Making Hong Kong an IT Society: Ways for Academic Institutions to Contribute

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Amidst a plenty of debate and diversity of views on the economic future of HKSAR, the IT-related transformation of Hong Kong continues to advance without much public debate and systematic scholarly analysis. While the Government has clearly announced strategic directions that call for innovative IT development and applications, major efforts still need to be devoted to the mid-level (tactical and technical) levels of planning and execution of the right kinds of IT R&D and applications development. Without such efforts, crucial linkages between IT development and economic growth could be neglected, with an increased risk of Hong Kong becoming primarily an IT-consumers society without adequate gains in terms of value-added business sectors and economic progress. Here, we analyze this very timely area of concern and show how Hong Kong's universities are in a unique position to contribute crucial efforts to shape the emerging IT society. We describe a specific societal framework which emphasizes major elements of IT society as well its major "contributing factors," and leads to a broad sketch of the role for universities. In general, towards realizing such an IT society. To illustrate this approach in more concrete terms, we briefly describe a sample of our own programs and projects undertaken at CUHK.

Keywords: IT Society, Economic Growth, IT R&D, IT Applications, Role of Academic Institutions in IT Policy and Planning

Introduction

While there is a plenty of debate and diversity of views on the economic prospects of HKSAR, it is not clear whether adequate public debate and systematic scholarly analyses are taking place in connection with the technological transformation of Hong Kong. In particular, the recent advances in Information Technologies (IT) (e.g., wireless communication networks and the products and services based on them e.g., mobile phones) have been enjoying a growing market among Hong Kong people and businesses. On the whole, thanks to Hong Kong's willingness to try new products and technologies, and its strategically located dynamic business environment, today Hong Kong is destined to be part of the global emerging IT society of the 21st century.

The crucial question now may indeed be: "Can Hong Kong grow beyond an IT consumer society into a society with IT business and industrial base?" In this paper, we examine this issue from a broad-based academic perspective, and suggest means for realizing value-adding IT industry and society. We show how Hong Kong's academic institutions are in a unique position to contribute crucial efforts needed to shape the emerging IT society. We also describe a specific societal framework which emphasizes major elements of IT society as well its major "contributing factors," and provide a broad sketch of the role for universities and other academic institutions towards realizing such an IT society.

The Background of HKSAR Economy and Government's Policy Directives

The HKSAR Government has been quite supportive of IT development in Hong Kong right from the start. In its maiden Policy Address, the Chief Executive Mr. Tung Chi-Hwa had unequivocally identified IT as the high-tech industry which needs to be actively promoted. The proactive stance of the HKSAR Government towards IT is even clearer today. As the Asian financial crisis began around mid-1997, Hong Kong's economy has met with serious problems. In response, the 2nd Policy Address clearly shows that the Government has further crystallized its determination to harness innovation and technology (particularly IT) to spur economic growth. Thus, the 2nd Policy Address contains many IT-related items, such as: creation of the Applied Science and Technology Research Institute to stimulate "mid-stream" R&D, setting up the HK$3 billion Innovation and Technology Fund, enhancing Hong Kong's role as the Internet hub and a global satellite center, and enhancing the Quality of Education through aggressive use of IT applications. In the context of this paper, it is especially important to note that Section 26 of the 2nd Policy Address specifically calls for more "collaboration of academic institutions and industry in research and development". Below, we elaborate on why Hong Kong's universities are in an especially privileged position to contribute in unique and valuable ways to this goal.

The Unique Position of Universities in Relation to the Mid-level Planning & Actions Needed

The Government's strategic directives and mandates still leave a considerable amount of mid-level efforts in terms of the analysis, planning and execution of the specific programs and projects to fulfill the strategic goals. Assuming adequate support from the Government, the onus for undertaking such mid-level and technical efforts clearly falls collectively on Hong Kong's Academic, Business and Industry Sectors. The academic institutions, in particular the universities, have talents and expertise in all fields ranging from pure sciences and technological disciplines all the way to socio-economic and cultural fields. Therefore, universities are possibly the richest organizational environments for dealing with the complex challenges of identifying, designing and carrying out specific projects to transform Hong Kong into an IT society.

Just as the engineering disciplines have always served as an effective interface between science and commercial technology, so have universities served as the relatively neutral liaison between business, government and the community at large. Thus, compared to business, industry, and community organizations, universities can be regarded as a relatively neutral ground without significant individual vested interests. Such special interests, whether individual or a corporate, often lead to conflicts of interest when public organizations are involved in a project of primarily public and societal significance.
A Framework for IT Society

Vision of IT society

Today, there are three big issues in the transformation of the IT society. An expert’s opinion, as radical as the farming and industrial revolutions of the past. In its essence, this latest transformation is brought about by the enormous speeds of information delivery made possible by the ever advancing IT. While promising a big surge in business productivity and economic prosperity, these advances are also profoundly changing almost all aspects of our daily lives. In the IT society, the routine activities of commerce and trade, health, education, recreation and leisure, transportation, housing, and government will take on a whole new dimension. And commercial activities will take place almost entirely electronically. For example, Internet-based on-line shopping will meet most of your shopping needs without your physically visiting any shopping mall. The world’s medical experts and resources could be reached by touch of a few buttons. Education will no longer be boring and restricted within certain boundaries of time and space. There will be more videos and games than you can imagine to be selected right from your home. The booking and ticketing of airlines will never be easier and you can do it anytime anywhere. The future living quarters will be equipped with built-in intelligence and will provide all the comfort and necessary security we all look for. The government will be far more transparent with its 24-hour Web-based multimedia information systems. In essence, the IT society promises to provide us a far better quality of life, in addition to improving our competitive edge and increase our per-capita income.

This vision of IT society is shared by many countries around the world. In the last decade, the U.S. Government and various commercial companies have allocated massive resources to IT R&D, and to deploying and implementing nationwide information infrastructures. The Next Generation Internet sponsored by Advanced Research Project Agency is aiming to deliver up to 1 Gbps to your desk top by 2002. European nations have a joint research and development effort in pushing information technologies. Japan has plans to deploy fiber to the home, targeting to deliver high-speed information to each household at low cost. The information superhighway in Singapore connects each classroom with ATM services. The multimedia corridor in Malaysia aims for similar visions. In short, every developed country in the world is turning into an IT society, and every major city is turning into an “InfoCity” as envisioned by Prof. Charles Kao. The changes in this information age are equally exciting. The growth rate of the World Wide Web is about 8 times faster as compared to those recorded by other computer communication technologies! Apart from showing a vast untapped market potential, these observations clearly reflect a high level of consumer receptiveness and positive attitudes towards the emerging IT society.

Elements of IT society

Our previous arguments undoubtedly favor the active pursuit of an IT society. What then makes an IT society? The elements of an IT society differ very little from what we experience nowadays. These elements include education, commerce, industry, health, entertainment, government, transportation, and housing, but with different degrees of using and deploying of IT. In other words, the state of IT society can be reached when all facets and sectors of the society improve their living quality and their productivity through exploitation of IT.

But the mere complexity of society prohibits full critical analyses on how and when IT will make improvements on individual sectors. The intertwined fabric of various sectors also argues that launching of IT must be simultaneous for all sectors and for all walks of life. Consequently, the realization of such state cannot be achieved by any single commercial sector in isolation or by relying only on the Government’s efforts. While applications of IT will be introduced to various commercial sectors, the social awareness of the usage and significance of IT has to be increased through various means and media. Naturally, both the Government and the academia will take up more shares of responsibility in educating the mass media. With particular reference to the educational institutions, which are the training grounds for the young and the pioneering fields of new technologies, it can be argued that the responsibilities and the roles they play will critically shape our pathways to the IT society.

While the IT society is formed by achieving all the necessary elements, to reach such goal requires many contributing factors or essential ingredients. These contributing factors are the thrusts in the areas of IT, education, finance, and policy settings organized by the Government, commercial sectors and academic institutions alike. One can visualize the elements and the contributing factors in a two-dimensional matrix representation. The contributing factors will be the rows, and the elements of an IT society will form the columns. Thrusts in each of these rows will reach some or all of the elements listed in the columns. With the exception of finance factor, the academia can play vital roles in paving our way to the IT society.

The Roles of Academic Institutions

For the research and development, there is little dispute that the R&D are the foundation of the information technologies. Whether Hong Kong needs to develop its own research efforts or just import technologies from elsewhere was one of the hottest debates in the pre-1997 era. However, as we articulate later in this paper, the need to develop such effort is a must. Not only is Hong Kong in a unique geographical vantage point, with its abundant human talents, installed communication networks, and complete legal and advanced regulatory systems, but it also has many other essential ingredients for a successful technology-development base.

Education is indisputably a key element in an IT society. From primary to secondary to tertiary education, the roles these institutions can play are numerous. These include:

- Training ground for technology leaders
- Programs targeted to raise the social awareness of an IT society
- Providing environment for future entrepreneurs
- Technology research and development
- Think tank for policy, regulatory, and legal matters
- Training ground for technology developers and managers

To make Hong Kong an IT society, there must be coherent efforts from the Government in regards to policy. Fair rules and laws are needed to be set up by the regulatory bodies as well. The recent move by Hong Kong Government in setting up the IT Bureau is the first bold and correct step in dealing with various IT policies. But the regulatory bodies require extensive background and knowledge in handling these issues. In the past, Hong Kong Government has relied heavily on consultations from overseas experts. Today, the ever-increasing pace of technology developments and much customization indicate the need for a group of resident experts. Equipped with the wealth of information in technology, economics, government policy, legal, and medical knowledge, individuals from the tertiary institutions are well-positioned to provide the necessary consultation for the Government and local industries in IT-related issues.

Con contributing Factors towards an IT Society

In the previous section, we have argued that critical roles can be played by the educational institutions in three contributing factors, namely, education, R&D, and policy settings. We will elaborate here these contributing factors along with some examples currently found at the Information Engineering (IE) Department of The Chinese University of Hong Kong (CUHK). These examples are just some samples we are familiar with and there are plenty of well-organized programs in other academic institutions in Hong Kong.

The Education Factor

The ways in which education helps to pave the way to IT society are numerous and substantial, and prominent in all educational segments through various methods and media. We group the different segments
into (1) the primary and secondary schools, (2) universities and technical or vocational colleges, and (3) various adult or continuous educational programs. Institutions (e.g., Public Library) and activities sponsored by the Government and other organizations. The teaching methods of interest here are those emphasizing the use of IT to improve teaching, the use of IT to improve learning, and the implementation of necessary information infrastructure.

The primary and secondary schools are the best stage to introduce the importance and the use of IT. As in U.S. and U.K., the computer and information concepts should be introduced as part of the core curriculum as early as in primary schools. We welcome the Government's recent policy in allocating funding for computers and the networking in Hong Kong's primary and secondary schools. The information infrastructure is the vital physical access that forms the basis of information distribution and database for information sharing among teachers and students. Educational software as an aid to learning, as well as teaching, should be developed in massive scale. This is in line with the Government objective to have more than 25 subject areas to be taught with the aid of IT in the next five years. While there are plenty of educational software available in English language, customized software for Chinese users is relatively scarce, especially for young students with age under ten. One such example is the rapid decline in English proficiency in our graduates in recent years. Customized IT software can be valuable in dealing with this ailment problem, in addition to the currently adopted Government policy of employing native speaking English teachers in primary and high schools.

However, a more fundamental change has to be made concurrently. The previous out-dated rote-learning model taught in primary and secondary schools should be replaced by interactive-learning model that has been successfully carried out in developed countries for years. The rote-learning model that stresses on reciting and memorizing can no longer be the right model of bringing out one's creativity which is necessary in science and technology innovation. By way of illustration, below we outline examples of relevant projects, spearheaded by teaching staff of the I.E. Department of CUHK, in the areas of (1) development of teaching and learning tool set, (2) educational content development, and (3) information infrastructure implementation.

**Example of Teaching and Learning Tools**

**INTELLLECT**

This project explores how advanced multimedia and networking technologies can be used to improve lecture delivery. The goal is to develop a stored lecture system, which has many interactive and networking features to facilitate multimedia presentation of coursework. The Independent Learning Center at CUHK is currently using the tool to devise self-learning coursework for English lessons.

**Example of Content Development**

**QUEST (Quality Education Studio)**

QUEST has two major projects in progress: SoundBytes and the Interactive Learning of Internet. SoundBytes is a Web-based application where "kids teach kids" English pronunciation through multimedia and the Web. The Interactive Learning of Internet is designed for the F-7 freshmen-level students on Internet, and makes extensive use of the interactivity of the Internet and the multimedia technologies. Currently, the Interactive Learning of Internet is introduced as a trial course to CUHK students with non-technical background.

**Example of Information Infrastructure**

**SchoolNet**

The School Net is an Intranet which provides a low-cost dial-in Internet service to more than 2,000 students and teachers, and has more than 150 secondary schools registered. There are plans to extend the existing work of School Net to set up the Hong Kong Cyber-Campus to link up all schools in Hong Kong. This will become the Hong Kong Education Information Infrastructure enabling students and teachers to exchange and discuss ideas, and supporting various organizations to develop and distribute educational content.

**The R&D Factor**

Research and development is indisputably a key driving force behind the IT revolution we are witnessing today. No one will question the importance of IT R&D and its beneficial impacts on the economy. Yet, there seems to be lingering doubts in some quarters whether Hong Kong has the capability to develop R&D and whether local R&D efforts are really the best economic solution. We will attempt to dispel this skepticism and point out how the academic institutions can contribute in this crucial process.

The Silicon Valley and its tremendous achievements have often been cited as the baseline showing how insufficiently prepared Hong Kong is for venturing into high tech. Yet, Hong Kong lacks the culture, the infrastructure, the experience and the list goes on. While these criticisms are valid in general, we should not lose sight of the advantageous position Hong Kong enjoys with regard to IT R&D. There are three important ingredients for the development of R&D: The Market, the People, and the Finance.

Hong Kong may not yet have a high tech development culture, but it has a consumer culture that is very receptive to certain IT related technologies. The fact that Hong Kong has one of the highest mobile phone market penetration rates and one of the highest per capita optical fiber installation in the world are not coincidences. As a result, Hong Kong is highly attuned to the latest trends and marketing developments in IT. In terms of its human resources, over the past few years, Hong Kong has managed to attract a influx of IT researchers and engineers from overseas. Moreover, its tertiary education institutions are well equipped with technical talents that Hong Kong has attracted for the last decade is the prime asset for technology development and thus the basis for a foundation of IT industry. Not only technologist and engineers can be trained through the offered curriculum, but some of the professors also have a wealth of commercial experience in project development and management. With proper incentives and rewards, the graduates together with the professors will form the primary force in Hong Kong for starting a local industry in IT, as in Stanford University and University of California at Berkeley in Silicon Valley, if the HKSAR can modify its immigration laws to encourage more skilled IT professionals to work in Hong Kong, the human resource problem can be overcome. Moreover, there is another clear advantage that Hong Kong enjoys; namely, Hong Kong is a bilingual society with many technical people well versed in both English and Chinese, Hong Kong can easily play the niche of a world center of Chinese Computing or Bilingual Computing development. Together with its current strength in finance, Hong Kong has the right set of preconditions to embark on the path of IT R&D.

With regard to the question of the economics of developing our own R&D, the short-term answer, of course, may favor simply importing technology on an as needed basis, however, our recent economic malaise point out the dangers of an economy based purely on finance and real estate, and reflects the need to diversify our economy. IT is an area promising a low entry cost with a high return value. With the proliferation of Web-based applications and the opening up of the mainland markets, the potential growth of IT in the near future is tremendous. It seems to us that the question is not whether developing our own IT R&D industry is an economical proposal; rather, the question should be whether we can afford to miss out on this opportunity.

The universities in Hong Kong have been involved in IT R&D for some time. One can easily enumerate a whole range of IT services, systems, and applications being developed and prototyped at universities. To put things in perspective and to better coordinate R&D activities, it is recommended that activities can be organized around a two-tier structure, as shown in the following figure:
Contents, services and applications, lie at the very top, being supported by IT Tools and infrastructure. Movies and multimedia lectures, educational software for children, and financial applications, data-mining software, videoconferencing services, for instance, are some examples of content and applications. Tools are needed to support the preparation of contents and the development of services. Authoring tools to expedite the preparation of Web pages and Java or ActiveX software components used to build larger software applications, for instance, are of interest. An underlying communication network, computer system, and end-equipment infrastructure is, of course, needed to deploy contents and support the daily operation of services. Optical broadband networks, wireless communications networks, Internet, and distributed computing systems are some of the examples.

One may easily fit individual IT R&D activities from universities into one of the three areas. A number of ongoing efforts at the CUHK are presented below as illustrating examples.

Examples of Projects to build IT Infrastructure

**WWIN (Wideband Wireless Intelligent Network)** Work is undertaken to build and experiment with a wideband wireless intelligent network. With this network infrastructure, for instance, wireless distribution of data, such as the wireless library, can be supported, truly fulfilling the vision of an Information-Anywhere system. Adaptive communication techniques, which scale network transfer according to quality of wireless channels, are being researched.

**Broadband Networks** Two operational ATM switching network testbeds have been used to test traffic control methodologies on broadband network. Such traffic control methods are indispensable when a plethora of multimedia services with diverse bandwidth and quality of service requirements are transported on the information superhighway. On the physical layer, many activities have been centered around optical networks, focusing on multi-wavelength packet-switched networks, network management and surveillance, broadband local access, and high-speed time-division multi-access systems.

**Internet Research** Network routing and management methods are crucial for the upgrading of Internet to broadband speed and multimedia applications. Based on an Internet Exchange called Cubix, experiments have been performed with novel routing methods such as the Routing Arbiter.

**Example of Projects to Build IT Tools**

*Jasmin 9 ANSBOK* This is a project to develop a search engine for Chinese and bilingual web pages. By means of an advanced probabilistic approach, the system achieves a high degree of accuracy in its search process. Such Chinese software is highly relevant for Hong Kong in positioning itself to compete with other countries. The search system can serve as a component to build even more sophisticated Chinese applications software (e.g., a system for organizing and indexing Chinese documents to be deployed over the Internet in a distributed manner).

**INTELECT** This project has been mentioned previously in Education Sector. Essentially, what is being built is a tool for authoring multimedia contents to be distributed over the Internet.

Examples of Development of IT Contents, Services or Applications

**QUEST** This project has also been mentioned in the previous section.

Basically, advanced Web technologies have been used to author educational contents for audiences ranging from primary school to university students.

**IT-Engineering Applications** CUHK is also developing some of the most interesting financial applications to be deployed over the Internet. Some of these applications allow users to log on from anywhere to manage their finances. Real-time data feeds of financial data (e.g., stock market indexes) are obtained via a satellite disk and fed into information-processing software and the processed information is deployed over the Internet.

The above list serves only as examples, and is by no means an exhaustive list of IT R&D activities at CUHK. Including activities in other universities, we feel that Hong Kong indeed already has a strong IT R&D base within its universities and is capable of developing novel information technologies. What is lacking is a high-tech development culture in the IT industry. Policies and incentive programs should be devised to encourage the movement of these technologies out from the research labs and into the marketplace and industry.

**The Policy, Legal and Regulation Factor**

It is obvious that the road to the IT society must be supported and protected by the proper policies, laws and regulations. Hong Kong has been the information hub in South-East Asia partly due to its geographic location. The major reasons, however, lie in the favorable existing policy and regulation, and an advanced and complete legal system. Favorable policy can be set up to promote the use of IT in industry. Examples may include tax incentives for the use of IT and upgrade, tax allowance for IT education for the employees, low rent in the Government sponsored science and Industry parks, and Government help in promoting and marketing of products from industry. Software piracy is a vexing legal problem; we have been witnessing today. Without proper intellectual property protection, the growth of software industry will be greatly impeded. The legal protection will also provide a level field of competition where foreign and domestic companies can compete fairly.

In view of the dynamic and for reaching impact of today's IT development, a unique way for universities to contribute is to establish an IT Think Tank organization. Specifically, the think tank can be defined to serve high-level arms of the HKSAR Government and industry through IT-related analyses, investigations and advisory reports. Interdisciplinary areas such as IT Education, Telemedicine, E-Commerce, IT for Finance, Geoinformatics, Bioinformatics, etc. can also be part of the Think Tank's area of interest. As previously articulated, our universities have an abundance of technology, economic, health, legal and policy experts, and they can generally be regarded as being relatively neutral with unbiased viewpoints. It is a tremendous waste of resources not to involve them as consultants to the Government on policy, legal and regulatory matters.

**Conclusion**

In conclusion, we have argued that the future IT society of Hong Kong must have a strong IT industry sector, complementing the growing IT consumer sector. We have presented a specific societal framework which emphasizes the major elements of IT society as well its major contributing factors, and sketched the role which universities and other academic institutions can play to realize such an IT society. We have elaborated on the role of the universities in terms of the three major factors, namely: the Education Factor, the R&D Factor, as well as the Policy, Legal and Regulation Factor. By way of illustration, we have briefly described a sample of our own programs and projects undertaken at CUHK, while recognizing that there are plenty of well-organized such programs in other academic institutions in Hong Kong.
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Soung C Liew received his SB, SM, EE, and PhD degrees from Massachusetts Institute of Technology, Cambridge, from 1984 to 1991. He was a Research Assistant in the Local Communication Networks Group at the MIT Laboratory for Information and Decision Systems, where he investigated fundamental design problems in high-capacity fiber-optic networks. From March 1988 to July 1990, Soung was at Bellcore, Morristown, New Jersey, where he engaged in fiber-optic and broadband network research in the Network Systems Research Laboratory.

Soung is currently Professor and Director of the Area of Excellence in Information Technology at the Chinese University of Hong Kong. Soung has had extensive experience with development projects and over 50 research publications in Internet Protocols and Applications, Video Communications, Multimedia, Broadband Networks, and Packet Switching. At the University, Soung is currently leading a project to develop a prototype on-demand system that makes use of advanced multimedia and networking technologies to improve the education process. (See http://www.ie.cuhk.edu.hk/~itcnet.) He also initiated and coordinated the first inter-university ATM network testbed in Hong Kong. Soung is the co-founder of NeoCell Limited, a startup company specializing in Internet Technology which has been contracted by Hutchison Telecom to build the first residential Internet in Hong Kong.

Frank Tung

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Wing-shing Wong graduated from Yale University with a combined MAB degree in 1976. He obtained an MS degree in 1978 and a PhD degree in 1980, both from Harvard University. He joined AT&T Bell Laboratories in 1982. From 1987 to 1992 he managed a group of technical staff working on a number of research and development projects and consulting activities. He joined the Chinese University of Hong Kong in 1992 and is now a Professor of Information Engineering. He has been the Chairman of the Information Engineering Department since 1995.

Wing is actively involved with many R&D projects of central relevancy to the Hong Kong industry. He leads a project on a Chinese search engine which was awarded the Certificate of Merit in Consumer Product Design of the 1999 Hong Kong Awards for Industry. He also leads a project to prototype innovative wireless data applications based on the DECT standard. Wing’s current research interests include mobile communication systems, Web technology development, and information security and control. Wing has published close to 80 refereed journal and conference papers. He has supervised more than 14 postgraduate students.

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