

The use of Internet, which is also commonly referred to as the implementation of ICT, indeed has helped the private sector, particularly the manufacturing sector to implement integrated value chain that creates and supports partnerships with the suppliers as well as the customers. By doing so, the companies, their suppliers as well as customers can find ways and means to cut costs, improve quality, expand markets as well as share benefits. This does not only create opportunities and wealth but also induce greater openness and transparency among the partners.

In the financial and banking sector, online financial services include forex trading; shares & equity trading; unit trusts trading; general insurance; traditional banking transactions; general bank enquiry, applications and requests as well as e-commerce portal service. These services allow traders and customers to execute buy/sell orders on the spot; view historical trading patterns; be alerted to breaking news in the market; view real time prices & volumes; read market commentaries; conduct withdrawals & deposits; transfer funds; as well as other trading and banking transactions. In other words, implementation and usage of ICT in the banking & financial sector, helps to expedite transactions.

ICT In The Public Sector

ICT in the public sector seems to grow at a slower pace than in the private sector. This is possibly due to the fact that organisational changes as a result of the introduction of ICT in the public sector are taking place more slowly than in the private sector. Secondly, ICT adoption in the public sector concerns the nature of public sector financing and procurement practices. The public sector normally follows a lengthy process to seek competitive tenders, thus leading to problems, such as outdated technology by the time the tender is completed.

However, in the past decade, many innovative local and national government agencies in the Asia Pacific region have started applying ICT to a growing range of public services. These applications are based on two key objectives, namely to achieve major improvements in speed of response, efficiency and accessibility of the public service, as well as to bridge the gap between the government and the community.

In addition to these two objectives, the highest social application of ICT, which is normally through the initiative of the government, is poverty alleviation. Table 2 shows the correlation between the adoption of ICT and poverty. (The usage of television, telephone and other medias are also considered as usage of ICT). The higher the human poverty index, the lower the number of telephone lines, PCs and TV as well as lower Internet user ratio. However, ICT can be considered also as a cause and an effect of poverty, depending on how ICT is being used as discussed later.

Table 2: Poverty and ICT Indicators

	Internet User Ratio	Telephone Lines/ 1000 population	PCs/1000 population	TV/1000 population	Human Poverty Index
Malaysia	2.97	183	42.8	228	14.2
Singapore	27.80	513	216.8	361	n.a.
Thailand	0.93	70	16.7	167	18.7
Philippines	0.60	25	9.3	125	16.3
Indonesia	0.20	21	4.8	232	27.7

Source: Derived from Tan Khee Giap, "The Impact of Information Technology on Banking Industry in Asia", Nanyang Business School, 3rd Asian Development Forum, 2001 and UNDP Human Development Report, 1999

ICT in the public sector or e-government develops in 6 stages. Not all government agencies will reach all the stages. There can also be disparity within a government, with different agencies implementing e-government at different stages. Some of the stages will also occur simultaneously.

1. Setting Up An Email System And Internal Network.

At this stage, the network application mainly supports basic administrative functions such as payroll and accounts. Adoption of such a system can deliver significant benefits like reduction of information handling costs, compliance costs and labour costs as well as allow faster and more accurate processing of tasks.

2. Enabling Inter-Organisational And Public Access To Information

This stage involves the development of systems that help to manage the workflow in the public sector. The adoption of ICT systems reduces paper work as business processes can now be managed electronically. The adoption of ICT systems also minimise delays that are normally associated with hard-copy documents and manual processing.

3. Allowing Two-Way Communication

The initial stage is to post one or more telephone or fax numbers or email addresses on the website and to encourage the public to send messages. The website also normally includes general information about the agency. Examples of promising ICT applications in the Asia Pacific public sector workflow system include i. Claims processing and management; ii. Bid and proposal routing and tracking; iii. Handling of customer service and complaints; iv. Grant and scholarship award, approval and processing; and v. Human resource recruitment and hiring. By adopting this stage, the governments are enabling inter-organisational and public access to information and feedbacks through their websites.

4. Allowing Exchange Of Values

At this stage, ICT supports the development of more flexible, convenient ways for the public to conduct businesses that involve exchange of values with the government. Such businesses include welfare claims, tax assessment, visa applications and license renewals conducted by the Singapore Government. In the case of the Philippines, the Customs Bureau developed the systems for customs payments, processing of clearance documents and releasing of shipments from customs control. In Korea, the Public Procurement Service, since 2000, conducts all purchases of commodities and accounting transactions via the Electronic Data Interchange (EDI).

5. Digital Democracy

At this stage, the use of ICT applications supports participatory and democratic processes, namely to empower civil society organisations to express opinions over the Internet. This system allows net-citizens to challenge the prescriptions and 'best practices' of governments and inter-governmental organisation, thus helping to prevent the premature adoption of standards of so-called 'best practices', which may actually be the practices that protect the interests of certain parties.

6. A Portal Taking Citizens Where They Need To Go

This stage involves a portal that integrates information and services from various government agencies to assist the public and other stakeholders to handle common interactions. The advantage of this portal is that it allows the users to receive a 'one-stop-service', especially for those who are not familiar with the functions of the different government agencies. One of the developed systems of e-government worldwide is Singapore, which ranked 2nd out of 22 countries surveyed worldwide on the maturity of e-government (Government of Singapore & Accenture, 2001).

Issues & Challenges

The move towards a knowledge-based economy through the use of ICT in countries like Hong Kong and Singapore are perceived to be hindered with fewer problems than in the less developed countries. This is mainly because in the less developed countries, particularly those with geographical diversity & unbalanced regional development, ICT related activities that are not properly planned and managed, for example e-banking, may lead to further income disparity. It is frequently believed that the introduction of ICT reduces opportunities for corruption. However, the reality is more complex. While ICT can facilitate the efforts to fight corruption, it can also have no effect or even provide new avenues for corruption. This is especially so for those with access to special skills in ICT, and access as well as control of some classified information.

A 1999 survey on Asian CEO issued by the World Economic Forum and Pricewaterhouse Coopers revealed that half of the respondents believed that the financial industry would be most significantly impacted by ICT (namely via Internet) over the next two years. Majority of the respondents also agreed that Internet access, transaction and use should not be taxed. Two issues however, emerged, i.e. concerning government regulations and the imposition of taxes on Internet activities are controversial and debatable. This refers to monopolistic regulatory environment, unlevelled playing field, over-regulation of tariffs and technology, as well as unclear and inconsistent policies.



It is also the perception of the consumer at large that embracing Internet would destroy the basic business and pricing model. This is mainly because transactions via the Internet are expected to reduce barriers and move closer to perfect competition. Consumers in general, have also developed low confidence in the Internet, particularly in terms of data confidentiality, system security and lack of legal precedent and trading in uncharted territory. There is also a problem of overcoming cultural hurdles to the Internet plunge.

In addition, the one time investment up-front for consumers, i.e. to purchase the computers with the minimum configuration to allow them to have access to the Internet could be a barrier to the adoption of Internet, especially among the poor.

Adoption of ICT, especially in the public sector also carries significant risks such as the possible alteration or loss of records during the transition from manual operations to ICT. There is also a possibility that essential functions cannot be performed if the ICT systems have teething problems.

Models of ICT Development

In the quest to promote and encourage the use of Internet among the society, many governments in the less developed and developing countries have embarked on programmes to bridge the digital divide. Two examples of such efforts are quoted below:

Example 1: Bangladesh

"Among the more successful models ever to emerge from the Third World is the micro-credit system introduced by the Grameen Bank of Bangladesh. The bank has initiated a cellular phone project, dubbed the Grameen Phone Company, which introduced the use of mobile phones in some 45,000 villages, giving residents access to ICT. Each mobile phone is acquired by an individual through a small loan from the bank. This phone becomes a village telephone service provider, earning income for the owner besides providing a much-needed utility to the community.

The bank is following up with an experimental Village Computer and Internet Programme or VCIP, which would provide email and Internet service to villagers. Villagers will now be able to avail themselves of email for a fraction of the cost of a long distance call. A simple form of e-commerce will also be initiated by this system. Farmers will now be able to check out market prices and study the list of wholesalers in Dhaka by surfing the Web."

Example 2: India

"The Dr Sugata Mitra 'Hole in the Wall' Project is to put an Internet kiosk in a poor Indian neighbourhood. After some time, children who could neither read nor write learned how to use the computer without the benefit of any instruction whatsoever."

Conclusion

Although the private sector ought to be the driver for ICT evolution, the government has a major role to play in taking the lead to facilitate the growth of ICT infrastructure as we move towards a knowledge-based economy. The biggest challenge within the knowledge-based economy is to educate and upgrade the population and labour force, which could be an expensive long-term process. However, by encouraging local initiatives, as seen from the two examples above, namely by getting the local agencies and institutions to facilitate the emergence of innovative ideas among the local communities, these agencies are providing a 'window of opportunity' for these communities, not only in upgrading their level of understanding and education, but also to improve their livelihood, hence, bridging income disparity.

Secondly, although the development of physical information infrastructure could be done more easily than educating and training the labour force, it should also be noted that Internet-specific laws, provision of data security, intellectual property rights and privacy policy should also be considered simultaneously. This would help to prevent the unnecessary complications resulting from Internet usage.

Lastly, the establishment of working partnerships at all levels and across functions is the key element in effective management of ICT projects. This involves the grassroots, namely the local citizens, community groups, local governments, business enterprises, etc.; developing a community infrastructure to facilitate the use of electronics facilities; as well as the establishment of information services as well as task forces which define responsibilities and

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Key Industries of the Future: Semiconductors, Telecommunications & Opto-Photonics.

The Electronics Industry in the Malaysian Economy

At present, the electrical and electronic industries are the largest sectors of the Malaysian economy, as measured by employment, output and export figures. From the figures presented by Mr. Sapuan Amir of MIDA, the electrical and electronic sectors accounted for fully 56% of total Malaysian exports for the year 2000. Employment in the electrical and electronic sector for the year 2000 was 432,498, or 17% of the 2,558,300 employed in manufacturing. Output per employee in 2000 in this industry was RM407,000 in 2000 compared to RM54,000 in 1981, an increase of over 750%.

The presence of prominent Multinationals (MNCs) such as Agilent, Dell, Intel, Komag, Motorola, Robert Bosch, created a sizable local market for component & supporting industries, including more than 200 tool and die companies, over 400 plastic molding companies, and many other supporting industries, such as stamped and machined parts, electroplating, packaging and printing.

This has also given rise to world-class Malaysian companies providing various services, ranging from precision metal parts, computer and computer peripherals, and semiconductors.

Semiconductors

Worldwide sales for this industry is estimated at US\$204 billion in 2000. This figure is projected to increase to US\$283 billion in 2004. North America is currently in the lead, with US \$64 billion in sales, or 32% of the world market. The Asia-Pacific region comes in second, accounting for US\$51 billion, or 24% of worldwide sales, with Japan third at 23%, and Europe fourth at 21%.

The Asia-Pacific region is expected to control about 26% of the market share by 2004, focusing mainly on consumer and computer products. North America maintains a narrow lead with 27% of worldwide sales, providing computer, networking and telecom products. Japan comes in at 24%, focusing on consumer and telecom products, and Europe at 23% providing telecom, wireless and infrastructure products. Worldwide, the most prominent products are expected to be in the computer, telecom and consumer areas.

With a historical compounded annual growth rate (CAGR) of 17% since its birth in the 1950s, the semiconductor industry is a key contributor to world growth, and is likewise expected to continue to play a prominent role in our economy.

Table 1: Semiconductor Industry Global Market Breakout

	2000 Sales		2004 Sales		Product Focus
	\$	%	\$	%	
North America	\$64B	32%	\$76B	27%	Computer Networking Telecom
Asia Pacific	\$51B	24%	\$73B	26%	Consumer Computer
Japan	\$47B	23%	\$68B	24%	Consumer Telecom
Europe	\$24B	21%	\$61B	23%	Telecom Wireless Infrastructure
Total	\$204B	100%	\$283B	100%	Computer Telecom Consumer

Source: Semiconductor Industry Association/World Semiconductor Trade Statistics



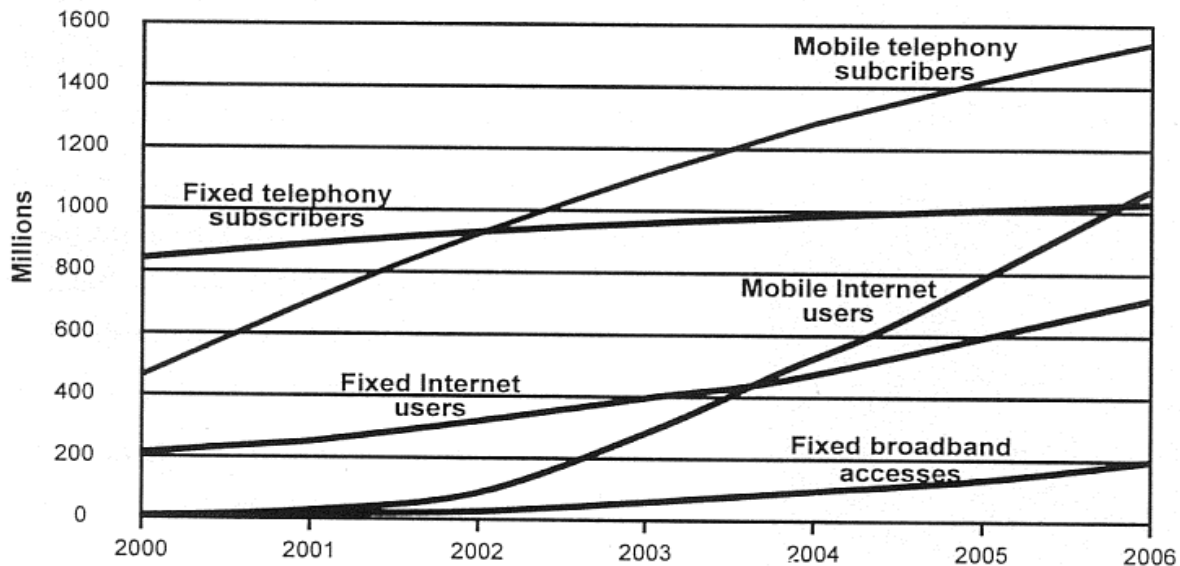
Telecommunications

The telecommunications industry is another sector expected to play a key role in the imminent future. With the world becoming increasingly mobile and increasingly connected, demand for telecommunication services is expected to increase rapidly.

As can be seen from the graph below, mobile services are expected to surpass fixed services within the decade. According to Ericsson's estimates, there are an additional 1.2 million mobiles, 600,000 new mobile subscribers, and 120,000 new mobile internet users worldwide every day.

Locally, the mobile subscriber market registered a 65% growth in 2000, and 30% in the first half of 2001. Mobile penetration, at 5.5 million subscribers today, is also expected to reach approximately 9 million, or a 40% penetration by 2004. According to Ericsson, this figure could reach 70-90% or over 20 million subscribers by 2010. With such figures, mobile telecommunications services is set to be a key area of expansion in the coming years.

Worldwide Subscribers and Users



Source: Ericsson

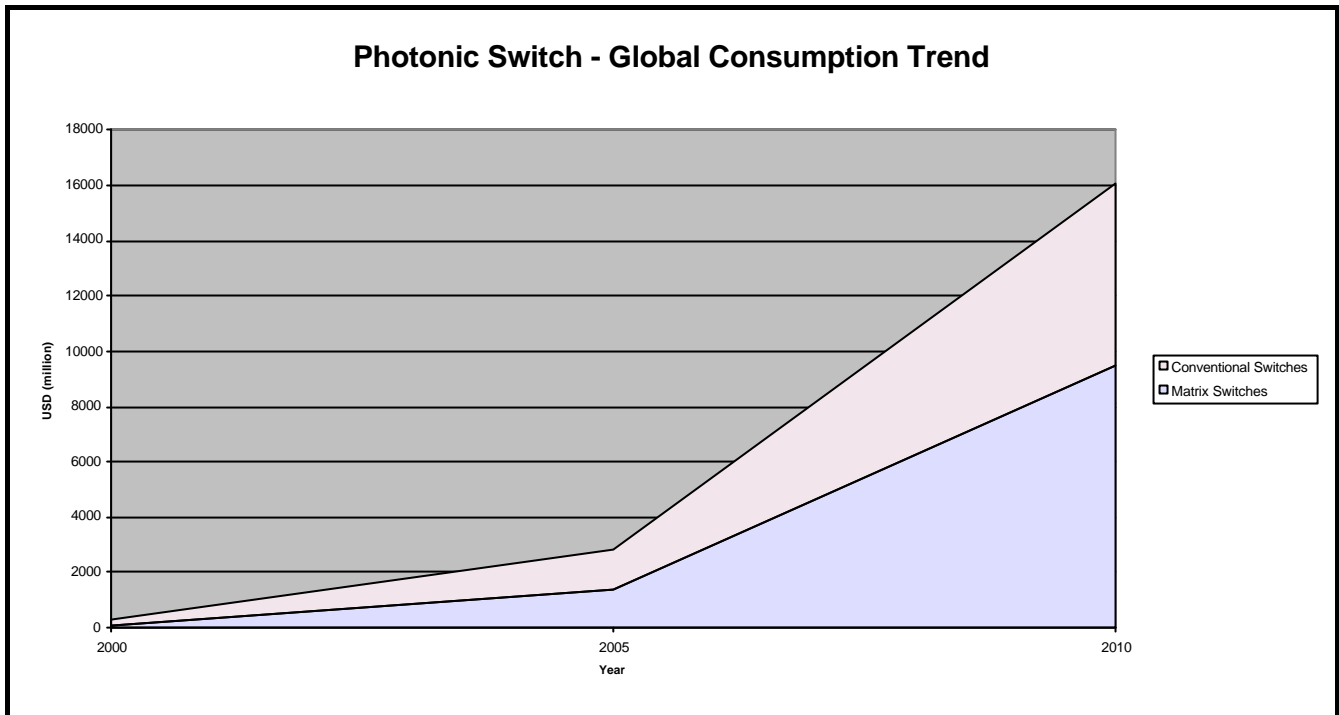
Optics and Photonics

The third key area of growth is that of opto-photonics industries. This technology, which is utilized in everything from computing and telecommunications, to healthcare and food industries, is an extremely broad area that offers many opportunities for growth.

The growth potential in the photonics industry is tremendous. The trend in the use of matrix switches vs. conventional switches is a clear indicator of such. The share of matrix switches, using photonics technology is set to move from 35% of the market in 2000, to 59% of the market in 2010, while conventional switches are set to decline from 65% of the market in 2000, to 41% of the market in 2010. At the same time, the value of the switch market is expected to increase from US\$308 million to US\$16.1 billion in the same period.

According to a 1997 study done by OITDA, the share of the photonics industry was estimated to be worth about \$34-50 billion in 1997 and expected to grow to \$500 billion in 2010. However, outlining the extraordinary growth in this sector, a new survey estimated that this industry grew to \$138 billion in 1998.

The photonics industry also registered high growth rates in countries such as Japan which grew 22.9% in 2000, and Canada, which is experiencing a 50% growth rate per year. Wages in the photonics industry are double the average wages in other industries and employment in this industry rose 117% in 1999, and 133% in 2000.



Year	Matrix Switches		Conventional Switches		Total	
2000	US\$108M	(35%)	US\$200M	(65%)	US\$308M	(100%)
2005	US\$1.37B	(49%)	US\$1.43B	(51%)	US\$2.8B	(100%)
2010	US\$9.50B	(59%)	US\$6.60B	(41%)	US\$16.1B	(100%)

Issues and Challenges

Perhaps the most pressing challenge which cuts across a whole range of sectors is that of manpower. Shortages in skilled manpower, especially researchers, are expected to be on the rise, especially in the semiconductor and opto-photonics industries.

Over the period 1988-1998, there was a decline of over 35% of total electronic and electrical degrees conferred in the United States, a problem shared by many other countries. Even leading producers of scientists such as the US and Japan are expected to face severe shortages of skilled workers and researchers in the area of opto-photonics. With declining birth rates and working age populations in addition to declining interest in science and engineering, it is imperative that governments, academic and industrial institutions encourage more engineering and science graduates.

Another challenge is the increasing costs of developing new technology. As these costs increase, the speakers called for greater cooperation in areas of mutual benefit, and also greater competition, to ensure that efficient use of resources is encouraged. Already, in reaction to this problem, several cooperative associations and organizations have been formed to better provide solutions to new technical challenges faced by both the semiconductor and photonics industries.

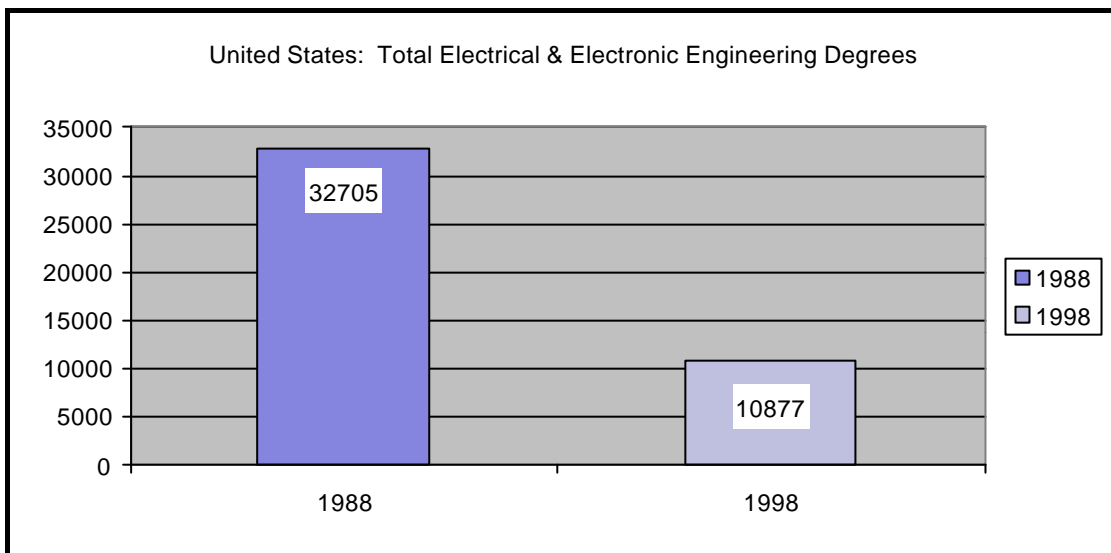
Malaysia, too has realized the need for greater human resource development, and has outlined this in the national vision policy. Already, strategies to promote industries of future growth have been put in place. However, funds for research and development is still lacking in Malaysia, especially funding from external sources. Of the private sector sources of research and development funds and expenditures in Malaysia for 1998, only 16.64% came from external sources, while 83.36% had to be provided by the company doing the research. Of the 16.64%, 8.34% came from other local companies, 4.80% from other foreign companies, 2.41% from state and local governments, 0.59% from other local funds, 0.28% from the ITAF fund, and 0.22% from other foreign funds.



Despite being almost twice the amount of two years ago, the national R&D expenditure for the year 1998 was only RM1.13 billion.

These figures outline the difficulty local firms, especially SMIs face when trying to break into these markets, which require not only a highly skilled workforce but also large sums of capital investment. Indeed, it has been pointed out that SMIs are crucial to the semiconductor and photonics industries in the developed countries. The lack of access to funding, especially for SMIs in Malaysia is a great hurdle that needs to be overcome, and steps should be taken to promote venture capital funding in Malaysia, and to make sure financial institutions, such as banks, are better equipped to understand and evaluate funding proposals for new technology.

Lastly, government policy should be made more accommodative to attract FDI higher up on the value chain. While the policies of the 1970s were developed to attract labor intensive industries, so as to capitalize on the cheap labor present in Malaysia and to tackle the problems of high unemployment then, current policy needs to reflect the changes in issues, which include the rising labor costs of Malaysia, as well as the need to move up the value chain. To this effect, more competitive incentives need to be provided, especially for continued investment (re-investment) by MNCs. It was also suggested that it should be made easier for offshore companies to develop technologies such as wafer fabrication on their own in Malaysia.



Conclusion

Despite the current slowdown in the global economy, especially in technology, the long term market for semi-conductors, telecommunications and optics and photonics is expected to be extremely vibrant. Indeed, since its birth in the 1950s, the semiconductor industry has experienced a CAGR of 17%. With the increasing integration of humans and computers, as can be seen in the increasing number of computer chips in various industries, ranging from cars and hospital equipment to microwaves ovens and refrigerators, these areas represent the key industries of growth for the near future.

In order not to miss out on these new areas of growth, it is imperative that Malaysia mobilize and organize its resources efficiently to provide a proper groundwork and environment for these industries to excel—specifically in the areas of research and development, funding, infrastructure and incentives. **§ Terence Too**

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budgets. This is evident in the US, where local agencies have taken a strong role in leading innovation. As the government plays a major role in boosting certain sub-sectors where market forces are weak to ensure general accessibility and affordability of ICT, a consistent government regulatory institution, is thus of crucial importance.

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