who are able to learn computer/Internet skills without institutional support. The profiles of people who learned to use the Internet by themselves (self-taught) are very similar to those of the typical users we discussed earlier. They are likely to be male, young, highly educated, students and professionals, and living in big cities. On the contrary, those disadvantaged groups in Internet usage, namely females, the elderly, the less educated, manual workers and housewives, are less likely to learn the necessary skills by themselves.

Institutional support given by school or workplace can help certain groups of disadvantaged users to gain access, but not all of them. For example, school and workplace seem to have similar effects on bridging the gender difference in Internet usage, since the odds of learning to use the Internet in the workplace or in school are both higher for females than for males (yet the gender difference in the workplace is not significant statistically). However, some disadvantaged groups in digital access are often blocked access to formal institutions that provide training or support to Internet usage. The less educated group is such a typical example. The lowest educational group among the Internet users (junior high school) suffers from the lowest probabilities of learning Internet via every channel listed in the table. Their disadvantage in formal educational institutions is transformed into a clear disadvantage in digital access.

These results suggest that although institutional supports are not necessarily solutions to the digital divide, solving the problem through personal networks is even less reliable in this regard. Taking housewives as the example, the chances of learning to use the Internet via family networks for housewives are the lowest among all groups of respondents, even though housewives spend most of their time with their families. More dimensional, and more diversified public programs that address the needs of different disadvantaged groups are what is needed.

Table 4.5: Logistic Regression of How People Learn to Use Internet (IS)

Independent	Self-taught=1/ Non=0		Work=1/ Non=0		School=1/ Non=0		Family=1/ Non=0	
	b	exp.(b)	b	exp.(b)	b	exp.(b)	b	exp.(b)
Sex	---	***	---		---	†	---	
Male	.364	***	1.439	-.134	.874	-.141	†	.869
Female	-.364	***	.695	.134	1.144	.141	†	1.151
Age	---	***	---		---	***	---	***
16-29	.300	†	1.350	-3.472	.031	.776	***	2.173
30-49	.241	*	1.273	1.679	5.360	.108		1.114
50 and up	-.542	***	.582	1.793	6.008	-.884	***	.413
Education	---	***	---		---	***	---	***
Junior high	-1.170	***	.311	-1.707	*	.182	-.997	***
Senior high	-.034		.967	.307	1.359	-.263	*	.769
College/univ.	1.203	***	3.331	1.400	***	4.055	1.260	***
Occupation	---	***	---		---	***	---	*
Professional	.460	***	1.584	1.379	***	3.972	.926	2.525
Manual	-.463	*	.629	.045	1.046	1.296	3.655	-.222
Housewife	-.734	*	.480	-.811	.444	-5.524	.004	-.506
Student	.737	***	2.090	-.613	.542	3.302	27.152	.342
Constant	-2.576			-6.412		-4.544		-2.685
Model ²	339.375		148.728		488.846		93.058	
N	953		953		953		953	
Pseudo R ²	.263		.135		.339		.089	

† p<.10, * p<.05, **p<.01, ***p<.001.

pseudo R² *= C/(C+N), C is the Model ².

Source: Institute of Sociology, and the Office of Survey Data, Academia Sinica, 1999.

4.3.2 Location as a Barrier to Access and Continual Use

1. Lack of Alternative Places to Go Online

In addition to the skills necessary to use computers and to go online, a place that allows one to access the Internet easily and cheaply is a fundamental requirement for one to be a constant user. Table 4.6 shows the changes (from 1997 to 2001) in the major place where people go online. Several phenomena are noteworthy. First, Chinese Taipei's Internet users showed a strong tendency to use the Internet at home. Among all Internet users in the sample, 72.7 percent of them claimed "home" as one of their main places to access the Internet. This figure also reflects the widespread household connection to the Internet in Chinese Taipei. Second, about one third of the users access the Internet from work or school (28.2 percent and 33.8 percent, respectively). This finding further confirms that people who have work or school affiliations have more opportunities to use Internet. Work and school affiliations not only mean more computer/Internet facilities available for use, but also imply existing support networks that provide technical help when needed. Third, the Internet café has become an important alternative for people who want to go online. While there is only 2 percent of Internet users chose netcafé as one of the major places to get online in 1997, this figure rose to 12.7 percent by 2001. As a supplementary place for many users to access the Internet, Internet cafés have important social meanings that cannot be overlooked. For one thing, Internet cafés provide a free environment to conduct online activities that often cannot be done elsewhere. They provide a place that is free from both the regulations and other restrictions one encounters at home, work, or school.

Government-sponsored local technology centers and other Internet facilities are extremely scarce in Chinese Taipei. Without local libraries and community centers that provide free or low-cost Internet access, people who have no educational or business affiliations are often deprived of the most important channel of access to digital information and services. A very small percentage of

users who access the Internet from places other than home, work, school, and netcafé (2.1 percent, as for “others”)³⁷, serves as evidence of the lack of alternative places in the public domain to go online in Chinese Taipei.

Table 4.6: Trends of Major Places to Access the Internet (PIU)

Column pct	Home	Work	School	Netcafé	Others	N Total users
1997	55.5	27.1	33.9	2.0	7.9	984
1999	62.8	31.7	35.8	3.7	7.5	3939
2001	72.7	28.2	33.8	12.7	2.1	3203

Note: The data used in this table derived from the question: “What are your major places of accessing Internet?” This question allows respondents to choose up to three places of using Internet.

Source: The Ministry of Transportation and Communications, Department of Statistics, 1997, 1999, 2001.

2. Gender and Age Segregation in Internet Café

However, the typical netcafé in Chinese Taipei is not a place for everyone with a need to use the Internet; it is highly segregated in terms of gender and age. In short, netcafé is specifically designed for young male adults. Most netcafés are equipped with multi-media PCs and cheaply leased high-speed bandwidth to attract virtual game players who are mostly male teenagers and young adults. The high beat sound effects of computer gaming as well as the thick smoke of cigarettes permeated through the air make netcafé a bar-like space in Chinese Taipei, which keeps females and older customers away.³⁸

Such a pattern of gender and age segregated netcafés is evident as revealed in Table 4.7. Teenagers and young adults (12 to 29 age group) are the dominant majority of the population who use Internet cafés as a major place to go online. For teenagers, the odds of using a netcafé as their major place to go online are more than 10 times higher than the average (10.701), and are almost 4 times (3.929) for the 20 to 29 age cohort. Furthermore, the gender mix of these netcafé-goers is highly biased towards the male. The chances for males to use netcafé as the major Internet access are 1.8 times higher than the average. As mentioned earlier, those who have school or work affiliations are also more likely to be the information-rich. Highly educated groups (college/university and graduate school) have a much better chance of accessing the Internet at school, at the workplace, and even at home. This suggests that the netcafé is a supplement rather than a substitute for Internet access for the disadvantaged groups.

³⁷ Since the “other” places of accessing Internet contain many possibilities, such as accessing Internet from a friend’s home, the actual percentage of using government sponsored access centers to reach Internet is even lower.

³⁸ While being asked of the possibility of imposing a nonsmoking policy in his Netcafé, one of our interviewees directly told us that it was impossible, since it would hinder the male customers from coming.

Table 4.7: Logistic Regression of Major Places Accessing Internet (PIU)

Independent variables	At Home=1/ Others=0		At Work=1/ Others=0		At School=1/ Others=0		At Netcafé =1/ Others=0	
	b	exp.(b)	b	exp.(b)	b	exp.(b)	b	exp.(b)
Sex	---	*	---	*	---	**	---	***
Male	.064 *	1.066	-.103 *	.902	-.114 **	.892	.626 ***	1.871
Female	-.064 *	.938	.103 *	1.109	.114 **	1.121	-.626 ***	.535
Age	---	***	---	***	---	***	---	***
Under 12	.594 ***	1.811	.274	1.315 ³⁹	1.303 ***	3.678	.698	2.010
12-19	1.640 ***	5.157	-1.110 ***	.330	3.289 ***	26.817	2.370 ***	10.701
20-29	.299 ***	1.349	.084	1.088	.575 ***	1.777	1.368 ***	3.929
30-39	.140 †	1.150	.932 ***	2.538	-1.315 ***	.269	-.165	.848
40-49	.013	1.013	.795 ***	2.214	-.869 ***	.420	-1.162 **	.313
50-59	-.625 ***	.535	.486 *	1.626	-.827 ***	.437	-.794 †	.452
60 and up	-2.062 ***	.127	-1.461 ***	.232	-2.156 ***	.116	-2.317 **	.099
Education	---	***	---	***	---	***	---	***
Primary	-1.635 ***	.195	-1.813 ***	.163	-.651 ***	.522	-1.659 ***	.190
Junior high	-.957 ***	.384	-1.784 ***	.168	-.980 ***	.375	.285 †	1.330
Senior high	-.188 **	.829	.087	1.091	-1.084 ***	.338	.626 ***	1.869
College/univ.	1.185 ***	3.270	1.540 ***	4.662	.651 ***	1.917	.595 ***	1.812
Graduate	1.595 ***	4.930	1.970 ***	7.174	2.065 ***	7.881	.154	1.166
Area	---	***	---	***	---	***	---	***
Northern	-.036	.965	.328 *	1.388	-.027	.974	.121	1.128
Southern	-.124	.883	-.397 *	.672	.008	1.008	.040	1.041
Eastern	-.314 *	.730	-.355	.702	-.019	.982	-.250	.779
Big cities	.475 ***	1.607	.424 ***	1.528	.038	1.039	.089	1.093
Constant	-.688		-2.637		-2.220		-4.285	
Model ²	2116.751		1576.077		1764.597		735.339	
N	3203		3203		3203		3203	
Pseudo R ²	.398		.330		.335		.187	

† p<.10, * p<.05, **p<.01, ***p<.001.

pseudo R² = C/(C+N), C is the Model ².

Source: The Ministry of Transportation and Communications, 2001.

3. The Korean Experience of Internet Café

The rapid growth of Internet access in the Republic of Korea has been fueled by the successful development of Internet cafés.⁴⁰ By early 2001, there were estimated more than 20,000 Internet cafés in the Republic of Korea. The widespread establishing of netcafés and the intensifying competition among them has led to a diversified netcafé culture which takes into consideration the needs of different types of users. Quiet corners, cozy space design, and nonsmoking areas were some visible policies to differentiate the products. Childcare service provided by some cafes allowed parents to be freed from their caretaking duties when going online. Special training programs were introduced to cater to the needs of the slower learning elderly.

4.4 Conclusions

The policy implications for the above findings are briefly summarized below. By identifying the

³⁹ This confusing figure could be resulted from a misunderstanding of the question. Respondents under 12 years old could have taken the answer of “workplace” as referring to all workplaces, including that of their parents.

⁴⁰ Donald Macintyre, 2000, “Wired For Life,” *Time* magazine, December 11, vol. 156, no. 23, pp. 18~23.

importance of supporting social networks and alternative places to access the Internet, policymakers can prudently and efficiently target support facilities to help disadvantaged groups. Based on these findings, two policy suggestions are made: (1) There should be more governmental investment on free/low-cost community centers that provide Internet access, and (2) A carefully designed Internet café regulation to encourage diversification to cater to the needs of different groups of the information disadvantaged. With appropriate guidance and incentives, the netcafé industry can develop diversified low-cost training programs and space to fit the needs of girls, housewives, and the elderly.

Derived from two comprehensive surveys on Internet use in Chinese Taipei, the analyses in this chapter focus on the changes of Internet connection taking place during the recent years and the discontinuation of Internet usage in Chinese Taipei. In-depth interviews with people of different gender, occupation, age group, educational level, and marital status help to explore the mediascapes of users, non-users, and former users. The narratives provided by interviewees enrich our understanding of the current problem of the digital divide in Chinese Taipei.

Regarding the general trend, the survey shows that there are 36.1 percent of respondents who are active Internet users now. 26.1 percent of the respondents used the Internet in 1997, and the figure rose to 36.1 percent in 2001. In terms of demographic variables, the ones resulting in inequality of Internet usage include age and educational levels—young people with a higher educational level constitute the majority of current Internet users. Gender and geographical location are no longer the deciding factors in influencing the adoption of the Internet.

As for non-users and former users, both groups share similar backgrounds—female, less-educated, older, and non-cosmopolitan residents comprise the major part of the two groups. The analysis of the relationship between Internet drop-out and the factors of gender and marital status show interesting findings. While the group of single females has the lowest dropout rate (9.7 percent) among the four groups, married women are the ones who show the strongest tendency to quit the net, the dropout rate of this group is 20.3 percent. Compared to the wave of connecting to the Internet created by housewives in Korea, married women in Chinese Taipei give up the Internet for various reasons. In-depth interviews reveal the specific cultures of media usage and the lack of facilitating policies in Chinese Taipei.

It is clear that the mere provision of economic resources, including computer and connection hardwares, will not bridge the digital divide. The creation of incentives and the provision of reliable support serve as the major solutions to tackling the digital divide.

The suggestion of more public sites for Internet access is proposed. Gender-biased and youth-friendly Internet cafés deter women and older people from making full use of Internet café.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Conclusions

1. The Digital divide allows multinational firms to play an ever-growing role in the allocation of production, and may become a “necessary evil” for developing economies if they are to benefit from the externalities of new knowledge. Even so, economies lying on the wrong side of digital divide will likely come to resent the rapid growth of advanced economies that lead the drive of digital revolution. The recent resurgence of anti-globalization movements sends a warning signal of this potentially catastrophic development. The digital divide also has a tendency of drawing human resources from the digitally-backward economies to the digitally-advanced economies, further worsening the gap between the two sides.

2. Within an economy, the digital divide will affect the regional location of industry. Information infrastructure, such as telecommunication and Internet facilities, is essential for accessing and exchanging information. Hence, regional differences in the readiness of the information infrastructure will affect industrial location. The agglomeration effect is not diluted in the knowledge-based economy, even if not reinforced. In vertically disintegrated production, the availability of shipping services, such as those provided by UPS or Federal Express, is essential to the movement of products to integrate the commodity chains across borders. The shipping service itself has an obvious agglomeration effect. Therefore, we may expect production to be concentrated in certain locations within an economy.
3. Our study found that a digital divide does exist in APEC member economies and the gap is widening. Possible contributing factors for the widening gap are two-fold: first, the more advanced economies liberalized their telecommunications markets in recent years which led to the growing supply of ICT service and a drastic cut in ICT costs, while many other APEC member economies are rather sluggish in reforming their telecommunications market. Secondly, the openness of an economy also affects the ICT diffusion and application, and FDI frequently brings ICTs into the host economies and promotes the usage of such technologies to the local business community.
4. Our empirical results suggest that the development of ICT infrastructure and the diffusion of ICT are critical for developing economies to narrow their digital gap with more developed economies. The study is based on an econometric model analysis of 92 economies' relevant economic statistics, covering a broad range of economic development status. As such, our empirical evidence suggests that the application of ICT is not merely a policy option but a top policy agenda that needs to be carried out forcefully in order to meet the globalization of the world economy.
5. It appears that the digital-divide problem associated with SMEs can be more easily resolved than that of other groups. The core problems of SMEs are the shortages of financial and human resources. Nevertheless their reluctance to sign up to the digital system can be overcome by competitive pressure and a little government assistance. IT technologies have afforded large firms more market power, but they also forced large firms to maintain more stable and closer relations with small firms. In other words, once a small firm allies with a large firm to engage in electronics-based transactions, this relationship-specific investment, although expensive, will last.
6. New production methods precipitated by IT technologies lead to a more concentrated market in the relevant industries. Scale economies become even more important in the new economy. Brand-marketers struggle to gain market share by pressing for low-cost, speedy, and fast production from their subcontractors. Small suppliers, while having no choice but to adopt new technologies, can only strengthen their bargaining position in the network with superior technologies. Being able to innovate and to continuously improve production efficiency is thus essential to the survival of SMEs in the information age.
7. Infrastructures are critically important in the development of B2C e-commerce. Consumers need access to the Internet and providers need a secure server to conduct online trade, and there is a great divide between economies in terms of both Internet access and the availability of secure servers. Without the build-up of basic infrastructures and a friendly environment, B2C e-commerce can not take place. The experience in the APEC region has suggested that liberalization of the telecommunications market is conducive to infrastructure building. Competition leads to capacity investment that drives the price down. It has been shown that consumers are price-sensitive to Internet access and therefore liberalization accelerates Internet penetration. In addition to hardware facility, online security is also crucial to consumer's confidence in electronic trading.

8. Logistic services that accommodate e-commerce, or e-logistics for short, have proven to be indispensable if e-commerce is to fulfill its potential. E-logistics includes the management of supply chains, inventory, and delivery, and spells the major difference between e-commerce and conventional trade. The existing e-logistics problems arise largely from the fact that e-commerce and the need for relevant logistic services have outgrown the development of new facilities. Some experience in the APEC region has suggested that alliance between Internet shops and old-fashioned stores is effective in solving the logistics problems. This implies that conventional stores have an important role to play in the digital age. E-logistics constitutes an entry barrier to e-commerce for domestic traders, and even more so for foreign traders. Therefore an economy that is under-developed in e-commerce needs not worry about the infiltration of foreign-based e-commerce as e-logistics acts as a natural barrier to trade.
9. The experience of the short history of e-commerce in the APEC region has shown that e-commerce means more than trading commodities or services in an electronic way. Successful e-commerce requires the right products or services which offer some distinctive value unattainable in conventional trade. This often implies that innovations are a pre-requisite for successful e-marketing. The bursting of the dotcom bubbles suggests that putting “old-economy” products on the web does not make a good business. It is a new kind of product, rather than a new kind of marketing, that creates value for e-commerce. Fortunately e-commerce innovations do not require sophisticated technologies as they often come from a transformation of old products. An economy lacking information technology has almost the same opportunities in making such innovations as the information-savvy economies.
10. The B2C e-commerce appears to be a local phenomenon. The digital divide between economies is likely to give rise to different paths of development of e-commerce rather than subject the digital-backward economies to the dominance of the digital-advanced economies. Although the building-up of infrastructures and human resources is indispensable to the development of e-commerce, e-commerce presents a new opportunity for digital backward economies to establish their unique industries. The experience so far has indicated that many innovations in e-commerce are culture-based and geared for local consumption. Contrary to the belief that e-commerce will lead to a globalized consumption pattern, addressing to distinctive local needs appears to be the winning formula in e-commerce.
11. It is encouraging to note that there are multiple routes to Internet access. Although computer terminals connected by fixed lines are most effective means of Internet access, cellular phones are a viable alternative. Japan’s stunning success in i-mode applications has proven that cellular phones are effective mechanisms for information transmission and commercial transactions. It is furthermore encouraging to note that the establishment of cellular networks can be jump-started whereby technology leap-frogging is possible. China’s quick accumulation of cellular-phone users attests to the possibility of improving the information infrastructure in a short span of time.
12. Compared to conventional trade, e-commerce can best serve the products whose consumers are less numerous and dispersed throughout the economy. Products of remote regions may belong to this category. E-commerce may put the remote regions in the national spotlight and henceforth entice investment in digital infrastructures to close the gap with the urban areas. In other words, e-commerce presents a great opportunity to remote areas with attractive products to overcome the “catch-22” problem. Again these products are often local specialties. As distance becomes unimportant in e-commerce, it facilitates product differentiation rather than product harmonization. Of course, to capitalize on this opportunity, remote areas have to be linked to the information network.
13. E-commerce may also present an opportunity for small and digital-weak firms to compete with large and digital-sophisticated firms. As online trading reduces the transaction costs and

barriers to entry, small firms can compete with large firms based on products rather than scale. In fact, e-commerce places greater focus on the strength of the products rather than the scale of production. However, to succeed in e-commerce, small firms need to form alliances with a large number of other firms, because it takes an assortment of resources to offer an attractive product in e-commerce. The difficulty small firms have in e-marketing because of shortages in the technical and financial resources needed to implement information technologies tend to fade away as the new division of labor in the industry helps solve the problem. It is the awareness and willingness on the part of small firms, not size *per se*, that are critical to the adoption of new technologies.

14. A narrow definition of the digital divide focuses on access to computers and the Internet. But access alone does not bridge the information gap; digital content is equally important. Many people fail to benefit from the Internet not because they have no access to the facility, but because there is no valuable Internet content for them. To make the best use of information technology, the community as a whole must be able to create and share community-relevant information to improve the lives and the health of its population. Therefore the digital divide is not only a problem for individuals, but also a hurdle for the whole community. A community approach to the digital divide may realize the benefit of network economies.
15. For an individual, failure to be present in the e-marketplace and to participate in Internet-based communications means running the risk of being isolated from the society. The narrowing of the digital divide is crucial for individuals to pursue education, to build community, to engage in public discourse, and to purchase goods and services for daily use. It is universally understood that younger and more educated people are more adaptive to the Internet, and therefore efforts must be made to assist older and less educated people to adjust. In addition to the provision of hardware facilities, incentives to bring these people online are also important.
16. One often-neglected dimension of the digital divide is the phenomenon of Internet dropout, that is, people who have had Internet access but decided to quit. Even though the size of this population is small, they nevertheless reveal major barriers to Internet participation. The barriers that they have revealed include insurmountable technical difficulties, lack of relevant digital content, lack of interactions with other users, and lack of time. The Internet dropout is particularly serious among married and nonworking women who attempted to use Internet but failed. This phenomenon can be explained by cultural factors and lack of supporting facilities.

Workplace and school are two common places where people first experience the Internet. This indicates that supporting facilities are conducive to Internet access, and technical help is essential because the current technology is not as friendly as people want it to be. In comparison, home is not a good place to start Internet access although it is a natural starting point for married women and the older cohort to begin their Internet usage. Internet cafés present an alternative entry point for people who are out of school or out of work. However, the development pattern of Internet café differs among the APEC members. Some have developed an Internet café industry differentiated enough to cater to the needs of the disadvantaged people such as women and the old, some have developed an industry that only caters to the needs of the information-savvy people, namely the younger cohorts. In this regard, government policy may play an important role in shaping the industry to make it a social mechanism for bridging the digital divide.

5.2 Policy Recommendations

1. Although ICT allows production to be performed in remote locations, facilitating a vertical disintegration of global production networks, it also has a tendency to strengthen the agglomeration effects, allowing production to be concentrated in certain locations. An economy interested in nurturing manufacturing industries must pay attention to the establishment of information infrastructures and logistics services in order to play a part in

global production. The digital divide poses a serious problem to an information-backward economy's opportunity in the international division of labor and needs to be eradicated. An economy's comparative advantage may not materialize if its information infrastructures are not ready.

2. Market opening is a useful facilitator of ICT diffusion. Liberalization of the telecommunications market intensifies competition in the market and drives the service price down, encouraging access to the Internet and usage of new communications equipment. Foreign direct investment may also bring new ICT technologies to an information-backward economy and international trade may bring links to the global networks for domestic firms. Therefore, the best way to invest in information infrastructure is to accompany such an investment with market opening. The conventional practice of opening the industrial sector for foreign competition before opening the service sector may have to be abandoned.
3. Several factors affect people's access to the Internet, including the cost of access, the level of education, and the degree of urbanization. For a developing economy, the digital divide can be bridged by lowering the cost of telecommunication service as mentioned above, and upgrading the level of general education. ICT actually provides new education tools that can reach remote areas and non-schoolers. The elderly, the females, and the disabled can therefore obtain their education through remote teaching devices enabled by the Internet. In view of this, education and Internet penetration should be taken as a "packaged policy" in promoting ICT.
4. Empirical studies have shown that external factors such as the quality of information networks, system standardization, transaction security, the availability of technical support, etc. are more conducive to the adoption of electronics-based trading than internal factors such as the size or technical capability of the firm. Therefore, the government should be more concerned with improvements in the environment for e-commerce than the ability of individual firms to accept e-commerce. Improvements in the trading environment is the best way to eliminate differences in the degree to which e-commerce is adopted.
5. Among individual firms, large firms and multi-plant firms have a higher propensity to adopt electronics-based trading than small and single-plant firms. The digital divide between firms of different size can be easily resolved by market pressure and the small assistance extended to SMEs. An industry-wide approach seems to be the best way to promote EDI or the Internet, as large firms can be the locomotive to lead a concerted drive toward digitization, in which SMEs will be automatically included through industry linkages.
6. Government should encourage market innovations to take advantage of new ICT technologies. Innovations that appeal to smaller and less-privileged consumers seem to be the best instrument for eliminating the digital divide. Such innovations tend to draw upon the cultural traditions and social structures of an economy. Innovations themselves are likely to generate substantial business value, but more importantly, they can get the less-privileged social class engaged in the electronic age.
7. Computer education offered to young children is the best way to eliminate the digital divide in the long run. More-computer-penetrated economies in APEC should donate computers, including second-hand equipment, to the less computer-penetrated economies to enhance the education capabilities of the latter. Training of computer instructors is also a useful way to improve the level of education. Computer input and output devices that accommodate small language populations should be subsidized by international organizations. Internet content providers based on minority language should also be supported by APEC. The Microsoft Corporation has a program addressing the digital divide in Africa, but the problem in Asia should be taken care of by APEC.

8. Electronic commerce in each economy should be adapted to the unique cultural and commercial practices of the economy. Successful adaptation can provide new momentum to traditional industries and generate growth in the knowledge-based economy. For example, traditional drugstores and marketplaces should be treated as a priority sector in adopting electronics-based trading. The digital divide between the modern and the traditional sector calls for special attention.
9. In a knowledge-based economy, consumer-related information seems to be the most valuable information. Access to consumer-related information provides a competitive edge for the firm. New production methods have been invented to exploit this competitive edge. The traditional producer-driven commodity chain seems to be giving way to a consumer-driven commodity chain. As a result, the market power of large firms seems to have been enhanced *vis-à-vis* the small firms. Specialization and technological superiority become crucial elements for the survival of SMEs. Government policies attempting to assist SMEs need to take this new reality into account and refocus their aims on technology assistance.

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ACRONYMS

ACRONYMS

ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
B2B	Business-To-Business
B2C	Business-To-Consumer
CEM	Contract Electronics Manufacturer
CKDB	Customer Knowledge Database
CPU	Central Processing Units
CRS	Computerised Reservations System
CTI	Committee on Trade and Investment
CTO	Configuration To Order
EC	Economic Committee
EDA	Electronic Design Aided
EDB	Economic Development Board
EDI	Electronic Data Interchange
ERP	Enterprise Resources Planning
EU	European Union
FCE	Faculty of Commerce and Economics [UNSW, Australia]
FDI	Foreign Direct Investment
FTA	Free Trade Agreements
FY	Fiscal year
G-7 / G8	Group of Seven // Group of Eight
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GDS	Global Distributions System
GEM	Growth Enterprise Markets
GNP	Gross National Product
HRD	Human Resources Development
IC	Industrial computer
ICT	Information and Communications Technology
IDM	Integrated Device Manufacturer
IMD	Institute for Management Development
IMF	International Monetary Fund
IPO	Initial Public Offering
IPOS	Intellectual Property Office of Singapore
IRTI	Industrial Research Training Initiative
IS	A Survey of the Internet Society
ISP	Internet Service Provider
IT	Information Technology
ITA	Information Technology Agreement
ITU	International Telecommunication Union
JITF	Jakarta Initiative Task Force
KBE	Knowledge-based Economy

KBI	Knowledge-based Industry
KBS	Knowledge-Intensive Business Services
KDIC	Korea Deposit Insurance Corporation
KLSE	Kuala Lumpur Stock Exchange
KOSDAQ	Korean Association of Securities Dealers Automated Quotation System
KVF	Korean Venture Fund
LEFS	Local Enterprise Finance Scheme
LMI	Labour Market Information
M&A	Mergers and Acquisitions
M&E	Machinery and Equipment
MDC	Multimedia Development Corporation
MESDAQ	Malaysian Association of Securities Dealers Automated Quotation System
MOTHERS	Market of the High-growth and Emerging Stocks
NAFTA	North American Free Trade Agreement
NASDAQ	National Association of Securities Dealers Automated Quotation System
NECTEC	National Electronics and Computer Technology Center
OECD	Organisation for Economic Cooperation and Development
PC	Personal Computer
PIU	A Survey of People's Internet Usage in the Chinese Taipei Area
R & D	Research and Development
RI	Research Institutes
SBA	Small Business Administration
SBICs	Small Business Investment Companies
SDF	Skills Development Fund
SETC	State Economic and Trade Commission
SIPs	Silicon Intellectual Properties
SMEA	SME Administration
SMEs	Small and Medium Enterprises
SOC	System-on-a-chip
TFP	Total Factor Productivity
TIF	Technopreneurship Investment Fund
TIGER	Taiwan Innovative Growing Entrepreneurs
TII	Technopreneur Investment Incentive
TLO	Technology Licensing Organizations
TP	Temasek Professor
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TSMC	Taiwan Semiconductor Manufacturing Corporation
UNSW	University of New South Wales, Australia
WB	World Bank
WTO	World Trade Organization