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OECD WORKSHOPS ON THE ECONOMICS OF THE INFORMATION SOCIETY: A SYNTHESIS OF POLICY IMPLICATIONS

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FOREWORD

The emergence of the Global Information Society and Global Information Infrastructure is being driven by rapid technological developments and fundamental restructuring of institutions and markets. These changes may dramatically affect economic efficiency, productivity and growth; job creation; and cultural and social expansion. To encourage and respond to these developments, governments have recognised the need for new and more appropriate frameworks and policies. Prerequisites for informed policy discussion and development are an understanding of the issues, their mechanisms and their implications and the development of effective indicators and quantitative methodologies to measure our progress.

In early 1995 the OECD's Committee for Information, Computer and Communication Policy, under the aegis of its Working Party on Information Technology Policy (later the Working Party on the Information Economy) launched an initiative designed to provide a forum aimed at developing economic data, research and analysis as the precursor for policy discussions on the emergent "information economy" at the OECD, and to help prepare the Organisation's work on "Global Information Infrastructure - Global Information Society" and electronic commerce. Six workshops, in Toronto, Istanbul, Tokyo, Porvoo, Seoul and London, were held over the period between June 1995 and March 1997. They concentrated on providing frontier research on the economics of the "information society", had a quantitative and empirical stress, and sought to identify and refine the analytical and statistical tools.

Each workshop was hosted by an institution, or coalition of institutions, in an OECD Member country in collaboration with the national authorities and that country's Delegation to the OECD, and the programme organised by the OECD Secretariat in co-operation with the hosting institution. In the workshops, leading experts from major economic research centres, academic bodies, consultancies, enterprises and industry groups, think tanks as well as officials from government and international institutions presented their views, including much original work, for discussion. This provided the opportunity for interaction and debate provided a stimulus for further research and highlighted priorities for future investigation. In each case, a rapporteur summed-up discussions and drew conclusions. Over the whole series more than 120 distinguished figures made presentations, keynote addresses or chaired sessions, and altogether well over 600 persons attended, providing a rich source of material and reflection for future directions of the OECD's work in this domain.

The OECD compiled and distributed the "Proceedings" of each workshop, to provide all relevant summary materials in a handy format. In addition, with the assistance of the European Commission, who also supported substantively three of the workshops, a book, "The Economics of the Information Society", containing an edited selection of papers from the first three workshops, was produced in 1997. However, no attempt has hitherto been made to synthesise the policy implications from the whole series of workshops. This paper, prepared by Marc Lee, RAIN Consulting, for Industry Canada Electronic Commerce Task Force, was made possible by a grant provided by the delegation of Korea and by the co-operation of the delegation of Canada.

The OECD acknowledges with thanks the support and enthusiasm of all those involved, and would mention in particular the contributions of Akio Onishi, formerly of the OECD Secretariat, and that of Ambassador Pasi Rutanen of Finland, former doyen of the Council of the OECD.

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OECD Workshops on the Economics of the Information Society

Workshop No.	Place	Date	Hosting and supporting Institutions	Theme of Workshop
1	University of Toronto, Toronto, Canada	28-29 June 1995	Centre for International Studies (CIS), University of Toronto	Economic and Social Effects of Information Infrastructures
2	Marmara Istanbul Hotel, Taksim, Istanbul, Turkey	14-15 December 1995	Tübitak-Bilten European Commission	Network Economics
3	Keidanren Kaikan Hotel, Tokyo, Japan	4-5 March 1996	Ministry of International Trade and Industry Ministry of Posts and Telecommunications	Electronic Commerce
4	Haikko Manor, Porvoo, Finland	6-7 June 1996	Research Institute of the Finnish Economy (ETLA) Helsinki School of Economics Ministry of Finance Technology Development Centre (TEKES) European Commission	Human Resources in the Information Society.
5	Hotel Shilla, Seoul, Korea	22-23 October 1996	Korea Information Society Development Institute (KISDI)	Government Responses to the Emerging Information Society
6	The Institution of Electrical Engineers (IEE) Savoy Place London, United Kingdom	19-20 March 1997	Science Policy Research Unit (SPRU), University of Sussex Institution of Electrical Engineers (IEE) European Commission (EC)	Market Competition and Innovation in the Information Society

PREFACE

This document is based on six workshops held by the OECD on the Economies of Information Societies -- in Toronto, Istanbul, Tokyo, Porvoo, Seoul and London. The purpose of the workshops was to develop and encourage leading-edge economic research, data and analysis on the emerging information society. Such micro- and macroeconomic study is geared to better understand the immense changes taking place, a prerequisite for informed policy discussions at both national and international levels.

This paper is not a complete summary of materials presented at the workshops, which looked broadly at theory, methodological approaches and empirical results to examine emerging economic features of the information society. Rather, the focus of this paper is to highlight and synthesise the policy implications for governments from the presentations and ensuing discussions at the workshops. The economic ideas of the workshops form the background and context of the paper. However, emphasis has been given to presentations and discussions that reflect policy matters.

Section I looks at the technological and economic underpinnings of the information society. It discusses some key concepts and implications of new economic ideas relevant to the information society that inform much of the subsequent sections. Section II addresses a number of important areas at the core of a broad policy framework for a global information infrastructure. Section III discusses electronic commerce and some key challenges in "getting from here to there". Section IV looks at the employment debate, the potentials of education and training, and quality of work. Section V points to some considerations for the role of government in the information society. Section VI examines concepts for data collection and measurement of indicators for the information society. A Conclusion summarises some of the main themes emerging from the workshops.

This paper is based on the intellectual contributions of a large number of individuals that participated. Annotations have been made to note specific and novel contributions. In other areas, where there is a great deal of consensus of thought among participants, no attempt has been made to cite specific authors.

More information on the GII/GIS initiative and summaries prepared for the individual workshops are available online at the OECD Web Site, *www.oecd.org*.

EXECUTIVE SUMMARY

Towards an information society

The information society can be found at the intersection of the once distinct industries of telecommunications, broadcasting, and computing, based around a paradigm of digital information. One driving force has to do with persistent increases in the processing power of computers on the market, accompanied by falling prices. Another element is the ability to link computers into networks, allowing them to share data, applications, and sometimes processing power itself, over distances as small as an office and as large as the planet.

This core model of distributed processing power and fast networks is at the heart of the information society. The potentials and realities of convergence are most evident in the global network of networks that is the Internet. Over the 1990s, the Internet has emerged from being an obscure tool for the research and education community to a household term. Because of its decentralised and inherently global nature, allowing many-to-many communication, the Internet is already considered the most dynamic and interactive medium in history, with wide-ranging scope of applications.

The Internet is effectively a world-wide experimental lab, where new technologies, applications, products and services are being tested. Barriers to entry are low, enabling a huge variety of small-scale enterprise and innovation in marketing and advertising, sales and distribution. This experimentation plays on the many-to-many features of the medium.

Business has been quick to adopt ICT and the Internet as strategic elements of competitiveness. Internally, ICT is used to enhance communications within and among functional areas such as sales, marketing, R&D and production. Companies have used ICT to better interact with their suppliers and partners, and have been able to drastically reduce inventories through "just-in-time" production methods. Similarly, the way in which companies interact with consumers is changing. The banking sector, for example, has extensively used ICT to change the way it does business with the customer.

Growth areas point in two main directions. First is economic activity around building the information infrastructure, including hardware in the form of computers, routers and fibre optic cable. Second, applications, content and services -- the new "knowledge industries" -- are the key areas of long run growth.

Indeed, knowledge is now recognised as being at least as important as physical capital, labour and natural resources, as a force driving growth, embedded in the structure of a production process, in the value-added capabilities of a product, in organisational structure, and in strategy. Innovation as a stated objective of a company’s operation is a key characteristic of the GIS.

Network economies

The dynamics of technology markets are based on different principles than traditional markets based on price. Competition is often among different standards or systems of technology, which can lead to dynamics of increasing returns. A firm that gets ahead tends to get more ahead and can "lock-in" the market from its competitors. Getting into the market early and setting the standard is a key business strategy.

In these markets, the model becomes one of "monopolistic competition." Extremely high costs of research and uncertain market outcomes pose substantial barriers to entry and limit the number of players competing. This implies that competitive solutions may not necessarily be the most efficient and that a certain degree of tolerance for monopolistic behaviour is required.

Moving into uncharted territory

While acknowledging the role of information and knowledge in the economy, many participants noted an irony: we are not really certain where we are heading with all of this. The emergence of new technologies, the application of technology and knowledge to traditional sectors, and the global context of competition all highlight the complexity and dynamism of the current environment.

Participants emphasised that much work remains to be done to better understand the unfolding information society, where paradigms are turned on their head so easily. Our theoretical frameworks have already been challenged. In turn, our ability to measure what is happening has been adversely affected. Given the pervasive nature of ICT, there is need for greater co-ordination among countries, through mechanisms such as the OECD, in setting out policy frameworks to guide the evolution of the GIS.

I. INTRODUCTION: TOWARDS AN INFORMATION SOCIETY

The information society can be found at the intersection of the once distinct industries of telecommunications, broadcasting and computing. Over the past century, each has contributed to an increase in our standard of living. Each has left broad societal changes in its wake. Remarkably, their convergence, into an information infrastructure, transcends the sum of these parts and offers many new potentials and possibilities.

The boundaries that defined each of these industries are becoming less clear with each passing year. New information and communications technologies (ICT) now incorporate different aspects of each of the areas, in a variety of ways and forms. Bits of digital code are the fundamental building blocks of the information society.

One driving force has to do with computer power. Moore's Law, the prediction of Intel founder Gordon Moore that the number of processors on a microchip will double every 18 months, continues to hold. Advances have meant a persistent increase in the processing power of computers on the market, while prices have been falling. Yesterday's supercomputer is today's bargain basement special.

With powerful modern computers, there is little need to be conservative in how they are used. So much processing power is available that it can be, and literally is, wasted. Graphical user interfaces enable people to interact more easily with their computers, accompanied by increasing sophistication in the ability to understand voice commands. Most software, including common word processing, is filled with "bells and whistles" that are rarely used.

Another key element is the ability to link computers into networks, allowing them to share data, applications, and sometimes processing power itself, over distances as small as an office and as large as the planet. A computer is now defined by its ability to be part of a network, rather than merely its stand-alone capabilities.

Data communications are growing at an exponential rate, and now exceed voice communications in most OECD countries. The cost of high-speed data transfer continues to fall dramatically, enabling further connectivity. A 56 kbps modem is now a standard peripheral on a new computer. Access through ADSL, which delivers 1.5 Mbps downstream, may be the new standard in a couple of years.

This core model of distributed processing power and fast networks is at the heart of the information society. In addition, both devices and transmission media appear in an increasing variety of forms. Wireless telecommunications are now common. Interfaces to the network are multifold and include personal computers, laptops, mobile phones, and electronic organisers, with talk even of appliances being networked together.

For most users, how the message actually gets there is less important than the fact that it does, somehow. The mechanism of transport is becoming more and more invisible to users, so that they can

focus on what needs to be done. But the underlying dynamics of how this happens is becoming ever more complex.

The potentials and realities of convergence are most evident in the global network of networks that is the Internet. Over the 1990s, the Internet has emerged from being an obscure tool for the research and education community to a household term. The number of people online is upwards of 50 million and continues to grow dramatically. When you get an email from your grandmother, the penetration of the Internet into everyday life becomes clear.

Because of its decentralised and inherently global nature, allowing many-to-many communication, the Internet is already considered the most dynamic and interactive medium in history, with a wide-ranging scope of applications. Though early in its development as a mass consumer medium, the Internet is by no means unsophisticated. Applications include: mail; browsing articles, books and essays; chat and discussion fora; telephony; interactive games; downloading software; and online services of all flavours.

The Internet is effectively a world-wide experimental lab, where new technologies, applications, products and services are being tested out, in pursuit of capturing a slice of the growing global market. Barriers to entry are low, enabling a huge variety of small-scale enterprises and innovations in marketing and advertising, sales and distribution. This experimentation plays on the many-to-many features of the medium.

Today's Internet is a harbinger of the broadband networks of the future, with much bigger pipes to ship around information. It will still be some time before TV or film quality appears common on the Internet for most users, though advances in multicasting allow a small number of users to receive live feeds from conferences, space shuttle launches, etc. Eventually, anything that currently can be done in stand-alone form, such as complex video games and simulations, will be able to migrate to a network format. There will likely be many surprises as well -- new ways of taking advantage of the processing power and bandwidth across many users.

Business has been quick to adopt ICT and the Internet. Indeed, the direction of technology is heavily influenced at early stages by the needs of business. Business applications are a major market for developers, taking tools developed as R&D to fairly wide penetration. These then are precursors for residential consumers, as markets grow and prices fall.

ICT and broader notions of information infrastructure are key strategic elements of competitiveness for companies, large and small. Applications are pervasive and exist at every level of the enterprise. They entail "business process re-engineering", or changing a firm's routines and activities around the potentials offered by ICT.

Internally, ICT is used to enhance communications within and among functional areas such as sales, marketing, R&D and production. Internet technologies are now common in private networks, in the form of intranets or extranets. Employee productivity is strengthened by computers themselves and network connections to databases and information sources, both inside and outside the company (although the absence of statistics to support this notion has been noted in the debate on the "productivity paradox").

ICT inevitably causes changes in the structure of organisation, as old job descriptions become obsolete. It also changes the relationships among the employees, enabling less hierarchical, more

network-based structures. Brynjolfsson[1] notes that firms investing highly in ICT are more likely to use team-based decision making, to invest in training and education, and to use subjective types of incentive systems.

Companies have used ICT to better interact with their suppliers and partners. Through "just-in-time" production methods, companies have been able to drastically reduce inventories. For example, Japan's Yokogawa Electric was able to reduce stock times from three months to 16 days (Imamura[2]). Commercial transactions, based on advances in electronic data interchange (EDI), also allow streamlining of billing and payment systems among suppliers and producers. In supermarkets, EDI is used to manage inventories, so that replacement products are ordered automatically as sales get recorded at the point of sale.

Similarly, the way in which companies interact with consumers is changing. The banking sector, for example, has extensively used ICT to change the way it does business with the customer. In the OECD countries, automatic banking machines are ubiquitous, and debit cards for real-time withdrawals are becoming more and more common. Both innovations reduce waiting times and provide access to funds 24-hours a day. For the banks, ICT is seen as a means of reducing costs while continuing to provide high levels of customer service.

Because of its decentralised nature, ICT has profoundly affected location decisions. More people are able to work at home, cottage or on the road. Companies are able to centralise their customer service operations in call centres accessible from a toll-free telephone number. Some areas, such as New Brunswick in Canada, have taken a strategic approach and have been successful in luring companies with the right mix of telecommunications infrastructure, labour costs and taxes.

Advances in telecommunications have diminished the impact of distance, to the point where software workers in India can deliver new code to a firm in the US overnight. Indeed, information infrastructures, even in more primitive forms, underlie the globalisation of production. Today, it is not uncommon for a product to have parts manufactured in several different countries, be assembled in another, and sold in yet another, all with marketing and finance conducted in a "home" country.

These changes have been well documented, and in some senses, are no longer the leading edge of best practices. Advances in ICT proceed unabated, offering more and more potentials for improving competitiveness. New innovations include a transition away from mass marketing toward increasingly customised, selective marketing, and the re-engineering of distribution channels.

Growth areas point in two main directions. First is the economic activity around building the information infrastructure. This includes manufacture of hardware, in the form of computers, routers and fibre optic cable, largely by big companies, as well as the operation of networks themselves. The second direction is in applications, content and services, the reasons why people interact electronically. This latter area is dependent on the former as an enabling foundation for their existence, in the same way that motels are dependent on highways.

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1. Brynjolfsson: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

2. Imamura: Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

Content, applications and services -- the new "knowledge industries" -- are the key areas of long-run growth. They are the electronic "stuff" that will traverse the medium. Hence, this area is already ripe with innovative activity, taking place in numerous small firms. Small and medium-sized firms are able to take more risks and can move much more rapidly in pursuit of opportunities (although they may need to overcome challenges such as getting financing or marketing exposure).

Not all efforts are successful -- each is an experiment to some degree. This is most true for those on the "bleeding edge". There is a trade-off between the risk taken and the huge profits that come with success. But there is no shortage of risk-takers. This is the Silicon Valley dream: to hit the next wave just right and ride it to be the next Apple or Microsoft.

Knowledge and information in the economy

Technological change, knowledge and information are at the heart of economic growth. If we take a long view of progress, our standard of living is higher not so much because we consume more than our ancestors, but because we consume new and different things and have better ways of making them. That is, growth has a very large qualitative dimension.

From the very origins of humanity, knowledge was vital to economies: how to make and use tools; knowing where to hunt for game; and where to gather medicinal plants. Knowledge is now recognised as being at least as important as physical capital, labour and natural resources as a force driving economic growth.

Knowledge can be embedded in how a production process is structured, in the value-added capabilities of a product, in organisational structure, in strategy. To some extent this can be codified, in the form of blueprints or instruction sets. Some argue that this codification of knowledge is a fundamental characteristic of the information society. Other aspects of knowledge are tacit, embedded in the user. This type of knowledge can only be acquired through time and learning by doing. Both codified and tacit knowledge underpin the new economy.

Notably, information is not knowledge. That more data and information are flowing around the network does not mean we are more knowledgeable. Information is data that is formatted to be of use in informing or in decision-making. Knowledge, on the other hand, is the capability to use information to achieve an end. And more than ever, attributes of knowledge, such as judgement and scepticism, are important faculties for those venturing online.

Economic theory traditionally assumes that information is equally available and costless to acquire. Market outcomes in the real world, however, are based on imperfect and asymmetrical information. Indeed, merchants make their living based on imperfect information -- knowing where to buy cheap, and where to sell at a profit. Ferné[3] cites a number of case studies to note that information is costly to get and not easy to apply. Models of the information society that fail to take this into account may be highly misleading.

Innovation, information and knowledge are thus critical as a basis of competitive advantage. Whereas in the past, advantage was more derived from resource endowments, climate and cultural factors,

3. Ferné: Workshop No. 5, Seoul, Korea, 22-23 October 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

today's competitive advantage is increasingly based on ability to innovate, and can be fleeting. These modern interpretations of economic growth, combined with the move toward information infrastructures, underlie the concepts of "information society" and "knowledge-based economy".

Innovation as a stated objective of a company's operation and the application of this objective to every element of the organisation is a key characteristic of the GIS. It embodies: the development of novel ideas, products and services; enhanced productivity of production processes, management and customer service; more adept marketing; better linkages with suppliers and distributors. It includes modern R&D activities, as well as the myriad incremental improvements that lead to productivity increases over time.

ICT is a key catalyst for change in each of these directions. It is the toolkit of an economy increasingly based on the use and application of knowledge. The strategic imperative of improving competitiveness points to the adoption and exploitation of new technology. However, without talented people to use these tools to meet a goal or objective, ICT bears little on enhancing productivity or competitiveness.

Network economies

The dynamics of technology markets are based on different principles than traditional markets based on price. Competition is often among different standards or systems of technology. When a market is new, and there are a number of technological options to accomplish the same thing, purchasing can be a risky endeavour. Becoming proficient at the use of a technology involves tacit knowledge. It is a learning process and takes time to acquire. Switching technologies in midstream often means relearning instruction sets or operations, thus most people want to avoid it.

Over time, competition dwindles and a small number of players remain, usually with one market leader. At this point, standards are relatively more established and the risk of incompatibility with what others are using diminishes. The more a standard is valuable, the more people adhere to it. And the more people adhere, the stronger the incentives for those that follow to take the same technology path. Similarly, for networks, like a telephone network or the Internet, the more people are already on it, the more the network itself becomes valuable.

These features of technology markets create dynamics of increasing returns. That is, the firm that gets ahead tends to get more ahead and can "lock-in" the market from its competitors. Getting into the market early and setting the standard is a key business strategy. While first-mover advantage is no guarantee of success, luck, historical circumstances and cunning strategy can also play a role in tilting the balance in favour of one company.

All of this means that the best product, standard or technology does not always win. "Bandwagon effects" can lock-in technologically inferior products. An example is the Beta videocassette format, considered by experts at the time to be a superior technology to VHS, which eventually came to dominate the market. Generally speaking, a superior technology will not easily displace an inferior one unless the benefits are an order of magnitude improvement.

In these markets, the model becomes one of "monopolistic competition". Extremely high costs of research and uncertain market outcomes pose substantial barriers to entry and limit the number of players competing. This implies that competitive solutions may not necessarily be the most efficient and that a certain degree of tolerance for monopolistic behaviour is required.

In part, this is due to the nature of business, which shifts costs heavily towards fixed, up-front costs, while marginal cost can fall close to zero (for cases of electronic dissemination of software or content). The first copy of Windows 95 cost Microsoft USD150 million to produce, while each subsequent copy cost pennies. New business strategies have emerged to take advantage of the features of digital goods. Netscape, for example, gives away its browser for free, and used this strategy initially to build up a huge market share, while making money on upgrades and other value-added services.

There are dangers that excessive market power will diminish overall competition. Incumbents may use market power to expand influence into other existing or emerging markets. There may be temptations for dominant firms to reduce compatibility of their products with others, as a competitive tactic. This may lead to quality problems in systems where performance is dependent on the interaction of a number of components from different vendors (Jullien[4] and Creti[5]).

Ultimately, market dominance into the future is by no means assured. As one participant noted "the battle between IBM and Apple was won by Microsoft." In such a volatile system, new developments can move competition to the next high stakes market of technological development. Even the shape of the market is highly uncertain at the outset.

Moving into uncharted territory

While acknowledging the role of information and knowledge in the economy, many participants noted an irony: we are not really certain where we are headed with all of this. The emergence of new technologies, the application of technology and knowledge into traditional sectors, and the global context of competition all highlight the complexity and dynamism of the current environment.

Our ability to predict which products are destined for success is poor. Few anticipated the mass penetration of the Internet, the fax machine or the personal computer. Even IBM, in the early 1980s, estimated the total world-wide market for computers at 25 000 units. With the pace of change accelerating, no-one is an authority on what consumers will ultimately find useful and desirable. The full implications of ICT, for business, consumers, governments and so on, are still unknown and will likely remain so in the near term. We simply do not know what we do not know.

Much work remains to be done to better understand the unfolding information society, where paradigms get turned on their head so easily. Indeed, our theoretical frameworks have already been challenged. In turn, our ability to measure what is happening has been adversely affected.

Most people believe that the way forward will be fuelled by the development and uptake of new network-based services. Some suggest that access to broadband networks will create the demand to support new services (a "Say's Law" for bandwidth). One element is video on demand, which has yet to mature into affordable and widespread usage, despite huge investments in trials. Nonetheless, these developments are leading to significant restructuring of infrastructure and markets. They are having real impacts on the economy and on people.

Participants warned against assuming utopian futures. Certainly, the Internet is revolutionary in its scope. But technologies cannot be parachuted into a set of circumstances and human relations, with the

4. Jullien: Workshop No. 1, Toronto, Canada, 28-29 June 1995.

5. Creti: Workshop No. 1, Toronto, Canada, 28-29 June 1995.

expectation that they will miraculously change things for the better. Technologies alone cannot solve social and economic problems. Rather, they require a context of social and economic policy to evolve into.

Particularly given the pervasive nature of ICT, there is need for greater co-ordination among countries in setting out such a policy framework, through mechanisms such as the OECD. This is also true within countries -- among government ministries, among federal and state, provincial and municipal level governments, and must include civil society and the private sector.

II. FRAMEWORK ISSUES FOR AN INFORMATION INFRASTRUCTURE

Most of the OECD countries represented at the Workshops have already taken steps toward articulating and implementing policy frameworks for information infrastructures, as part of national strategies to take advantage of the opportunities available. Framework issues discussed at the workshops included: competition policy; interoperability; access; liability; and intellectual property.

Competition policy

The broadest area of consensus from the workshops is that development of products, services and content for the global information infrastructure should be led by the private sector. A dynamic and competitive framework will provide consumers with the most choices, at reasonable quality and price.

This is important as we move into a world characterised by uncertainty, where no-one is sure what consumers will find compelling. With a huge number of innovative small firms seeking to develop the next "killer app", the market is the best force for making use of the decentralised information across the economy to allocate resources.

This emerging world, however, is not arising in a vacuum. Both broadcasting and telecommunications have historically been regulated to meet a variety of social and economic goals, and the regulatory structures of each have been different to meet different ends. Of the areas of convergence, only the computer industry has not grown in a regulated environment.

The convergence of technologies implies a need for convergence of regulation as content becomes network independent. A primary role for governments in this regard is to revisit their regulatory frameworks to establish new, comprehensive frameworks to best enable these competitive forces to work.

This is no simple task, due to a multitude of factors and historical circumstances in each industry. Some recommend that government step completely out of the way, with clear rules posted. Others feel that there is a role for government in the near term to ensure a smooth transition to a new framework, in particular to ensure competition. What is clear is that the nature of the new economy changes the nature of market outcomes and thus challenges the development of framework policies.

In telecommunications, traditional policy supported the development of national, regulated monopolies, based on notions of economies of scale and natural monopoly. Economies of scale were substantial in the delivery of telephone service, so there was no need to duplicate investment by having two or more wires to every home.

Today, the landscape has changed. Numerous technological developments have led to the emergence of alternative delivery mechanisms that challenge the economies of scale of existing monopolies. Wireless communications and direct broadcast satellite offer new possibilities for communications over the air. Cable television provides a second wire to the home for the delivery of television channels (to a greater or lesser extent depending on the country). These new infrastructures are

seen as potential competitors in the provision of telephony and Internet services. Meanwhile, telcos are eager to use their telecommunications infrastructure to deliver video services.

In previously regulated sectors, competition for the delivery of a wide variety of services is feasible. Long distance competition in North America has led to substantial decreases in the prices paid by consumers. The OECD notes that average leased line costs for access to the Internet in countries with monopoly telecommunications providers are 44% higher than in countries where there is competition.

In developing a policy framework based on competition, the existence of alternative delivery technologies is necessary but not sufficient for a competitive outcome. Because government created an unlevel playing field from the outset, the transition from regulated monopoly to competition must ensure that sustainable competitive outcomes arise. Otherwise, if governments simply opened up everything to competition, incumbent, formerly regulated monopolies with large market power may be able to drive out the emerging competition, and thus become private monopolies.

As noted above, network economies can lead to "lock-in" effects where a disproportionate market share may fall to one firm. The key challenge in moving to a competitive framework is to avoid re-monopolisation, or domination of markets to the detriment of overall welfare. Pogorel notes that while competition has been predicted as the paradigm in telecommunications for several years, there are still calls to "stimulate" the market.

Tendencies toward both competition and monopolisation exist in markets. Competition thrives and is most innovative and dynamic in the early stages of a market. Like the computer industry, different technologies, standards and protocols fight it out. In later stages of a market, there tends to be consolidation -- competition drives out the losers and rewards the winners. In the unregulated ICT industry, for example, several "bottlenecks" are dominated by a strong market leader. Microsoft dominates the market for desktop operating systems, Intel dominates the processor market, and Cisco the router market.

Consolidation may also occur due to mergers and acquisitions. In the United States, the 1996 *Telecommunications Act*, with the overt goal of spurring wide-open competition, has also led to consolidation due to significant merger and acquisition activity. This may simply reflect adjustments to the new liberalised environment of global competition in the face of convergence.

Care is required, however, to ensure that new mergers do not stifle competition or create undue barriers to entry. Such competitive safeguards may be urgent in the light of significant merger activity among the largest players. Full vertical integration in areas previously dominated by monopolistic market structures is not conducive to a competitive environment and may counteract promotion of diversity in applications development (Fenoulhet[6]).

Even oligopolistic outcomes, with two or three dominant players, may pose a challenge. Bologna[7] warns against the dangers of excessive concentrations in media content and distribution industries. Dominant players also have the capability to buy out innovative small firms that are seeding a new market or developing related, but specialised or superior, technology. Cisco and Microsoft do this all

6. Fenoulhet: Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

7. Bologna: Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

the time, as part of their competitive strategy. Micas[8] argues that anti-trust policies may require reconsideration and fine-tuning in this liberalised environment.

Interoperability and interconnection

In a complex, competitive environment, market forces, if left unchecked, may lead to market fragmentation, increased barriers to entry and interoperability among networks. Waverman[9] adds that market power may lead software companies to install codes to enable interoperability only with their own products. However, this is not always the case, as the interaction of market players depends on which parts of the overall system they control. In many instances, market forces may create incentives for interoperability.

A key issue from the perspective of interconnection of infrastructure is access charges, or tariffs new entrants must pay to incumbents for carrying traffic over their network (Fenoulhet[10]). Regulators are insisting on transparency (that the terms and conditions set for interconnection are made public) and unbundling of costs to identify the real underlying costs of providing a service. While this has been a big issue for interconnection with incumbent telcos, private peering arrangements have been popular among Internet service providers.

Some market players may not want interoperability, as their market power is based on the creation of an exclusive differentiated service. Walker[11] notes that in such circumstances, there may be a government role to ensure interoperability when the social benefits are high and the risks of acting low, or in cases where the market does not provide the type and level of service wanted by consumers at appropriate prices. This may include situations where the dominant player has little or no incentive to enable interoperability.

All of this may just be a way of life in these markets. Participants reiterated that markets may not behave in traditional ways in certain areas or sectors. As an element of competitive strategy, firms seek to control the emerging platform and the design of technology in that platform. Indeed, the fight for control over a standard or platform is a key element of modern competition in ICT industries.

Greenstein[12] notes that focusing only on the firm may lead to incorrect conclusions, as the computer industry is largely based on platforms -- integrated clusters of technically standardised components that buyers use to make applications. Platforms may have a large degree of inertia over time, although there is still innovation within the components of the platform (such as improvements in the hard drive). Many firms may be engaged in supplying components within a given platform, and be in competition to varying degrees depending on segment. Thus, it does not suffice only to look at Microsoft, but at the dynamics of the Windows-Intel platform and the multitude of other players that are a part of that platform.

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8. Micas: Workshop No. 6, London, 19-20 March 1997; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

9. Waverman: Workshop No. 2, Istanbul, Turkey, 14-15 December 1995; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

10. Fenoulhet: Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

11. Walker: Workshop No.6, London 19-20 March 1997.

12. Greenstein: Workshop No. 6, London, 19-20 March 1997.

No-one can guess the direction of technology and the changes in distribution of power among firms. If there is a tendency for a single platform to dominate, policy intervention to spur competition may have adverse effects. When looking at issues of market domination by a single firm, policy must take into account the rapid changes taking place in the world market and the various lock-in effects.

Because of convergence, mergers, and technological change, the regulatory process must evolve to reflect these new realities and not impede progress. There are concerns about the outcomes that may result through processes that are entirely market-led. Communications are part of our social fabric -- they should not be left entirely to the short-term dictates of competition.

While the private sector is clearly given the task of leading us forward, government is being called upon to meld the market forces toward seamless interoperability, universal access, with all manner of enlightening content. Ferné cites several core areas where continued government involvement is justified: ensuring transparency, fair practice and interoperability; regulatory reform; and, encouraging broader consensus between public and private sector actors with regard to harmonisation of policies and regulations.

These are certainly noble aims, but moving forward is somewhat tricky. While government remains the best mechanism for intervention to exercise leadership for society, interventions by governments are potentially hazardous. There are fears that the opposite problem -- over-regulation -- will arise. How to intervene in the process intelligently to steer the very powerful forces underway, and if this is even possible, is a fundamental question.

Access

Most participants underscored the importance that the benefits of the information society be widespread. Amidst the turmoil of globalisation and technological change, we must avoid creating a society of haves and have-nots, or know and know-nots. Interactive media, like the Internet, will be much more a part of life -- in commerce, education, communication, interacting with government -- in the future. At a minimum, there must be some kind of policy scheme that enables access for all to the information infrastructure.

Access has many dimensions. For those in remote and rural areas, physical access to the infrastructure is potentially a problem. Because competition will tend to proliferate more in larger markets, like the biggest cities, rural and remote areas may not have access to the information infrastructure, or may be subject to the whims of monopoly service providers. This would be a shame, as the information infrastructure is really a means of diminishing the impact of distance.

Another dimension is economic access, or affordability. Owning computer equipment and paying access fees may be unaffordable for the poor. There was some debate as to whether this was a matter of income for those that cannot afford it, or whether this was a matter of price.

Some focused on regulatory pricing policies and schemes to ensure that access is affordable. In principle, access cost should equal the marginal cost of providing access. But there are difficulties as multiple and diverse services are offered over the same infrastructure. Directly assigning these costs to one element or another can be troublesome.

This "bundling" of services means that costs have become disentangled from revenues. In regulated environments, cross-subsidisation across different market segments supported policy goals

while ensuring a rate of return to the telco. In a competitive environment, these policy objectives may need to be met in a different manner. However, a danger is that access schemes may act as a barrier to competition in the form of a costly burden on new and vulnerable market entrants.

Murroni[13] supported access policies that looked at specific application areas, then targeting funds to those that needed them. An important question revolves around what exactly we are trying to guarantee access to. Is there something apart from basic telephone service in our telecommunications universe that merits subsidisation from government? Currently, there is nothing so compelling about the Internet that makes it an essential service on a par with something like telephony. Ensuring access to banal or trivial content -- whether entertainment, sports, music or pornography -- hardly stands up as an ideal public policy objective. As new services arise, governments will have to assess whether ensuring access to specific services should be a policy objective.

Another possibility is that there are huge positive externalities from inclusive, widespread access to the information infrastructure. The more people on the network, the greater its value. Furthermore, the more citizens are exposed, the less fear they will have and the more likely they will be included in the information society. This might even lead to an increase in innovative behaviour among those who would normally have been excluded. In some countries, government-led schemes have put terminals at schools, libraries and other community locations as short- to medium-term mechanisms to enable access.

In a competitive environment, another issue is when government should intervene. Perhaps the market will get a particular service to 90% penetration levels, then access targets can be set for the rest. An environment of competition is anticipated to lead to maximum penetration, if costs and prices continually fall. Of course, this result is not guaranteed in the face of monopolistic practices and intellectual property considerations.

A final element of access is cognitive -- that people not only have an affordable connection, but that they are able to understand and utilise what is there. Research indicates that certain knowledge is required before information can be effectively used or before people can have meaningful interactions. In a network of hundreds of millions of users, there is also misinformation, disinformation and propaganda to contend with. This suggests a real need for the development of media literacy skills, which are currently poor even for today's media.

Whether people have sufficient knowledge to be able to use a networked computer effectively, is still a major issue. Despite marketing claims of "user-friendliness", computers remain far from simple to operate for the average user. The reality is that computers crash, applications can be bulky and confusing, and the Internet a nesting place for viruses. Most organisations, private and public, now have on-site professionals to keep the network running smoothly and to assist users with confusing software. An SME or household will not be likely to have such luxuries.

Liability of network providers

The same ability that enables widespread sharing of information and knowledge also enables the spread of material considered illegal or immoral by law or custom. Most countries have laws that counter freedom of speech in a number of areas, such as decency, violence, hate material, or sedition. While there are many reasons why some people would want to control content, liability considerations for network providers need clarification.

13. Murroni: Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

Internet service providers (ISPs) administer and manage servers and facilities for access to the Internet. They are potentially liable in a number of areas under state, provincial or national laws. This applies to their own actions in the day-to-day operations of their facilities, but also in large part to third parties that upload material on their server or access it through the Internet. Laws and precedents in the area of online activities are evolving, as cases are made based on the application of existing jurisprudence from off-line to online worlds.

In addition, there will be regional variations in such laws, which complicate matters in a medium that does not recognise borders. Different levels of community standards are challenged by an inherently global medium. Still, people are ultimately rooted in places where laws apply. As Industry Canada notes: "the cyberspace is not a no-law land".

Cavazos[14] examined the potentials in the context of the US, based on precedents in a number of areas. Internet technology allows users to disseminate messages and commentary to huge numbers of individuals without traditional constraints of editorial control or fact checking. If such messages are alleged to be defamatory (libel and slander), systems operators could be targets in litigation.

Similar considerations apply for cases of copyright. Information that appears on an ISP's server may include hundreds of thousands of files, and will be in a state of continual change due to direct posts by systems operators and indirect ones by users. For an ISP, any of these files could represent a copyright infringement, if the user that posted it did not receive permission from the copyright owner.

In other instances, the uploaded material could be in violation of laws regarding decency, hate or treason, such as child pornography, anti-Semitic literature, or seditious material. Liability remains unclear where this material is posted by a third party on the server of an ISP.

The situation is complicated in instances of caching of Web pages. This is technologically rooted in a process whereby ISPs retain a copy on their server of frequently accessed Web pages. This increases the efficiency of downloading, as bandwidth is not consumed downloading the material from the originating site. Caching, however, may be viewed, for example, as a copyright infringement, as a copy of the protected work is created without permission, even though this is done without intent.

It may be impossible for an ISP to monitor and verify the legitimacy of every upload received, unless directly posted by the ISP itself. Attempts to make this the case could have a negative impact on the development of a core business area underlying the information society. Furthermore, an issue for ISPs in regard to the above is how to administer or monitor activities on their servers without violating the privacy expectations of users. Given these factors, strong enforcement of a strict standard of liability could drive many ISPs out of business.

ISPs prefer some form of "common carrier status" where the onus for violation is on the subscriber, making them ultimately responsible for their actions online. Industry has also supported the development of voluntary codes of conduct. In Canada, the Canadian Association of Internet Providers introduced such a Code of Conduct to mitigate potential liability. The French government has also proposed some form of a voluntary code of conduct for the industry. Ultimately, clarification of a harmonised international framework is required to clear the way for the applications and content that are what the Internet is all about.

14. Cavazos: Workshop No. 5, Seoul, Korea, 22-23 October 1996.

Intellectual property rights

Information networks radically alter both the production and distribution of new digital products. Electronic goods such as software, content and applications, once produced, can be distributed over information networks cheaply and around the world. However, this means that they can also be readily copied and distributed. This creates challenges to the intellectual property of the companies that made the initial investment.

The existing copyright regime is based on "fixation" of the work, which is no longer the case with electronic documents. This tends to blur traditional concepts of copyright, but wide circulation of electronic documents also has the impact of weakening people's respect for copyright in the digital environment.

The traditional legal tools for protecting intellectual property are multifold: copyright, trade secrets, patents, etc. Each is currently part of a national legal regime and may need reconsideration in a global context. Clearly, some degree of international harmonisation is necessary, though there is uncertainty as to whether intellectual property at the international level will be more or less protective than at the national level.

In addition to legal remedies, various technological developments, such as digital watermarks and cryptolopes, may enhance enforceability. Education is also a key element, as many users may be unaware that they are in violation of intellectual property laws, particularly copyright. However, complete protection may never be possible, as there may be incentives for infringement havens, where information can be put on the Internet, broadcast or copied.

Several commentators noted the trade-off involved in intellectual property rights (IPRs). Barton[15] believes we need to rethink intellectual property in the context of global information infrastructures. IPRs can be considered a distortion of free market principles, as their absence would lead to widespread copying and imitation. Monopoly rents are granted in the case of IPRs by society as a trade-off for technological and social progress. As IPRs inevitably lead to monopoly powers over technological and other ideas, there is some danger in moving too far towards protecting IPRs, with a regime that is overly strong.

Ultimately, there is need for a balance between the needs of producers and consumers, similar to the one struck in the print world. In the case of copyright, laws and frameworks should give authors an incentive to create and publish, while maintaining the right of the public to make fair use of that information. Similarly for other areas, this can be stated as balancing between market structures that benefit consumers through lower prices and market structures that benefit consumers through more sophisticated products.

Positions by nations on the relative strength of an IPR regime are likely to be a function of the interests of their firms in the global market. Larger, more established firms will support versions of IPRs that enhance their market position, while smaller competitors will support weaker versions that enable them to better compete.

Competitive tactics include the use of standards and network externalities as a barrier to entry. Barton notes that if the command sets of a software programme are deemed proprietary, then this prevents competition as users would need to learn a completely new command set. While the US court permitted

15. Barton: Workshop No. 6, London, 19-20 March 1997.

greater competition in this instance, the trade-off shows up as a decreased incentive to write such a programme.

IPRs may also strengthen a market position against subsequent innovation. Here, there is a balance between incentives for initial innovation and incentives for later innovation. A similar issue is the extent to which market power in one area can be levered to other markets. These issues are particularly relevant in the ICT industry where the pace of change is very rapid.

New challenges continue to present themselves. Skills developed by a person on the job might be considered trade secrets that are proprietary to the company. This might impede an individual's ability to change jobs.

The heart of these issues is whether IPRs stifle competition, innovation or create large barriers to entry. Concepts of broader social benefits of access to information must also be considered. With such extensive trade-offs, any regulatory regime must assess whether it is actually delivering the results it claims to support (Kahin[16]).

Concluding remarks

Policy frameworks must accommodate a variety of potentially conflicting interests. Most important is striking the right balance in each area, so that there are incentives for economic investment in infrastructure, applications and content, while ensuring safeguards that the information society is inclusive and protects the interests of the public.

What is being defined is not just a framework for private sector enterprise, but something much broader. The parameters of the information society will be fundamental to the social context of our children. While keeping an optimistic vision of the information society as a beacon, both care and caution are also required to avoid any pitfalls.

16. Kahin: Workshop No. 6, London, 19-20 March 1997.

III. ELECTRONIC COMMERCE

Most participants were enthusiastic about the possibilities of electronic commerce. The potentials for "friction-free capitalism" in a single, global market hold much allure, promising a new age of electronic prosperity. However, the workshops revealed how unprepared society is. Compared to the total economy, electronic commerce is still largely a dream.

A number of challenges must be met before today's networks are iron-plated for tomorrow's commerce. Policy issues in electronic commerce include: consumer protection and ensuring trust; privacy and security; and electronic money. There are overlaps across these areas.

Part of the resolution of these issues will come from developments in the private sector, such as the development of payment systems. Government has a role in setting out frameworks and law enforcement regimes to enable electronic commerce, but because of the early stage of development, any interventions should be selective and cautious.

Consumer protection

The decentralised, global nature of the Internet readily enables communication over large distances. Commercial transactions may prove somewhat more challenging, particularly in the common instance where the buyer does not know the seller. Even for free information on the Internet, a healthy dose of scepticism is encouraged. The potential for malfeasance may keep consumers away unless measures are designed to protect them.

Trust and reputation are major factors in ensuring that people and organisations will actually use the networks for commercial functions. Where trust relationships are already in place, this is not so much an issue. But this may pose impediments to developing new business relationships within and across national boundaries. If cheating or opportunistic behaviour are possible, there are going to be risks.

Human judgement and contact is the basis for developing trust, and this cannot be easily replicated in the online world. Loyalty in the absence of face-to-face interactions may be hard to find across the vast electronic ether. These are factors deeply entrenched in social norms. Cultural considerations may exacerbate this element -- for instance, the Japanese prefer to know someone on a more personal level before doing business with them.

Consumers are most concerned about the lack of effective complaints and redress systems. In part, consumers need more information to make better decisions, so they will not become victims of fraud. Telemarketing fraud is still common, posing challenges even when originating in the same country, and with a legal regime in place. In international dealings, the situation is not very clear, and there are currently no established rules for consumer protection online. This poses a barrier to wider usage and delays the diffusion of electronic commerce.

A truly international framework for consumer protection is ultimately required. This might include: clarification of negotiation issues among parties; conformity to agreed upon terms and conditions; harmonising laws across jurisdictions; and defining and registering all payment receipts (though there may be privacy considerations in the latter case). Also, consumer protection is needed for instances where the electronic payment device is lost or if the issuers of electronic money default.

A number of non-legal devices may also be important elements of the way forward. Given difficulties in harmonising laws across jurisdictions, a "standard form contract" may be desirable. Just as there are "infomediaries" that provide information about information, there may be a role for intermediaries in matching buyers and sellers due to the absence of ready trust (Kokuryo[17]). An additional element is the development of trusted "brands", like bookseller Amazon.com that may be widely recognisable as a proxy for quality and service.

Privacy and security

In recent years, coinciding with the advent of information infrastructures, public consciousness of privacy and security issues has grown. Led by fear-provoking media stories of brilliant but sociopathic hackers wantonly breaching privacy and security on the Internet, people have become much more sensitive to potential losses of their privacy in an electronic environment. Whether this is the case or not, perceptions rule the day, and may have significant impacts on the trust and confidence of people in electronic commerce, slowing down penetration and usage.

Stories are sometimes exaggerated, yet there are still dangers. The Internet poses some risk, as it was not designed with privacy principles in mind. In an economy based increasingly on the use and exploitation of information, various forms of personal information may have large commercial value. Personal data, such as records held by banks, doctors or insurance companies need protection due to their sensitive, and valuable, nature. Even meta-data, such as call patterns or use of cryptography constitute data about a user, and could constitute a breach of privacy.

Privacy protection issues may come into conflict with the desires of firms to buy and sell personal information and to better market their wares. Sophisticated new technologies now make possible data mining, electronic profiling and database linking. These tools already enable marketers to target consumers with ever greater accuracy. Yet, while privacy concerns are frequently voiced about negative consequences, many people voluntarily provide this information in exchange for give-aways, coupons, or air miles.

Indeed, people give away information all the time, consciously and unconsciously. The crux of the issue is whether information is being used for purposes other than those for which it was originally gathered. If people have assurances that information will be secure and kept confidential, as is the case for financial information provided to banks, they may not be concerned.

In some cases, privacy cannot be considered an absolute right. There may be legitimate reasons where there is a societal need to know, such as in the compilation of population health statistics. In these circumstances, clarification of who "needs to know" and what constitutes "legitimate access" is required. Defining these rights in international contexts is important.

17. Kokuryo: Workshop No. 6, London, 19-20 March 1997; Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

The demand for solutions -- technological, legal, or otherwise -- has grown in accordance with international electronic trading, e-mail and Internet applications. For the private sector, security of systems is also a major issue due to the increasing role of industrial espionage and professional computer hackers, at a time where intellectual property is increasingly a basis of competitiveness.

Safeguards that compose a security system protect access to the system and the information that resides therein from unauthorised usage externally or internally. An element of security measures is technological, in the hardware and software of the system, and may involve design issues such as the use of mainframes or network topology. However, creating a secure environment must also encompass organisational policies with regard to personnel and information. These latter elements include security audits, education and training on security issues and addressing levels of access to information.

Some commentators felt that achieving zero security risk in an open environment may be an unrealistic goal. This may be a price paid for the advent of open systems architectures for computing. Others cited the potentials of cryptography as a technical infrastructure to accommodate a wide variety of privacy and security needs online. Cryptography enables:

- Confidentiality of data communications.
- Authentication of data to prove the identity of the sender.
- Ensuring that data have not been intercepted and that they have not been modified in transport (integrity).
- A mechanism to prevent the sender or receiver from denying the transmission (non-repudiation).

Kamata[18] notes that national governments may be unable to regulate the use of cryptography. It is largely software, with vendors in several countries, with different legislation governing usage. Policy should be co-ordinated at the international level as much as possible, to ensure that the resulting system is effective and does not pose barriers to trade.

Various competing interests around privacy and security exist, including legitimate law enforcement considerations. Advocates for law enforcement note that encryption can be used by criminals and terrorists to conceal their activities. Cases include child pornographers transmitting encrypted images, and co-ordination of terrorist plots. Other concerns may be more mundane, as in the case of someone dying, where access to encrypted documents may be required by an heir or other appropriate party.

A balance must be struck between protection of privacy and security through technology, legislation or policies, and defining criteria for legitimate access. A reinvigorated "Clipper chip" type initiative, however, where the US government is able to unscramble any messages would likely continue to be unacceptable to users in the US or entities in different countries. Most OECD countries support the development of a public key cryptography system, where a trusted third party is involved. Who such a trusted third party should be, at the international level, is unresolved.

18. Kamata: Workshop No. 5, Seoul, Korea, 22-23 October 1996.

Mansell[19] notes that a wide range of social, economic and political issues surround encryption debates. The outcomes of these debates will shape the environment in which new legislative and regulatory conditions emerge. A framework for moving forward may be found in the *OECD Guidelines for the Protection of Privacy and Transborder Flows of Personal Data* (1980) and the guidelines on *Security of Information Systems* (1992). The OECD has significant experience in balancing in this area and is a logical place for further developing policy surrounding cryptography in the electronic environment.

Electronic payments

In some regards, electronic payments and money are hardly new. Much of the banking system is already in electronic format. Consumers are well accustomed to the use of credit cards as a non-cash form of payment. Numerous arrangements for EDI payments have been in existence for some time. However, the move from a closed network for EDI to open network structures that support widespread commerce is a big leap.

Much of the discussion in this area is in the "last mile", the emergence of widespread electronic money as a substitute for cash, including online usage. It is likely that no single payment scheme will dominate in the near future. Typical of the early stages of technology development, a number of players are moving to set a standard for payments in the online world.

One broad thrust is the adaptation of existing financial systems to the electronic environment, which includes activities by credit card companies, the incumbent banks, and adaptations of billing systems. In addition, a variety of novel payments systems have emerged based on conversion of traditional deposits into encrypted digital tokens. DigiCash and Mondex are two of the better known examples of these new entrants.

Each system has different characteristics, such as providing the same degree of anonymity as cash, enabling direct monetary exchanges among individual consumers, or transferring micro-payments of a fraction of a cent. Payments schemes may be direct withdrawals from accounts, or may involve the creation of new currencies. Some payment schemes may complete a transaction at once, while others are cheque-like systems that involve a potential for dishonour after the time of the transaction. In addition, card-type systems, like Mondex, store value electronically on a chip on a credit card sized "smart card", while network-type systems, like DigiCash, transmit electronic cash over the network.

Which system or systems will emerge as a standard ultimately depends on the technology choices of consumers and merchants. In the interim, consumers may experience inconvenience due to the incompatibility of different payment schemes. This may lead to delays in adoption, or use of multiple electronic caches, for consumers and merchants alike.

Before electronic transactions change the nature of commercial relationships, a number of issue areas suggest that an internationally harmonised legal and policy framework will be required. One dimension, which parallels the discussion on privacy of information, is the anonymity of electronic cash. Privacy advocates support anonymity as a means of preventing governments or corporations from accumulating detailed information on how individuals or households are spending their money.

19. Mansell: Workshop No. 6, London, 19-20 March 1997; Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996.

At the other extreme, there are also concerns among policy makers that the widespread use of anonymous electronic money could provide avenues for tax evasion and money laundering. Traditional enforcement of both policy objectives relies on limitations to holding large amounts of cash, and financial institutions keeping records of transfers and the identities of the transferring parties. Anonymous versions of digital cash remove such records, yet are much more easily transmissible than physical cash.

It is too early at this stage to know whether anonymous payment systems will be preferable to consumers. Indeed, traceable electronic cash may be able to provide consumers with value-added information or “freebies”, so for some consumers this benefit will outweigh the cost of privacy losses.

Another policy issue is which entities are able to issue electronic money. Pre-paid telephone and other "smart" cards are already in circulation, as is *de facto* money. Free entry into the market for payment services is possible, as the traditional test for whether banking regulations apply is whether the undertaking accepts deposits. Reed[20] notes that most electronic money schemes are structured so that money is in the control of the user, not the bank, which takes the undertaking outside of traditional banking supervision laws.

Further, clarification of qualifications or obligations of the issuers of electronic money, or of the rights and risks of the payer and intermediaries, will be required. These uncertainties pose an impediment if there are instances of non-payment, operational malfunctions, or if the non-bank entity goes bankrupt. These issues have implications for other financial institutions that are affected, and influence the confidence people have overall in an electronic funds system.

In early developmental stages, payment mechanisms by non-banking institutions may not have government guarantees of legal tender. This situation resembles early parts of this century, before central banks intervened to create national currencies. During this time, money was issued by a multitude of independent banks, and there was a risk in holding currency, such as if the bank went bankrupt. For electronic money schemes, this might increase the risk of carrying these forms of payment and discourage usage.

A role of a central bank may be necessary to protect the safety and security of the payment system. Shin[21] recommends that issuing electronic cash should be decided in a way that best protects the security of the payment system. Only institutions under the authority of banking regulations should be allowed to issue electronic cash, or if non-bank institutions are allowed to do so, then they should be subject to reserve requirements. Addressing this may be problematic due to the global nature of transactions, and where many central banks no longer impose reserve requirements on their chartered banks.

With modern foreign exchange markets, electronic money could be traded just as another currency. Another possibility is that electronic money will mirror existing national currencies. In either event, the additional number of people able to participate in currency trading may increase the risks due to currency speculation. This may lead to instability of exchange rates, and possibly a threat to monetary policies.

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20. Reed: Workshop No. 5, Seoul, Korea, 22-23 October 1996.

21. Shin: Workshop No. 5, Seoul, Korea, 22-23 October 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

Depending on the type of electronic money standard, national governments also face loss of seigniorage, the rent received in the process of money creation. Similarly, possibilities for counterfeiting of electronic cash are feasible in theory, though there is little evidence currently due to the early stage of development. The lure of an "evergreen" source of funds will certainly provoke criminal interest.

Since a wide degree of acceptance among consumers is necessary, payment systems must address measures for consumer trust and desire to use the system. It is unclear whether some kind of regulatory intervention is necessary and can be effective for these circumstances. Because electronic payments schemes are not currently well established, assessing solutions or alternatives is difficult. There is a bigger danger that intervention in the absence of sufficient information could be harmful or detrimental to the development of electronic commerce.

While digital cash may reduce transaction costs, constructing, maintaining and operating an effective system is not a small task and involves significant investment. The infrastructure must provide much of the same functionality as the broader security system. It must ensure that payer and receiver can be identified and authenticated, to verify transactions, and to prevent electronic counterfeiting. These functions may be readily harmonised with overall network security in a PKI type scheme, though there is no guarantee that independently developed systems will evolve this way.

Concluding remarks

Advances in each of the above areas have been made. Continual international co-operation is clearly a necessary ingredient for moving forward. Removing these barriers are necessary conditions for the emergence of electronic commerce, though they may not be sufficient.

For broad penetration, electronic commerce must be more compelling, by an order of magnitude, than the shopping mall. A shopping mall provides a distinct physical location, with numerous shops under one roof, where people have a social experience and can touch what they want to buy. The basis of success for electronic commerce must be through convenience, better customer service, enhanced product selection, or whatever. Services must provide practical solutions to the problems of day-to-day life, or else novel diversions.

Demographic considerations currently undermine the demand side. Dreams of an online shoppers' paradise are periled by low usage rates among women and mainstream consumers, the demographic group that does most of the shopping. If these people do not have a compelling interest in going online, then e-commerce will be confined to technology that operates in the background, but that is not overtly part of the consumer experience.

IV. EMPLOYMENT, EDUCATION AND TRAINING

The impact of ICT on employment and the labour market was a central issue in the workshops. With unemployment a persistent problem in many OECD countries, the notion that a move toward the information society would exacerbate the existing problem is troublesome. A number of research findings were presented addressing different dimensions of employment, skills and training.

The transformations underway as a result of ICT are primarily affecting the mix of skills that are in demand in the labour market. Papaconstantinou[22] notes that during the 1980s, OECD economies saw an increase in the skills of the labour force, as demonstrated by increased educational attainments. Employment has grown most rapidly for white-collar, high-skilled workers in OECD economies, compared to white-collar, low-skilled workers and blue-collar workers, both high- and low-skilled.

This correlates with the notion that the knowledge intensity of work on average has been rising. Wolff[23] notes that in the US from 1950 to 1990, the proportion of the labour force that could be classified as "information workers" -- knowledge producers such as scientists and engineers, and data processors such as doctors, managers and clerical workers -- has grown.

Stafford[24] adds that to some extent the increased productivity of these workers means that they now perform functions that were previously done by other workers (few have secretaries or typing pools anymore). This change is more evident for the post-1980 period, when personal computers became more common. Ferné[25] notes that while many organisations are levering ICT to significant performance improvements, administrative personnel and middle management are among those made redundant due to ICT.

Papaconstantinou[26] notes that there has been a polarisation of skills and the disappearance of middle-skill jobs. Lehr[27] adds that ICT progress appears to be accentuating the gap between skilled, highly-educated workers and less-skilled workers. So, we will need to confront larger issues of equity and income distribution in society that result. What is clear is that ICT creates a demand for certain skills while eliminating the need for other skills. Even so, the distinction between skilled and unskilled may be misleading. It is more an issue of having appropriate versus inappropriate skills.

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22. Papaconstantinou: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

23. Wolff: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

24. Stafford: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

25. Ferné: Workshop No. 5, Seoul, Korea, 22-23 October 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

26. Papaconstantinou: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

27. Lehr: Workshop No. 3, Tokyo, Japan, 4-5 March 1996.

All of this translates into employment impacts at the level of the overall economy. ICT eliminates jobs that can now be accomplished in hardware or software. At the same time, new jobs are continually created. What the net impact will be in the future, in terms of overall employment, remains unclear. It will certainly vary depending on industry, geography and skill group, but exactly how is not well understood.

Some believe that over time, as adjustments are made in the labour market, ICT will lead to the creation of entirely new industries that we cannot fully anticipate today. Proponents of this view are looking at broad sweeps of history, noting that similar transitions have occurred in the past, notably with the Industrial Revolution, that led to all kinds of new employment. Likewise, in the long term, we should expect more high-skilled, high-wage jobs to be created.

Others are more sceptical, noting that the transition induced by the Industrial Revolution took several painful generations. Moreover, the nature of ICT itself changes the shape of the existing situation. If ICT only raises the productivity of high-wage, high-skill workers and renders low-wage, low-skill workers increasingly redundant, this may well reinforce the very effect an ICT-based jobs policy set out to reverse (Hulten[28]).

Creating wealth now requires less people than it did in the past, whether in traditional industries that have been downsizing, or in new industries. Indeed, technology can lead to a reduction of job skills as more can be accomplished by technology. Even the builders of the information infrastructure have been engaged in shedding excess employees to become more competitive.

Dumort[29] notes that there is no guarantee that the benefits of telecom liberalisation and increased competitiveness will compensate for the negative direct impacts of rationalisation and of labour productivity increases achieved through substitution of labour for capital. ICT does potentially affect many service sector jobs, particularly if online commerce booms.

Soete[30] raises the issue of whether the service industries can continue to play the former role of "employment reservoir". He notes that wages in the advanced industrial economies have been eroded by the emergence of a global marketplace where low-wage workers compete for the few jobs created by footloose global corporations. As services are not dependent on material resources, their location is increasingly independent of any geographical considerations. As a result, the international "footlooseness" of many service activities has increased.

Soete also notes that to the extent there are job losses, this could adversely affect the demand for new services. Notably, new services tend to be time consuming. That is, they fit a society with more free time. This raises the issue of whether working time reductions might be a vehicle to both combat unemployment and to increase demand for new services.

Hulton argues that the focus on how many jobs (direct plus multipliers) are created by a specific IT project or infrastructure investment is misplaced. The right focus is what matters for growth, and that is the rate of return to an ICT investment. He suggests that governments invest in infrastructure, as a

28. Hulten: Workshop No. 6, London, 19-20 March 1997; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

29. Dumort: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 2, Istanbul, Turkey 14-15 December 1995.

30. Soete: Workshop No. 1, Toronto, Canada, 28-29 June 1995.

means of increasing the marginal productivity of workers. Here, governments must be sure that any particular infrastructure investment is justified on its own terms, through cost-benefit analysis.

To deal with possible job losses, some cushioning policies may be needed. Caille[31] notes that governments may need to intervene to introduce policies that are aimed at creating jobs for young qualified workers, ensuring existing jobs are upgraded, providing retraining and public service jobs and finding ways to support the lifelong unemployed.

Government can also play a role in supporting the growth and development of SMEs, the most dynamic sector of the knowledge-based economy. Challenging areas for SMEs include financing, due to their typically intangible asset base, and marketing, due to the high costs of exposure. Government involvement here can decrease risk and barriers to entry.

Education and training

Most participants agreed on the role of education and training in remedying this situation. This is seen as a clear area for government involvement that can lead to employment creation in the long run. But it is also cited as a short-term response to the structural changes in the labour market.

ICT and information infrastructures themselves offer huge potentials to widen the scope of access to training and education. Various forms of tele-learning may benefit the geographically disadvantaged, but are also seen as a part of a new culture towards learning based on self-responsibility and lifelong learning. In some visions, multiple careers await those joining the labour force, with periods of retraining in between.

Ultimately, tele-learning may need to be coupled with some degree of interaction with teachers and other students in order to be effective. Evidence on best practices would be useful to better understand both the potentials and limits of tele-learning. Indeed, we have little real understanding of what exactly a "good" educational system means and what its characteristics are. The answer may change from culture to culture. (That computer industry icons Bill Gates and Steve Jobs are both college drop-outs does not help our understanding!)

If effective access to training can be accomplished, where distance is less a factor, the costs of acquiring training fall. This removes, at least, the physical impediments to ameliorating the lack of skills and education that characterise the "have-nots". Other considerations are important as well, including culture, poverty, functional and digital literacy.

Despite the well-known correlation between education level and employment, caution is required, as education alone is not a panacea. Hansen[32] notes that in Canada, unemployment rates cannot be explained by education levels alone. Attention must be paid to mis-matches between the needs of industry and the training provided by the formal education sector. In addition, many jobs that previously employed people without university degrees are now filled with those with university degrees. This poses the question of whether skills are being applied to best advantage. Vence Deza[33] adds that educational

31. Caille: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

32. Hansen: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

33. Vence Deza: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

attainment levels are not necessarily beneficial unless accompanied by work experience and skill development on the job.

What is meant by "skill" can be troublesome as well. For knowledge workers or symbolic analysts, the emphasis may not be so much on vocational skills, but the need for social skills as part of interacting with the working environment. Knowledge assets include the capabilities of employees beyond the skills and IQ necessary to do their jobs. These include innovativeness, creativity, resourcefulness, strategic thinking and the ability to communicate. Attempts to measure the relative demand for such skills are challenging with regard to determining what skill sets or functions are equivalent.

Skill sets in demand are also constantly changing. In advanced sectors, where demand may swing from C to C++ to Java programming, governments may be unable to forecast skill requirements and thus training needs. The private sector may be better suited to take on a training role, whether this is in-house, or through some kind of consortium that trains people for companies in related fields. The onus on government would be to educate people to be able to learn.

Keeping skills up to date is critical, as once someone is retrained, the skills in demand may have already shifted. Even where there has been persistent demand for skilled software programmers, there has been a mismatch between jobs and skills. Jobs may go unfilled, as not everyone, even if targeted as a child, has the aptitude, wherewithal and interest in becoming a programmer.

The biggest challenge from a social point of view is what to do with those who are displaced by technological change, but who may not have the skills to bridge the gap. For example, the line worker who loses his job is unlikely to become a computer programmer or a multimedia content developer. Without an appropriate strategy to address this aspect of structural change, social costs may eventually be paid in the form of welfare, crime and drug abuse.

Quality of work

ICT also changes the nature and quality of work. Mansell[34] notes that there have been advantages and disadvantages to this. Ability to work at home or at a distance and greatly enhanced access to information are two widely cited “pros” for knowledge workers. “Cons” include the cumulative impact of many hours working with a computer, including physical ailments such as screen fatigue and carpal tunnel syndrome.

Quality of work considerations are related to the type of work undertaken. Some workers may be considered information or knowledge workers because they interact with a computer all day. However, their roles may be limited to data entry. McDonald's workers would fit this category, even though the interfaces they use to networked systems are simplistic by design. The most horrific scenario is some form of "electronic sweatshop" where individual keystrokes are monitored at a distance.

Overall, jobs have become more mobile, and can shift from one region to another quite easily, depending on underlying infrastructure and labour. Many regions are employing this strategy of competing for the investment of bigger players to locate customer service and sales operations in call

34. Mansell: Workshop No. 6, London, 19-20 March 1997; Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996.

centres. However, such jobs may be candidates for movement yet again if a better opportunity comes along. Today Moncton, tomorrow Kuala Lumpur.

The crucial features of a high-wage job are related to the value-added to the final product. Creating volumes of low-end service jobs, where there is little value added, is a strategy, but may not lead to the results the governments of OECD Member countries are striving for. Emphasis on job creation must look more broadly than generic "jobs" to what type of jobs are truly beneficial.

V. GOVERNMENT IN THE INFORMATION SOCIETY

Most participants noted the potentials for ICT to enhance efficiency of government operations internally and in the delivery of services. Ferné[35] notes that there is a wide perception that government is lagging behind in the use of new technology to carry out its functions. In contrast, participants suggested that governments in an information society must be model users of ICT. There are a number of dimensions to what this implies.

In theory, government can lever ICT to provide more and better services at lower costs, a benefit from restructuring around the potentials of the new technology. This might include: reduction of paper-based transactions, internally and externally, through electronic data interchange and electronic documents; facilitating administrative change and restructuring to improve productivity; development of performance indicators and benchmarks; training and education applications; and, a means of increasing dialogue among stakeholders.

In practice, this is somewhat more difficult, as there are a multitude of clients, needs and policy objectives. Budgetary and financial constraints may play a role, as will organisational cultures and structures. The organisational basis for an information chain, even if it hinders the accessibility of government information for external clients, may be difficult to change. Mozes[36] notes that the received wisdom was that ICT would help in the downsizing of government, but this was not the case. In spite of the belief the computers would lead to a "paperless office", in reality they have actually enhanced the ability to print more paper.

To actually achieve better outcomes, electronic service delivery should engage end-users in design and solicit feedback from a wide variety of people who interact with the system, including employees and recipients of services. Barriers to accessing information should be reduced as much as possible for the public and other stakeholders. In addition, partnerships with the private sector should be explored, as appropriate.

Wood[37] notes that in spite of potentials to improve service delivery, there is little assurance that this will lead to improved access for citizens, or in creative and cost-effective applications. Other factors must be considered, including: grassroots involvement; community infrastructure development; encouraging innovation in public service processes; creating directories; strategic partnerships; and pre-operational testing.

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35. Ferné: Workshop No. 5, Seoul, Korea, 22-23 October 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

36. Mozes: Workshop No. 6, London, 19-20 March 1997; Workshop No. 5, Seoul, Korea, 22-23 October 1996; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

37. Wood: Workshop No. 5, Seoul, Korea, 22-23 October 1996.

One clear area for electronic services delivery is as a content provider for a wide variety of information. Governments can create links to legislation and regulation. They can post a variety of information on programmes and initiatives. Public interest materials, such as health and environmental information, can be made more widely accessible, as can the content of traditional access to information requests, like declassified documents and internal memos.

Citizens are already demanding more and better information from their governments. Ultimately, the information provided must be useful and relevant to the public. The Internet is already a natural fit as a delivery mechanism, although different media sources should be considered for more widespread diffusion of information. Several countries have already taken major steps in this direction, though there is little empirical evidence on relative accessibility of government information.

Some have suggested that broader-based access to information might enhance the democratic process. Gaultieri[38] notes that to date, new technology has not increased public input into policy formation in any appreciable way. Whether ICT can ultimately enhance democratic structures is not clear. It will likely depend on the way and context in which it is implemented. Openness, transparency and accountability are important elements of any such move.

There are fundamental differences between making volumes of government data, information and reports available online, and actually giving citizens more incentive and power to participate in government, or to exercise more control over government resources and operations. Certainly, politicians may embrace ICT as a means of getting out their message without distortion or interpretation from the press. However, some commentators noted that governments may be more interested in getting their message across than in receiving feedback from the electorate. Or some governments may simply not be interested in enhancing democracy in any significant manner.

A number of tax issues for governments were raised. Cawley[39] notes that changes due to the information society may increase the difficulty for governments to enforce tax collection. Hence, governments may seek to raise new revenue or merely to replace existing sources. Sales taxes on electronic goods and services may prove difficult to collect due to problems in defining the location of sale -- whether this is where the buyer or seller is.

New bit taxes, gauged to throughput of data, have also been suggested as a source of revenue for the information society. Cawley notes that this tax poses some interesting issues. It may lead to incentives for additional compression or to maintain a work in analogue form. Measuring bits may not be accomplished as easily as some might think, particularly in statistically shared network architectures. In addition, disincentives to using online systems or to using larger bandwidth-consuming video or graphic elements of multimedia might arise.

An additional area for clarification is the relative treatment of transactions in off- and online worlds. An electronic product will be substitutable to varying degrees for its real world equivalent. Taxation in one realm may create inefficiencies or distortions in production or consumption. This may be desirable, however, as a means of creating incentives for getting online.

38. Gaultieri: Workshop No. 5, Seoul, Korea, 22-23 October 1996.

39. Cawley: Workshop No. 6, London, 19-20 March 1997.

Government does make some influential choices when it makes technology decisions. A measure of caution was urged, that governments should not overly force the pace of adoption of technology. The available evidence suggests that revolutionary new technologies take time to diffuse into society. Infrastructure companies need to amortise their existing investments, just as firms need to mesh new technology in with legacy systems and standards. Human dimensions are important as well, and may include resistance and the need for retraining of employees.

VI. MEASURING THE INFORMATION SOCIETY

The issue of data and metrics in the context of the information society was another key area of discussion across all of the workshops. While the level of discussion of the GIS has already achieved an advanced state, gaps in our datasets, measurement tools and indicators need to be filled in order to have a deeper understanding of the changes taking place.

Statistics and empirical evidence have a vital linkage into the policy making process. They are necessary in formulating, implementing and evaluating policy responses and frameworks. In addition, individual countries are interested in benchmarking their performance against others, and in identifying barriers and opportunities.

Gärdin[40] notes that our original frame of reference for statistics was the physical goods and production orientation of the industrial economy. Classification systems were based on manufactured goods, not immaterial and mobile information and related services. We could not count pieces of information produced, in the same way as we counted cars produced.

The utility of information is contextual, dependent on how it is used or applied. Information can be readily used by many people at the same time. It depreciates, but not in the same way as a capital good. What is required is a statistical frame of reference -- which includes concepts, definitions, variables, data collection and survey systems -- necessary to understand and measure the information economy. Many noted that the considerable work done in developing the NAICS has helped to address some of these issues.

Participants were interested in metrics to better understand the evolving services and information environments. They desired indicators of how well the infrastructure itself was functioning, including identifying key infrastructure characteristics and functions that require monitoring, such as service availability. The OECD's 1996 work and report on the GII/GIS noted similar concerns, and recommended the formation of a group within the OECD to address them. Since then, the Working Party on Indicators for the Information Society has made considerable progress on these issues.

Gardin outlined some general directions for the development of statistics for the information society:

- *Enterprise statistics* -- a taxonomy of enterprises and their ways of interaction; indicators for SMEs; and, new statistical concepts and categories to reflect information and communications services products.

- *Human resources* -- employment; training; education; skills; competence levels; occupations; and professions.

40. Gärdin: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 2, Istanbul, Turkey, 14-15 December 1995.

- *Geographic localisation and concentration patterns* -- clustering and distribution of different economic activities and professions.

- *Communication patterns* -- interactions among persons, goods or messages; volume and quality statistics; price information.

- *Use and demand* -- extent of and reason for use; costs and expenditures; investments; use of different services and applications; personal and enterprise differences; non-users and users differences.

Sciadas[41] noted that both demand and supply side statistics were important, and described a methodological approach around broad sectors of society:

- *Households* -- infrastructure data; software and Internet usage; price measures to complement existing telecom price indices.

- *Business* -- price and firm size information; transaction measures; performance metrics.

- *Government* -- indicators for the availability, use and application of government services; infrastructure statistics for schools, plus cost and usage information; service availability for hospitals and other health care institutions; library services.

Atham[42] noted the importance on gathering information about SMEs. This is a relatively dynamic sector, so better information on success factors would be useful to policy makers. However, collecting consistent data from SMEs may prove to be difficult. The SME landscape changes frequently with new entrants and exits, making it difficult to collect data and to sustain relatively large sample sizes. This makes it hard to generalise about SMEs.

Internationally comparable datasets were emphasised. As year to year changes are slow within a country, international comparisons can prove highly valuable in benchmarking the performance of different policies or industrial sectors. Many participants highlighted the need for governments to work together with organisations like the OECD to harmonise their data collection procedures and to create a co-ordinated system of international statistics.

National statistics tend to emphasise convergence within a country, while international statistics stress only certain sectors, like telecommunications. A comprehensive set of indicators that captures both dimensions is thus required. To this end, Kawachi[43] proposes an international comparison framework, consisting of key statistical areas: diffusion and usage of a wide variety of equipment; qualitative dimensions of communication infrastructures, including measures of status and access; and content and services, including sub-areas for developments in communications services, online services, the Internet and packaged content.

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41. Sciadas: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996; Workshop No. 3, Tokyo, Japan, 4-5 March 1996; Workshop No. 1, Toronto, Canada, 28-29 June 1995.

42. Atham: Workshop No. 4, Helsinki (Porvoo), Finland, 6-7 June 1996.

43. Kawachi: Workshop No. 3, Tokyo, Japan, 4-5 March 1996.

Because of the profound changes taking place, social as well as economic statistics are vital for a balanced analysis of impacts. Indeed, social relationships are as important as economic relationships in forming patterns of network communication.

Ultimately, we need to be sensitive to the limits of data collection. While our wish list is long, much of what is desirable may not necessarily be easily measured. This is particularly true for qualitative factors. In addition, there may be large costs involved in data collection to get at some of the answers. Even with ready data sets, the need to standardise for large variable sets poses a challenge, as measurement of new services may be hard to disentangle from impacts caused by other factors.

Governments will need to establish priorities and clarify their specific information requirements. And this must be done against what is do-able in the short term. Some participants felt that existing measures and data sets, in public or private sectors, should be used first. In these instances, however, making the data fit together may be difficult. Some participants also felt that new indicators should supplement the existing industry data, not seek to replace them.

In areas such as finance, health care and education, defining the unit of output is problematic. A significant proportion of output gains achieved through ICT do not show up as cost savings, but as quality improvements, wider consumer choice, better customer service, increased access to information, time savings and convenience. Existing measures, based on value or quantity of output fail to take these considerations into account. Even at the most fundamental level, the "productivity paradox" demonstrates the difficulty of measuring the impacts of ICT: computers show up everywhere but in the numbers.

To address qualitative issues, different methodologies should be employed. Case studies may be complementary to highlight qualitative factors that do not necessarily show up in more rigorous quantitative statistical analyses. Case studies may also point at the relevant performance parameters for further firm, industry or national level study.

This is a longer-term process and includes: classification issues; data quality; quality changes; and units of measurement. Gearing statistical systems to new products and services in the market takes time -- designing and performing surveys. When data can be collected, there will still be a time lag before useful information can be gathered.

National statistical agencies are making progress on these issues. Co-ordination at the international level is particularly important as we move ahead, and the work of the OECD’s WPIE continues to be an important forum for advancing co-ordination and understanding of the frameworks and metrics needed to measure the GII/GIS.

CONCLUSIONS

This paper has highlighted key features of the ongoing discussion of issues relevant to the emerging information society. While there may be disagreement on how best to move forward in some areas, there are a number of areas of consensus and a number of themes that link together the discussion.

First, more study is needed. In spite of the massive increase in the availability and accessibility of information, getting the right information in a timely manner is what most governments are striving for. The workshops told us how little we really know about what is going on and what is to come. Perhaps it is the case that all of the most important decisions must be made on the basis of imperfect information. Still, through data collection, new models and empirical results we can improve the starting point.

Second, making progress at the international level often means revisiting our underlying assumptions and principles. New economic concepts are important in understanding the changes underway. Finding consensus in these areas is certainly useful, but the real challenge often comes in implementation, where the day-to-day realities and political considerations may be far from ideal.

Third, we must strive to find the appropriate balance among differing views and interests. The challenge is the smooth integration of the previously distinct regulatory environments of telecommunications and broadcasting. This must include removing barriers to the fusion and interconnection of networks, be they telco, cable or wireless, and the merging of services based on different technologies. Market incentives to stimulate investment in infrastructure and new applications must be balanced by instruments to safeguard the competitive environment (such as abuse of dominant positions to stifle competition), to ensure pluralism and diversity of content, and to provide adequate protection for citizens and organisations against various forms of content abuse (privacy, security and intellectual property).

Fourth, the way forward must be inclusive. Access is an important consideration here, as is the need to engage the public in areas that directly affect them, particularly as they relate to important government services. The dialogue of the information society must move beyond an elite that is "in the know".

Finally, while the information society is global in the sense that entry nodes to the information infrastructure span the planet, even telephones are far from well diffused in most countries of the world. GIS concepts are most applicable to the OECD Member countries and to the elite of developing countries. In this sense, there is a way to go before the information society becomes truly global.

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